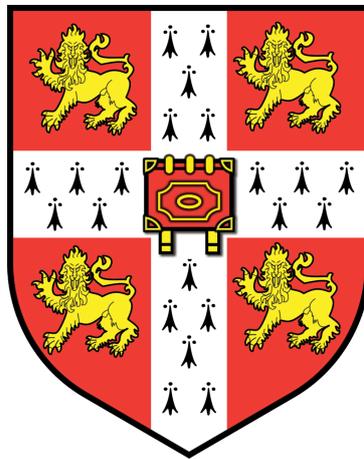


The Finance-Growth Nexus in Britain, 1850-1913



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Summary

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This thesis argues that the financial sector played a positive, but limited role in British economic growth from 1850 to 1913. It examines empirically the role played by different types of financial institutions: commercial banks, stock markets and merchant banks. To this end, the thesis uses recently developed time series and dynamic panel methods for the econometric analysis, alongside new data on different parts of the financial system. The results suggest that at a national level, the growth of commercial banks had a limited impact on British economic development over the long run, and stock markets had no impact. However, changes in bank lending influenced economic growth to a significant extent in the short term. Growing conservatism in bank lending practices did not significantly increase credit constraints, as had been previously suspected. Findings from new geographically disaggregated data indicate that the spread of bank offices improved the economic performance of English and Welsh counties. Increased concentration of the banking industry did not hinder economic growth, a result that challenges widespread suggestions in the relevant literature. Moreover, the development of provincial stock exchanges – exchanges outside London - did not influence county-level economic growth, contrary to the view that they were important for the expansion of local industry. Finally, this thesis is the first to assess econometrically the role of merchant banks. It demonstrates that their trade financing activities were beneficial not only for the growth of British international trade, but also for that of the domestic economy.

Declaration

This dissertation is the result of my own work and includes nothing which is the outcome of work done in collaboration except as declared in the Preface and specified in the text. It is not substantially the same as any that I have submitted, or, is being concurrently submitted for a degree or diploma or other qualification at the University of Cambridge or any other University or similar institution except as declared in the Preface and specified in the text. I further state that no substantial part of my dissertation has already been submitted, or, is being concurrently submitted for any such degree, diploma or other qualification at the University of Cambridge or any other University or similar institution except as declared in the Preface and specified in the text. It does not exceed the prescribed word limit of 80,000 words by the Degree Committee of the Faculty of History.

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Introduction

This thesis investigates whether from 1850 to 1913 the development of the British financial sector was related to economic growth. I focus on the role that commercial banks, stock markets, and merchant banks played in the economy. Furthermore, I examine the impact of financial development at a regionally disaggregated level, and apply recently developed time series methods for the econometric analysis. The empirical approach, combined with new data, makes it possible to investigate the evolution over time of the links between financial development and macroeconomic growth in the British context with unprecedented clarity and detail.

Overall, this thesis shows that commercial banks played a role in British economic growth, whereas the stock markets did not. Changes in bank lending influenced economic growth in the short term, but they were not a significant determinant of British economic development in the long run. Moreover, the spread of commercial bank offices influenced local economic growth, whereas provincial stock markets did not have such an impact. This thesis also demonstrates how the international trade financing activities of merchant banks influenced not only the growth of British exports and imports, but also that of the domestic economy in general. It transpires that their positive contribution to the tradable sector was substantial enough to impact the economy at large.

Macroeconomic research has provided significant empirical evidence of a relationship between the growth of the financial sector and that of the real economy using post-WW2 data. A causal relationship has typically been found to run from finance to growth.¹ This topic has also been, for a long time, of considerable in-

1. For extensive reviews of the literature, see: Ross Levine, 'Finance and Growth: Theory and Evidence', in *Handbook of Economic Growth*, ed. P Aghion and S Durlauf, vol. 1 (Amsterdam: Elsevier, 2005), 865–934; and James B Ang, 'A Survey of Recent Developments in the Literature of Finance and Growth', *Journal of Economic Surveys* 22, no. 3 (2008): 536–576. Meta-analyses of the literature are provided by: Philip Arestis, Georgios Chortareas and Georgios Magkonis, 'The Financial Development and Growth Nexus: A Meta-Analysis', *Journal of Economic Surveys* 29, no. 3 (2015): 549–565; and Petra Valickova, Tomas Havranek and Roman Horvath, 'Financial Development and Economic Growth: A Meta-Analysis', *Journal of Economic Surveys* 29, no. 3 (2015): 506–526.

terest in economic history. Both Gerschenkron and Cameron *et al.* used historical evidence to argue that the growth of the banking sector accelerated the economic development of several backward European economies in the 19th century.² In a related vein, based on evidence from 35 countries from 1860 to 1963, Goldsmith posited that the size of the financial sector and that of the economy have tended to be correlated over the long run.³ Yet, to investigate the significance and direction of causality between finance and economic growth beyond mere theoretical statements, a more rigorous quantitative approach is needed. A growing body of econometric studies has shown that the growth of the financial sector has tended to cause, rather than merely to correlate with, historical economic growth.⁴

Notwithstanding the fact that Britain had by far the largest financial sector in Europe from 1850 to 1913, there is little econometric research on the nation's finance-growth nexus. This is despite the fact that the relationship between the British financial sector and the economy has been a hotly debated issue in the historical literature.⁵ In one of the few quantitative studies on the UK, Rousseau and Wachtel find that bank assets and per capita GDP had a significant relationship from 1880 to 1929. Moreover, they show that the level of financial development achieved at a given time was a significant predictor of economic growth in the

2. Alexander Gerschenkron, *Economic Backwardness in Historical Perspective*. (Cambridge, MA.: Belknap Press of Harvard University Press, 1962); Rondo E. Cameron *et al.*, *Banking in the Early Stages of Industrialization: A Study in Comparative Economic History* (New York: Oxford University Press, 1967).

3. Raymond William Goldsmith, *Financial Structure and Development* (New Haven: Yale University Press, 1969).

4. Stijn Van Nieuwerburgh, Frans Buelens and Ludo Cuyvers, 'Stock Market Development and Economic Growth in Belgium', *Explorations in Economic History* 43, no. 1 (2006): 13–38; Sibylle Lehmann-Hasemeyer and Jochen Streb, 'The Berlin Stock Exchange in Imperial Germany: A Market for New Technology?', *American Economic Review* 106, no. 11 (2016): 3558–3576; Anders Ögren, 'Financial Revolution and Economic Modernisation in Sweden', *Financial History Review* 16, no. 01 (2009): 47–71; Michael D Bordo and Peter L Rousseau, 'Historical Evidence on the Finance-Trade-Growth Nexus', *Journal of Banking & Finance* 36, no. 4 (2012): 1236–1243.

5. The literature will be reviewed subsequently. See: William Kennedy, *Industrial Structure, Capital Markets, and the Origins of British Economic Decline* (Cambridge: Cambridge University Press, 1987); Philip L Cottrell, *Industrial Finance, 1830-1914: The Finance and Organization of English Manufacturing Industry* (London: Methuen, 1980); Michael Collins and Mae Baker, *Commercial Banks and Industrial Finance in England and Wales, 1860-1913* (Oxford: Oxford University Press, 2003).

following period.⁶ The results in the cases of the US, Sweden and Germany also tend to point towards a positive effect running from finance to growth in the late 19th century.⁷

Generally, there are significant limitations in this line of research as it currently stands. Economic historians have rarely used methods which allow for changes in the finance-growth nexus over time. This is important, because the link is very likely to have changed considerably over time in consequence of changes in the regulatory environment, of economic downturns, or as the financial sector itself matured. Furthermore, our understanding of the channels through which finance influenced economic growth remains limited. This is partially to do with the fact that the existing literature has mostly focused on examining highly aggregated time series, such as broad money and GDP, and as such has not fully accounted for the complexity of the financial system. Finally, few researchers have utilised geographically disaggregated historical data, which can provide a more accurate view of how finance and growth may have been intertwined.

Finance comes in many forms, and different forms can impact the economy in distinct ways.⁸ Therefore, I will examine the relationship between the economy and different types of financial institutions. In this vein, my analysis of merchant banks investigates whether shocks in trade credit impacted the economy through exports, and if stock markets caused investment-led economic growth. Moreover, there is an increasingly widespread appreciation that the macroeconomic impact of financial fluctuations may change in different economic environments.⁹ To detect

6. Peter L Rousseau and Paul Wachtel, 'Financial Intermediation and Economic Performance: Historical Evidence from Five Industrialized Countries', *Journal of Money, Credit and Banking* 30, no. 4 (1998): 657–78. The authors also find this relationship in Canada, the US, Sweden and Norway in 1870-1929.

7. See, for example: Pontus Hansson and Lars Jonung, 'Finance and Economic Growth: The Case of Sweden 1834–1991', *Research in Economics* 51, no. 3 (1997): 275–301; Katharina Diekmann and Frank Westermann, 'Financial Development and Sectoral Output Growth in Nineteenth-Century Germany', *Financial History Review* 19, no. 2 (2012): 149–174; Matthew Jaremski, 'National Banking's Role in US Industrialization, 1850–1900', *The Journal of Economic History* 74, no. 01 (2014): 109–140.

8. See: Asli Demirgüç-Kunt and Ross Levine, 'Finance, Financial Sector Policies, and Long-Run Growth', *World Bank Policy Research Working Paper Series, 4469*, 2008, and the section below on theoretical background for a review of some of the most important theoretical models.

9. Martin Bijsterbosch and Matteo Falagiarda, 'The Macroeconomic Impact of Financial Fragmentation in the Euro Area: Which Role for Credit Supply?', *Journal of International Money and Finance* 54 (2015): 93–115.

such time-dependent shifts in the relationship between financial development and economic growth, this thesis will deploy recent developments in Bayesian time series econometrics. It will also apply tools from dynamic panel econometrics to examine how the experiences of different counties varied in terms of finance and growth.

The thesis proceeds by first examining the role of banks and stock markets in the economy as a whole in 1850-1913. This is followed by a more detailed examination into the impact that changes in bank lending had on economic outcomes, which is made possible by new monthly data on bank credit. The third chapter examines the role that banks played in county-level economic growth, and the fourth chapter does the same with provincial stock exchanges. The fifth chapter looks at merchant banks and international trade financing, and assesses the importance of their business activities for the British economy.

Historical Context

Britain had the world's most developed financial sector throughout the period 1850 to 1913.¹⁰ The stock market in London, along with the banking system, had by 1850 reached a size that was both unprecedented and very considerable.¹¹ Yet, the influence of an earlier legislative and institutional framework was still lingering in the mid-19th century. This meant that the financial system continued to transform not only as a result of increased innovation and fundamental economic factors, but also in consequence of the new opportunities created by the removal of regulation inherited from the early 19th century. This section outlines the most important developments in the financial sector's structure and the surrounding legal framework, and discusses how historians view the role of banks and stock markets in 1850-1913.

Restrictive legislation on the formation of joint-stock enterprises, combined with the Bank of England's lobbying to maintain its dominance, had constrained

10. Ranald C Michie, *The London Stock Exchange: A History* (Oxford: Oxford University Press, 1999), 70-74; Youssef Cassis, *Capitals of Capital: A History of International Financial Centres, 1780-2005* (Cambridge: Cambridge University Press, 2006), 98.

11. *Ibid.*, Ch. 3.

the banking system's growth until 1826. Before 1826, England and Wales had many small banks, which took on small-scale commercial banking functions: offering deposit and checking accounts as well as lending to businesses.¹² Their operations were limited in scale, because banks were restricted to six partners (owners), whereby the amount of capital they could raise was limited. In contrast, joint-stock banks could issue securities to a large number of investors. This allowed them to build a substantial capital base and to have more resources at their disposal. Legislation in 1826 allowing joint-stock banking largely came to being after a string of banking crises in the late 18th and early 19th centuries made it clear that a system consisting of small unit banks was extremely fragile.¹³ Policymakers and contemporary observers looked to Scotland as an example to follow.¹⁴ From the early 18th century, the nation had developed a system of deposit banking with a few large joint-stock banks at its core.¹⁵ As a result the Scottish system had exhibited a considerably higher degree of financial stability than the English and Welsh one.

Over 100 joint-stock banks were formed in England and Wales between 1826 and 1844, either as new entities or as a result of conversions and mergers of private banks. The formation of new joint-stock banks was discouraged again in 1844, when minimum capital and financial reporting requirements were implemented.¹⁶ The legal environment for banks became very liberal only after 1857, when they started to be governed by a more lenient corporate law, which placed few restrictions on the formation of joint-stock companies. Banks were allowed to opt for limited liability in 1858. With limited liability, investors were no longer at risk of losing all of their personal wealth if their bank failed, whereby an important source of uncertainty that came from owning bank shares was eliminated. Instead,

12. In the 19th century, commercial banks rarely ventured into lending to individuals for non-business purposes. At the beginning of the century, several banks also financed their activities by issuing notes. See: Richard S Grossman, *Unsettled Account: The Evolution of Banking in the Industrialized World Since 1800* (Princeton: Princeton University Press, 2010), 46-47.

13. Ibid., 173-176; John D Turner, *Banking in Crisis: The Rise and Fall of British Banking Stability, 1800 to the Present* (Cambridge: Cambridge University Press, 2014), 36-38, 69-70; Randal C Michie, *British Banking: Continuity and Change from 1694 to the Present* (Oxford: Oxford University Press, 2016), 75-76.

14. Larry Neal, 'The Financial Crisis of 1825 and the Restructuring of the British Financial System', *Federal Reserve Bank of St. Louis Review*, no. May (1998): 53-76.

15. Sydney George Checkland, *Scottish Banking: A History, 1695-1973* (Glasgow: Harper Collins, 1975), 117-119.

16. Grossman, *Unsettled Account*, 180-181. Only 7 joint-stock banks formed from 1844 to 1857.

investors' liability became commensurate to the capital they invested.¹⁷ Yet, the limited liability form saw widespread adoption in England and Wales only after the failure of the City of Glasgow Bank in 1878. Although the event itself did not constitute a significant crisis outside Scotland, it focused attention on the problems associated with unlimited liability, as most shareholders of the bank went bankrupt after the failure.¹⁸

Besides the adoption of limited liability, perhaps the most significant changes in the structure of the late 19th century banking sector were the merger waves in the 1880s and 90s. Among the drivers for the combinations of banks was a low interest rate environment, which forced banks to seek new sources of returns, while still managing their risk exposure.¹⁹ Through mergers and the rapid spread of branches, the English and Welsh banking system came to be dominated by a handful of large banks with hundreds of offices by the turn of the century. More permissive legislative frameworks in Ireland and Scotland had allowed their banking systems to embark on a path towards consolidation considerably earlier, so that, by 1900, each part of the UK had a high degree of banking sector concentration.²⁰ The nation's commercial banks ranked among the world's largest at the beginning of the 20th century, although they focused on a considerably narrower range of functions than the largest continental banks.²¹

The capital market - the market for debt and equity instruments - also underwent substantial changes from 1850 to 1913, although it operated under fewer legal constraints than the banking sector during this period.²² An organised market for securities existed in London already in the 18th century, although the London Stock Exchange (LSE) was officially founded in 1801. The Napoleonic wars proved an important catalyst for the market's expansion, as continental fin-

17. Grossman, *Unsettled Account*, 178-180, 183.

18. John D Turner, 'the Last Acre and Sixpence': Views on Bank Liability Regimes in Nineteenth-Century Britain', *Financial History Review* 16, no. 02 (2009): 111-127.

19. Grossman, *Unsettled Account*, 185-187; Joseph Sykes, *The Amalgamation Movement in English Banking, 1825-1924* (London: P.S. King & Son, 1926), 48.

20. Michie, *British Banking*, 77-79.

21. Caroline Fohlin, *Mobilizing Money: How the World's Richest Nations Financed Industrial Growth* (Cambridge: Cambridge University Press, 2012), 50.

22. Of course, company laws may have constrained what entities could use the stock markets to raise capital. These laws could have mattered at least until the late 1850s, when it became easier to limit on shareholder liability.

anciers fled to London, while the UK kept expanding its placements of war debt.²³ A repeal of the Bubble Act in 1825 removed obstacles for joint-stock company formation, and allowed new companies to issue securities without Parliamentary charters.²⁴ Yet, despite increasing issuance of company shares, in 1850, the London Stock Exchange remained primarily a market for government debt. Over the late 19th century, it transformed itself into a market where a wide range of securities were traded. It drew considerably more activity than its competitors in New York, Berlin and Paris, and was still the world's leading stock exchange in 1914.²⁵ Britain also had several smaller stock exchanges in cities outside London, which provided markets for the securities of provincial companies.²⁶ However, the role that these exchanges played in the economy has received comparably little attention from economic historians. This dissertation aims to fill this gap.

The stock market became increasingly integrated with the rest of the financial system over the 19th century. Insurance companies and banks, along with other institutional investors, relied on the market for buying securities for their reserves.²⁷ Stock brokers also had a constant need for short-term loans. By lending to brokers and dealers who held longer-term securities, banks could earn a relatively high rate of return on their funds, while still being able to withdraw them at short notice.²⁸ Michie argues that this made credit effectively cheaper by allowing banks to achieve higher returns on their short-term assets, while the liquidity of these loans also contributed to the banking system's stability.²⁹

London was not just Britain's, but the world's leading financial centre throughout 1850-1913.³⁰ Over time, the nation's financial system took on an increasingly international orientation. Indeed, perhaps the most remarkable change in the British capital markets in the late 19th century is that they became, in a sense,

23. Michie, *London Stock Exchange*, 33-34.

24. Graeme G Acheson *et al.*, 'Rule Britannia! British Stock Market Returns, 1825-1870', *The Journal of Economic History* 69, no. 04 (2009): 1107-1137.

25. Michie, *London Stock Exchange*, 70-71.

26. John R Killick and William Thomas, 'The Provincial Stock Exchanges, 1830-1870', *The Economic History Review* 23, no. 1 (1970): 96-111.

27. Ranald C Michie, *The Global Securities Market: A History* (Oxford: Oxford University Press, 2006), 26-28.

28. Michie, *London Stock Exchange*, 27-28, 52-53, 67; see also: Leslie Sedden Pressnell, *Country Banking in the Industrial Revolution* (Oxford: Clarendon Press, 1956).

29. Michie, *The Global Securities Market: A History*, 28-30.

30. Cassis, *Capitals*, 41, 83-85.

less British. The LSE listed a growing number of foreign and colonial securities as the 19th century progressed. Securities relating to the debt of foreign governments, railways and other types of infrastructure became especially prominent. The stock exchange thereby facilitated the channelling of savings from Britain to several parts of the world.³¹

Another dimension in which the City took a leading international role was in the money markets - markets where short-term debt securities are traded. London became the centre through which merchant banks financed international trade, and where both domestic and foreign financial institutions would park their short-term funds. In this context, London's leading position was even stronger, relative to competing financial centres, than it was in terms of the stock markets. Yet, both trade financing and the money markets more broadly have been given comparatively little attention in the historical literature, and their role in the British economy has hardly been explored.³²

The financial system was characterised by a high degree of specialisation. That is, different types of financial institutions tended to focus on a narrow range of tasks, instead of providing a wide range of financial services through a single entity. This contrasts with the traditional characterisation of universal banks, found in several continental European countries, which would provide a comprehensive range of services under one roof.³³ In addition to providing credit, universal banks could provide investment banking functions, whereby they would help their customers raise capital from financial markets, or to arrange mergers and acquisitions. British commercial banks would largely limit themselves to the provision of short-term credit for domestic companies. If a customer of a commercial bank needed to raise external capital for a longer period, it would need to seek it through the stock markets or, more often in the case of smaller firms, privately through friends and acquaintances.

31. Irving Stone, *The Global Export of Capital from Great Britain, 1865-1914: A Statistical Survey* (New York: St. Martin's Press, 1999); see also: Michael Edelstein, *Overseas Investment in the Age of High Imperialism: The United Kingdom, 1850-1914* (New York: Taylor & Francis, 1982).

32. On the money markets see: Wilfred T C King, *History of the London Discount Market* (London: Routledge, 1936); and on merchant banks, see: Stanley D Chapman, *The Rise of Merchant Banking* (London: Taylor & Francis, 1984).

33. Caroline Fohlin, 'The Balancing Act of German Universal Banks and English Deposit Banks, 1880-1913', *Business History* 43, no. 1 (2001): 1-24.

While the financial system grew considerably from 1850 to 1913, the nation's economic performance was also reasonably good.³⁴ British real GDP per capita growth averaged 1.2% from 1850 to 1913.³⁵ The second industrial revolution was underway in the late 19th century, during which several other European economies were growing substantially faster, thereby catching up with the British economy.³⁶ This is to be expected from standard economic growth models, and recent literature argues that Britain generally grew at a rate that was close to its potential.³⁷ Productivity differences in Britain, Germany and the US remained roughly constant throughout the period at issue, and the key reason for Germany catching up with Britain in terms of industrial output was an increase in its manufacturing workforce.³⁸ In Britain, competition served to make producers more efficient, but significant inefficiencies existed mainly in strongly cartelised industries, such as railways and chemicals. A low degree of competition and slow adoption of new technology was primarily an issue in the service sector, which led to lower productivity growth.³⁹ In manufacturing, the methods of mass-production that were emerging in the US were not yet suited to many industries in the British isles, as the market for goods was often significantly smaller.⁴⁰

Until the 1990s, several economic historians argued that there were important weaknesses in the financial sector in 1850-1913, which potentially constrained the growth of the British economy. These views stemmed largely from a negative view of the sector's structure and of its international orientation. One argument was that the banking sector did not provide enough long-term finance to domestic firms, because banks were preoccupied with short-term lending, and were perhaps

34. Nicholas Crafts, 'Economic Growth During the Long Twentieth Century', in *The Cambridge Economic History of Modern Britain*, ed. Roderick Floud, Jane Humphries and Paul Johnson, vol. 2 (Cambridge: Cambridge University Press, 2014), 26–59.

35. Jutta Bolt and Jan Luiten Zanden, 'The Maddison Project: Collaborative Research on Historical National Accounts', *The Economic History Review* 67, no. 3 (2014): 627–651. The data will be plotted and examined in more detail in the first chapter.

36. In terms of GDP per capita, Britain remained well ahead of both Germany and France by 1913, while USA had caught up with Britain.

37. For a review, see: Crafts, 'Economic Growth'.

38. Stephen N Broadberry, 'Anglo-German Productivity Differences 1870–1990: A Sectoral Analysis', *European Review of Economic History* 1, no. 2 (1997): 247–267.

39. Stephen N Broadberry, *Market Services and the Productivity Race, 1850-2000* (Cambridge: Cambridge University Press, 2006), 129-137.

40. Nicholas Magee, 'Manufacturing and Technological Change', in *The Cambridge Economic History of Modern Britain : Economic Maturity : 1860 - 1939*, ed. Roderick Floud and Paul Johnson, vol. 2 (Cambridge: Cambridge University Press, 2004), 74–98.

excessively conservative. This constrained finance to new and more innovative industries. A related argument was that the stock markets channelled funds abroad at the expense of the domestic economy, while at the same time failing to give sufficient attention to firms in emerging industries.⁴¹

The negative opinions of British banks originated partially from the perceived success of German (and several other continental) universal banks in providing long-term finance to industry. They were thought to have had superior lending practices relative to British banks, which lent on a short-term, transactional basis. Moreover, universal banks occasionally held supervisory board seats, along with equity stakes in their largest clients. They were thus thought to have influenced the management of companies and their merger decisions.⁴² Gerschenkron's highly influential hypothesis suggests that banks - universal banks in particular - were highly beneficial for the rapid industrial take-off of late industrialisers such as Germany. Gerschenkron maintained that this was the result of banks mobilising savings and helping satisfy the high capital demands of late industrialising countries.⁴³ In this respect, however, regardless of whether universal banks were better for the economy than commercial banks, the former were better suited for relatively undeveloped economies, and may not have been as important in the macroeconomic context of Britain in 1850-1913. The needs for rapid capital mobilisation in Britain were not as large as in poorer continental countries, and there were already other channels - both formal and informal capital markets - through which capital could be raised when needed.⁴⁴

Since the 1990s, historians have argued that the differences between the lending practices of continental universal banks and British commercial banks have been greatly exaggerated, by traditional comparisons resting on stereotypes which

41. Kennedy, *Industrial Structure*, 120; Cottrell, *Industrial Finance*; Frank W Paish, 'The London New Issue Market', *Economica* 18, no. 69 (1951): 1-17. On capital exports specifically, see: Sidney Pollard, 'Capital Exports, 1870-1914 Harmful or Beneficial?', *The Economic History Review* 38, no. 4 (1985): 489-514.

42. Richard Tilly, 'Universal Banking in Historical Perspective', *Journal of Institutional and Theoretical Economics (JITE)/Zeitschrift für die gesamte Staatswissenschaft*, 1998, 7-32.

43. Gerschenkron, *Economic Backwardness in Historical Perspective.*, 12-15.

44. Ranald C Michie, *The London and New York Stock Exchanges 1850-1914* (London: Allen & Unwin, 1987), 107-111.

are ungrounded in historical facts.⁴⁵ It turns out that short-term lending was the primary form of extending credit in both Germany and Britain. British banks commonly rolled over short-term loans over several years, as did their continental counterparts. This both limited their risk and provided a means to monitor their customers, which might have led to borrowers using their funds in a more productive manner.⁴⁶ Collins also shows that the loan terms of British banks were generally flexible, while Capie and Collins argue that it was rare for banks to turn down loans from industrial customers.⁴⁷ In other words, the extent to which British firms faced bank credit constraints seems to be limited. British banks were not involved with the management decisions of companies, but the degree to which (German) universal banks did so was also limited.⁴⁸ Moreover, if British banks hardly ever invested in industrial equities, German banks only did so very rarely.⁴⁹ At least from a comparative perspective, the case for deficiencies in British banking is thus greatly weakened.

With regards to capital markets, in most countries smaller firms would seek capital privately, and rely on retained profits for funding long-term capital expenditures.⁵⁰ Needs for significant amounts of external capital only became relevant as firms grew in scale, and could no longer rely on informal capital markets. But on the eve of WW1, the British economy primarily consisted of small firms. Whether finance had a role to play in this outcome, or whether the formal financing of domestic industry was limited in scope because of the size of firms, is not easily answered using purely historical accounts. Economic historians have

45. Caroline Fohlin, 'Universal Banking in Pre-World War I Germany: Model or Myth?', *Explorations in Economic History* 36, no. 4 (1999): 305–343.

46. Michael Collins, 'English Bank Development within a European Context, 1870–1939', *The Economic History Review* 51, no. 1 (1998): 1–24. However, British banks rarely lent for fixed capital investment.

47. Forrest Capie and Michael Collins, 'Industrial Lending by English Commercial Banks, 1860s–1914: Why Did Banks Refuse Loans?', *Business History* 38, no. 1 (1996): 26–44; Forrest Capie and Michael Collins, 'Banks, Industry and Finance, 1880–1914', *Business History* 41, no. 1 (1999): 37–62.

48. Jeremy Edwards and Sheilagh Ogilvie, 'Universal Banks and German Industrialization: A Reappraisal', *The Economic History Review* 49, no. 3 (1996): 427–446; Fohlin, 'Universal Banking'.

49. However, there were significant exceptions on the continent. For example, Belgian banks held a significant amount of industrial shares in their portfolios. See: Tilly, 'Universal Banking', 11–12.

50. Robert Cull *et al.*, 'Historical Financing of Small-and Medium-Size Enterprises', *Journal of Banking & Finance* 30, no. 11 (2006): 3017–3042.

nevertheless argued that the lack of access to large markets for mass-produced goods - not other factors such as a lack of finance - was behind the small scale of the typical British firm's operations.⁵¹

Additionally, there is no evidence of British investors showing a 'foreign bias': they did not irrationally eschew domestic securities and favour foreign ones.⁵² Instead, investors quite rationally diversified their portfolios in order to benefit from higher expected risk-adjusted returns from foreign securities.⁵³ There is little evidence that such foreign investment crowded out domestic enterprises seeking funds on the capital markets.⁵⁴ Instead, savings tended to flow abroad during times of domestic economic weakness, when the incentives to invest domestically were lower.⁵⁵

Britain benefited from having a remarkably stable financial system after the 1880s, whereas financial crises were a frequent occurrence in other countries during the late 19th century. The costs of financial instability should be factored in when assessing the benefits of the financial sector to the economy. Before large banks with national branch networks were formed, and before banks adopted more prudent business practices, even Britain experienced frequent banking crises: 1810, 1825, 1836, 1847, 1857, 1866 and 1878.⁵⁶ To some extent, it was the experience with the crises of 1866 and 1878 that spurred banks to become more conservative in their lending practices, to adopt a more transactional, arms-length, approach to dealing with clients, and to allocate a smaller share of their resources to loans to industrial customers.⁵⁷ Yet herein lies an unresolved issue in British financial history: did the same banking practices that led to financial stability come at a cost

51. For a review of the literature, see: Crafts, 'Economic Growth'.

52. Michael Edelstein, 'Foreign Investment, Accumulation and Empire, 1860-1914', in *The Cambridge Economic History of Modern Britain*, ed. Roderick Floud and Paul Johnson (Cambridge: Cambridge University Press, 2004), 190-226.

53. William N Goetzmann and Andrey D Ukhov, 'British Investment Overseas 1870-1913: A Modern Portfolio Theory Approach', *Review of Finance* 10, no. 2 (2006): 261-300; Benjamin R Chabot and Christopher J Kurz, 'That's Where the Money Was: Foreign Bias and English Investment Abroad, 1866-1907', *The Economic Journal* 120, no. 547 (2010): 1056-1079.

54. Edelstein, 'Foreign Investment'.

55. Mauro Rota and Francesco Schettino, 'The Long-Run Determinants of British Capital Exports, 1870-1913', *Financial History Review* 18, no. 01 (2011): 47-69.

56. Turner, *Banking in Crisis*, Ch. 4. The City of Glasgow bank crisis of 1878 was not a major crisis across the UK (although it was in Scotland), while the Baring crisis in 1890 hardly affected domestic commercial banks.

57. Collins and Baker, *Commercial Banks*, 83-91.

for the economy? Collins and Baker consider the evidence of growing conservatism in lending practices consistent with the notion that banks became less supportive of industry, although given the limited evidence of firms facing credit constraints, they do not go as far as to argue that bank conservatism stifled economic growth.⁵⁸

Overall, economic historians have taken an increasingly forgiving, albeit cautious, view of the British banking system and capital markets as it pertains to their contribution to the economy. The financial system did have some weaknesses, which will be discussed in the chapters below, but there is little evidence of firms facing substantial financial constraints. However, clear gaps remain in the literature. Namely, the quantitative aspects of the link between finance and growth warrant much more attention. In this respect, the literature on pre-WWI Britain is particularly lagging behind research on the US and several other European cases. A further gap in the literature is that it has given little attention to the role of more specialised types of financial institutions, other than commercial banks and stock markets. We know little about the economic role of merchant banks, although they are known to have helped finance a large amount of British trade, and in this way might have promoted economic growth. Regional aspects of British finance and growth are also yet to be explored in sufficient detail, although economic historians and economists have highlighted several benefits to using geographically disaggregated data for studying the impact of financial development.⁵⁹ The economic importance of provincial stock exchanges - exchanges outside London - has hardly been studied at all, although they collectively formed a significant part of the domestic capital market.

Given the amount of work that has gone into studying the historical features of various aspects of the British financial system from a qualitative perspective, this thesis will focus on quantitative aspects, where the scope for originality is considerably greater. A quantitative framework is suited for answering the re-

58. Ibid., 203-219; 251-258; Mae Baker and Michael Collins, 'English Commercial Bank Stability, 1860-1914', *Journal of European Economic History* 31, no. 3 (2002): 493-493; Mae Baker and Michael Collins, 'Financial Crises and Structural Change in English Commercial Bank Assets, 1860-1913', *Explorations in Economic History* 36, no. 4 (1999): 428-444.

59. See, for example: Iftekhar Hasan, Michael Koetter and Michael Wedow, 'Regional Growth and Finance in Europe: Is There a Quality Effect of Bank Efficiency?', *Journal of Banking & Finance* 33, no. 8 (2009): 1446-1453; Jaremski, 'National Banking's Role'; Fabio Braggion, Narly Dwarkasing and Lyndon Moore, 'Nothing Special About Banks: Competition and Bank Lending in Britain, 1885-1925', *The Review of Financial Studies*, 2017, 3502-3537.

search questions of this thesis, as it is helpful for ascertaining the direction and significance of a causal relationship between finance and growth. After all, the financial sector's growth may have been a mere symptom of economic growth. And if financial development did affect economic growth, what was the size and the magnitude of this effect? Even an approximate answer to these questions will greatly improve our understanding of the role that finance played in the British economy, while making it easier to compare the British case with findings from other historical and modern cases.

Theoretical Background on Finance and Growth

This section outlines the main findings from the theoretical literature on the relationship between financial and economic development. The overview is general, and more in-depth discussions on relevant points and the empirical literature will be provided in the chapters ahead.

The theoretical literature on the links between the financial sector and the real economy has expanded considerably since the 1980s, when the financial sector began to be incorporated into several endogenous economic growth models.⁶⁰ These models allow the financial sector's growth to be influenced by economic growth, and vice versa. Some of these contributions are formalisations of old ideas, but theoretical advances have also provided new perspectives on the topic. In particular, novel insights have been gained through the application of the concept of asymmetric information to financial markets. In this context, asymmetric information exists when one party to a financial contract or transaction has more knowledge than another. For example, borrowers know more about their firms' prospects than lenders do, making it more difficult for lenders to discriminate between borrowers who are creditworthy and ones who are not. Moreover, lenders need to ensure that their funds are not diverted into projects that are either wasteful or extremely risky. An important function of financial intermediaries is to reduce the costs that arise from asymmetric information. By doing so, they

60. For a review, see: Levine, 'Finance and Growth'.

influence investment and savings decisions that are taken in an economy.⁶¹

The concept of financial development is not adequately captured by one indicator or criterion. Instead, there are several functions performed by the financial sector that can support economic development. Levine puts these into five general categories.⁶² These are as follows:

1. Mobilising and pooling savings to productive investment;
2. Facilitating diversification, trading and thus, the management of risk;
3. Producing information about potential investments and screening borrowers, thus improving the efficiency of capital allocation;
4. Enhancing corporate governance and the enforcement of contracts;
5. Facilitating the exchange of goods and services by improving the system of payments, and by financing transactions.

Financial development occurs when the financial sector becomes better at performing these functions.⁶³ Note that each function relates to two more general channels through which the financial sector can contribute to economic growth: improving capital accumulation; or improving productivity and innovation.⁶⁴

Perhaps the most intuitive of these ways is the act of mobilising and pooling of savings for productive investment.⁶⁵ Banks enjoy economies of scale in the costly process of collecting deposits from several savers. They can therefore specialise in lending these funds for productive purposes as parts of well-diversified and liquid

61. Joseph E Stiglitz and Andrew Weiss, 'Incentive Effects of Terminations: Applications to the Credit and Labor Markets', *The American Economic Review* 73, no. 5 (1983): 912–927; Bengt Holmström and Jean Tirole, 'Market Liquidity and Performance Monitoring', *Journal of Political Economy* 101, no. 4 (1993): 678–709; Bengt Holmström and Jean Tirole, 'Financial Intermediation, Loanable Funds, and the Real Sector', *the Quarterly Journal of economics* 112, no. 3 (1997): 663–691.

62. Levine, 'Finance and Growth'.

63. Here, I follow the widely accepted definition by Levine. See: Ibid., 869–870. See also: Martin Čihák *et al.*, 'Financial Development in 205 Economies, 1960 to 2010', *Journal of Financial Perspectives* 1, no. 2 (2013): 17–36.

64. This point is highlighted by Ang, 'Survey'. See also: Nieuwerburgh, Buelens and Cuyvers, 'Stock Market Development'.

65. Valerie R Bencivenga and Bruce D Smith, 'Financial Intermediation and Endogenous Growth', *The Review of Economic Studies* 58, no. 2 (1991): 195–209.

portfolios. Likewise, stock markets allow investors to pool their resources into ventures through buying shares. The importance of pooling resources is demonstrated by an influential model by Acemoglu and Zilibotti, where high-risk projects require large, *indivisible* lump-sum investments. These projects would not be financed if everyone managed their own, relatively small portfolios. Intermediaries possessing larger resources, collected from several savers, can undertake large lump-sum investments while maintaining diversified portfolios, thus improving the allocation of resources within an economy.⁶⁶

Savers can be induced to pool their funds if financial intermediaries allow them to earn higher risk-adjusted returns through portfolio diversification. Modern portfolio theory posits that investors can expect to earn superior risk-adjusted returns by owning a well-diversified portfolio of securities, instead of a few individual securities. Yet, creating such a portfolio is difficult for individuals with comparatively little capital, especially when investments are indivisible. If investors are not able to pool their resources into diversified portfolios, they may prefer to allocate all of their funds to low-risk, low return investments. In the context of the real economy, portfolio diversification (for example, of a bank's loans) can lead to the channelling of resources to high risk, high-return projects, which in the long run can be beneficial for economic growth.⁶⁷ More innovative ventures tend to be risky, but intermediaries can help allocate a part of their funds to such projects, while diversifying some of the underlying risk away.⁶⁸

A related way in which financial intermediaries and markets allow investors to reduce the risk of their portfolios is through liquidity transformation. If investors are unwilling to commit a significant share of their savings to projects which pay off after a long time, they may limit themselves to low-risk but liquid investments. Financial intermediaries make claims to long-gestation projects easily tradable, for example in the form of shares of companies, inducing investors to allocate some

66. Daron Acemoglu and Fabrizio Zilibotti, 'Was Prometheus Unbound by Chance? Risk, Diversification, and Growth', *Journal of Political Economy* 105, no. 4 (1997): 709–751.

67. Jeremy Greenwood and Boyan Jovanovic, 'Financial Development, Growth, and the Distribution of Income', *Journal of Political Economy* 98, no. 5, Part 1 (1990): 1076–1107; Gilles Saint-Paul, 'Technological Choice, Financial Markets and Economic Development', *European Economic Review* 36, no. 4 (1992): 763–781; Maurice Obstfeld, 'Risk-Taking, Global Diversification, and Growth', *The American Economic Review*, 1994, 1310–1329.

68. Acemoglu and Zilibotti, 'Prometheus'; Robert G King and Ross Levine, 'Finance, Entrepreneurship and Growth', *Journal of Monetary Economics* 32, no. 3 (1993): 513–542.

of their funds in these.⁶⁹ A similar logic applies to bank deposits: banks provide loans for several months or years, yet depositors can withdraw their funds at a short notice.⁷⁰

The portfolio diversification channel is one possible mechanism that links the financial sector to economic growth in Britain in 1850-1913, as banks generally lent to a large set of customers with varying degrees of risk.⁷¹ The channel could also have worked through the capital markets, as far as funds were raised by domestic companies. Moreover, the substantial size of the banking sector, along with the depth of the capital market, suggest that the maturity transformation channel could have increased economic growth. Savers could invest in assets (including bank deposits) with underlying maturities of several months or years, yet they could convert these same assets to cash at short notice.

Financial intermediaries can enhance the monitoring and enforcement of contracts, reducing costs associated with asymmetric information. Through monitoring of firms, they can induce managers to act in the investor's or lender's best interests, which increases the efficiency of how capital is employed in an economy. The prospect of having their funds being allocated better, in turn, increases the willingness of savers to invest their money.⁷² An example of how financial institutions enhance corporate governance occurs when firms try to raise new debt from banks or capital markets. If firms frequently apply for new external finance, managers are motivated to show, through their actions, that they are using it productively.⁷³ Aghion *et al.* show that in this way, debt markets reduce managerial slack (resources not being employed remuneratively) through reducing the idle cash balances that firms hold.⁷⁴ Financial institutions such as banks also help reduce the monitoring costs that savers face. In a seminal contribution, Diamond

69. Douglas W Diamond and Philip H Dybvig, 'Bank Runs, Deposit Insurance, and Liquidity', *Journal of Political Economy* 91, no. 3 (1983): 401–419; Ross Levine, 'Stock Markets, Growth, and Tax Policy', *The Journal of Finance* 46, no. 4 (1991): 1445–1465.

70. Franklin Allen and Douglas Gale, 'Financial Markets, Intermediaries, and Intertemporal Smoothing', *Journal of Political Economy* 105, no. 3 (1997): 523–546.

71. Capie and Collins, 'Industrial Lending'; Capie and Collins, 'Industry and Finance'.

72. Stiglitz and Weiss, 'Incentive Effects'.

73. Enhancing corporate governance refers to aligning the interest of (say) a company's managers and investors.

74. Philippe Aghion, Mathias Dewatripont and Patrick Rey, 'Competition, Financial Discipline and Growth', *The Review of Economic Studies* 66, no. 4 (1999): 825–852.

outlines a model in which investors outsource monitoring and enforcement activities to financial intermediaries.⁷⁵ Because the effort in monitoring is not duplicated by each individual investor or saver, the costs of exerting corporate governance are reduced.

In a related vein, several models posit that financial intermediaries are able to allocate their funds more remuneratively than individuals, because they possess better information and expertise in evaluating borrowers and investees.⁷⁶ The productivity of capital is raised by intermediaries that channel resources to the most productive projects, which further increases the incentives of savers to invest.⁷⁷ Having more capital flow into the most productive firms, in turn, eventually translates into higher economic growth. Through scrutinising firms more closely, intermediaries may also reduce the amount of collateral that prospective borrowers need, thereby increasing the availability of finance to a larger set of lenders. The reason for this, according to an influential model by Holmström and Tirole, is that financial institutions are willing to substitute collateral requirements with improved information gathering.⁷⁸ For example, if a bank is absolutely convinced that a borrower will generate sufficient revenue to repay a loan, it might be willing to lend without additional forms of security. Substituting between information and physical collateral is particularly important for the financing of new and possibly more innovative firms, which might possess fewer tangible assets.⁷⁹

There are reasons to believe that banks enhanced corporate governance in Britain in the late 19th and early 20th centuries. Banks frequently reviewed and rolled over their short-term loans to customers.⁸⁰ This implied a constant threat for a borrower that its credit line could be extinguished if funds were used wastefully. Lines of credit also allowed new client-specific information to be obtained

75. Douglas W Diamond, 'Financial Intermediation and Delegated Monitoring', *The Review of Economic Studies* 51, no. 3 (1984): 393–414.

76. John H Boyd and Edward C Prescott, 'Financial Intermediary-Coalitions', *Journal of Economic Theory* 38, no. 2 (1986): 211–232; King and Levine, 'Finance, Entrepreneurship and Growth'; Luc Laeven, Ross Levine and Stelios Michalopoulos, 'Financial Innovation and Endogenous Growth', *Journal of Financial Intermediation* 24, no. 1 (2015): 1–24.

77. Greenwood and Jovanovic, 'Financial Development'.

78. Holmström and Tirole, 'Loanable Funds'.

79. Pierre-Richard Agénor and Otaviano Canuto, 'Access to Finance, Product Innovation and Middle-Income Traps', *Research in Economics* 71, no. 2 (2017): 337–355.

80. Mae Baker and Michael Collins, 'English Industrial Distress before 1914 and the Response of the Banks', *European Review of Economic History* 3, no. 01 (1999): 1–24.

frequently. The role of capital markets in improving corporate governance is more ambiguous. The law afforded investors limited protection from abuses by company directors or managers, and imposed only light financial reporting requirements on public companies.⁸¹ This might have lessened the ability of investors' to monitor and discipline a given company's management.

Banks play an important role in improving the efficiency of the payments system and the system of short-term credits. This function is at a centre of several important theoretical models. Kashyap *et al.* model banks as liquidity providers: their core function is to provide funds to help meet unpredictable needs for cash through lines of credit, which firms can rely on when needed.⁸² They suggest that banks lending on overdrafts are some of the cheapest providers of short-term loans.⁸³ Therefore, a more developed banking sector allows firms to deploy their resources more efficiently, as they need to maintain smaller (unproductive) cash buffers in case of unexpected economic shocks.⁸⁴ British commercial banks, being primarily focused on short-term lending in the late 19th century, could have contributed to the economy in this manner.

Many recent theoretical contributions have linked banks' functioning as liquidity providers to economic growth. Aghion *et al.* consider this possibility in a model where firms face an uncertain economic environment. If the economy changes unexpectedly, firms face a sudden need for funds in order to adjust their operations to a new economic setting. To the extent that financial intermediaries are able to provide pre-agreed lines of credit, firms are more likely to invest in riskier, but higher return projects, which ultimately leads to more economic growth.⁸⁵ In such a setting, they also become less dependent on cash buffers, because pre-agreed lines

81. Gareth Campbell and John D Turner, 'Substitutes for Legal Protection: Corporate Governance and Dividends in Victorian Britain', *The Economic History Review* 64, no. 2 (2011): 571–597. This is discussed further in section 1.2.1.

82. Anil K Kashyap, Raghuram Rajan and Jeremy C Stein, 'Banks as Liquidity Providers: An Explanation for the Coexistence of Lending and Deposit-Taking', *The Journal of Finance* 57, no. 1 (2002): 33–73.

83. This is because deposits provide a cheap source of funding relative to what other intermediaries can obtain, while overdraft contracts require banks to maintain relatively small buffers of cash.

84. Bengt Holmström and Jean Tirole, 'Private and Public Supply of Liquidity', *Journal of Political Economy* 106, no. 1 (1998): 1–40.

85. Philippe Aghion *et al.*, 'Volatility and Growth: Credit Constraints and the Composition of Investment', *Journal of Monetary Economics* 57, no. 3 (2010): 246–265.

of credit provide firms the same type of insulation from adverse economic shocks that idle cash reserves do. At the same time, credit lines can be used just as normal loans, to finance firm growth.⁸⁶ However, as alluded to above, repeated current account transactions also provide banks with the ability to gather information about their clients at a high frequency.⁸⁷ The threat of revocation of credit lines can thus also function as a mechanism to prevent the wasteful use of the lender's funds.⁸⁸

The theories discussed above, when tested empirically, support the view that more developed financial systems lead to more economic growth, although these findings come with some qualifications. This empirical evidence has been gathered using a wide range of methodologies and approaches.⁸⁹ For reasons of economy of space these empirical studies will be discussed in the chapters that follow.

86. Karl V Lins, Henri Servaes and Peter Tufano, 'What Drives Corporate Liquidity? An International Survey of Cash Holdings and Lines of Credit', *Journal of Financial Economics* 98, no. 1 (2010): 160–176.

87. Eugene F Fama, 'What's Different About Banks?', *Journal of Monetary Economics* 15, no. 1 (1985): 29–39; Lars Norden and Martin Weber, 'Credit Line Usage, Checking Account Activity, and Default Risk of Bank Borrowers', *The Review of Financial Studies* 23, no. 10 (2010): 3665–3699.

88. Viral Acharya *et al.*, 'Credit Lines as Monitored Liquidity Insurance: Theory and Evidence', *Journal of Financial Economics* 112, no. 3 (2014): 287–319.

89. For reviews, see: Valickova, Havranek and Horvath, 'Financial Development'; Levine, 'Finance and Growth'; Thorsten Beck, 'The Econometrics of Finance and Growth', in *Palgrave Handbook of Econometrics*, ed. T Mills and K Patterson, vol. 2 (Basingstoke: Palgrave Macmillan, 2009), 1180–1209.

Chapter 1

Stock Markets, Banks and the Economy, 1850-1913

Chapter Summary

This chapter investigates whether stock markets and banks played a role in British economic growth from 1850 to 1913, or whether financial development followed economic growth. In order to answer this question, it uses a new dataset on paid-in capital of domestic firms listed on British stock exchanges, and exploits recent developments in time series econometrics. These econometric techniques allow us to examine potential changes in the relationship between the financial sector and the economy over time. The results suggest that the growth of the stock markets and that of the banking sector had little impact on economic growth.

1.1 Introduction

Economic historians have generally taken a cautious view about the role of commercial banks and stock markets in late 19th century British economic growth. The London Stock Exchange raised vast amounts of capital for domestic and foreign railways, as well as foreign firms and governments, but the same cannot be said about its contribution to domestic industry - at least before the 1880s.¹ Commercial banks were preoccupied with short-term lending for working capital expenditures, and their lending practices became increasingly conservative over time.² At the same time, historians have argued that most firms could easily cover their long-term financing needs through private means and through reinvested profits, and that capital was generally forthcoming from the stock markets when it was needed.³ However, discussions about the role of financial institutions in British economic growth, especially when it comes to the stock markets, have

1. Sidney Pollard, 'Capital Exports, 1870-1914 Harmful or Beneficial?', *The Economic History Review* 38, no. 4 (1985): 489-514.

2. Mae Baker and Michael Collins, 'Financial Crises and Structural Change in English Commercial Bank Assets, 1860-1913', *Explorations in Economic History* 36, no. 4 (1999): 428-444.

3. Michael Collins, *Money and Banking in the UK: A History* (London: Croom Helm, 1988), 116-117; Michael Collins, *Banks and Industrial Finance in Britain: 1800-1939* (London: Macmillan, 1991), 32-36; Philip L Cottrell, 'Domestic Finance, 1860-1914', in *The Cambridge Economic History of Modern Britain*, ed. Roderick Floud and Paul Johnson (Cambridge: Cambridge University Press, 2004), 253-279; Ranald C Michie, 'The London Stock Exchange and the British Securities Market 1850-1914', *The Economic History Review* 38, no. 1 (1985): 61-82.

still largely revolved around the availability of long-term finance. This appears to be a symptom of the disconnect between the historical and economic literature on finance and growth.

Mobilising savings for investment is just one of the several channels through which financial intermediaries can influence economic growth, and historical evaluations of their role should take this into account.⁴ The theoretical and empirical macroeconomic literature suggests that financial intermediaries can improve economic performance through fostering productivity growth, rather than just capital deepening.⁵ Indeed, after the 1960s, the causal link from financial development to economic growth has not tended to run through capital accumulation.⁶ Even if financial development is important for investment, it often enhances economic performance by increasing the productivity of capital employed, rather than the amount of capital that is invested.⁷

This chapter builds upon the empirical literature on finance and growth in economic history. This is an active area of research, and several econometric studies on 19th century Germany, Sweden and Belgium have found a link between the growth of the financial sector and the economy.⁸ To the best of my knowledge, Rousseau and Wachtel are the only ones to have used time series econometrics to study finance and growth in the UK before WW1, although their sample only

4. See the introduction to this thesis.

5. For a review, see: Ross Levine, 'Financial Development and Economic Growth: Views and Agenda', *Journal of Economic Literature*, 1997, 688–726; Ross Levine, 'Finance and Growth: Theory and Evidence', in *Handbook of Economic Growth*, ed. P Aghion and S Durlauf, vol. 1 (Amsterdam: Elsevier, 2005), 865–934.

6. Thorsten Beck, Ross Levine and Norman Loayza, 'Finance and the Sources of Growth', *Journal of Financial Economics* 58, no. 1 (2000): 261–300.

7. Inessa Love and Lea Zicchino, 'Financial Development and Dynamic Investment Behavior: Evidence from Panel VAR', *The Quarterly Review of Economics and Finance* 46, no. 2 (2006): 190–210.

8. See e.g. Pontus Hansson and Lars Jonung, 'Finance and Economic Growth: The Case of Sweden 1834–1991', *Research in Economics* 51, no. 3 (1997): 275–301; Anders Ögren, 'Financial Revolution and Economic Modernisation in Sweden', *Financial History Review* 16, no. 01 (2009): 47–71; Carsten Burhop, 'Did Banks Cause the German Industrialization?', *Explorations in Economic History* 43, no. 1 (2006): 39–63; Katharina Diekmann and Frank Westermann, 'Financial Development and Sectoral Output Growth in Nineteenth-Century Germany', *Financial History Review* 19, no. 2 (2012): 149–174; Stijn Van Nieuwerburgh, Frans Buelens and Ludo Cuyvers, 'Stock Market Development and Economic Growth in Belgium', *Explorations in Economic History* 43, no. 1 (2006): 13–38.

covers the years after 1880, and they exclude stock markets from their study.⁹ A recent working paper by D’Onofrio and Rousseau incorporates UK data from 1870 to 1929 into a panel time series study on broad money, trade and growth, but the authors present little detail on finance and growth which is specific to the UK.¹⁰ This chapter thus constitutes the first study on the role of the stock markets in British economic growth during the period 1850-1913, while also exploring the banking sector’s role during an earlier period than previous econometric studies on this topic.

A significant limitation of many of the existing contributions on this topic is that their models assume a linear and continuous relationship between the financial sector and the economy. British financial history for the period 1850-1913, however, implies that the relationship between the financial sector and the economy is likely to have changed considerably as stock markets started listing more British industrial undertakings, and as the banking sector expanded in size but became more risk-averse. Indeed, in modern times, the link between financial sector development and economic growth has not been stable.¹¹ For example, it has been claimed that as a financial system becomes large enough, its growth may become inconsequential for economic growth.¹²

This chapter utilises recent developments in time series econometrics to test if stock markets or commercial banks contributed to British economic growth from 1850 to 1913. The models are able to account for potential changes in the relationship between finance and growth, and to factor in the ongoing structural change in the economy and the financial system. To obtain a suitable indicator for stock market development, a new dataset on the paid-in capital of securities listed on British stock exchanges is used. Tests for Granger-causality, which have been applied commonly in the finance and growth literature, provide little evidence of

9. Peter L Rousseau and Paul Wachtel, ‘Financial Intermediation and Economic Performance: Historical Evidence from Five Industrialized Countries’, *Journal of Money, Credit and Banking* 30, no. 4 (1998): 657–78.

10. Alexandra D’Onofrio and Peter L Rousseau, ‘Financial Development, Trade Openness and Growth in the First Wave of Globalization’ (2016), Working Paper, available at SSRN: <http://dx.doi.org/10.2139/ssrn.2804072>.

11. Peter L Rousseau and Paul Wachtel, ‘What is Happening to the Impact of Financial Deepening on Economic Growth?’, *Economic Inquiry* 49, no. 1 (2011): 276–288.

12. Siong Hook Law and Nirvikar Singh, ‘Does Too Much Finance Harm Economic Growth?’, *Journal of Banking & Finance* 41 (2014): 36–44.

banking-driven growth. At most, the growth of the banking sector and that of the economy were mutually reinforcing. The development of the stock markets did not have a significant impact on the economy. There is also no evidence that stock markets or banks influenced subsequent capital accumulation. Instead, in a manner consistent with previous literature on postwar data, banks primarily influenced the economy's productivity levels. Yet even this result is statistically weak. More advanced models provide even less evidence of financial intermediaries having influenced economic growth.

1.2 Historical Features of the Financial System

1.2.1 Stock Markets

The London Stock Exchange was the world's leading securities market throughout the period 1850-1913.¹³ Despite its considerable size, it was primarily a market for public debt and railway securities until the late 19th century. This is illustrated in figure 1.1, which shows that until the mid-1880s, the paid-up capital of these two classes of securities accounted for over 90% of the total amount that was listed on the exchange.¹⁴ Foreign entities constituted a growing share of new listings, and by 1914, almost a third of the world's marketable securities could be traded in London.¹⁵ It was not until the 1890s that a significant number of domestic industrial companies started to be quoted on the exchange. These are included in the 'Commercial and industrial' category in the figure below.¹⁶ The amount of capital that companies in this category had raised from investors rose from £173m

13. Ranald C Michie, *The London Stock Exchange: A History* (Oxford: Oxford University Press, 1999), 70-74, 88; Youssef Cassis, *Capitals of Capital: A History of International Financial Centres, 1780-2005* (Cambridge: Cambridge University Press, 2006), 83, 98.

14. Paid-up capital refers to the amount of capital that has been raised from investors.

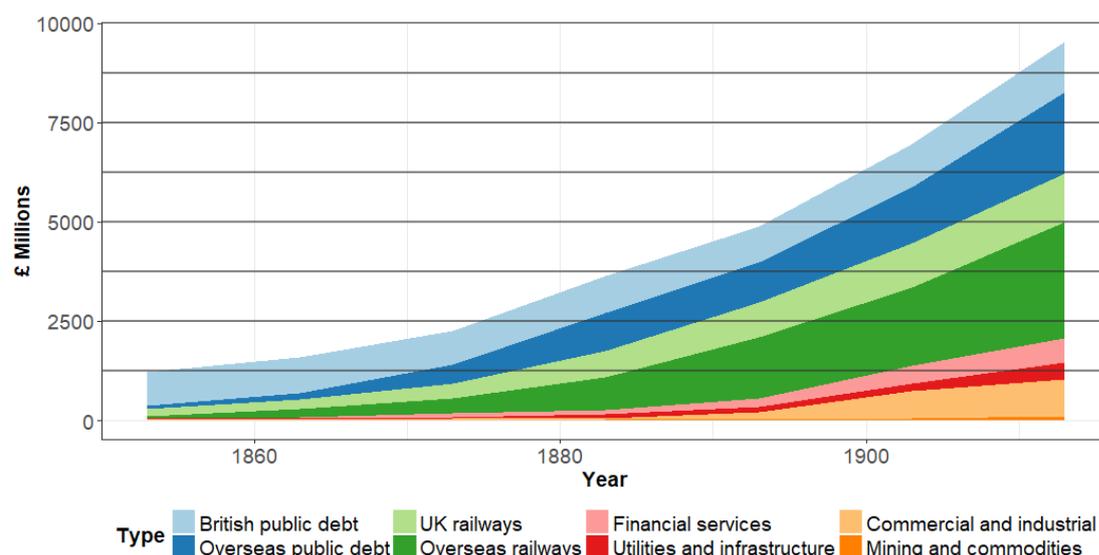
15. Larry Neal and Lance Davis, 'The Evolution of the Structure and Performance of the London Stock Exchange in the First Global Financial Market, 1812-1914', *European Review of Economic History* 10, no. 3 (2006): 279-300.

16. However, this category also includes some foreign companies, or British companies primarily operating abroad. See: Ranald C Michie, *The London and New York Stock Exchanges 1850-1914* (London: Allen & Unwin, 1987), table 2.3.

(or 12% of UK GDP) in 1893 to £918m in 1913 (43% of GDP).¹⁷

Based on the limited listings of domestic enterprises, one might question the economic importance of the LSE before 1890. But for much of the period at issue, provincial exchanges played a significant role in providing markets for the securities of smaller domestic firms.¹⁸ In light of such specialisation, it is necessary to consider the operations of *all* British exchanges before making inferences about their economic impact. Yet, historians have thus far mainly examined London and provincial stock exchanges separately.¹⁹

Figure 1.1: Paid-up capital of securities listed on the London Stock Exchange, £ millions, 1853-1913



Source: Ranald C Michie, *The London Stock Exchange: A History* (Oxford: Oxford University Press, 1999), 88, table 3.2. The data is at 10-year intervals from 1853 to 1913. Public debt figures include both government debt and that of public bodies. The Commercial and industrial category also includes iron, steel coal and shipping companies, along with breweries and distilleries.

Before WW1, smaller British commercial enterprises primarily raised capital

17. The GDP figures are based on the balanced estimates by Solomos Solomou and Martin Weale, 'Balanced Estimates of UK GDP 1870–1913', *Explorations in Economic History* 28, no. 1 (1991): 54–63.

18. Ranald C Michie, 'The London and Provincial Stock Exchanges, 1799-1973: Separation, Integration, Rivalry, Unity', in *Enterprise and Management: Essays in Honour of Peter L. Payne*, ed. Peter Lester Payne, Derek Howard Aldcroft and Anthony Slaven (Aldershot: Scolar Press, 1995), 200-202; Cottrell, 'Domestic Finance', 267.

19. William Thomas, *Provincial Stock Exchanges* (London: Cass, 1975); Michie, *London and New York*.

through informal channels, such as the owners' personal contacts.²⁰ For many of these companies, it was often cheaper to do so, as underwriting services could be expensive.²¹ Nevertheless, companies that needed external capital from the stock markets - especially as they started growing larger - generally found it forthcoming.²² Even firms in riskier, but possibly more innovative industries, such as car manufacturing or electrical engineering, encountered relatively few problems raising funds.²³ According to Cottrell, this shows that lack of demand for external capital may have been the main cause of the low levels of industrial financing raised through the stock market before the 1890s.²⁴

At the outset, it is important to note that the core function of a stock exchange is to provide a secondary market for securities, not to raise new capital.²⁵ The latter function is often performed by institutions and actors *connected* to the stock market (such as company promoters), and *through* the market (such as initial public offerings).²⁶ But even secondary markets can be important for encouraging investment. Rousseau and Sylla argue that the incentives for raising new capital might be lower without stock markets, because markets make it easier for entrepreneurs to sell their shares onwards.²⁷ Prospective entrepreneurs thus have a means to 'cash out' if their ventures succeed. As pointed out in the introduction, stock markets may also increase the incentives for investors to fin-

20. *Ibid.*, 107-111.

21. Alexander Kirkland Cairncross, *Home and Foreign Investment, 1870-1913* (Cambridge: Cambridge University Press, 1953), 101.

22. Katherine Watson, 'The New Issue Market as a Source of Finance for the UK Brewing and Iron and Steel Industries, 1870-1913', in *The Evolution of Financial Institutions and Markets in Twentieth-Century Europe*, ed. Youssef Cassis, Gerald D Feldman and Ulf Olsson (Aldershot: Scolar Press, 1995), 211-248.

23. Ranald Michie, 'The Finance of Innovation in Late Victorian and Edwardian Britain: Possibilities and Constraints', *Journal of European Economic History* 17, no. 3 (1988): 491. Michie suggests that the main exception to this were industries where government regulations constituted a significant constraint, such as the case of telephones.

24. Philip L Cottrell, *Industrial Finance, 1830-1914: The Finance and Organization of English Manufacturing Industry* (London: Methuen, 1980), 187-188, 269-270; Cottrell, 'Domestic Finance'.

25. Peter L Rousseau and Paul Wachtel, 'Equity Markets and Growth: Cross-Country Evidence on Timing and Outcomes, 1980-1995', *Journal of Banking & Finance* 24, no. 12 (2000): 1933-1957; Michie, *London and New York*, 100-102.

26. Michie argues that this has been a major source of confusion in the historical literature on British capital markets. See: *Ibid.*

27. Peter L Rousseau and Richard Sylla, 'Emerging Financial Markets and Early US Growth', *Explorations in Economic History* 42, no. 1 (2005): 1-26.

ance enterprises, because they facilitate trading claims on projects which require a long-term commitment of capital, while at the same improving their ability to construct diversified portfolios. Moreover, they can also make it easier for groups of investors to monitor and instil discipline on company directors.²⁸ The institutional context of the capital markets may nevertheless have constrained their ability to perform some of these functions.

Despite the few apparent constraints on capital from the stock markets, the markets did suffer from some institutional weaknesses. Britain had little legislation for the purposes of protecting investors before WW1.²⁹ Minority shareholders could do little to monitor, let alone constrain the behaviour of directors or managers, and they could not individually sue a company's management for the misappropriation of resources.³⁰ Presumably, this would have increased the perceived riskiness of a whole host of securities, while diminishing the capital markets' ability to improve corporate governance. Furthermore, financial disclosure requirements of publicly traded companies were largely voluntary before 1900, and were very limited throughout the rest of the prewar years. By law, companies in only a few industries needed to publish balance sheets during initial public offerings (IPOs) before 1908. This made it more difficult for investors to evaluate potential investments and to monitor a given company's performance.³¹

Stock exchanges could themselves impose rules to make up for the limitations of existing legislation. Like other exchanges in Britain, the London Stock Exchange was a largely self-regulating organisation before 1914.³² Raising capital on the exchange could be done both through special settlement - an unregulated form - or through an official quotation, whereby the exchange put various requirements for an IPO.³³ These requirements included allotting at least two thirds of shares to the public, and a minimum capital requirement of £100,000. But even in the regulated form of IPOs, the stock exchange only required financial statements to

28. See the introduction of this thesis.

29. Julian Franks, Colin Mayer and Stefano Rossi, 'Ownership: Evolution and Regulation', *Review of Financial Studies* 22, no. 10 (2009): 4009–4056.

30. Ibid.

31. Leslie Hannah, 'Pioneering Modern Corporate Governance: A View from London in 1900', *Enterprise and Society* 8, no. 3 (2007): 642–686.

32. Neal and Davis, 'Evolution'.

33. Carsten Burhop, David Chambers and Brian Cheffins, 'Regulating IPOs: Evidence from Going Public in London, 1900–1913', *Explorations in Economic History* 51 (2014): 60–76.

be circulated in the early 1900s.³⁴

Economic historians have questioned if such legislative lacunae in the protection of investors had harmful consequences, and if self-regulatory approaches by the stock exchanges were sufficient to compensate for these weaknesses. Empirical evidence suggests that while the overall failure rate of London IPOs in 1900-1913 was similar to that found on modern stock markets, the failures of unregulated IPOs - the majority of new issues - was high, and their share price performance was typically poor.³⁵ In this sense, lack of shareholder protection was indeed harmful for investors, although stock exchange regulations could mitigate the issue.

If it was primarily smaller firms which resorted to unregulated IPOs, their high failure rate could have been related to problems with adverse selection. Investors may have become sceptical of any new issues, owing to the difficulty of evaluating their prospects. Such scepticism would have translated into the costs of raising capital, potentially affecting even better companies. It follows that high-quality companies may have been discouraged from seeking external funds, unless they qualified for an official quotation. This is supported by qualitative evidence, which indicates that a lack of regulations led to fraudulent practices in company promotion, such as misleading accounts, which increased public mistrust of domestic industrial issues.³⁶ Indeed, although most companies found capital forthcoming, there is some evidence of very small companies - ones that had to rely on unregulated IPOs - that occasionally experienced difficulties when trying to raise capital from the public in London.³⁷

A significant body of research argues that legal protection of shareholders is an

34. Ibid.

35. Ibid. The authors control for firm characteristics. Failure is measured as delisting within five years of the offering without compensation to the shareholders.

36. John Armstrong, 'The Rise and Fall of the Company Promoter and the Financing of British Industry', in *Capitalism in a Mature Economy: Financial Institutions, Capital Exports and British Industry, 1870-1939*, ed. J J van Helten and Y Cassis (Cambridge: Edward Elgar, 1990), 115-138; David Kynaston, *The City of London: Vol. II: Golden Years 1890-1914* (London: Chatto & Windus, 1996), 457-465.

37. AE Harrison, 'Joint-Stock Company Flotation in the Cycle, Motor-vehicle and related industries, 1882-1914', *Business History* 23, no. 2 (1981): 165-190. However, Harrison also acknowledged that these firms could meet the capital shortfall through subsequent share issues with more generous terms, or through bank lines of credit.

important determinant for the degree to which the public holds shares.³⁸ Identifying managers that are misallocating resources requires reliable financial reports, and rectifying the situation necessitates a legal system capable of enforcing contracts between managers and shareholders. Widespread share ownership in late 19th century Britain itself suggests that there were factors which mitigated issues with lacking legal protection of shareholders.³⁹ Indeed, in such environments, alternative (albeit imperfect) mechanisms to enhance corporate governance are often used. For example, Campbell and Turner show that high dividends were used to compensate for limited investor rights in the late 19th century.⁴⁰ Dividend payments are an observable measure of a firm's performance, and a company cannot pay excessive dividends for a prolonged period of time without increasing its debt burden or drawing on its productive assets. A high payout policy may furthermore leave managers with less capital to misallocate. Additionally, firms often enshrined rules into their articles of association that went beyond legal requirements. These regulated the extent to which shareholders were provided financial reports; what matters they could vote on; and set limitations on insider dealing.⁴¹ According to Acheson *et al.*, such measures were widely applied in late Victorian Britain, and may have allowed the stock markets to improve corporate governance.⁴²

The overarching view that may be drawn from the literature on this issue is that there were few observable constraints on stock market financing for domestic firms, with the caveat that the capital markets also suffered from certain institutional weaknesses. Nevertheless, the degree to which stock markets contributed to economic growth remains unclear. Additionally, since domestic enterprises started quoting on stock exchanges in increasing numbers towards the end of the 19th century, the relationship between stock markets and economic growth might not

38. Rafael La Porta *et al.*, 'Law and Finance', *Journal of Political Economy* 106, no. 6 (1998): 1113–11.

39. Graeme G Acheson *et al.*, 'Corporate Ownership and Control in Victorian Britain', *The Economic History Review*, 2015, Graeme G Acheson *et al.*, 'Corporate Ownership, Control, and Firm Performance in Victorian Britain', *The Journal of Economic History* 76, no. 1 (2016): 1–40; Franks, Mayer and Rossi, 'Ownership: Evolution and Regulation'.

40. Gareth Campbell and John D Turner, 'Substitutes for Legal Protection: Corporate Governance and Dividends in Victorian Britain', *The Economic History Review* 64, no. 2 (2011): 571–597.

41. Graeme G Acheson, Gareth Campbell and John D Turner, 'Common Law and the Origin of Shareholder Protection', *Queen's University Centre for Economic History Working Paper*, no. 04 (2016).

42. *Ibid.*

have been constant over time.

1.2.2 Commercial Banks

British commercial banking expanded rapidly in the late 19th century. Even as the last restrictive pieces of legislation had been removed by the 1860s, several other changes in the banking system may have influenced its contribution to economic growth. Banks became larger through increased branching and merger activity, but amalgamations of banks also increased the prevalence of collusive practices. And while the resources that banks had at their disposal increased, the share of their assets lent to businesses declined.

Commercial banks reduced their private sector lending considerably after the 1870s. There was a sharp increase in the safety and liquidity of bank balance sheets after the City of Glasgow Bank failure in 1878.⁴³ The crisis left most of the bank's shareholders bankrupt, and was followed by most commercial banks limiting the liability of their owners by 1885.⁴⁴ Although the crisis itself may have been sufficient to increase bank conservatism, the adoption of a new legal structure also contributed to bank prudence. In the absence of deposit insurance, limited liability banks had to convince depositors that their money was safe, as depositors could no longer rely on the private wealth of shareholders in case their bank failed. To do so, limited liability banks maintained higher ratios of capital to liabilities than did banks with unlimited liability.⁴⁵ As long as depositors were satisfied in their bank's safety, limited liability could have induced banks to take additional risks. But this incentive to increased risk-taking was counterbalanced by the practice of retaining uncalled capital: capital which the bank could demand from shareholders when needed. To avoid having to do so, bank shareholders still had every incentive to ensure their banks were prudent, which led to banks lending

43. Baker and Collins, 'Financial Crises and Structural Change'.

44. John D Turner, 'the Last Acre and Sixpence': Views on Bank Liability Regimes in Nineteenth-Century Britain', *Financial History Review* 16, no. 02 (2009): 111–127.

45. Graeme G Acheson and John D Turner, 'The Death Blow to Unlimited Liability in Victorian Britain: The City of Glasgow Failure', *Explorations in Economic History* 45, no. 3 (2008): 251–252.

less relative to their assets.⁴⁶

Previous experiences of crises and the adoption of limited liability may not have been the only factors increasing the conservatism of bankers in the late 19th century. Private and small joint-stock banks were typically absorbed into larger banks through the merger waves of the 1880s and 1890s, which coincided with the creation of large bank branch networks across the country.⁴⁷ This mattered, because smaller provincial banks, along with (typically smaller) private banks, tended to commit a larger share of their assets to private sector lending.⁴⁸ As will be discussed in the third chapter, the largest banks needed to codify lending rules in order to manage the risk that was taken at hundreds of different branches, which might have led to less flexible lending practices.⁴⁹

According to Grossman, increased concentration rendered banks inefficient in allocating capital by relieving them of competitive pressures, while allowing them to maintain significantly more conservative balance sheets.⁵⁰ There were certainly potential advantages to banking sector consolidation, as larger banks could enjoy higher economies of scale by economising on administrative overheads.⁵¹ Yet, having fewer competitors also encouraged collusive behaviour of the largest London-based banks. For example, these banks agreed to fix the interest rate on deposits in the three decades before WW1.⁵² Additionally, banks in counties with less competitive banking sectors constrained their lending to certain types of customers,

46. Richard S Grossman and Masami Imai, 'Contingent Capital and Bank Risk-Taking Among British Banks before the First World War1', *The Economic History Review* 66, no. 1 (2013): 132–155.

47. Cottrell, 'Domestic Finance', 255, 270-273; Richard S Grossman, 'Rearranging Deck Chairs on the Titanic: English Banking Concentration and Efficiency, 1870–1914', *European Review of Economic History* 3, no. 3 (1999): 323–349.

48. Michael Collins and Mae Baker, 'Sectoral Differences in English Bank Asset Structures and the Impact of Mergers, 1860-1913', *Business History* 43, no. 4 (2001): 1–28.

49. Lucy Newton, 'Regional Bank–Industry Relations During the Mid-Nineteenth Century: Links between Bankers and Manufacturing in Sheffield, C. 1850 to C. 1885', *Business History* 38, no. 3 (1996): 64–83; Victoria Barnes and Lucy Newton, 'How Far Does the Apple Fall from the Tree? The Size of English Bank Branch Networks in the Nineteenth Century', *Business History*, 2017, 1–27.

50. Grossman, 'Rearranging'.

51. Joseph Sykes, *The Amalgamation Movement in English Banking, 1825-1924* (London: P.S. King & Son, 1926), 56-59. This will also be discussed in more depth in the third chapter.

52. Charles A E Goodhart, *The Business of Banking, 1891–1914* (London: Weidenfeld / Nicolson, 1972), 178-179.

while requiring more collateral from borrowers.⁵³

Notwithstanding the fact that banks were generally conservative, in a series of contributions, Baker and Collins have argued that there were several positive aspects related to the developments in late 19th century banking. Banks were indeed preoccupied with short-term lending during the latter half of the 19th century, but they would commonly roll these loans over.⁵⁴ This practice made it easy to gather information about customers at frequent intervals, while reducing agency problems, as customers had to prove repeatedly that loans were used for productive purposes.⁵⁵ Rolling over short-term loans thus made it possible to lend to a wider range of customers - even riskier ones - while offering flexible loan terms if problems arose.⁵⁶ Nevertheless, this was only thanks to the maintenance of a transactional approach to customer relationships, coupled with increasingly liquid loan portfolios. This inevitably translated into a smaller share of banks' resources dedicated to loans for firms.⁵⁷

Commercial banks' increased reliance on London's financial and money markets, where they could buy securities and make short-term loans to obtain higher returns on their near-cash holdings, may have improved the stability of the banking system.⁵⁸ However, Baker and Collins suggest that this same development could have made banks less supportive of British industry, as an increasing share of their resources was allocated elsewhere.⁵⁹ This question will be examined in more detail in the following chapter. However, as mentioned above, there is little evidence of constraints on commercial bank credit for firms, as short-term loans

53. Fabio Braggion, Narly Dwarkasing and Lyndon Moore, 'Nothing Special About Banks: Competition and Bank Lending in Britain, 1885–1925', *The Review of Financial Studies*, 2017, 3502–3537.

54. Michael Collins, 'English Bank Development within a European Context, 1870–1939', *The Economic History Review* 51, no. 1 (1998): 1–24.

55. Michael Collins and Mae Baker, *Commercial Banks and Industrial Finance in England and Wales, 1860-1913* (Oxford: Oxford University Press, 2003), 251-252.

56. Mae Baker and Michael Collins, 'English Industrial Distress before 1914 and the Response of the Banks', *European Review of Economic History* 3, no. 01 (1999): 1–24.

57. Ibid.; Mae Baker and Michael Collins, 'English Commercial Bank Stability, 1860-1914', *Journal of European Economic History* 31, no. 3 (2002): 493–493.

58. Mae Baker, Caroline Eadsforth and Michael Collins, 'Avoiding Toxic Assets and Ensuring Bank Stability: English Commercial Bank Investments, 1880–1910', *Business History* 51, no. 6 (2009): 854–874; John D Turner, *Banking in Crisis: The Rise and Fall of British Banking Stability, 1800 to the Present* (Cambridge: Cambridge University Press, 2014), 180.

59. Baker and Collins, 'Financial Crises and Structural Change'.

were generally easy to obtain.⁶⁰ Notwithstanding the evidence that banking sector concentration led to some instances of local credit constraints, banks appear to have rejected a rather small percentage of loan applications.⁶¹ Nevertheless, a large share of rejected loan applications in the late 19th century came from young firms, which may have been more innovative, despite their riskiness.⁶² Bankers sometimes refused these loans, because bank managers were sceptical of certain industries, or because firms in emerging sectors could not offer sufficient collateral or evidence of stable cash flows.⁶³ But rejecting some customers with uncertain cash flows appears to be sound banking practice, rather than excessive conservatism, especially since we observe that a large majority of firms found bank loans forthcoming.

As the literature on banking now stands, we know a good deal about the lending practices of British banks, and about their relationships with certain classes of borrowers. But as is the case for the stock market, we do not have a rigorous understanding of the macroeconomic impact of their operations.

1.3 Empirical Literature on Finance and Growth

A large number of empirical studies, based on post-WW2 data, have found evidence of a relationship between financial development and economic growth.⁶⁴ A seminal study in this field was conducted by King and Levine, who used cross-country growth regressions to show that the level of financial development was

60. Forrest Capie and Michael Collins, 'Banks, Industry and Finance, 1880–1914', *Business History* 41, no. 1 (1999): 37–62.

61. Forrest Capie and Michael Collins, 'Industrial Lending by English Commercial Banks, 1860s–1914: Why Did Banks Refuse Loans?', *Business History* 38, no. 1 (1996): 26–44. Of course, customers who knew they could not get loans may have been discouraged from applying.

62. Ibid.

63. Collins and Baker, *Commercial Banks*, 208–219.

64. See: Levine, 'Finance and Growth' and James B Ang, 'A Survey of Recent Developments in the Literature of Finance and Growth', *Journal of Economic Surveys* 22, no. 3 (2008): 536–576 for surveys of the literature. For recent meta-analyses of the research, see: Petra Valickova, Tomas Havranek and Roman Horvath, 'Financial Development and Economic Growth: A Meta-Analysis', *Journal of Economic Surveys* 29, no. 3 (2015): 506–526 and Philip Arestis, Georgios Chortareas and Georgios Magkonis, 'The Financial Development and Growth Nexus: A Meta-Analysis', *Journal of Economic Surveys* 29, no. 3 (2015): 549–565.

correlated with subsequent economic growth in the years 1960-1989, even when several other factors associated with economic development (such as education or political stability) are controlled for.⁶⁵ Rousseau and Sylla perform similar growth regressions on historical data in a study of 17 countries over the period 1850-1997. They show that the ratio of broad money to GDP was associated with subsequent economic growth through several sub-periods in their sample, especially during the years 1850-1929.⁶⁶

A shortcoming of standard cross-country regressions is that they are rarely useful for making claims about causality. Suppose, for example, that a country's banking sector expands rapidly in a given year, followed by rapid economic expansion in a subsequent period. Did the financial sector grow because bankers expected the economy to expand, or did the economy expand because the financial sector grew? It is difficult to exclude the former possibility *ex ante*, which means that the growth of the financial sector is said to be *endogenous* to economic growth. Causal statements about finance and growth can be made by examining the impact of the exogenous component of financial development, which is the part that cannot be explained by other factors, such as economic fundamentals. Early attempts to make causal inferences used instrumental variables for financial development, such as a country's legal origin, finding that earlier results from cross-national regressions remain largely valid.⁶⁷

Researchers have subsequently refined their approach to studying finance and

65. Robert G King and Ross Levine, 'Finance, Entrepreneurship and Growth', *Journal of Monetary Economics* 32, no. 3 (1993): 513-542. The authors measure financial development by either bank credit divided by bank and central bank domestic assets; bank liquid liabilities to GDP; or credit to the private sector to GDP.

66. Peter L Rousseau and Richard Sylla, 'Financial Systems, Economic Growth, and Globalization', in *Globalization in Historical Perspective*, ed. Michael D Bordo, Alan M Taylor and Jeffrey G Williamson (Chicago: University of Chicago Press, 2003), 373-416. The authors' results are robust to using the rate of inflation as an instrument.

67. Ross Levine, 'The Legal Environment, Banks, and Long-Run Economic Growth', *Journal of Money, Credit and Banking*, 1998, 596-613. The logic behind this instrumental variable is that different legal systems - such as common law or civil law - impact the growth of the financial system differently. See: La Porta *et al.*, 'Law and Finance'.

growth in a cross-national setting by using methods for dynamic panel data.⁶⁸ Besides mitigating issues with endogeneity, the methodology is able to exploit the time dimension of the data. Studies using this framework have therefore been able to look at several yearly observations for any given country, rather than just two points in time, which leads to more accurate estimates and fewer issues with potential data-mining.

Influential contributions by Beck, Levine and Loayza apply dynamic panel methods to postwar data, obtaining results which are consistent with those of earlier cross-country regressions: a higher level of financial development increased economic growth.⁶⁹ The authors thus argue the banking sector and the financial markets are causal factors in economic development. Their results also indicate that financial intermediaries boost growth through improving productivity, while the evidence of intermediaries increasing capital accumulation is weaker. Subsequent research suggests that this is the case particularly in more developed countries.⁷⁰ However, evidence from historical data is more ambiguous. In a dynamic panel study of 17 countries over the period 1870-2009, Madsen and Ang find that financial development influenced both capital accumulation and productivity growth.⁷¹

An important limitation of most regression models utilising cross-national data is the assumption that the relationship between finance and growth is the same

68. Panel data encompasses several observations across time for each country. The most commonly applied methods are those by Arellano and Bond as well as Blundell and Bond. See: Manuel Arellano and Stephen Bond, 'Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations', *The Review of Economic Studies* 58, no. 2 (1991): 277–297; and Richard Blundell and Stephen Bond, 'Initial Conditions and Moment Restrictions in Dynamic Panel Data Models', *Journal of Econometrics* 87, no. 1 (1998): 115–143.

69. Beck, Levine and Loayza, 'Finance and the Sources of Growth'; Ross Levine, Norman Loayza and Thorsten Beck, 'Financial Intermediation and Growth: Causality and Causes', *Journal of Monetary Economics* 46, no. 1 (2000): 31–77 and Thorsten Beck and Ross Levine, 'Stock Markets, Banks, and Growth: Panel Evidence', *Journal of Banking & Finance* 28, no. 3 (2004): 423–442.

70. Felix Rioja and Neven Valev, 'Finance and the Sources of Growth at Various Stages of Economic Development', *Economic Inquiry* 42, no. 1 (2004): 127–140; Felix Rioja and Neven Valev, 'Stock Markets, Banks and the Sources of Economic Growth in Low and High Income Countries', *Journal of Economics and Finance* 38, no. 2 (2014): 302–320.

71. Jakob B Madsen and James B Ang, 'Finance-Led Growth in the OECD Since the Nineteenth Century: How Does Financial Development Transmit to Growth?', *Review of Economics and Statistics* 98, no. 3 (2016): 552–572. The authors measure financial development by ratios of: broad money; bank assets; and bank credit to GDP.

across countries.⁷² This is often unrealistic, particularly when countries at different stages of economic (and financial) development are included in the same model. In a related vein, it is also difficult to draw inferences about the experience of any particular country from the results of these models.

The multiple time series approach provides a flexible setting for examining the interplay between finance and growth. These methods explicitly allow for the possibility that the development of the financial sector is partially driven by economic factors, while imposing few restrictions on the functional form between financial and economic variables. The approach is especially useful for economic historians interested in country-specific studies. Evidence from time series methods indicates that in most countries after the 1960s, financial development had a causal impact on growth.⁷³ Nevertheless, there are also prominent time series studies which find evidence of causality running from economic development to the growth of the financial sector, or evidence in support of a bidirectional causal relationship between finance and growth, which suggests that the financial sector and the real economy tend to co-evolve.⁷⁴

Econometric studies on historical links between banking and growth have so far concentrated largely on Germany, Sweden and the US.⁷⁵ Studies on Germany have reached at least mildly positive results. Burhop uses the multiple time series approach for German data spanning the years 1880-1913. He finds that joint-stock banks influenced the growth of heavy industry, although the evidence of their

72. Fohlin makes several additional remarks on problems with cross-country regressions in this context. See: Caroline Fohlin, *Mobilizing Money: How the World's Richest Nations Financed Industrial Growth* (Cambridge: Cambridge University Press, 2012), 204-207.

73. Philip Arestis, Panicos O Demetriades and Kul B Luintel, 'Financial Development and Economic Growth: The Role of Stock Markets', *Journal of Money, Credit and Banking*, 2001, 16-41; Dimitris K Christopoulos and Efthymios G Tsionas, 'Financial Development and Economic Growth: Evidence from Panel Unit Root and Cointegration Tests', *Journal of Development Economics* 73, no. 1 (2004): 55-74.

74. James B Ang and Warwick J McKibbin, 'Financial Liberalization, Financial Sector Development and Growth: Evidence from Malaysia', *Journal of Development Economics* 84, no. 1 (2007): 215-233; Panicos O Demetriades and Khaled A Hussein, 'Does Financial Development Cause Economic Growth? Time-Series Evidence from 16 Countries', *Journal of Development Economics* 51, no. 2 (1996): 387-411; Kul B Luintel and Mosahid Khan, 'A Quantitative Reassessment of the Finance-Growth Nexus: Evidence from a Multivariate VAR', *Journal of Development Economics* 60, no. 2 (1999): 381-405. Bidirectional causality also implies that financial development does not play a strong independent role in economic growth.

75. Studies on finance and regional growth in economic history will be discussed in the third chapter of this thesis.

contribution to economic growth more broadly appears to be weaker.⁷⁶ However, Diekmann and Westermann find more positive results by using similar methods, but data for a wider set of German banks.⁷⁷ They show that increases in bank lending influenced German economic growth, and that it contributed primarily to the growth of the service and agricultural sectors. Equity finance, on the other hand, mainly contributed to the growth of the industrial sector. The underlying reasoning behind this result is that large firms became increasingly reliant on capital markets for their financing needs, while smaller firms relied on banks. These findings support this chapter's empirical approach, where both banks and stock markets are included into an econometric model, because these institutions may have contributed to economic growth in different ways.

Time series studies focusing on the Swedish case have also tended to find a positive link between the banking sector and economic growth in the late 19th century.⁷⁸ However, these results may not be robust. When the start date of the dataset of these studies is extended to the earlier part of the 19th century, and when the insurance sector's development is taken into account, the banking sector's contribution to growth becomes less significant.⁷⁹

As mentioned above, Rousseau and Wachtel have previously used time series methods to study the economic impact of the banking system's growth in the UK, while also examining the cases of the US, Norway, Sweden and Canada.⁸⁰ The authors find evidence of finance-led growth from 1880 to 1929, but their econometric approach is problematic. Their Granger-causality test may not be robust when applied to non-stationary series, and they do not adequately control for the stock markets or the distortion caused by WW1. Thus, the British finance-growth nexus certainly needs further econometric research. Moreover, the analysis should be extended to the pre-1870 period.⁸¹

The econometric literature on stock markets and historical economic growth

76. Burhop, 'Did Banks'.

77. Diekmann and Westermann, 'Financial Development and Sectoral Output'.

78. Ögren, 'Financial Revolution'; Hansson and Jonung, 'Finance and Economic Growth'.

79. Mike Adams *et al.*, 'Commercial Banking, Insurance and Economic Growth in Sweden between 1830 and 1998', *Accounting, Business & Financial History* 19, no. 1 (2009): 21–38.

80. Rousseau and Wachtel, 'Financial Intermediation'.

81. The omission of stock markets is also a shortcoming of D'Onofrio and Rousseau, 'Financial Development'.

is still in its infancy. The evidence gathered so far points towards a positive link between the two. In the case of Belgium, Nieuwerburgh *et al.* use a time series approach to show that the growth of stock markets contributed to the nation's economic performance from 1832 to 2002.⁸² Similarly, the Berlin stock exchange in 1892-1913 played a significant role in the financing of innovative firms, indicating that it had a positive role in the modernisation of the German economy.⁸³ Rousseau and Sylla show that an increase in the listed securities on the stock markets (along with the growth of the money stock) predicted subsequent economic growth in major US cities in 1790-1850.⁸⁴ Stock markets may also have indirectly contributed to economic growth through supporting the growth of the banking sector.⁸⁵ For example, Rousseau argues that the banking system in late 19th century New York expanded partially because share prices revealed information about the soundness of individual banks.⁸⁶ This further motivates the need to examine the economic impact of stock markets and banks jointly.

Economists have recently taken a more nuanced view of the link between finance and growth. An important advance in several recent studies is to allow for non-linearities in the relationship. The strength of the finance-growth nexus tends to depend on a country's degree of economic development. For example, Aghion *et al.* show that between 1960 and 1995, financial development had a larger impact on the economic growth of poorer countries.⁸⁷ Specifically, they show that more financial development (measured by private credit) helps countries to catch up more rapidly to the income levels of rich countries. The positive contribution of finance weakens as convergence occurs. Fung provides further evidence on this, while also showing that poorer countries tend to catch up in terms of financial development, and not just economic growth.⁸⁸ Such findings are, to a certain ex-

82. Nieuwerburgh, Buelens and Cuyvers, 'Stock Market Development'.

83. Sibylle Lehmann-Hasemeyer and Jochen Streb, 'The Berlin Stock Exchange in Imperial Germany: A Market for New Technology?', *American Economic Review* 106, no. 11 (2016): 3558–3576.

84. Rousseau and Sylla, 'Emerging'.

85. Ögren, 'Financial Revolution'.

86. Peter L Rousseau, 'The Market for Bank Stocks and the Rise of Deposit Banking in New York City, 1866–1897', *The Journal of Economic History* 71, no. 4 (2011): 976–1005.

87. Philippe Aghion, Peter Howitt and David Mayer-Foulkes, 'The Effect of Financial Development on Convergence: Theory and Evidence', *The Quarterly Journal of Economics* 120, no. 1 (2005): 173–222.

88. Michael K Fung, 'Financial Development and Economic Growth: Convergence or Divergence?', *Journal of International Money and Finance* 28, no. 1 (2009): 56–67.

tent, consistent with the Gerschenkron hypothesis, which implies that finance can be particularly helpful in catch-up growth, whereas the most developed countries benefit less from a large financial sector.⁸⁹ In the case of the UK in 1850-1913, these findings imply that, as the leading economy, the country may have stood to gain less from financial development than did more backward countries.

Following the Great Recession, the view that financial development is important for growth has come under even more scrutiny. There is now evidence that after a certain point, the financial sector's expansion becomes inconsequential, or even a drag, on economic performance.⁹⁰ This (somewhat arbitrary) threshold exists partially because the impact of financial instability tends to be more severe when the financial system itself is large. Additionally, economies where credit grows too rapidly tend to be more prone to financial crises.⁹¹ This appears to have been the case for more than a century, as evidence from cross country data from 1870 to 2008 suggests that rapid credit expansion has been a good predictor of subsequent financial crises.⁹²

The link between finance and growth has also tended to weaken after the 1990s, casting further doubt on whether the results of most of the pre-crisis literature still hold.⁹³ Many developed economies transitioned from highly regulated financial systems before the 1980s to increasing liberalisation, by removing several constraints on the availability of finance. Empirically, less severe constraints on finance should show up as a more tenuous relationship between financial and economic development. Moreover, the positive impact of financial intermediation is reduced in the post-1990s data by an increased occurrence of financial crises.⁹⁴ A further factor restraining the financial sector's contribution has been the changing composition of bank credit. In several developed economies, a growing share of

89. Alexander Gerschenkron, *Economic Backwardness in Historical Perspective*. (Cambridge, MA.: Belknap Press of Harvard University Press, 1962).

90. Law and Singh, 'Too Much Finance'; Jean-Louis Arcand, Enrico Berkes and Ugo Panizza, 'Too Much Finance?', *Journal of Economic Growth* 20, no. 2 (2015): 105–148.

91. Lorenzo Ductor and Daryna Grechyna, 'Financial Development, Real Sector, and Economic Growth', *International Review of Economics & Finance* 37 (2015): 393–405; Pierre-Olivier Gourinchas and Maurice Obstfeld, 'Stories of the Twentieth Century for the Twenty-First', *American Economic Journal: Macroeconomics* 4, no. 1 (2012): 226–265.

92. Moritz Schularick and Alan M. Taylor, 'Credit Booms gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises, 1870-2008', *American Economic Review* 102, no. 2 (2012): 1029–61.

93. Rousseau and Wachtel, 'Happening'.

94. Ibid.

bank lending has been granted for the purposes of financing household consumption and real estate transactions, which has not been found to benefit economic growth.⁹⁵

In light of this evidence, allowing for the possibility of a changing relationship between the financial sector and the economy is important when it comes to statistical inference. Indeed, recent studies on the economic impact of financial shocks have demonstrated that the link between financial and economic conditions varies substantially over time.⁹⁶ Their findings suggest that simpler models may lead to wrong conclusions about the link between finance and growth. A significant advantage of this chapter's methodology is to allow for such time-variance.

1.4 Data

The empirical literature on finance and growth has not reached a consensus on which indicator for financial development should be used. Traditionally, proxies for the size of the banking sector (for example broad money, deposits, private sector lending) or the stock market (market capitalisation, transaction volumes) have been used. These indicators say little about how efficient the financial sector was in allocating resources and mitigating information asymmetries.⁹⁷ Nevertheless, in post-WW2 data, proxies of the financial sector's size tend to correlate with other measures of financial development, such as access to finance, or the financial sector's cost-efficiency in providing its services.⁹⁸ The availability of data for the

95. Thorsten Beck *et al.*, 'Who Gets the Credit? And Does it Matter? Household vs. Firm Lending Across Countries', *The BE Journal of Macroeconomics* 12, no. 1 (2012); Arcand, Berkes and Panizza, 'Too Much Finance?'; Dirk Bezemer, Maria Grydaki and Lu Zhang, 'More Mortgages, Lower Growth?', *Economic Inquiry* 54, no. 1 (2016): 652–674.

96. Martin Bijsterbosch and Matteo Falagiarda, 'The Macroeconomic Impact of Financial Fragmentation in the Euro Area: Which Role for Credit Supply?', *Journal of International Money and Finance* 54 (2015): 93–115; Michael Ellington, Chris Florackis and Costas Milas, 'Liquidity Shocks and Real GDP Growth: Evidence from a Bayesian Time-Varying Parameter VAR', *Journal of International Money and Finance* 72 (2017): 93–117; Oana Peia and Kasper Roszbach, 'Finance and Growth: Time Series Evidence on Causality', *Journal of Financial Stability* 19 (2015): 105–118. This literature will be discussed further in the second chapter of this thesis.

97. Asli Demirgüç-Kunt and Ross Levine, 'Finance, Financial Sector Policies, and Long-Run Growth', *World Bank Policy Research Working Paper Series*, 4469, 2008, Aug, 'Survey'.

98. Martin Čihák *et al.*, 'Financial Development in 205 Economies, 1960 to 2010', *Journal of Financial Perspectives* 1, no. 2 (2013): 17–36.

pre-WW1 years, moreover, acts as a significant constraint to the indicators that can be used. Therefore, this chapter follows much of the existing literature in terms the choice of the choice of proxies for financial development. These will be outlined in the subsections below.

A further caveat about the data is that it measures the growth of components of the *formal* financial sector. It is thus not an all-encompassing measure of the availability of finance, especially as long-term financing of smaller companies was often done through personal contacts rather than formal channels. However, this issue is largely inescapable in the context of the 19th and early 20th centuries, and is not entirely resolved even in the context of modern developing countries.⁹⁹

The yearly economic data used in this chapter is consistent with much the of empirical literature on finance and growth.¹⁰⁰ These real economic variables for the UK include GDP, total factor productivity (TFP) and gross fixed capital formation (excluding dwellings). TFP is a proxy of how efficiently factors of production (capital and labour) were employed, although the measure used here ignores other potentially important factors such as human capital. Fixed capital formation is a measure of capital investment in the economy. The data is plotted in figure 1.2. These series are used in separate models to test if finance influenced growth through any specific channel.¹⁰¹ However, I also experiment with models including both fixed capital formation and GDP.

TFP cannot be measured directly, but needs to be calculated through measuring economic output after accounting for the labour force and capital stock employed the economy.¹⁰² Any inaccuracies in GDP, capital stock, or labour share of income are thus directly translated into inaccuracies in the measurement of TFP.

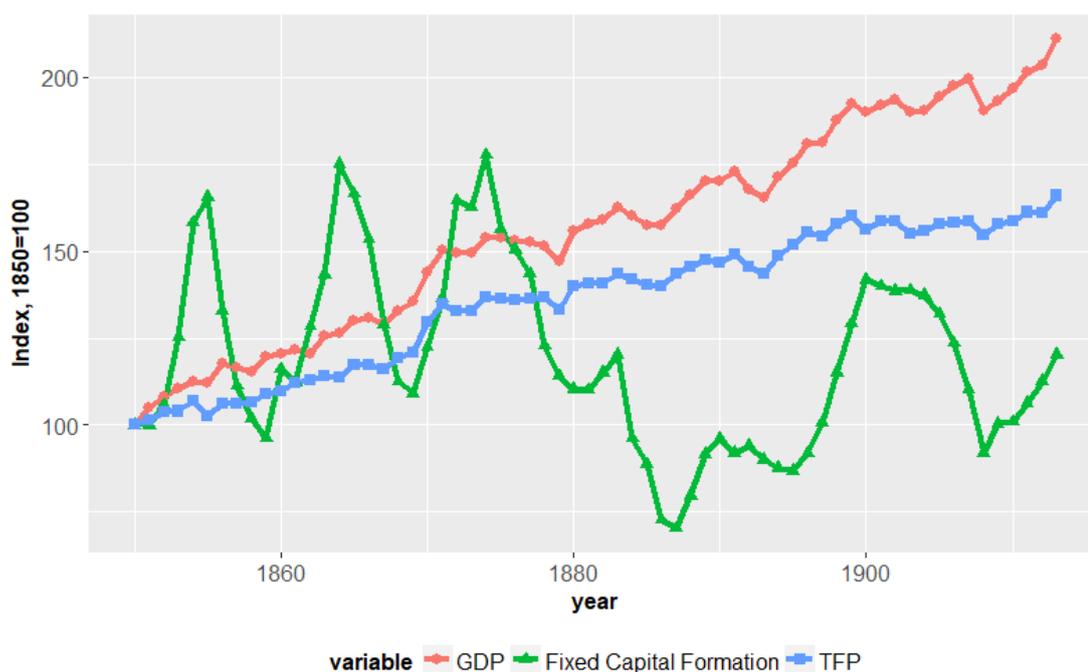
99. Meghana Ayyagari, Asli Demirgüç-Kunt and Vojislav Maksimovic, ‘Formal Versus Informal Finance: Evidence from China’, *The Review of Financial Studies* 23, no. 8 (2010): 3048–3097; Franklin Allen *et al.*, ‘Financing Firms in India’, *Journal of Financial Intermediation* 21, no. 3 (2012): 409–445.

100. Thorsten Beck, ‘The Econometrics of Finance and Growth’, in *Palgrave Handbook of Econometrics*, ed. T Mills and K Patterson, vol. 2 (Basingstoke: Palgrave Macmillan, 2009), 1180–1209.

101. Arestis, Demetriades and Luintel, ‘Financial Development’.

102. For calculation and background on TFP, see: Charles R Hulten, ‘Total Factor Productivity: A Short Biography’, in *New Developments in Productivity Analysis*, ed. Charles R Hulten, Edwin R Dean and Michael Harper, vol. 63 (Chicago: University of Chicago Press, 2001), 1–54.

Figure 1.2: Fixed capital formation, TFP and GDP, 1850-1913



Sources: see text. Fixed capital formation and GDP in real, per capita terms.

None of these series are perfectly accurate in the case of the UK before WW1.¹⁰³ Nevertheless, TFP remains the most comprehensive measure of productivity available for our purpose.

The TFP data is taken from the calculations of Thomas *et al.*, which, in turn, are based on data compiled by Mitchell.¹⁰⁴ The other economic data is in real terms. Data on fixed capital formation at constant prices, excluding buildings and works, is taken from Mitchell, who relies on previous work by Feinstein.¹⁰⁵ For GDP data, I primarily rely on series by Solomou and Weale for the years

103. Charles Hilliard Feinstein, *National Income, Expenditure and Output of the United Kingdom, 1855-1965*, vol. 6 (Cambridge: Cambridge University Press, 1972).

104. Ryland Thomas and Nicholas Dimsdale, *A Millennium of UK Data*, Bank of England OBRA dataset, 2017, <https://www.bankofengland.co.uk/-/media/boe/files/statistics/research-datasets/a-millennium-of-macroeconomic-data-for-the-uk.xlsx>, accessed: 18 January 2018; Brian R Mitchell, *British Historical Statistics* (Cambridge: Cambridge University Press, 1988).

105. *Ibid.*, Ch. XVI, Table 6. I also experimented with fixed capital formation data compiled by Feinstein and Pollard, which did not change the results. See: Charles H Feinstein and Sidney Pollard, *Studies in Capital Formation in the United Kingdom 1750-1920* (Oxford: Oxford University Press, 1988), Table III, 431-432.

1870-1913.¹⁰⁶ This series has been linked to estimates by Feinstein covering years before 1870, and converted to real terms (in market prices) by Thomas *et al.*¹⁰⁷ To convert the financial data, discussed below, to real terms, I use the price index by O'Donoghue *et al.*¹⁰⁸

1.4.1 Banking

I use deposits as the primary indicator for the development of the banking system. Figures on British bank deposits from 1870 to 1913 are quite comprehensive, and are available in statistics compiled by Capie and Webber.¹⁰⁹ This series has been combined with earlier, slightly less comprehensive data running from 1850 to 1870, in order to obtain a continuous series from 1850 to 1913. This is done through backwards extrapolation of the later series by applying to it the growth rate of the earlier series. Note that the longer series (1850-1913) is examined using econometric models which yield unbiased estimates for the years for which accurate data is available (1870-1913), even though the pre-1870 part of the sample might contain inaccuracies.¹¹⁰

Estimates of bank net public liabilities for the years 1844-80 for England and Wales have been constructed by Collins.¹¹¹ While this series also includes notes issued by commercial banks, deposits are by far the largest component of these liabilities. In 1866-1870, for example, commercial bank notes were only 2% of deposits. The sample on which Collins estimates net bank liabilities accounts for approximately 40-60% (depending on the year) of the offices of joint-stock banks in England and Wales. For banks missing from the sample, he assumes that they had

106. Solomou and Weale, 'Balanced'

107. Thomas and Dimsdale, *Millenium*. The series in question is the 'Chained composite measure of UK GDP at market prices.' For details on Feinstein's estimates, see: Feinstein, *National Income*.

108. Jim O'Donoghue, Louise Goulding and Grahame Allen, 'Consumer Price Inflation Since 1750', *ONS Economic Trends*, no. 604 (2004).

109. Forrest Capie and Alan Webber, *A Monetary History of the United Kingdom: 1870-1982* (London: Allen / Unwin, 1985).

110. Further discussion about this is deferred to section 1.5.2.

111. Michael Collins, 'Long-Term Growth of the English Banking Sector and Money Stock, 1844-80', *The Economic History Review* 36, no. 3 (1983): 374-394.

the same amount of liabilities per office as banks in his sample did.¹¹² A downside of the figures by Collins is that they are smoothed, presumably to reduce a high degree of variability that the series would display otherwise.

In order to make the pre-1870 series cover all of the UK, and thus to make it consistent with the available economic data, I add Scottish and Irish data on bank public liabilities to my sample.¹¹³ For Scotland, Checkland provides comprehensive data on bank public liabilities from 1865 to 1870.¹¹⁴ From 1850 to 1865 figures of Scottish bank public liabilities are constructed from the balance sheets of individual banks, both from published sources and archival records. The included banks are listed in appendix table 1.6. The earlier figures on Scottish banks are spliced with data provided by Checkland. Data on Irish bank deposits is available in work by O'Rourke.¹¹⁵ These series are then added to the series by Collins, which covers England and Wales.

Bank deposits essentially measures the amount of resources that banks had available, but says little about the way in which these funds were allocated.¹¹⁶ Therefore, the implicit assumption of this chapter is that their ability to provide credit to the economy, along with their efficiency in allocating credit, was proportional to deposits. There is not much choice on alternative proxies for the banking system, given the scarcity of data for pre-WW1 UK. It is nevertheless worth exploring the validity of some other potential indicators that have been used in the literature.¹¹⁷

Data on prewar British bank credit is available only for a short period, covering the years 1880-1913.¹¹⁸ For an earlier period, there are several problems with constructing series from published data, and unpublished data is not available for a substantial number of banks. It was uncommon for private banks to report

112. The availability of archival sources suggests that it would be difficult to make a large improvement upon the estimates by Collins.

113. I use public liabilities instead of deposits, to make the data consistent with Collins' series.

114. Sydney George Checkland, *Scottish Banking: A History, 1695-1973* (Glasgow: Harper Collins, 1975).

115. Kevin H O'Rourke, 'Monetary data and proxy GDP estimates: Ireland 1840-1921', *Irish Economic and Social History* 25, no. 1 (1998): 22-51.

116. Demetriades and Hussein, 'Does Financial Development Cause'.

117. Levine, 'Finance and Growth'.

118. David K Sheppard, *The Growth and Role of UK Financial Institutions, 1880-1966* (London: Methuen, 1971).

their credit figures before the 1890s. Before the late 1870s, a significant share of joint-stock banks did not report these figures either. As far as outstanding credit was reported, the figures could be highly aggregated, lumping together bills, advances, loans to brokers and the money market, and sometimes even the investments in government and railway bonds.¹¹⁹ As a robustness check for this chapter's empirical results, the credit data for 1880-1913 is analysed using simpler econometric techniques.

Broad money aggregates have fallen out of favour as indicators for financial development, although several early studies relied on such data.¹²⁰ These series aggregate measures of monetisation with measures of financial development (namely deposits), and thus do not directly measure the resources available to financial institutions. Broad money, as an indicator, therefore risks needlessly obscuring the concept of financial development. In the context of prewar British data, it is also known that existing aggregates of narrow money are not accurate, especially for years before 1870.¹²¹ These inaccuracies would lead to further measurement error, biasing the econometric estimates.¹²² Therefore, monetary aggregates are not used in this chapter. Preliminary testing does, however, suggest that this chapter's results with data from 1870-1913 are robust to using M3 instead of bank deposits.¹²³

1.4.2 Stock Markets

An important component of this chapter's original contribution derives from the use of new data on British capital markets. There are no satisfactory pre-existing proxies for their development. Intuitively, one might expect that the market capitalisation of British stock exchanges gives an indication of how the financial markets

119. Collins and Baker, *Commercial Banks* have published data on various credit ratios, created from published and internal bank balance sheets that could be found, but have not made the underlying data available.

120. Levine, 'Finance and Growth'.

121. Nuno Palma, 'Reconstruction of Money Supply over the Long Run: The Case of England, 1270-1870', *The Economic History Review*, 2017,

122. See: Qi Liang and Teng Jian-Zhou, 'Financial Development and Economic Growth: Evidence from China', *China economic review* 17, no. 4 (2006): 395-411; and references therein for further discussion of the problems with using M2 or M3 as a measure of financial development.

123. This is presumably because most of the variation in M3 estimates is due to deposits.

developed, but this is not a suitable indicator to use in a time series econometric context. Stock market valuations are forward-looking indicators: they partially reflect investor expectations of future economic conditions. Even in a historical context, stock market valuations have tended to carry predictive power for the subsequent growth of the economy.¹²⁴ Using this data in an econometric model would thus unduly bias the results in favour of the finance-led growth hypothesis.¹²⁵ Furthermore, yearly fluctuations in market valuations are unlikely to proxy accurately how well capital markets function.

This chapter builds a new series on paid-in capital as an indicator for the development of capital markets. This measure has previously been used in the historical finance-growth literature.¹²⁶ Paid-in capital measures how much capital has been raised or converted into public securities through stock markets. Firms before WW1 would often issue shares with a nominal capital that was higher than the paid-in (or paid-up) capital - the amount of capital that was actually raised. Investors thus only paid a part of a share's nominal value during an IPO. Shareholders could then be liable to contribute more capital, up to the amount of nominal capital, if called by the company to do so. As a proxy for the growth of capital markets, paid-in capital has the advantage of being less sensitive to changes in investor expectations than market capitalisation. However, it might still include a minor forward-looking element, but to a far lesser extent than in the case of market valuations. After all, firms are more likely to receive external financing if investors think they have positive prospects, which partially depends on expectations of economic growth.

Grossman provides yearly series of paid-in capital of British equities for the years 1869-1929, but his data leaves out preferred shares and debentures (fixed-income securities).¹²⁷ My dataset improves upon this work. As the most important improvement, I have included debentures and preference shares to the dataset,

124. Samad Sarferaz and Martin Uebele, 'Tracking down the Business Cycle: A Dynamic Factor Model for Germany 1820–1913', *Explorations in Economic History* 46, no. 3 (2009): 368–387. Testing if market capitalization predicts growth may thus tell us about the behaviour of capital markets, rather than finance and growth.

125. Ang, 'Survey'.

126. Diekmann and Westermann, 'Financial Development and Sectoral Output'.

127. Richard S Grossman, 'Bloody Foreigners! Overseas Equity on the London Stock Exchange, 1869–1929', *The Economic History Review* 68, no. 2 (2015): 471–521.

so that the amount of capital raised by the market is not understated. This is important, because a significant amount of capital, even for industrial companies, was raised through fixed-income securities, which several investors preferred.¹²⁸ Additionally, I have created a monthly series - although in this chapter I use yearly averages of the monthly figures. I have also manually excluded foreign securities, or securities of companies that operated abroad. Finally, the dataset includes securities listed on provincial stock exchanges.

The underlying data on paid-in capital comes from the *Investor's Monthly Manual* (IMM), which is hosted at the Yale International Center for Finance (YICF).¹²⁹ The dataset based on the IMM covers the years 1870-1913 and includes information on most securities listed on British stock exchanges.¹³⁰ It consists of over 1.3 million rows of data - one row for each security per month that it was listed, giving information on several features related to the size of an issue as well as a security's price movements. The primary fields of interest in this study are the paid-in capital per share and the number of shares for each security, from which the total paid-in capital can be calculated. The raw data from YICF is not fit for use because of several inaccuracies due to the optical character recognition software that has been used for reading in the tables from the IMM, as well as errors in the IMM itself. How the data was made usable thus requires some explanation.

The data was cleaned up in two stages. First, the errors made in the digitisation of the IMM were detected and corrected. There were thousands of entries which were marked as 'unreadable' or where the software mixed numbers up. Most typically, 3 was confused with 8, or 5 with 3. The fact that the number was wrong could be detected as a temporary discontinuity in the paid in capital of a company.¹³¹ The true value of paid in capital could then be manually obtained from a copy of the IMM. There were also hundreds of missing entries for certain

128. Janette Rutterford, 'The Merchant Banker, the Broker and the Company Chairman: A New Issue Case Study', *Accounting, Business & Financial History* 16, no. 1 (2006): 45-68.

129. Yale International Center for Finance, *London Stock Exchange Project*, Yale School of Management, 2017, <https://som.yale.edu/faculty-research/our-centers-initiatives/international-center-finance/data/historical-financial-research-data/london-stock-exchange>, accessed: 22 December 2017.

130. YICF hosts data from 1869 to 1929.

131. If there the paid in capital per share is e.g. £8 for several years, changing to £3 in one month in between, there would most probably be an error.

years.¹³² These cases showed up as discontinuities in the series, which could be detected and then corrected. When months of data were missing, I inserted the relevant figures from copies of the IMM.

The second step was to correct for inaccuracies in the IMM itself, which was more problematic.¹³³ There are hundreds of cases where the paid-in capital per share or the number of shares of a given security are left blank for an extended period of time. There are also several cases where a security is only included in the IMM data well after its IPO, or when a security is removed without explanation. Although there is no guarantee that all of these types of errors could be found, a significant number could be cross-checked with *The Economist*, as well as the *Stock Exchange Yearbook*. Furthermore, the IMM itself lists details of new issues in a separate section of the publication, which could be compared to the figures in the database.

For the years prior to 1870, there is a limited amount of accurate data on the listings on all British stock exchanges. The best available series on paid-in capital is provided by Acheson *et al.*, who create their dataset from a contemporary publication, *The Course of the Exchange*.¹³⁴ While providing a comprehensive set of data for the London Stock Exchange, a significant downside of this series is that it excludes provincial exchanges. This exclusion might introduce a degree of measurement error in the underlying time series before 1870, which is difficult to adjust for, given the limited amount of surviving information from provincial stock markets. However, it should be noted that several provincial stock markets saw subdued activity for a few decades following the end of the second railway mania in 1846, so the measurement error induced by their exclusion is unlikely to be large.¹³⁵ The methodology employed in this chapter also does not yield biased estimates for years with accurate data, even if data at the start of the sample is potentially inaccurate.

132. Especially 1894 proved problematic, when hundreds of securities were missing from the database for no apparent reason, even though they were listed in the IMM.

133. For a more extensive discussion of problems in this publication, see Richard S Grossman, 'New Indices of British Equity Prices, 1870–1913', *The Journal of Economic History* 62, no. 01 (2002): 121–146.

134. Graeme G Acheson *et al.*, 'Rule Britannia! British Stock Market Returns, 1825–1870', *The Journal of Economic History* 69, no. 04 (2009): 1107–1137.

135. John R Killick and William Thomas, 'The Provincial Stock Exchanges, 1830—1870', *The Economic History Review* 23, no. 1 (1970): 96–111. See also the fourth chapter of this thesis.

Certain exclusions from the stock exchange data are warranted when the objective is to examine the impact of capital markets on growth. It is difficult to justify in theory why portfolio investment in foreign stocks would have a significant impact on the British domestic economy through increasing investment, productivity or improving corporate governance. Hence, companies which were foreign, or which had all of their activities abroad, are excluded. In doing this, I follow the approach of Nieuwerburgh *et al.*, who identify and remove foreign firms, or firms operating abroad, for testing the Belgian stock market's effects on the economy.¹³⁶ I also follow the literature by excluding public sector debt securities, which might needlessly distort the underlying series, by making them less informative about the extent to which the private sector was served by the capital markets.¹³⁷

The first step in the process of removing foreign securities followed the approach of Grossman, who removes all securities denominated in foreign currencies, and tries to identify foreign companies by name.¹³⁸ More accuracy was then gained by cross-referencing some of the names of suspected foreign companies with issues of *The Economist* and the IMM, both of which often provided information about a new issue when it was listed.

Figure 1.3 shows the yearly stock market and deposit data used in this chapter. As the historical literature suggests, the paid in capital of domestic firms expanded significantly throughout the period 1850-1913, with especially strong growth after the 1880s. The composition of this expansion changed over time, however, with companies in sectors other than railways, infrastructure and finance starting to account for an increasing portion of the growth in the last 30 years of the sample.¹³⁹ The growth of deposits was already significant in the 1860s and 1870s, although noticeable fluctuations can be observed during the Overend and Gurney crisis of 1866, and the failure of the City of Glasgow bank in 1878.

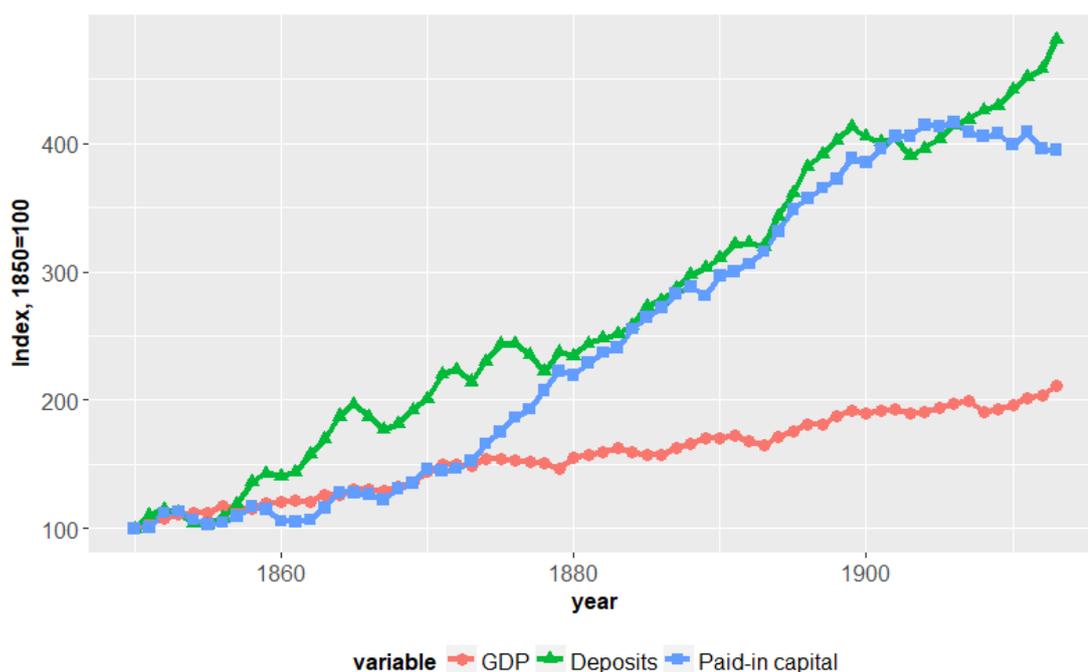
136. Nieuwerburgh, Buelens and Cuyvers, 'Stock Market Development'.

137. *Ibid.*; Ang, 'Survey'.

138. Grossman, 'New Indices'.

139. Michie, *London Stock Exchange*, 88. See also figure 1.1.

Figure 1.3: GDP, deposits and paid-in capital, 1850-1913



Sources: See text. The data in this figure is in real terms and scaled by population.

1.4.3 Comparison with Other Indicators for the Development of Capital Markets

The purpose of this subsection is to illustrate briefly that the series on paid-in capital correlates well with other available indicators of the development of British stock markets, thus validating its use.

Securities Listed on the London Stock Exchange Official List

Hannah has recently criticised data collected by Grossman from the IMM on the paid-in capital of securities listed on the London Stock Exchange.¹⁴⁰ He shows that there are wide disparities between contemporary published figures on paid-in capital on the LSE and the figures that Grossman reports. This is a clear problem

140. Leslie Hannah, 'The London Stock Exchange 1869-1929: New Bloody Statistics for Old?', *LSE Economic History Working Papers*, nos. 263/2017 (2017); Grossman, 'Bloody Foreigners!'

with Grossman's data, and brings into question the validity of constructing series based on the IMM. My data on paid-in capital is more consistent with contemporary data, as it addresses issues with Grossman's series by including debt securities and preference shares.

The London Stock Exchange's Share and Loan Department reported annual figures on the paid-in capital of securities on the exchange from 1881 onwards.¹⁴¹ These were published in *Burdett's Official Intelligence* in 1881-1897, and the *Stock Exchange Official Intelligence* thereafter. This data - referred to as the 'official list data' - is presented together with my data on paid-in capital in figure 1.4. One of the series shows the growth of the total capital quoted on the official list, except for securities with coupons payable abroad. Another shows the growth of capital of *mostly* domestic securities on the official list, excluding public sector debt. The series is mostly domestic, because some securities in the categories included may also be foreign, particularly later in the sample.¹⁴²

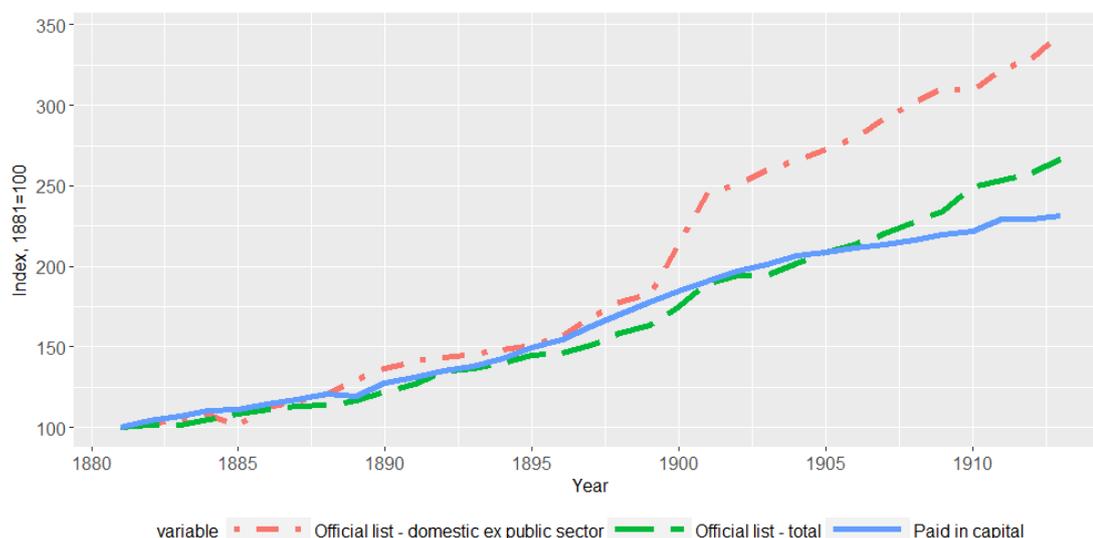
Whatever the problems in Grossman's data are, they do not appear to be present in the data used in this chapter. Figure 1.4 shows that the growth of my data on paid in capital is, for the most part, consistent with the growth rate of the official series. The primary exception to these similarities in growth trends occurs around 1900-1902, where the domestic official list series expands more rapidly than my paid-in capital series. There is no individual item that can explain why the domestic series grew so quickly in these two years, although the capital of banking and insurance companies expanded markedly during this time. It is likely that this is in part driven by listings of foreign financial institutions. The official list does not distinguish between domestic and foreign banks.

Even if we were to assume that the 1900-1902 episode of growth in the domestic series is was due to an increase in domestic listings, this omission would be of little consequence for the econometric results. This is because the change only happens over two or three years. In fact, the bias would be irrelevant for the conclusions of this chapter when methods outlined in section 1.5.2 are used.

141. As no earlier data is available, the series are not used for econometric purposes.

142. The calculations make it impossible to distinguish between foreign and domestic securities, for example, categorised as power, gas and electric lighting companies.

Figure 1.4: Amount of paid-in capital quoted on the London Stock Exchange compared with data used in this thesis, 1881-1913



Note: Data in real, per capita terms.

Sources: Data from *Burdett's Official Intelligence* for years 1881-1897, and from the *Stock Exchange Official Intelligence* thereafter. Domestic securities listed on the official list include categories primarily composed of firms conducting their business in the UK. The categories are: UK railways; banking, commercial, industrial & etc., power, gas and electric lighting; insurance; iron, coal and steel; shipping; telegraphs and telephones; tramways and omnibus; and waterworks. The 'Official list - total' includes public sector securities.

Membership of the London Stock Exchange

Several studies in the finance-growth literature have favoured turnover ratios - the value of shares traded divided by a market's total capitalisation - or other measures of liquidity to measure the development of capital markets.¹⁴³ Unfortunately, such data is not available for prewar Britain, especially before the turn of the century. Indeed, relatively little is known about the liquidity of stock exchanges for most of the late 19th century.

It would be difficult to build a consistent series on transaction volumes based on tax records. Stock exchange transactions were taxed from the 1870s to 1893, but the tax was abandoned as the government feared that business would be

143. See Ross Levine and Sara Zervos, 'Stock Markets, Banks, and Economic Growth', *American Economic Review*, 1998, 537-558 and Ang, 'Survey'.

driven to other financial centres.¹⁴⁴ Stamp duties were collected on transfers of certain marketable securities after 1893, but there were major changes in what types of securities were subject to this tax. For example, there was an imposition of duties on previously excluded foreign and colonial certificates at the turn of the century.¹⁴⁵ These inconsistencies, together with an extremely high year-on-year variability, render the stamp duty data unsuitable for econometric purposes.

A proxy for the ease of trading shares on the capital market can be obtained from the membership figures of the London Stock Exchange.¹⁴⁶ Members of the Stock Exchange were individuals for whom stockbroking was the primary occupation. They were thus in the business of providing liquidity to the markets.¹⁴⁷ Figure 1.5 compares the membership of the LSE with the data on paid-in capital. The figures clearly suggest that paid-in capital was quite well correlated with stock exchange membership. Therefore, paid in-capital might also correlate with the market's overall liquidity.

The close co-movement between paid-in capital and LSE membership is somewhat surprising, because there were several changes to the rules that governed the growth of the membership. For example, higher membership fees were introduced in 1881, and new members were required to buy shares of the London Stock Exchange after 1900.¹⁴⁸ Nevertheless, the membership kept increasing remarkably steadily until 1905-1907, when several members were unable to meet their commitments and went bankrupt.¹⁴⁹ Indeed, this episode indicates the first clear divergence between the two series in figure 1.5, and suggests that paid-in capital might be better for our purposes.

144. Michie, *London and New York*, 89.

145. Commissioners of Inland Revenue, Forty-Sixth Report For the Year ended 31st March 1903 p. 129.

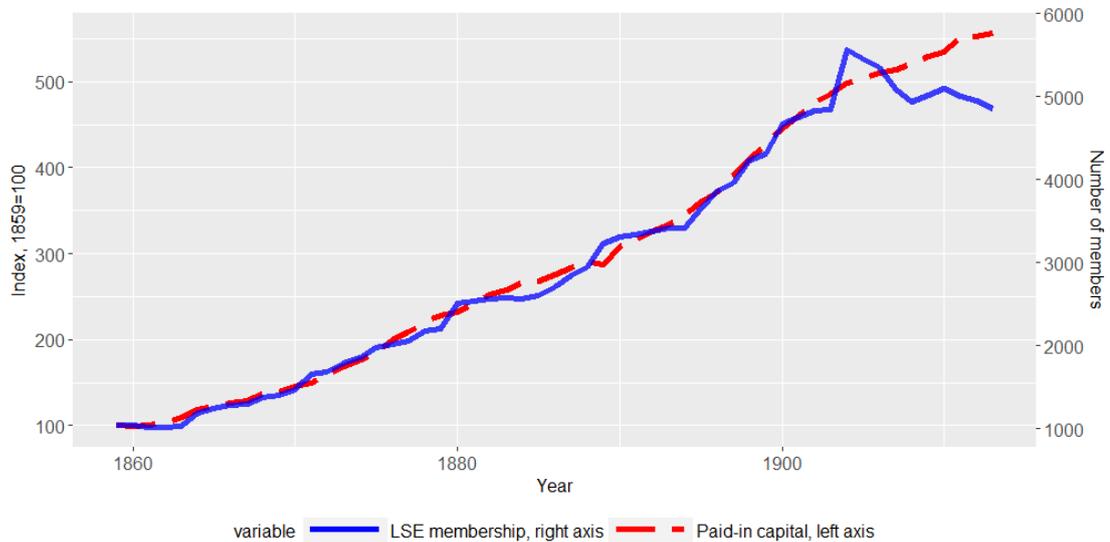
146. Membership of provincial stock exchanges is not discussed in this chapter, because the data is not continuous for most exchanges before 1890.

147. A minor caveat is that members could, of course, deal in any type of security. If some members specialised on foreign stocks, the figures may not fully reflect the ease of dealing in domestic securities.

148. Neal and Davis, 'Evolution'.

149. *Ibid.*

Figure 1.5: Membership of the London Stock Exchange, 1859-1913



Membership data from: Minutes of the Trustees and Managers of the London Stock Exchange, 1859-1914, CLC/B/004/B/03/MS19297, Records of the London Stock Exchange, Guildhall Library, London.

1.5 Econometric Evidence

The empirical results are presented in two stages. I begin with models which are consistent and comparable with those used in several other studies. This is followed by a more advanced approach.

The questions that this chapter addresses are as follows:

1. Did the growth of the banking system or capital markets play a causal role in economic growth?
2. If so, did they boost growth through capital accumulation or through productivity growth?
3. Was the growth of the banking system or capital markets a symptom, rather than a cause, of economic growth?
4. How strong was the link between the financial sector and the economy?

5. Did the relationship between the financial sector and the economy change over time?

1.5.1 Granger-Causality

The first set of hypothesis tests are performed using yearly data and standard tools from multivariate time series econometrics: vector autoregressions (VARs). This approach is appropriate for testing hypotheses in a country-specific setting, and makes it possible to examine the channels potentially linking finance and the economy. Because other studies in this field of economic history and economics have often used a similar approach, the results are easily comparable with findings from other cases.¹⁵⁰ The VAR approach has the benefit of needing few *a priori* restrictions on how the data should behave, making it less likely that results are driven by potentially implausible constraints imposed on a model.

In order to test if finance causes growth using multivariate time series econometrics, we typically test if the growth of stock markets or banks Granger-caused GDP growth. Finance is said to Granger-cause GDP if past growth of the financial sector helps predict subsequent changes in GDP. To illustrate this using a basic example, consider the following VAR system with one lag (i.e. incorporating data from one previous year):

$$\begin{cases} stockmkt_t &= \alpha_1 + \beta_{11,1}stockmkt_{t-1} + \beta_{12,1}gdp_{t-1} + u_{1,t} \\ gdp_t &= \alpha_2 + \beta_{21,1}stockmkt_{t-1} + \beta_{22,1}gdp_{t-1} + u_{2,t} \end{cases} \quad (1.1)$$

The variables $stockmkt_t$ and gdp_t are indicators for the development of the stock market and the economy at time t , respectively. β_{ij} are parameters to be estimated, which link past values of economic or financial development with their values at time t . α_i represent constants, or trends if $stockmkt_t$ and gdp_t are in differences. $u_{i,t}$ for each equation is a residual - the part that cannot be explained

150. See: Beck, 'The Econometrics of Finance and Growth' for a discussion on econometric aspects of studying finance and growth, along with a review of studies using the time series approach.

by the model. The system of equations says that the development of stock markets and the economy in a given year is a function of: 1. the state the stock markets in the previous year; 2. the state of the economy in the previous year; and 3. a constant or a trend.

If the hypothesis that $\beta_{21,1} = 0$ cannot be rejected, the stock market does not Granger-cause GDP. In other words, if $\beta_{21,1} = 0$, then past values of the stock market's development cannot help predict the economy's subsequent development. If we have several lags, we test if all the parameters linking the state of the stock markets in past periods to GDP at time t are zero.¹⁵¹

Note that in the VAR model, we allow for the possibility that finance and growth interact with each other over time: economic development may lead to more financial development and vice versa. In other words, the variables in the model (finance, growth and other indicators) are allowed to be potentially endogenous. The VAR applied to the present setting thus has some degree of consistency with endogenous growth models, which allow a degree of mutual interaction between the real economy and the financial sector.

In more general matrix notation, used in this thesis, the VAR is given by the following equation:

$$\mathbf{y}_t = \boldsymbol{\mu} + \sum_{i=1}^{\rho} \mathbf{B}_i \mathbf{y}_{t-i} + \mathbf{u}_t \quad (1.2)$$

where \mathbf{y}_t is a vector of the variables at time t. In model (1.1), we would have $\rho=1$ (the number of lags), and

$$\mathbf{y}_t = \begin{bmatrix} stockmkt_t \\ gdp_t \end{bmatrix} \text{ and } \mathbf{B}_1 = \begin{bmatrix} \beta_{11,1} & \beta_{12,1} \\ \beta_{21,1} & \beta_{22,1} \end{bmatrix}$$

For causality tests, the VAR model lag lengths are selected using the Akaike Information Criterion (AIC), while ensuring that residuals are not autocorrelated

151. The hypothesis that several parameters are zero is tested using a Wald-test.

as suggested by the Portmanteau and LM-tests.¹⁵² The AIC is commonly used to select a model which fits the data well, but does not include too many parameters.¹⁵³

The variables considered in this chapter are: GDP; deposits; paid-in capital; TFP; and fixed capital formation (investment). All of the variables are not included in the model simultaneously. While cross-sectional regressions need several control variables to deal with omitted variable bias (bias induced by the exclusion of relevant variables), the time series approach tries to reduce this bias by using a sufficient lag structure combined with several observations across time.¹⁵⁴ Indeed, adding too many variables into a VAR model without a large sample can lead to imprecise estimates. The baseline set of results are obtained using data from 1870 to 1913. For these years, the quality of the data is significantly more accurate than for 1850-1870. Specifically, for these years we have far more accurate measures of deposits and paid in capital as indicators of financial depth.

All variables, except for TFP, are set in logarithmic real, per capita terms. Another alternative, used in some studies, would be to divide the indicator for financial development by GDP. But such a transformation makes it difficult to study the possibility of reverse Granger-causality - of economic growth causing financial development - because the economy appears in the denominator of the financial variable.¹⁵⁵ The results are, however, robust to using models where the financial variable is scaled by GDP.

A traditional approach to testing for Granger-causality would be to start by testing if the underlying series are non-stationary, which would tell us if the series exhibit explosive behaviour, and need to be differenced. A second step would entail testing for cointegration: whether non-stationary series in the VAR share common stochastic trends. If the series have these properties, causality tests would

152. Helmut Lütkepohl, *New Introduction to Multiple Time Series Analysis* (New York: Springer Science & Business Media, 2007), 146-148, 169-173.

153. The AIC selects the model based on the model fit, but induces a penalty for the number of parameters used.

154. Beck, 'The Econometrics of Finance and Growth'.

155. For a discussion on this point, see: Jong Hun Kim and Peter L Rousseau, 'Credit Buildups and the Stock Market in Four East Asian Economies', *Journal of Macroeconomics* 34, no. 2 (2012): 489-503.

be conducted on a vector error correction model.¹⁵⁶ However, research has shown that the Wald-statistic for causality tests in a VECM may not have an asymptotic χ^2 distribution.¹⁵⁷ A correct distribution for the test statistic is essential for accurate statistical inferences.

To get around these issues, and to test for causality in a more general sense, this chapter employs the methodology by Toda and Yamamoto.¹⁵⁸ The test is robust to integration (non-stationarity) and cointegration properties of the time series being tested, and is therefore applicable here. The authors show that testing for causality with non-stationary variables can be done by estimating a VAR with data in levels with one extra lag. Parameter estimates of this additional lag are then excluded from a Wald-test, which is used to test for causality. Besides not relying on a biased test-statistic, an important advantage of the Toda-Yamamoto test is that it does not necessitate potentially low-powered tests of stationarity. Consequently, this has become a generally recommended approach for causality testing.¹⁵⁹

Results from Granger-causality Tests

Table 1.1 shows results from Toda-Yamamoto tests for Granger-causality when real deposits per capita is used as a proxy for the banking sector's development. Under the heading 'Test', the variable on the left is the one that Granger-causes the right-hand side one. If the value in the column 'p-value' is less than 0.05 (or at least less than 0.1), we may infer Granger-causality from the causal variable to the dependent (right-hand side) variable.

The results show that there was bidirectional causality between deposits and GDP growth, although both relationships are significant only at the 10% level.

156. This is done, for example, in Rousseau and Wachtel, 'Financial Intermediation'. For details, see: Lütkepohl, *Multiple Time Series*, 262.

157. Ibid., 317-318. For a more detailed discussion, see: Hiro Y Toda and Peter CB Phillips, 'Vector Autoregressions and Causality', *Econometrica: Journal of the Econometric Society*, 1993, 1367-1393.

158. Hiro Y Toda and Taku Yamamoto, 'Statistical Inference in Vector Autoregressions with Possibly Integrated Processes', *Journal of Econometrics* 66, no. 1 (1995): 225-250. This approach is also recommended by Lütkepohl, *Multiple Time Series*, 317-318.

159. Ibid.

This means that there is some, albeit weak, evidence that the growth of the economy and the growth of the banking sector were mutually reinforcing. However, commercial banks did not play an independent role in fostering British economic growth. There is no evidence of a causal relationship between paid-in capital and GDP, suggesting that stock markets did not play significant role in British economic growth.

Table 1.1: Toda-Yamamoto test for Granger-causality with proxies for stock markets and banks, data for 1870-1913

Test	Chi-squared	p-value	Inference
Deposits \rightarrow GDP	5.43	0.066*	Causality
Paid in K \rightarrow GDP	2.826	0.243	No causality
GDP \rightarrow Deposits	5.588	0.061*	Causality
Paid in K \rightarrow Deposits	2.379	0.304	No causality
GDP \rightarrow Paid in K	1.329	0.515	No causality
Deposits \rightarrow Paid in K	1.507	0.471	No causality

The model has 2 lags. *, **, and *** indicate a p-value of less than 0.1; 0.05; and 0.01, respectively.

The result linking banks to the economy in table 1.1 becomes weaker if we repeat the same exercise with credit data.¹⁶⁰ The results are displayed in table 1.2. The growth of bank credit appears to have been a result of economic growth. In other words, the expansion of credit was largely driven by demand, while it did not significantly contribute to economic performance. This exercise has similarities with the Granger-causality tests used by Rousseau and Wachtel, but with data for stock markets, a superior methodology (the Toda-Yamamoto test), and exclusion of interwar data.¹⁶¹ My results might be due to the shorter sample and inaccuracies in the credit data, but taken at face value, they suggest that Rousseau's and Wachtel's result of finance-driven growth in Britain needs to be treated with scepticism.

In order to examine more closely the channels linking economic and financial variables, models with alternative economic indicators are estimated. Table 1.3

160. Data from: Shepard, *Growth and Role*, Appendix table 1.1. Bank credit here is defined as the sum of discounts and advances. There is a break in the series in 1891, when private banks are included in the series. The series has been made consistent with post-1891 figures by applying the growth rate of the series from 1880 to 1891 for the series starting in 1892.

161. Rousseau and Wachtel, 'Financial Intermediation'.

Table 1.2: Toda-Yamamoto test for Granger-causality with credit as a proxy for banking, data for 1880-1913

Test	Chi-squared	p-value	Inference
Credit \rightarrow GDP	1.49	0.475	No causality
Paid in K \rightarrow GDP	0.313	0.855	No causality
GDP \rightarrow Credit	5.468	0.065*	Causality
Paid in K \rightarrow Credit	1.226	0.542	No causality
GDP \rightarrow Paid in K	2.591	0.274	No causality
Credit \rightarrow Paid in K	2.146	0.342	No causality

The model has 2 lags.

presents results from models using two different indicators: TFP and fixed capital formation. In the first specification, TFP and deposits interact in a mutually reinforcing manner, although evidence of causality running from banking to TFP growth is only significant at the 10% level. Moreover, there is no causal relationship between banks and investment, as shown on right-hand side of the table. This is to be expected, because banks rarely lent for capital investment.

Table 1.3: Toda-Yamamoto tests for Granger-causality with data on TFP or investment

1. Model with TFP		2. Model with investment	
Test	p-value	Test	p-value
Deposits \rightarrow TFP	0.067*	Deposits \rightarrow Investment	0.881
Paid in K \rightarrow TFP	0.752	Paid in K \rightarrow Investment	0.976
TFP \rightarrow Deposits	0.048**	Investment \rightarrow Deposits	0.195
Paid in K \rightarrow Deposits	0.486	Paid in K \rightarrow Deposits	0.981
TFP \rightarrow Paid in K	0.527	Investment \rightarrow Paid in K	0.892
Deposits \rightarrow Paid in K	0.439	Deposits \rightarrow Paid in K	0.032**

The lag length of the model with TFP is 2, whereas that of the model with investment is 1 .

The findings shown in table 1.3 provide no evidence of stock markets driving either productivity growth or investment. We might reasonably expect investment to have been the primary channel through which stock markets were linked to the economy. In this light, the result reinforces the notion that stock markets were not important for British economic growth. The result that deposits Granger-caused paid-in capital is not straightforward to explain, but the fact that this finding is

not present in other model specifications in this section suggests that the result might be spurious.

The specifications used so far have been parsimonious and followed several past studies in terms of variable selection.¹⁶² However, as pointed by Luintel and Khan, the omission of relevant variables can lead to misleading estimates in time series studies on finance and growth.¹⁶³ To increase theoretical consistency with standard economic growth models, a model which includes both investment and GDP, along with paid-in capital and deposits, is estimated. The result from this larger model are shown in table 1.4. The findings are consistent with those from more parsimonious models presented in table 1.1. As in the smaller model, we observe that there was bidirectional causality between deposits and GDP. On the other hand, stock markets do not appear to have played a role in economic growth.

Table 1.4: Toda-Yamamoto test for Granger-causality with proxies for investment, banking and stock markets

Test	Chi-squared	p-value	Inference
Paid in K → GDP	4.248	0.236	No causality
Deposits → GDP	7.119	0.068*	Causality
Investment → GDP	1.618	0.655	No causality
GDP → Paid in K	4.232	0.237	No causality
Deposits → Paid in K	3.675	0.299	No causality
Investment → Paid in K	4.191	0.242	No causality
GDP → Deposits	8.421	0.038**	Causality
Paid in K → Deposits	4.784	0.188	No causality
Investment → Deposits	6.055	0.109	No causality
GDP → Investment	2.386	0.496	No causality
Paid in K → Investment	3.571	0.312	No causality
Deposits → Investment	5.834	0.12	No causality

The model has 3 lags.

The methodology through which these results were derived is consistent with several existing time series studies on finance and growth, which makes the results straightforward to compare with findings from other cases. The results suggest

162. Stock markets, growth and banking sector development are used in a VAR specification for example in Rousseau and Wachtel, 'Equity Markets'; Arestis, Demetriades and Luintel, 'Financial Development'; Peia and Roszbach, 'Finance and Growth: Time Series Evidence on Causality'.

163. Luintel and Khan, 'Quantitative Reassessment'.

that the impact of stock markets on historical economic growth in Britain was considerably weaker than it was in Belgium and the US.¹⁶⁴ As for the banking system, it may have reinforced economic growth, but it did not play a strong independent role in driving it. To some extent, the banking sector's growth was both a symptom and cause of economic growth, although it bears repeating that the result is not statistically strong. This finding differs from what several other studies on pre-WW1 finance and growth have found. Moreover, the story is not one of banks driving investment, as it might be in the case of Germany.¹⁶⁵ Instead, as far as commercial banks contributed to economic activity, they did so through fostering productivity growth. This is in line with several studies based on post-WW2 data, and further reinforces the argument that economic historians should emphasise other channels beyond capital deepening when examining the effect of finance on economic performance.

Sectoral View

This section explores the impact of the banking sector's development on the output of the manufacturing and service sectors. This could shine further light on the types of firms that benefited from the banking sector's growth. Table 1.5 shows the impact of deposits on gross value added in both manufacturing and services, using Feinstein's data.¹⁶⁶ The left panel (specification 1.) shows results when Feinstein's series for total service sector output (excluding communication and transportation services) is used, whereas the model in the right panel (specification 2.) uses output from distribution services. This distinction is necessary, because the total service sector output includes non-market (i.e. public sector) services, as well as a measure of value added in financial services itself. Distribution services - primarily wholesale and retail trade - accounts for a large share of market services, and may thus serve as a more useful proxy for the service sector's output.

When the total service sector output is used in a VAR model, the results (table 1.5) suggest that there was a positive impact of banking on growth in both

164. Nieuwerburgh, Buelens and Cuyvers, 'Stock Market Development'; Rousseau and Sylla, 'Emerging'.

165. Burhop, 'Did Banks'.

166. Feinstein, *National Income*.

Table 1.5: Toda-Yamamoto tests for Granger-causality with data on manufacturing and service sector output

1. Model with all services		2. Model with distribution services	
Test	p-value	Test	p-value
Services → Manufacturing	0.889	Dist. Services → Manufacturing	0.901
Deposits → Manufacturing	0.03**	Deposits → Manufacturing	0.19
Manufacturing → Services	0.01***	Manufacturing → Dist. Services	0.176
Deposits → Services	0.076*	Deposits → Dist. Services	0.052*
Manufacturing → Deposits	0.443	Manufacturing → Deposits	0.57
Services → Deposits	0.375	Dist. Services → Deposits	0.448

The lag length of the model with all services is 2, whereas that of the second model is 3. Source: Charles Hilliard Feinstein, *National Income, Expenditure and Output of the United Kingdom, 1855-1965*, vol. 6 (Cambridge: Cambridge University Press, 1972). Manufacturing output from table 51; and output in distributive services from table 53. Total service sector output, excluding communication and transportation services, is based on Feinstein's data is from Brian R Mitchell, *British Historical Statistics* (Cambridge: Cambridge University Press, 1988), Ch. XVI, table 8.

manufacturing and services. However, due to the issues discussed above associated with the total service sector output data, more weight should be put on results from a model using distribution services. When this proxy is used, the results change significantly. The results from specification 2. suggest that there is no causality from deposits to manufacturing. However, the result of a causal link from banking to services holds, albeit still only at the 10% level. Moreover, the result on highly significant causality from manufacturing to services in the model including total service sector output probably have to do with the underlying quality issues affecting the service series.

The discrepancies between the results in the table indicate a lack of robustness. This might have to do with the highly conjectural nature of Feinstein's sectoral data, particularly for the earlier part of the sample.¹⁶⁷ Alternatively, it might have to do with the results from the model using data on all services being polluted by the problems affecting Feinstein's series for services used in that model. It follows that the result of causality running from deposits to services from the model with

167. This is partially because his sectoral input data is lacking, forcing him to make some rough estimates. See: Robert Charles Oliver Matthews, Charles Hilliard Feinstein and John C Odling-Smee, *British Economic Growth, 1856-1973* (Oxford: Oxford University Press, 1982), Appendix D.

distributive services is to be preferred. Meanwhile, the result of causality running from deposits to sectoral growth in the first model specification is to be considered spurious. While there is weak evidence of finance contributing to service sector output, owing to a lack of better sectoral output data, it is difficult to make bold statements about the impact of finance on sectoral growth. Nevertheless, these results are consistent with findings from German data, in that it was primarily less capital-intensive sectors of the economy that benefited from the banking system's growth.¹⁶⁸

Structural Breaks

Structural breaks in the underlying series may limit the validity of the inferences drawn from the models discussed above. Structural breaks refer to unexpected shifts in the evolution of a time series. If breaks represent temporary changes in the series, they could be dealt with using dummy variables in conjunction with the Toda-Yamamoto test.¹⁶⁹ However, if these breaks reflect more gradual changes, or if the relationships between financial and economic variables change, the models applied thus far are not adequate, even when dummy variables are used. This possibility motivates the application of more sophisticated models, outlined in the following section.

The indicators of financial development - deposits and paid in capital - both include several breaks. This can be shown by utilising the Bai-Perron test.¹⁷⁰ The test is carried out on the following equation:

$$y_t = \alpha + \beta y_{t-1} + \gamma t + \left(\sum_{i=1}^k \delta_i D_i \right) + u_t \quad (1.3)$$

where y_t is the value of a series of interest at time t . We test if any number of parameters corresponding to dummies D_i are significant. D_i is an indicator

168. Diekmann and Westermann, 'Financial Development and Sectoral Output'.

169. A dummy variable is a variable which takes the value 1 in given years and 0 in others.

170. Jushan Bai and Pierre Perron, 'Computation and Analysis of Multiple Structural Change Models', *Journal of Applied Econometrics* 18, no. 1 (2003): 1-22.

variable, taking the value 1 in a given year and zero otherwise. The date at which D_i is 1 is the proposed date of the structural break. The Bai-Perron algorithm tests for breakpoints at unknown dates, and returns the dates at which structural changes in the variable y are most likely to have occurred.

The Bai-Perron test on deposits suggests 2 breakpoints, for the years 1876 and 1899, based on the Bayesian Information Criterion.¹⁷¹ Especially the 1876 breakpoint is to be expected, as it is close to the City of Glasgow Bank failure in 1878. With regards to paid in capital, the test suggests at least 4 breakpoints, for the years 1880, 1889, 1895 and 1905. In the presence of such instability in the series, it is useful to apply methods that are able to deal with non-linearities in the underlying data.

1.5.2 TVP-VAR

The models used above assume that the relationship between finance and the economy is stable over time. This assumption is restrictive, because the British economy and financial system both underwent considerable changes from 1850 to 1913. The relationship between banks and the economy may thus have been very different in, say, 1900 compared to 1870. A changing relationship between finance and economic growth should also be expected in light of the empirical studies reviewed above, showing that the effect of finance on growth tends to weaken as countries become more developed.¹⁷²

The financial sector grew and changed in important respects over the period 1850-1913. The banking system became more stable after the crises in 1866 and 1878 as lending practices changed and became more conservative.¹⁷³ Additionally, the banking sector went from being very fragmented to being highly concentrated. Meanwhile, the orientation of British stock markets became increasingly international, but they also saw more listings by domestic industrial enterprises after

171. For details, see: Bai and Perron, ‘Computation and Analysis’.

172. Felix Rioja and Neven Valev, ‘Does One Size Fit All?: A Reexamination of the Finance and Growth Relationship’, *Journal of Development Economics* 74, no. 2 (2004): 429–447; Rousseau and Wachtel, ‘Happening’.

173. Baker and Collins, ‘Financial Crises and Structural Change’.

the 1880s. In order to study if any of these changes led to time-varying linkages between finance and growth, a novel econometric approach is needed.

VAR models with time-varying parameters (TVP-VARs) have become a widely used tools in empirical macroeconomics following the contributions by Primiceri as well as Cogley and Sargent.¹⁷⁴ This approach has been applied to historical data to study monetary policy, the drivers of inflation, among other topics in macroeconomic dynamics.¹⁷⁵ Yet, it has only recently been applied to the study of the macroeconomic impact of financial shocks.¹⁷⁶ The advantage of the TVP-VAR approach is that it allows us to examine how the relationships between various macroeconomic time series change over time. Since it allows for these time-varying relationships, the model has a superior forecasting performance than several other commonly used econometric models.¹⁷⁷

Consider the time-varying parameter VAR with ρ lags and N variables, representing different macroeconomic time series :

$$\mathbf{y}_t = \boldsymbol{\mu}_t + \sum_{i=1}^{\rho} \mathbf{B}_{i,t} \mathbf{y}_{t-i} + \boldsymbol{\nu}_t \quad (1.4)$$

$$\text{var}(\boldsymbol{\nu}_t) = \mathbf{R}_t \quad (1.5)$$

174. Giorgio E Primiceri, ‘Time Varying Structural Vector Autoregressions and Monetary Policy’, *The Review of Economic Studies* 72, no. 3 (2005): 821–852; Timothy Cogley and Thomas J Sargent, ‘Drifts and Volatilities: Monetary Policies and Outcomes in the Post WWII US’, *Review of Economic Dynamics* 8, no. 2 (2005): 262–302.

175. Tobias Straumann and Ulrich Woitek, ‘A Pioneer of a New Monetary Policy? Sweden’s Price-Level Targeting of the 1930s Revisited’, *European Review of Economic History* 13, no. 2 (2009): 251–282; Martin Kliem, Alexander Kriwoluzky and Samad Sarferaz, ‘On the Low-Frequency Relationship between Public Deficits and Inflation’, *Journal of Applied Econometrics* 31, no. 3 (2016): 566–583; Pooyan Amir-Ahmadi, Christian Matthes and Mu-Chun Wang, ‘Drifts and Volatilities Under Measurement Error: Assessing Monetary Policy Shocks over the Last Century’, *Quantitative Economics* 7, no. 2 (2016): 591–611; John W Keating and Victor J Valcarcel, ‘The Time-Varying Effects of Permanent and Transitory Shocks to Real Output’, *Macroeconomic Dynamics* 19, no. 3 (2015): 477–507.

176. Bijsterbosch and Falagiarda, ‘Macroeconomic Impact’ and Luca Gambetti and Alberto Musso, ‘Loan Supply Shocks and the Business Cycle’, *Journal of Applied Econometrics* 32, no. 4 (2017): 764–782.

177. Antonello D’Agostino, Luca Gambetti and Domenico Giannone, ‘Macroeconomic Forecasting and Structural Change’, *Journal of Applied Econometrics* 28, no. 1 (2013): 82–101.

The vector \mathbf{y}_t contains the observations of the N macroeconomic or financial series at time t . $\boldsymbol{\mu}_t$ are time-varying constants, and the $N \times N$ matrix $\mathbf{B}_{i,t}$ contains VAR-parameters to be estimated for lag i . Note the subscript t . This means that at each time t , the parameters are allowed to change. In an ordinary VAR with static parameters, this subscript would not exist. $\boldsymbol{\nu}_t$ are error terms and \mathbf{R}_t contain the variances of the errors.

The model also allows for variance of the error terms to change over time. Modeling the variance as a time-varying random variable is referred to as stochastic volatility, volatility being another term for standard deviation.¹⁷⁸ Primiceri argues that if stochastic volatility is not allowed for, the model becomes less useful for forecasting and potentially imprecise, as it would confound economic volatility with structural change in the relationships between macroeconomic variables.¹⁷⁹ This is why the time-varying covariance structure, embodied in \mathbf{R}_t , is useful. For purposes of estimating the model, it is decomposed as follows:

$$\mathbf{R}_t = \mathbf{A}_t^{-1} \mathbf{H}_t \mathbf{A}_t^{-1'} \quad (1.6)$$

Where \mathbf{A}_t governs the contemporaneous relationships between the error terms. It is specified as a lower triangular matrix with 1's on the diagonal. In the trivariate case:

$$\mathbf{A}_t = \begin{bmatrix} 1 & 0 & 0 \\ a_{21t} & 1 & 0 \\ a_{31t} & a_{32t} & 1 \end{bmatrix} \text{ and } \mathbf{H}_t = \begin{bmatrix} h_{1,t} & 0 & 0 \\ 0 & h_{2,t} & 0 \\ 0 & 0 & h_{3,t} \end{bmatrix}$$

This structure simplifies considerably the estimation of the parameters, which vary over time. Define $\boldsymbol{\beta}_t$ as a stacked vector of all the coefficients, such that $\boldsymbol{\beta}_t = \text{vec}([\boldsymbol{\mu}_t, \mathbf{B}_{1,t}, \dots, \mathbf{B}_{\rho,t}])'$.¹⁸⁰ Then the dynamics of the parameters can be summarised as follows:

178. Recall that the standard deviation (or volatility) is defined as the square root of the variance.

179. Primiceri, 'Time Varying'.

180. The *vec* operator denotes vectorisation, whereby a matrix is converted to a vector by stacking its columns.

$$\boldsymbol{\beta}_t = \boldsymbol{\beta}_{t-1} + \mathbf{e}_t; \quad \text{var}(\mathbf{e}_t) = \mathbf{Q} \quad (1.7)$$

$$\ln(h_{i,t}) = \ln(h_{i,t-1}) + z_{i,t}; \quad \text{var}(z_{i,t}) = w_i \quad (1.8)$$

$$a_{ij,t} = a_{ij,t-1} + v_{i,t}; \quad \text{var}(v_{i,t}) = s_i \quad (1.9)$$

for all i and j (which indicate the variable to which the parameters relate).

The equations say that the parameters evolve as random walks: they are determined by their own past values and a random process. Here, the variance matrix \mathbf{Q} is very important, because the degree to which the coefficients can vary depend on it. The same goes for the variances w_i and s_i , which determine how much the error variances and covariances can change over time.

The model has several parameters, and its estimation using maximum-likelihood methods would be inefficient. Bayesian estimation is useful in this case, especially as it provides a natural approach for achieving shrinkage for the possible parameter values. Primiceri develops a Markov Chain Monte Carlo (MCMC) algorithm for estimating the model, which is applied in this chapter.¹⁸¹ The time-varying parameters can be sampled using an algorithm by Carter and Kohn, which relies on Kalman filtering.¹⁸² The stochastic volatilities are sampled using an algorithm by Kim *et al.*, whereby it is sampled from a mixture of normal distributions.¹⁸³ More details on estimation and priors that were used for the parameters can be found in the appendix. Here, it suffices to note that the priors are broadly consistent with those found in the TVP-VAR literature.

181. Primiceri, ‘Time Varying’. There is a minor mistake in the estimation of stochastic volatility in Primiceri’s algorithm. It is fixed by changing the order in which parameters in the Gibbs sampler are sampled. See: Marco Del Negro and Giorgio E Primiceri, ‘Time Varying Structural Vector Autoregressions and Monetary Policy: A Corrigendum’, *The Review of Economic Studies* 82, no. 4 (2015): 1342–1345.

182. Chris K Carter and Robert Kohn, ‘On Gibbs Sampling for State Space Models’, *Biometrika* 81, no. 3 (1994): 541–553.

183. Sangjoon Kim, Neil Shephard and Siddhartha Chib, ‘Stochastic Volatility: Likelihood Inference and Comparison with ARCH Models’, *The Review of Economic Studies* 65, no. 3 (1998): 361–393.

1.5.3 Results from TVP-VARs

The time-varying parameter model is estimated using the following three variables: GDP, deposits and paid in capital. The variables are in log-differences and converted to real, per capita terms. These types of models are typically specified with a parsimonious lag structure, and studies with quarterly data often use two lags.¹⁸⁴ The results in this section are derived using a VAR with one lag, although they are robust to using models with two lags. The results are obtained from running the MCMC algorithm 50,000 times, with the first 30,000 draws discarded.¹⁸⁵

Time-varying Granger-causality

This section presents results from Granger-causality tests based on the time-varying VAR. The intuition of the test is the same as that of the ordinary Granger-causality test. Namely, it tells us if X (e.g. financial development) helps predict Y (e.g. economic growth) at a statistically significant level. To answer this, we compare the estimated model with a model where the relevant causal variable is set to 0. In a TVP-VAR context, such a comparison is done at each point in time, for different sets of parameters. Koop et al. outline a method for doing this, which is applied below.¹⁸⁶ The advantage of testing for Granger-causality is that it requires no additional assumptions of the model once it has been estimated. This is in contrast to impulse response analysis, which is discussed in the next subsection.

Results in figure 1.6 show the probability that there is *no* Granger-causality from deposits (top panel) or paid-in capital (bottom panel) to economic growth, at each point in time. The lower the line is on the left axis, the more likely it is

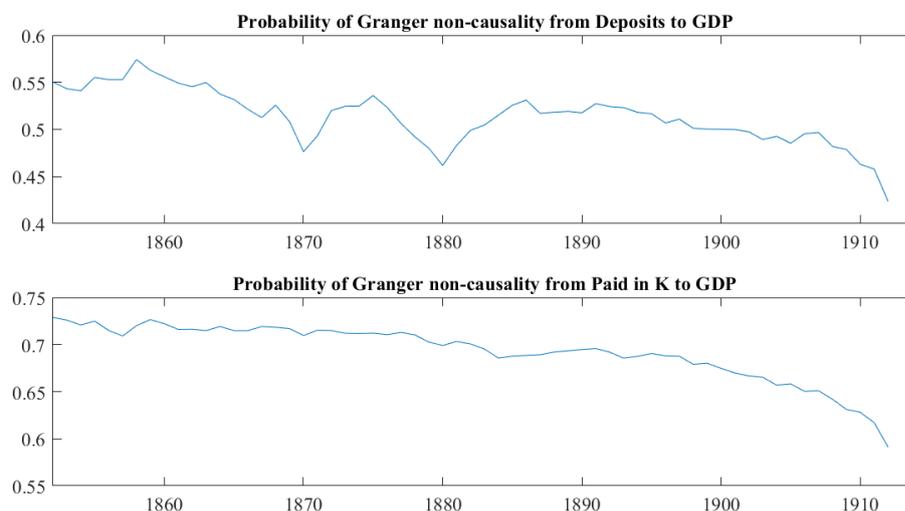
184. Primiceri, ‘Time Varying’; Luca Benati and Thomas A Lubik, ‘Sales, Inventories and Real Interest Rates: A Century of Stylized Facts’, *Journal of Applied Econometrics* 29, no. 7 (2014): 1210–1222; Kliem, Kriwoluzky and Sarferaz, ‘On the Low-Frequency Relationship between Public Deficits and Inflation’; Amir-Ahmadi, Matthes and Wang, ‘Drifts and Volatilities Under Measurement Error: Assessing Monetary Policy Shocks over the Last Century’.

185. Primiceri, ‘Time Varying’.

186. For further details, see: Gary Koop, Roberto Leon-Gonzalez and Rodney W Strachan, ‘Dynamic Probabilities of Restrictions in State Space Models: An Application to the Phillips Curve’, *Journal of Business & Economic Statistics* 28, no. 3 (2010): 370–379; and appendix 1.A.2.

that there is Granger-causality. Informally, these can be thought of as similar to p-values from a regression. To infer Granger-causality, the line should be below 0.1 (corresponding to a 10% probability). As is clear from the figures, there is no evidence of finance-led growth in Britain from 1850 to 1913. The probabilities of no causality to GDP fluctuate between 0.45 and 0.55 in the case of deposits, and 0.6-0.75 in the case of paid-in capital.

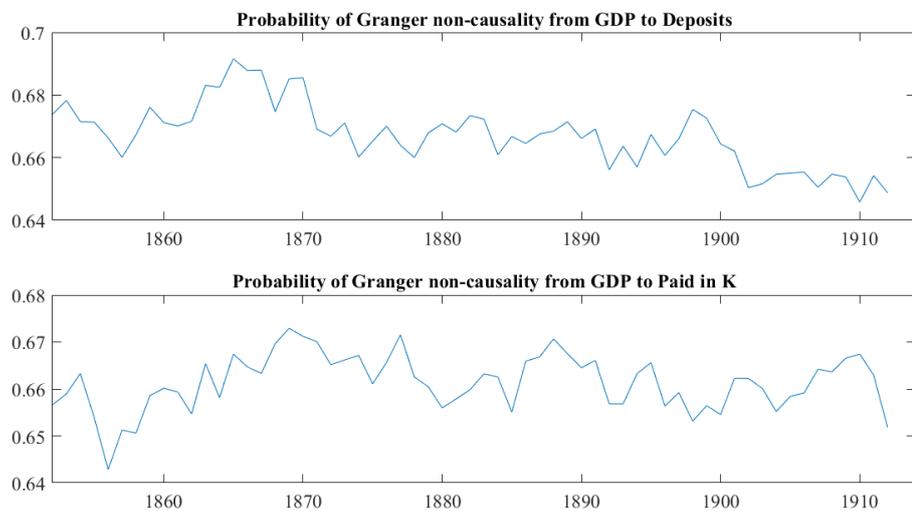
Figure 1.6: Time-varying Granger-causality tests of deposits and paid-in capital to GDP



There is also no evidence of reverse causality from growth to finance, as shown in figure 1.7. In fact, it is highly probable that the growth of the banking sector and stock markets was *not* driven by economic growth. These results are obtained by using training sample priors, which are typically used in the literature, but they are also robust to using Minnesota-type priors, and models with both 2 lags.¹⁸⁷ The results thus bring into question the robustness of the findings from static models, discussed above.

187. For information about Minnesota-type priors for TVP-VARs, see: Dimitris Korobilis, 'Assessing the Transmission of Monetary Policy Using Time-Varying Parameter Dynamic Factor Models', *Oxford Bulletin of Economics and Statistics* 75, no. 2 (2013): 157–179.

Figure 1.7: Time-varying Granger-causality tests of GDP to deposits and paid-in capital



Impulse Responses

In this section, the results from the TVP-VARs are shown as impulse response functions (IRFs). These show how shocks in a given variable (such as deposits) impacted others (such as GDP). We can think of a shock to deposits as the change in deposits that cannot be explained by prevailing economic conditions, or by other variables in the VAR. The impulse response functions on deposits essentially shows ‘what would have happened if deposits grew 1% faster than expected in a given year?’ The result depends on the estimated parameters, which makes the IRFs convenient for summarising linkages between variables, as they depict the magnitude rather than just the significance of a relationship. They also yield an important robustness check to the time-varying causality results, which might suffer from slight inaccuracy due to the short sample.

For the impulse responses to have an economic interpretation, we typically impose a structure on how the variables interact contemporaneously, while leaving their relationships otherwise unrestricted. The economic interpretation arises from identifiability, which means that the econometric model has only one way to arrive at a given result.¹⁸⁸ To this end, I apply sign restrictions. These impose the

188. If the model is not identified, then it could be used to summarise features of the data, but not yield an economic interpretation.

condition that financial and economic variables should move in the same direction contemporaneously, but can move freely subsequently.¹⁸⁹ These assumptions are theoretically consistent with standard endogenous economic growth models augmented with financial variables.¹⁹⁰ The results are also robust to restrictions where the financial indicator of interest is set to move contemporaneously in opposite direction relative to other variables in the model.¹⁹¹

Figure 1.8 shows the impulse response of GDP from a shock to bank deposits (upper panel) and paid in capital (lower panel) after one year. Impulse responses at longer horizons are insignificant, and are thus omitted. The solid line in each graph represents the median impulse response obtained by running the estimation algorithm 20,000 times. The dashed lines indicate the 84% and 16% quantiles of these draws, typically used in Bayesian statistics. To some extent, they can be interpreted as analogues for confidence intervals.¹⁹² In other words, if the lower dashed line is above zero, then we can infer a positive effect from one variable to another. A significant negative effect exists if the upper dashed line is below zero.

The results in the upper panel of figure 1.8 are consistent with those obtained from time-varying causality tests: an increase in deposits had little impact on GDP throughout 1850 to 1913. While the median impulse does show time-variation (the line in the middle fluctuates over time), the impact is not statistically significant in any year.

Turning to the stock markets, the lower panel in figure 1.8 also gives little evidence of stock markets having a positive impact on economic growth. The impact of shocks to paid-in capital were marginally significant only around 1870 and 1880, while remaining insignificant throughout the rest of the period. Although

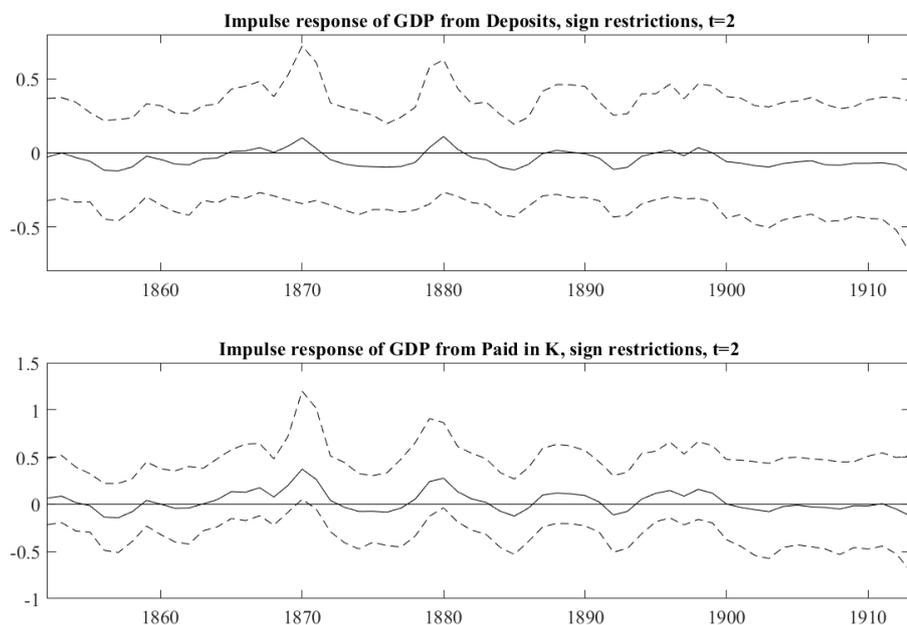
189. For applications of sign-restrictions in TVP-VAR models, see, for example: Luca Benati, ‘The “Great Moderation” in the United Kingdom’, *Journal of Money, Credit and Banking* 40, no. 1 (2008): 121–147; Fabio Canova and Luca Gambetti, ‘Structural Changes in the US Economy: Is There a Role for Monetary Policy?’, *Journal of Economic Dynamics and Control* 33, no. 2 (2009): 477–490.

190. Luintel and Khan, ‘Quantitative Reassessment’.

191. Identifying shocks by using Cholesky-decomposition, whereby financial variables are allowed to respond to economic variables instantly, but economic variables are allowed to respond to financial variables only after 1 or 2 lags, would clearly be unrealistic when using yearly data.

192. However, they cannot be thought of as equivalents of a ‘16% confidence level’. The reason we use 84% and 16% quantiles instead of 5% and 95% quantiles is because the posterior draws are typically highly dispersed in these quantiles.

Figure 1.8: Response of GDP to a shock in deposits and paid-in capital after 1 year

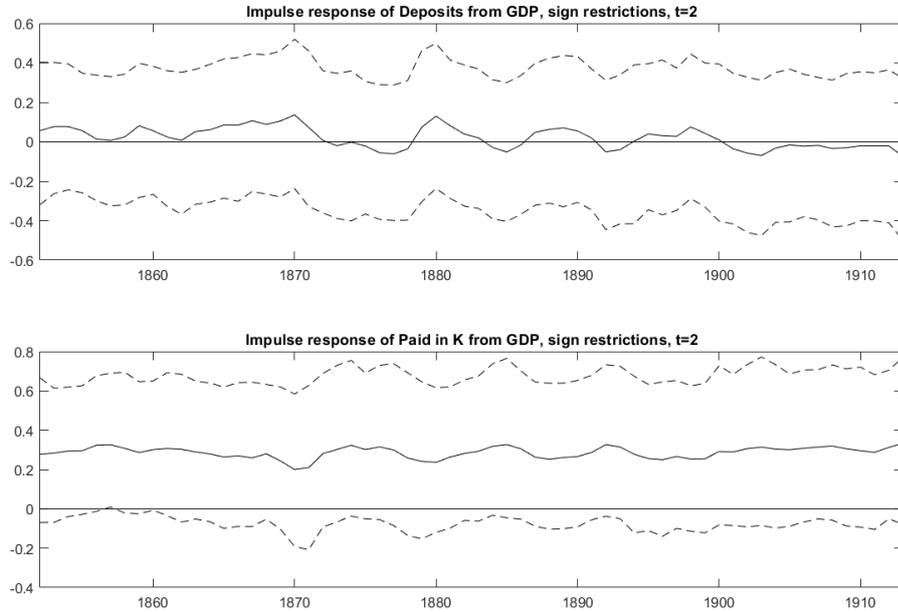


the result for these two years should not be overemphasised, it is noteworthy that they were near the financial crises of 1866 and 1878, potentially indicating that these were the few years when financial constraints were significant. Overall, however, the model provides no evidence of economic growth having been driven by the expansion of the stock market.

The impact of changes in economic conditions on the development of the banking sector and the stock markets was largely insignificant over a two year horizon. The impulse response of GDP to deposits and paid-in capital after one year are shown in figure 1.9. Note that the impulse response has relatively wide bands, indicating a relatively large degree of variance in the responses. However, these results are robust to using more restrictive priors as well (which would allow for less variance) - the impact of GDP on deposits remains insignificant. This implies that the commercial banking system grew, to a significant extent, due to factors that were not directly linked to economic conditions alone. The response of paid-in capital from GDP is positive, but only marginally significant during a few years. At most, this might be taken as relatively weak evidence of the stock market's growth having been demand-driven in certain years. However, it is likely

that most of the market's growth can be explained by other factors.

Figure 1.9: Response of deposits and paid-in capital to a shock in GDP after 1 year



The overarching conclusion that can be drawn from the results in this section is that there was no significant causal relationship between the growth of banks or stock markets on one hand and the economy on the other. Notwithstanding the consistency of most of the TVP-VAR results with those obtained from Toda-Yamamoto tests, the findings from the simpler models might be partially clouded by time-variance in the relationship between financial variables and GDP, along with macroeconomic volatility and structural breaks. Indeed, the TVP-VAR provides substantial evidence of time-variance in these relationships, although the relationships are not significant at any point in time.

1.6 Discussion and Conclusion

This chapter uses new data and methods to test if there was a causal link between financial development and economic growth in the UK from 1850 to 1913. The results suggest that there was not. The growth of the capital markets did not have a significant impact on the economy over this period. The banking sector's

contribution to long-term economic growth, over horizons of 1 years and above, also appears to have been limited. Models that have been widely used in the literature provide some evidence that the growth of the banking system and that of the economy reinforced each other from 1870 to 1913. However, these results are statistically weak and not robust to using more accurate models. But to the extent that such a link existed, it operated through enhancing the productivity with which resources were deployed, and not through capital deepening.

An advantage of this chapter's methodology is that the findings are easy to compare with econometric studies on other historical cases. In this regard, the results are consistent with the Gerschenkronian argument (although they do not explicitly test it): that a leading economy such as Britain benefited less from financial development than did more backward economies in the late 19th and early 20th centuries. More broadly, they are also consistent with recent literature that argues that the growth of a large and already well-developed financial sector often has little impact on economic growth in advanced economies. Indeed, there were important differences between Britain and countries that may have benefited significantly from financial development in the late 19th and early 20th centuries, such as Germany, Japan and Sweden. These countries had substantial room to catch with the British economy, while possessing significantly less sophisticated financial sectors. In this vein, it is not surprising that Britain gained less from further financial development.

This is the first study on finance and growth on pre-WW1 UK that allows for the possibility of a changing relationship between the financial sector and the economy. The results from these methods have further implications on the historical literature on British banking. Existing evidence suggests that banks had shifted a significant share of their assets away from loans to the non-financial sector, especially after the late 1870s.¹⁹³ Yet, notwithstanding the clear evidence of changes in the structure and practices in the banking system, these changes did not have a significant impact on the broader economy. Notably, crises such as 1866 or 1878 did not appear to change the link between the banking sector and the economy over the longer run, although it is precisely after these episodes

193. Michael Collins and Mae Baker, 'English Commercial Bank Liquidity, 1860–1913', *Accounting, Business & Financial History* 11, no. 2 (2001): 171–191; Baker and Collins, 'Financial Crises and Structural Change'.

that substantial changes in banking practices and the banking industry appear to have occurred.¹⁹⁴ Nevertheless, a potential criticism to this chapter's approach is that annual data aggregated at the national level is too coarse to understand the relationship between finance and economic growth. Subsequent chapters address this criticism by looking at the relationship from other perspectives. In particular, the next chapter will use higher frequency data on bank credit.

The results pertaining to the stock markets also have implications for the historical literature, supporting a cautious view of their role in promoting economic growth during the period at issue. This is not controversial with regards to the years 1850-1880, as before the 1880s, domestic companies (with the exception of railways and financial institutions) would rarely seek capital from the public. What is more surprising is the muted role of the stock markets after 1880. Their economic impact did not change from earlier years, despite the fact that in this period, domestic companies in several industries began relying on stock exchanges to a greater extent. At the same time, the chapter does not find support the argument that the growth of the capital markets was merely driven by domestic demand.¹⁹⁵ Economic growth contributed to the expansion of the stock markets only at a marginally significant level during a few years between 1850 and 1913. It follows that institutional factors, along with demand coming from abroad, might be more relevant for explaining the rapid expansion of the British stock markets.

An optimistic way to interpret the results on capital markets is to suggest that the supply of long-term finance was not constrained significantly in the UK in 1850-1913, at least over a horizon of one year or more. This would be consistent with arguments suggesting that firms in the late 19th century could easily find capital through private channels if needed.¹⁹⁶ The contribution of the stock markets may therefore have been muted, because a large share of firms could find substitutes for capital raised from the public. Notwithstanding this possibility, the results still imply that the capital markets did not make a significant contribution to the economy through other channels, such as improving corporate

194. Baker and Collins, 'Commercial Bank Stability'; Turner, *Banking in Crisis*, 120-127; Richard S Grossman, *Unsettled Account: The Evolution of Banking in the Industrialized World Since 1800* (Princeton: Princeton University Press, 2010), 185-187.

195. Cottrell, 'Domestic Finance'.

196. For reviews, see: *Ibid.*; Robert Cull *et al.*, 'Historical Financing of Small-and Medium-Size Enterprises', *Journal of Banking & Finance* 30, no. 11 (2006): 3017-3042.

governance. As to whether the stock markets' ability to foster growth through corporate governance was hindered through institutional weaknesses remains unclear, and further research on the topic is needed.

1.A Appendix to Chapter 1

1.A.1 Data on Scottish Banks

The sources used to supplement the deposit data with that of Scottish banks are outlined in table 1.6.

Table 1.6: Data on public liabilities of Scottish banks included in the sample

Bank	Coverage	Source
Bank of Scotland	1850-1865	Bank of Scotland balance sheets, BOS/4/7/4/1-4, Lloyds Banking Group Archives
British Linen Bank	1860-1865	For 1860: British Linen Bank balance sheets, BLB1/5/22/2, Lloyds Banking Group Archives, Edinburgh. After 1861: Richard Saville, <i>Bank of Scotland: A History, 1695-1995</i> (Edinburgh: Edinburgh University Press, 1996), table A.21
Clydesdale Bank	1850-1865	James Macarthur Reid, <i>The History of the Clydesdale Bank, 1838-1938</i> (Glasgow: Blackie & Son Limited, 1938), 82, 153
Royal Bank of Scotland	1850-1865	RBS balance sheets, RB/257/2-4, RBS Archives
Union Bank of Scotland	1850-1865	Saville, <i>Bank of Scotland</i> , table A.22
Western Bank of Scotland	1850-1857	Western Bank of Scotland balance sheets, WB/10, RBS Archives
Total for the Scottish banking system	1865-1870	Checkland, <i>Scottish Banking</i> , table 44

1.A.2 Priors and Estimation of the TVP-VAR

In Bayesian estimation, we are concerned with obtaining the posterior probability distribution of parameters, which contains information about the parameters conditional on the data. In order to obtain estimates, we need to specify priors, which contain our prior beliefs about the parameters. Priors, together with the model likelihood function which includes information about the observed data, are then used to estimate the posterior distribution. More formally, let $f(\mathbf{y}|\boldsymbol{\theta})$ represent the likelihood function of the data conditional on the parameters, where \mathbf{y} is the observed data and $\boldsymbol{\theta}$ are all the parameters. The posterior and prior distributions are denoted $p(\boldsymbol{\theta}|\mathbf{y})$ and $p(\boldsymbol{\theta}_k)$, respectively.¹⁹⁷

The posterior distribution of parameters is then obtained via Bayes' rule:

$$p(\boldsymbol{\theta}|\mathbf{y}) = \frac{f(\mathbf{y}|\boldsymbol{\theta})p(\boldsymbol{\theta}_k)}{\int f(\mathbf{y}|\boldsymbol{\theta})p(\boldsymbol{\theta})d\boldsymbol{\theta}} \quad (1.10)$$

$$p(\boldsymbol{\theta}|\mathbf{y}) \propto f(\mathbf{y}|\boldsymbol{\theta})p(\boldsymbol{\theta}_k) \quad (1.11)$$

Where \propto denotes 'proportional to': the estimates of the parameters are proportional to the prior distributions and the likelihood function.¹⁹⁸

Bayesian priors are a convenient way to provide some degree of restriction to what values the parameters can take. In a time-varying model they are particularly important, because they also determine the amount of time-variance that can take place.¹⁹⁹ However, it is still possible to specify priors which make the posterior draws heavily data-driven. A common starting point for doing this is to estimate a time-invariant VAR using a training sample. Because of the relatively short sample in my case, and lack of data before 1850, I use the full sample as my training sample. A similar approach has been used previously in economic history by Straumann and Woitek, although owing to more data, they do not use all of

197. Here, '| ' denotes 'conditional on'.

198. For more details on estimation and prior specifications for TVP-VARs, see Jouchi Nakajima *et al.*, 'Time-Varying Parameter VAR Model with Stochastic Volatility: An Overview of Methodology and Empirical Applications', *Monetary and Economic Studies* 29 (2011): 107–142; Primiceri, 'Time Varying'; Cogley and Sargent, 'Drifts'.

199. Primiceri, 'Time Varying'.

their sample for training.²⁰⁰

The priors of the parameters in the TVP-VAR specified by Primiceri can be summarised as follows:

$$\boldsymbol{\beta}_0 \sim N(\hat{\boldsymbol{\beta}}_0, c_\beta \cdot V(\hat{\boldsymbol{\beta}}_0)) \quad (1.12)$$

$$\mathbf{H}_0 \sim N(\hat{\mathbf{H}}_0, c_h \cdot \mathbf{I}_N) \quad (1.13)$$

$$\mathbf{A}_0 \sim N(\hat{\mathbf{A}}_0, c_a \cdot V(\hat{\mathbf{A}}_0)) \quad (1.14)$$

$$\mathbf{Q} \sim IW(k_Q^2 \cdot V(\mathbf{Q}_{prior}) \cdot \kappa, \kappa) \quad (1.15)$$

$$\mathbf{W} \sim IW(k_W^2 \cdot N, \mathbf{I}_N) \quad (1.16)$$

$$\mathbf{S}_i \sim IW(k_S^2 \cdot (i+1) \cdot V(\mathbf{S}_{prior}), (i+1)) \quad (1.17)$$

The underlying parameters to be estimated are outlined in section 1.5.2. Here, S_i is the i th row of matrix S . S is block diagonal such that: $S_1 = s_1$; $S_2 = [s_2, s_3]$. W is a diagonal matrix with elements w_i .

$\hat{\boldsymbol{\beta}}_0$; $\hat{\mathbf{H}}_0$ and $\hat{\mathbf{A}}_0$ are estimates based on a constant-parameter VAR on the full sample. $V(\cdot)$ denotes the estimated variances of these parameters. $N(\cdot)$ and $IW(\cdot)$ are the normal and inverse-Wishart distributions, respectively. κ is the prior degrees of freedom allowed for the distribution of \mathbf{Q} . To avoid unnecessary restrictions, it is set to the minimum allowed for the prior to be proper: $(1 + N\rho) * N + 1$.²⁰¹ This allows the data significant freedom to determine how much time-variance there is in the parameters.

Following Kang *et al.*, I specify $V(\mathbf{Q}_{prior}) = \mathbf{I}_{N \times (N\rho+1)}$ and $V(\mathbf{S}_{prior}) = \mathbf{I}_N$.²⁰² This constitutes an uninformative and relatively flat prior, and contrasts with the more traditional approach by e.g. Primiceri, who sets $V(\mathbf{Q}_{prior}) = V(\hat{\boldsymbol{\beta}}_0)$ and $V(\mathbf{S}_{prior}) = V(\hat{\mathbf{A}}_0)$.²⁰³ In a small sample, the latter approach is too restrictive,

200. Straumann and Woitek, ‘Pioneer’.

201. Cogley and Sargent, ‘Drifts’.

202. Wensheng Kang, Ronald A Ratti and Kyung Hwan Yoon, ‘Time-Varying Effect of Oil Market Shocks on the Stock Market’, *Journal of Banking & Finance* 61 (2015): 150–163.

203. Primiceri, ‘Time Varying’.

as it imposes too many prior constraints on the amount of time-variance that the model can exhibit. In a longer sample this matters less. However, my results are robust to using the latter specification, although this type of model's time-variance is muted.

For the hyperparameters, I set $k_Q = 0.0035$; $k_S = 0.01$; $k_W = 0.05$.²⁰⁴ For the priors of β , \mathbf{A} and \mathbf{H} , I set $c_\beta = 4$; $c_a = 4$ and $c_h = 4$, which are consistent with the specification of Primiceri.²⁰⁵ I have experimented with setting priors of k_Q between 0.001 and 0.01; k_S between 0.01 and 0.1; k_W between 0.01 and 0.1. I have also tried changing c_β ; c_a and c_h between 1 and 4. The results are robust to these changes, although high levels of k_Q and low values of k_W led to high degrees of dispersion and instability in the draws.

These priors are broadly consistent with those used in the macroeconomic literature.²⁰⁶ More details on estimation is provided by Del Negro and Primiceri.²⁰⁷

Once the model parameters have been estimated, it is possible to test for Granger-causality in a time-varying setting using the approach outlined by Koop *et al.*²⁰⁸ This method builds on the intuition behind Bayesian model selection. Suppose we have two models, M_1 and M_2 , where model 1 incorporates restrictions on the relationship between finance and the economy. In other words, M_1 contains the restriction that all elements of β that link past values of financial development to economic growth are zero, which implies Granger non-causality. Let $p(M_1)$ denote the prior probability that model M_1 is correct, whereby the corresponding probability for the unrestricted model is $p(M_2) = 1 - p(M_1)$.

To ascertain whether there is Granger-causality, we evaluate the probability that M_1 is true. The posterior odds ratio is used to compare the restricted and unrestricted models:

204. k_Q and k_S are set to relatively small values to adjust for the impact of setting uninformative priors on time-variances ($V(\mathbf{Q}_{prior})$ and $V(\mathbf{S}_{prior})$).

205. Primiceri, 'Time Varying'.

206. Cogley and Sargent, 'Drifts'; Primiceri, 'Time Varying'.

207. Del Negro and Primiceri, 'Time Varying Structural Vector Autoregressions and Monetary Policy: A Corrigendum'; Primiceri, 'Time Varying'. See also the appendix of the working paper version of Gambetti and Musso, 'Loan Supply Shocks and the Business Cycle'.

208. Koop, Leon-Gonzalez and Strachan, 'Dynamic Probabilities'.

$$\frac{p(M_1|\mathbf{y})}{p(M_2|\mathbf{y})} = \frac{f(\mathbf{y}|M_1) p(M_1)}{f(\mathbf{y}|M_2) p(M_2)} = BF \frac{p(M_1)}{p(M_2)} \quad (1.18)$$

Where $p(M_i|\mathbf{y})$ is the posterior probability that model i is true under the data \mathbf{y} , and BF stands for ‘Bayes factor’, which is central to the method outlined by Koop *et al.* This is the ratio of the marginal likelihoods, which are defined as:

$$f(\mathbf{y}|M_i) = \int f(\mathbf{y}|\boldsymbol{\theta}_i, M_i) p(\boldsymbol{\theta}_i|M_i) d\boldsymbol{\theta}_i \quad (1.19)$$

Let $\boldsymbol{\beta}_{restricted}$ incorporate the restriction that there is no Granger-causality from finance to economic growth. Koop *et al.* show that in the TVP-VAR case, the Bayes factor can be obtained as the ratio of the unrestricted posterior and prior, evaluated at the point where the restrictions on $\boldsymbol{\beta}$ hold. Formally:

$$BF = \frac{p(\boldsymbol{\beta} = \boldsymbol{\beta}_{restricted}|\mathbf{y})}{p(\boldsymbol{\beta} = \boldsymbol{\beta}_{restricted})} \quad (1.20)$$

This calculation can be based directly on the draws of the TVP-VAR estimation algorithm. Koop *et al.* outline the precise formulae for doing this.²⁰⁹ Once the Bayes factor is calculated, it is possible to calculate the probability of a Granger-causal relationship between macroeconomic variables during each year in the sample.

1.A.3 Robustness of TVP-VAR Results

Variables in Levels

This section shows results of a model where the variables are in log levels, not differences. In applied work with VARs using higher frequency data, variables are frequently set in levels. This is because differencing variables might needlessly

209. Ibid.

throw away information.²¹⁰ Furthermore, in Bayesian settings where large samples of data are available, keeping non-stationary variables in levels is rarely an issue.²¹¹ This is even less of an issue with the TVP-VAR, where the model is by default able to take into account structural change.

However, there are downsides to using non-stationary variables in this type of a model with a comparatively small sample. Namely, numerical instability becomes an issue, which makes the model either impossible to estimate or the results difficult to replicate. In order to get rid of this problem, we need to impose more restrictive conditions on the model than we would in with a model in differences. This can either be done by placing highly restrictive priors, or by forcing each draw to be stationary. The former could lead to model misspecification, while the latter approach has been shown to be mathematically wrong.²¹² Indeed, earlier work with TVP-VARs combined with yearly data has used differenced data.²¹³

Due to the model's lack of stability with several prior specifications when the data is in levels, the results from a model with levels data should be treated with a degree of scepticism.²¹⁴ It is nevertheless reassuring that findings from a TVP-VAR with data in levels, shown in table 1.10, are consistent with those found in the models with differenced data.

210. Walter Enders, *Applied Econometric Time Series*, 4th ed. (New York: John Wiley & Sons, 2015), 291.

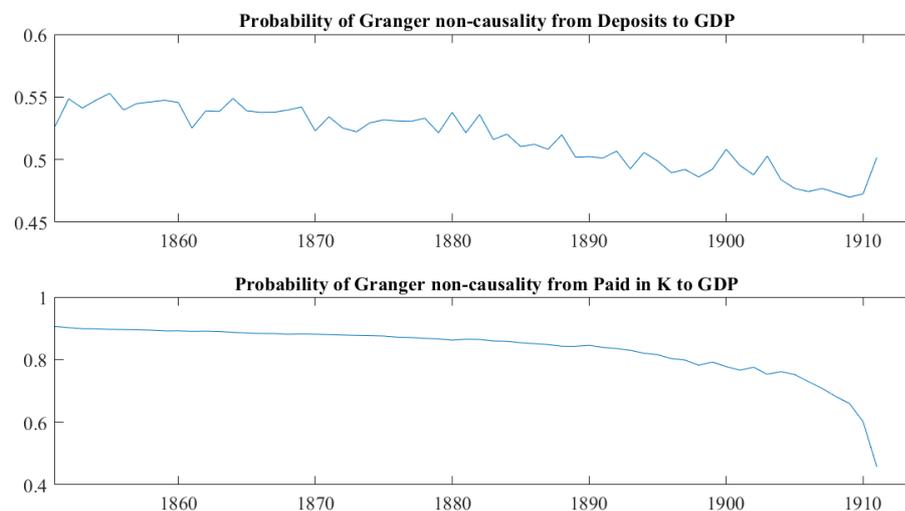
211. Christopher A Sims, 'Bayesian Skepticism on Unit Root Econometrics', *Journal of Economic Dynamics and Control* 12, nos. 2-3 (1988): 463-474; Christopher A Sims, James H Stock and Mark W Watson, 'Inference in Linear Time Series Models with Some Unit Roots', *Econometrica*, 1990, 113-144.

212. Gary Koop and Simon M Potter, 'Time Varying VARs with Inequality Restrictions', *Journal of Economic Dynamics and Control* 35, no. 7 (2011): 1126-1138.

213. Keating and Valcarcel, 'The Time-Varying Effects of Permanent and Transitory Shocks to Real Output'.

214. The priors, following the notation in section 1.A.2, were set to $k_Q = 0.001$; $k_S = 0.01$; $k_W = 0.01$; $c_\beta = 4$; $c_h = 2$; $c_a = 4$.

Figure 1.10: Time-varying Granger-causality tests of deposits and paid-in capital to GDP, variables in levels



Systems with Fixed Capital Formation

Figure 1.11 shows results from a VAR system with GDP, deposits, and fixed capital formation. In figure 1.12, the exercise is repeated with a VAR including data on GDP, paid-in capital, and fixed capital formation. Neither system provides evidence of causal relationships between financial and economic variables. There is no evidence of investment-led growth being caused either by stock markets or banks.

Figure 1.11: Time-varying Granger-causality tests between GDP and deposits, equation with fixed capital formation

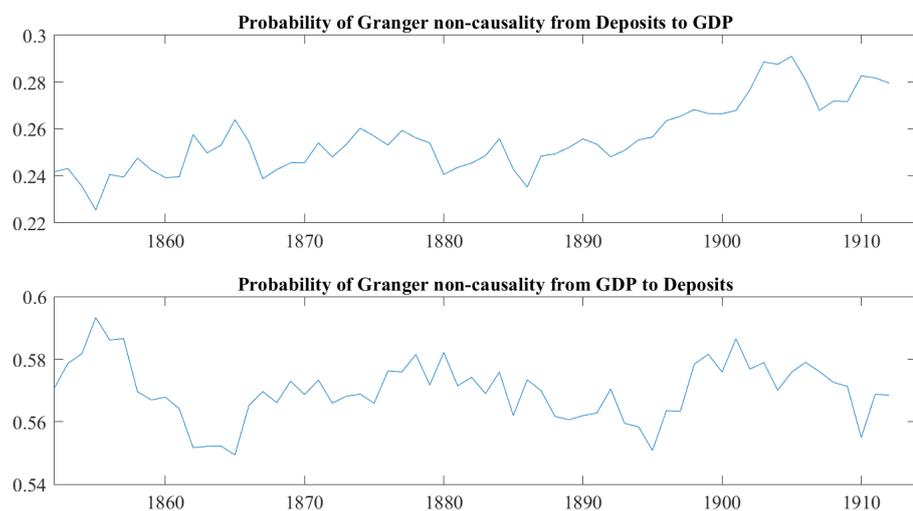
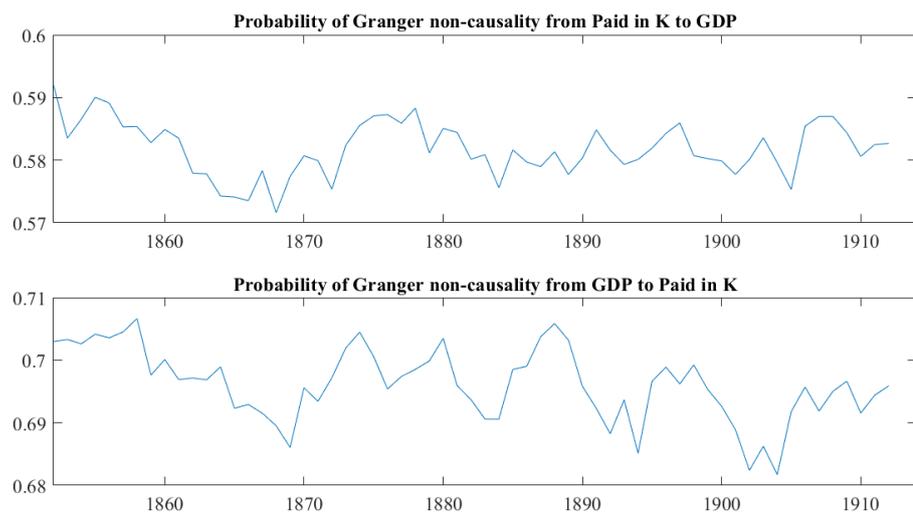


Figure 1.12: Time-varying Granger-causality tests between GDP and paid-in capital, equation with fixed capital formation



Chapter 2

Bank Credit and the Economy, 1880-1913: A Monthly Perspective

Chapter Summary

This chapter uses a new monthly dataset to show that changes in bank credit influenced British economic growth in the short term in the period 1880-1913. It highlights the role of banks in alleviating credit constraints in the economy, which could not be observed from yearly data used in the previous chapter. Furthermore, it shows that prudent banking practices during the period rendered bank lending far less sensitive to interest rates than what it is today. Yet, the fact that bank lending practices became progressively more conservative after the 1880s does not appear to have worsened credit constraints significantly. This is in contrast with the prevalent view in the history of British banking.

2.1 Introduction

How important were changes in bank lending for the British economy in 1880-1913? This chapter supplements the previous one by focusing on the impact of monthly changes in credit availability. The motivation for this arises from the fact that banks lent predominantly on a short-term basis, and that the yearly data, used in the previous chapter, may thus be too coarse to reveal the links between financial conditions and economic growth.

This chapter demonstrates that changes in bank credit influenced British economic growth in the short term, over horizons of 12 months and below. The banking sector could thus act as a significant driving force behind business cycles, even though the financial system in 1880-1913 was remarkably stable. Moreover, the findings highlight an important consequence of the prudent banking practices in place from the 1880s, which is that bank lending was considerably less sensitive to money market interest rates than it is today. Yet, the growing conservatism of banks' lending practices did not lead to constraints on the supply of credit.

The period 1880-1913 is characterised by substantial changes in the commercial banking sector, which began in earnest following the 1878 City of Glasgow

Bank failure. Banks increased the liquidity of their assets by lending on a shorter time-frame, while concurrently reducing the relative share of credit to firms outside the financial sector.¹ These developments have been highlighted as potential hindrances to the level of support that banks afforded to industrial customers. Yet, the implications of these developments for credit availability remain unclear.² Understanding the economic impact of these changes is central to the debate over the role of British banks in the economy at the time.

Had the market for loans functioned perfectly, we could simply dismiss these changes by arguing that the supply of credit was determined by the demand for it.³ Yet, the banking sector was far from being perfectly competitive. Waves of mergers lessened the competitive pressures faced by banks, allowing them to tighten their lending standards and to constrain credit in counties where they had significant market power.⁴ Grossman argues that a lack of competition allowed banks to extract positional rents from their customers, as evidenced by high profits.⁵ And yet, it is difficult to reconcile increased market power of banks with evidence showing that banks rarely refused to grant credit to firms, and offered rather flexible terms for their loans.⁶ We clearly need to shed more light on the role of banks and credit constraints in this period.

While the changing composition of bank balance sheets and lending practices has received significant attention from economic historians, there is remarkably

1. Michael Collins and Mae Baker, 'English Commercial Bank Liquidity, 1860–1913', *Accounting, Business & Financial History* 11, no. 2 (2001): 171–191.

2. Mae Baker and Michael Collins, 'Financial Crises and Structural Change in English Commercial Bank Assets, 1860–1913', *Explorations in Economic History* 36, no. 4 (1999): 428–444; Mae Baker and Michael Collins, 'English Commercial Bank Stability, 1860–1914', *Journal of European Economic History* 31, no. 3 (2002): 493–493; Michael Collins and Mae Baker, *Commercial Banks and Industrial Finance in England and Wales, 1860–1913* (Oxford: Oxford University Press, 2003), 219.

3. Philip L Cottrell, 'Domestic Finance, 1860–1914', in *The Cambridge Economic History of Modern Britain*, ed. Roderick Floud and Paul Johnson (Cambridge: Cambridge University Press, 2004), 253–279.

4. Fabio Braggion, Narly Dwarkasing and Lyndon Moore, 'Nothing Special About Banks: Competition and Bank Lending in Britain, 1885–1925', *The Review of Financial Studies*, 2017, 3502–3537.

5. Richard S Grossman, 'Rearranging Deck Chairs on the Titanic: English Banking Concentration and Efficiency, 1870–1914', *European Review of Economic History* 3, no. 3 (1999): 323–349. Competition between banks is discussed in more detail in the third chapter of this thesis.

6. Michael Collins, 'English Bank Development within a European Context, 1870–1939', *The Economic History Review* 51, no. 1 (1998): 1–24.

little empirical work on the effects these changes had. Goodhart produced important pioneering work on this topic in the 1970s.⁷ He used published monthly data on British bank balance sheets from 1891 to 1914, and examined, among other things, how changes in balance sheet ratios correlated with proxies of financial and economic conditions. For example, he showed that advances (short-term loans) correlated positively with domestic economic conditions. However, to assess whether banks helped generate economic growth, we need to ascertain more than just simple correlation, and prove the existence of a clear causal relationship between credit conditions and economic performance.

This chapter uses extensions of the new tools from multiple time series econometrics outlined in the previous chapter to examine the economic impact of changes in bank credit at higher frequencies. Surely, if bank credit played an important role in the economy, then changes in credit should lead to observable changes in economic conditions.⁸ The methodology makes it possible to study not only the role that banks played in economic growth, but also to explore the impact of changing lending practices. The latter can be done by examining how the relationship between bank credit and the economy changed over time. The empirical investigation is based on a new dataset of monthly credit figures of several banks, covering the years 1880-1913.⁹

Although this chapter chiefly focuses on finance and growth, it also relates to the literature examining the impact of credit supply shocks.¹⁰ Credit supply shocks, broadly defined, refer to changes in bank credit that are not warranted by prevailing economic or financial conditions.¹¹ The focus in this literature is typically on shorter term economic growth rather than the long run approach of the finance-growth literature. Nevertheless, these two strands are intertwined. Studying credit shocks can also deepen our knowledge about finance and growth in the longer term. For example, Helbling *et al.* demonstrate that credit shocks

7. Charles A E Goodhart, *The Business of Banking, 1891–1914* (London: Weidenfeld / Nicolson, 1972).

8. Randall S Kroszner, Luc Laeven and Daniela Klingebiel, ‘Banking Crises, Financial Dependence, and Growth’, *Journal of Financial Economics* 84, no. 1 (2007): 187–228.

9. The data is discussed in more detail in section 2.2.1.

10. For a review, see: James Morley, ‘Macro-Finance Linkages’, *Journal of Economic Surveys* 30 (2015): 698–711.

11. Ben S Bernanke and Alan S Blinder, ‘Credit, Money, and Aggregate Demand’, *The American Economic Review* 78, no. 2 (1988): 435–439.

were an important driver of economic growth in G-7 countries from 1988 to 2009, but that they were especially important during recessions.¹² Kroszner *et al.* show that sectors that are highly reliant on external finance contract disproportionately during banking crises, while during normal times, a large banking sector allows them to grow faster than other sectors.¹³ Their evidence from crisis and non-crisis periods suggests that banks play a central role in lessening credit constraints, which makes them important for the growth of firms that are heavily dependent on external finance.¹⁴

Credit supply shocks have become an important area of study following the Great Recession, especially as the financial sector has been better integrated into macroeconomic models.¹⁵ Changes in bank loan supply have constituted an important driver of recent business cycles in developed countries, thus being central to our understanding of their macroeconomic performance.¹⁶ Evidence from time-varying models has shown that credit supply shocks had a positive impact on the economies of the Euro area before the financial crisis of 2007-2009, but that they also explained a significant part of the economic decline in the crisis years.¹⁷ In the case of the US, the impact of financial shocks has also been found to be significant but time-varying. Before the Great Recession, financial factors could explain 20% of variation in the evolution of GDP, but during the recession they could explain up to 50% of it.¹⁸ Ignoring time-variation would thus lead to inaccurate inferences about the impact of changes in credit supply. Indeed, the importance of credit for business cycles, especially during periods of macroeconomic instability, has been

12. Thomas Helbling *et al.*, 'Do Credit Shocks Matter? A Global Perspective', *European Economic Review* 55, no. 3 (2011): 340–353.

13. Kroszner, Laeven and Klingebiel, 'Banking Crises, Financial Dependence, and Growth'.

14. See also: Raghuram G Rajan and Luigi Zingales, 'Financial Dependence and Growth', *The American Economic Review* 88, no. 3 (1998): 559.

15. Morley, 'Macro-Finance Linkages'.

16. Andrea Gerali *et al.*, 'Credit and Banking in a DSGE Model of the Euro Area', *Journal of Money, Credit and Banking* 42, no. s1 (2010): 107–141; Nikolay Hristov, Oliver Hülsewig and Timo Wollmershäuser, 'Loan Supply Shocks During the Financial Crisis: Evidence for the Euro Area', *Journal of International Money and Finance* 31, no. 3 (2012): 569–592.

17. Martin Bijsterbosch and Matteo Falagiarda, 'The Macroeconomic Impact of Financial Fragmentation in the Euro Area: Which Role for Credit Supply?', *Journal of International Money and Finance* 54 (2015): 93–115; Luca Gambetti and Alberto Musso, 'Loan Supply Shocks and the Business Cycle', *Journal of Applied Econometrics* 32, no. 4 (2017): 764–782.

18. Esteban Prieto, Sandra Eickmeier and Massimiliano Marcellino, 'Time Variation in Macro-Financial Linkages', *Journal of Applied Econometrics*, 2016,

demonstrated empirically using pre-WW1 and interwar US data.¹⁹

Finally, this chapter contrasts the debate on the effects of conservative banking practices in the late 19th century with current research on bank risk-taking. An important driver of bank risk-taking today is the growth of credit in response to lower interest rates. Research in this field has shown that banks tend to increase their lending volumes and lend to riskier borrowers when interest rates decline.²⁰ Bank leverage and interest rates are, of course, partially determined by economic conditions, but the finding holds even when this is factored in.²¹ Researchers have interpreted these findings as evidence of imprudent behaviour by banks.

Lower interest rates lead to more risk-taking today, because the funding costs of banks are closely tied to short-term rates.²² Faced with lower funding costs, banks can grow their profits by increasing their lending at longer term rates, which are more stable, and take longer to adjust to a lower interest rate environment.²³ In other words, low interest rates increase the incentives for banks to engage in maturity transformation. Yet increasing the maturity mismatch between loans and deposits is inherently risky. In a model by Valencia, what eventually increases a given bank's cost of borrowing is a growing risk of default by the bank, which in

19. Charles W Calomiris and R Glenn Hubbard, 'Price Flexibility, Credit Availability, and Economic Fluctuations: Evidence from the United States, 1894-1909', *The Quarterly Journal of Economics*, 1989, 429-452; Ben S Bernanke, 'Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression', *The American Economic Review* 73, no. 3 (1983): 257-276. Bernanke uses a proxy for credit contractions - deposits in failed banks - to build his argument. For a broader overview of credit as a driver of historical business cycles, see: Moritz Schularick and Alan M. Taylor, 'Credit Booms gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises, 1870-2008', *American Economic Review* 102, no. 2 (2012): 1029-61.

20. Gabriel Jiménez *et al.*, 'Hazardous Times for Monetary Policy: What Do Twenty-Three Million Bank Loans Say About the Effects of Monetary Policy on Credit Risk-Taking?', *Econometrica* 82, no. 2 (2014): 463-505; Giovanni Dell'Ariccia, Luc Laeven and Gustavo A Suarez, 'Bank Leverage and Monetary Policy's Risk-Taking Channel: Evidence from the United States', *Journal of Finance* 72, no. 2 (2017): 613-654; Manthos D Delis and Georgios P Kouretas, 'Interest Rates and Bank Risk-Taking', *Journal of Banking & Finance* 35, no. 4 (2011): 840-855.

21. Valentina Bruno and Hyun Song Shin, 'Capital Flows and the Risk-Taking Channel of Monetary Policy', *Journal of Monetary Economics* 71 (2015): 119-132.

22. *Ibid.*

23. *Ibid.*; Fabian Valencia, 'Monetary Policy, Bank Leverage, and Financial Stability', *Journal of Economic Dynamics and Control* 47 (2014): 20-38. Valencia also shows that this behaviour is exacerbated when banks have limited liability, because bank owners face limited losses if their borrowers fail to pay back.

turn increases its funding costs.²⁴ The ability of depositors and counterparties to monitor the bank is therefore crucial for the extent to which lower funding costs are translated into higher risk-taking.²⁵ Furthermore, if lower rates reduce the return of holding safe assets, then banks may be incentivised to search for higher yields in riskier assets, especially as lower rates make risky borrowers better able to service their debts.²⁶

There are several reasons why we should not expect short-term money market rates to have driven credit expansion during the period 1880-1913. Banking practices at the time limited banks' ability to directly profit from lower interest rates. Perhaps most importantly, in contrast to today's practices, banks did not engage in liability management: they did not seek to raise funds by offering higher deposit rates than their competitors. Interest rate fixing between commercial banks held the deposit rate steadily between 1-1.5% below the Bank of England discount rate in 1880-1913, and interest was rarely paid on current accounts.²⁷ Depositors thus lacked an important incentive (the deposit rate) to 'shop around' and channel their resources to any specific bank. Leading banking manuals at the time, moreover, considered the practice of bankers trying to get depositors to switch banks a manifestation of 'excessive competition' which was 'deplorable and dangerous', while also being detrimental to a bank's standing.²⁸

Banks did not, in general, rely on wholesale funding from other financial institutions, which made their funding costs less sensitive to prevailing market rates.²⁹ Few banks have surviving internal balance sheet figures which provide an unambiguous breakdown between liabilities to bankers and other agents on one hand and other depositors on the other. Preliminary evidence from two large banks for which such evidence is available, however, suggests that liabilities to other financial

24. Ibid. Depositors or creditors are assumed to increase the interest rate required for a riskier bank.

25. Ibid.; Giovanni Dell'Ariccia, Luc Laeven and Robert Marquez, 'Real Interest Rates, Leverage, and Bank Risk-Taking', *Journal of Economic Theory* 149 (2014): 65–99.

26. Ibid. Dell'Ariccia *et al.* also argue that banks might have lower incentives to monitor their borrowers when rates are lower.

27. Anthony Hotson, *Respectable Banking: The Search for Stability in London's Money and Credit Markets Since 1695* (Cambridge: Cambridge University Press, 2017), 5, 12; Edward T Nevin and Edward William Davis, *The London Clearing Banks* (London: Paul Elek, 1970), 126.

28. JW Gilbert, *The History, Principles and Practice of Banking, Vol. 2* (London: G Bell & Sons, 1919), 13-14.

29. Hotson, *Respectable Banking*, 14-15.

institutions were between 0.9-1.5% of their total liabilities in 1900-1903.³⁰ This figure comes close to the figure of 1.7% that Sheppard estimates as the highest ratio of ‘miscellaneous liabilities’ to total liabilities in 1880-1913 (this figure is 1.5% in 1900), and below the 2%-3% range within which his (imprecise) estimate of the ratio of interbank deposits to commercial bank deposits fluctuated during this period.³¹

The extent to which banks engaged in maturity transformation was very limited in 1880-1913, further inhibiting their ability to profit from lower interest rates. Late 19th and early 20th century banking practitioners and authors of banking manuals were unambiguous about the need to keep the mainstay of banking as short-term lending (combined with ample liquid reserves) so as to avoid significant maturity mismatches between liabilities and assets.³² These recommendations were translated into practice, as is evidenced by only a small portion of bank loans in 1880-1914 (less than 5%) being granted for a duration exceeding 12 months, although banks generally allowed short term credits to be rolled over for a longer period.³³ There was no effective cartel for advances, and, as suggested earlier in this thesis, loan terms were generally flexible.³⁴ However, Hotson suggests that there a degree of stickiness to rates on advances, with a floor at roughly 5%, which in turn might have made the demand for these loans less elastic to interest rates.³⁵

Finally, the professionalisation and formalisation of banking practices, combined with stronger systems of internal controls on branch managers, further constrained risk-taking. By 1890, there was a firm tendency towards maintaining certain ratio (typically at least 10%) of cash to deposits which arose due to a

30. End of December figures in: Weekly Balance Sheet Figures, Metropolitan Bank, December 31, 1900 - December 31, 1903, UK R 0034, HSBC Archives; Weekly General Abstracts of Balances, North & South Wales Bank, December 31, 1900 - December 31, 1903, UK M 0084, HSBC Archives.

31. David K Sheppard, *The Growth and Role of UK Financial Institutions, 1880-1966* (London: Methuen, 1971), 126-127, 182-183.

32. Walter Leaf, *Banking* (London: Williams & Norgate, 1946), 164-169; George Rae, *The Country Banker, His Clients, Cares, and Work* (New York: Charles Scribner's Sons, 1920), 207-214. See also: Hotson, *Respectable Banking*, 163-166.

33. Collins and Baker, *Commercial Banks*, 194-197.

34. See pp. 11-13 and 32-34 of this thesis.

35. Hotson, *Respectable Banking*, 12.

sense of increased public scrutiny of bank balance sheets.³⁶ Another expression of ‘ratio-consciousness’ was bank directors’ tendency to avoid having their bills and advances as a share of deposits rise above a fixed ratio, such as 60%.³⁷ Evidence from loan data suggests that branch managers were successfully applying their banks’ codified lending practices, which reduced risk-taking by requiring managers to justify and seek their directors’ approval for all loans exceeding certain discretionary thresholds.³⁸ In other words, large banks generally heeded the advice of Gilbert by keeping branches ‘in strict subordination to the head office’, which helped prevent branch managers from lending excessive amounts.³⁹

Dwarkasing uses loan-level data to demonstrate that a 19th century Welsh bank - the North and South Wales Bank - did not increase its risk-taking when faced with lower money market interest rates.⁴⁰ Depending on the model specification, she finds a positive or insignificant relationship between its lending volumes and interest rates, which she argues reflects the bank’s prudent behaviour. This chapter presents evidence on credit volumes at the aggregate level, with data covering a larger set of banks, confirming Dwarkasing’s intuition: banks did not increase their credit/assets ratios as interest rates declined.

2.2 Data

The dataset used in this chapter includes bank private sector credit, indicators for economic conditions, and open market interest rates. The former two are discussed in sections 2.2.1 and 2.2.2 below. Interest rates are included in the analysis

36. Nevin and Davis, *The London Clearing Banks*, 78-79; As for the ratio of near-cash assets to total liabilities, large joint-stock banks maintained a ratio above 20% after 1890. See: Collins and Baker, *Commercial Banks*, 122-126, 253.

37. Goodhart, *Business of Banking*, 156-158.

38. Collins and Baker, *Commercial Banks*, 169.

39. JW Gilbert, *The History, Principles and Practice of Banking, Vol. 1* (London: G Bell & Sons, 1916), 424.

40. Narly Ratna Devi Dwarkasing, ‘Essays on Historical Banking’, CentER, Center for Economic Research (PhD diss., Tilburg University, School of Economics and Management, 2014), 88-125.

following a standard practice in modelling macro-financial linkages.⁴¹ Specifically, I use the open market interest rate. This is the rate on high-quality bills of exchange, which were short-term debt instruments acknowledging one party's debt to another. Three reasons inform the choice of using the open market rate rather than the discount rate of the Bank of England. First, despite a degree of stickiness in the interest rate for advances, the open market rate was an important benchmark for the cost of short-term finance for a substantial set of firms able to borrow via bills of exchange.⁴² Indeed, Collins and Baker suggest that advances and bills were substitutes, and they had a significant negative correlation on bank balance sheets in 1880-1913.⁴³ Second, there are reasons why we might not want to regard the Bank of England in the 19th century as a modern central bank in the sense of independently setting the country's monetary policy. Constraints imposed by its balance sheet - its financial strength - and the gold standard reduced the credibility of some of its interest rate policy decisions.⁴⁴ Third, at the monthly frequency, the Bank rate may be too slow-moving, in that it may have often changed significantly only after monetary conditions changed.

2.2.1 Bank Balance Sheets and the Private Sector Credit Ratio

In the short run, the largest changes in credit supply are likely to come from the amount of credit that banks extend from their *existing* resources. At a yearly level, on the other hand, changes in credit supply may be more heavily influenced by changes in the resources that banks had available - their assets. The availability of records makes it difficult to build an accurate monthly series on the absolute quantity of bank credit in the economy. To understand how fluctuations in bank

41. See, for example: Jean Boivin, Marc P Giannoni and Ilian Mihov, 'Sticky Prices and Monetary Policy: Evidence from Disaggregated US Data', *The American Economic Review* 99, no. 1 (2009): 350.

42. Stickiness in advance rates created an incentive for bankers to rediscount unsecured bills on the open market - a practice which the largest banks were nevertheless considered unacceptable. See: Goodhart, *Business of Banking*, 132. Similar restrictions did not apply to acceptance finance, discussed in chapter 5.

43. Collins and Baker, 'Commercial Bank Liquidity'.

44. Stefano Ugolini, 'Liquidity Management and Central Bank Strength: Bank of England Operations Reloaded, 1889-1910', *Norges Bank Working Paper*, no. 10 (2016).

lending influenced the economy, I have built a new monthly dataset of bank credit to asset ratios, which is explained in detail below. The empirical model in this chapter focuses on the impact of short-term fluctuations in this ratio, and the results are therefore not affected substantially by the longer term growth of aggregate credit volumes.

The data consists of both published and unpublished accounting records. The unpublished records are internal monthly balance sheets. These are gathered from the Royal Bank of Scotland, Lloyds Banking Group, HSBC and Barclays archives, and cover the collections of most banks for which monthly accounts could be found. Published monthly data of 14 London joint-stock clearing banks is available from 1891 to 1913.⁴⁵ Details on the sources and the banks that are included in the sample are outlined in appendix 2.A.3.

The use of archival records makes it possible to increase the coverage of banks significantly beyond the level allowed by published records. In particular, it allows the inclusion of banks outside London, and a few leading private banks (such as Barclays) to be represented. A further improvement from the existing (published) data is to extend the coverage period backwards to 1880.⁴⁶ For the years 1880-1891 no published monthly data exists, and the data for this part of the sample relies entirely on archival records.

Since the number of bank mergers and acquisitions was high in 1880-1913, using raw credit data would introduce several large discontinuities in the series. Attempts to correct for such breaks would inevitably introduce a degree of bias. I therefore use data on credit ratios rather than credit figures in levels. This follows both Goodhart's approach, as well as several contributions in the literature on credit supply shocks.⁴⁷

To explain how the variable for the credit/assets ratio is constructed, it is

45. As for why these banks began publishing monthly balance sheets, see: Goodhart, *Business of Banking*, 4-5.

46. Although some monthly accounting records exist for the 1870s, the coverage of the data would be very limited. These have therefore not been utilised.

47. Goodhart, *Business of Banking*; Kim Abildgren, 'Financial Structures and the Real Effects of Credit-Supply Shocks in Denmark 1922-2011', *European Review of Economic History*, 2012, 490-510; Morley, 'Macro-Finance Linkages'.

necessary to provide some background information on what assets British banks held on their balance sheets.⁴⁸ The assets of commercial banks during the period at issue can be roughly classified from the most liquid to the least liquid as follows:

1. Cash and deposits at other banks;
2. Money at call and at brokers. Money at brokers included very short-term loans to stockbrokers. Money at call was composed of deposits, typically kept at discount houses, which invested in short-term bills of exchange;
- 3a. High-quality bills of exchange held for investment purposes, which were often bought from other financial institutions;
- 3b. British government bonds (consols);
- 4a. Other investments, such as railway or colonial government bonds;
- 4b. Bills of exchange;
5. Advances.

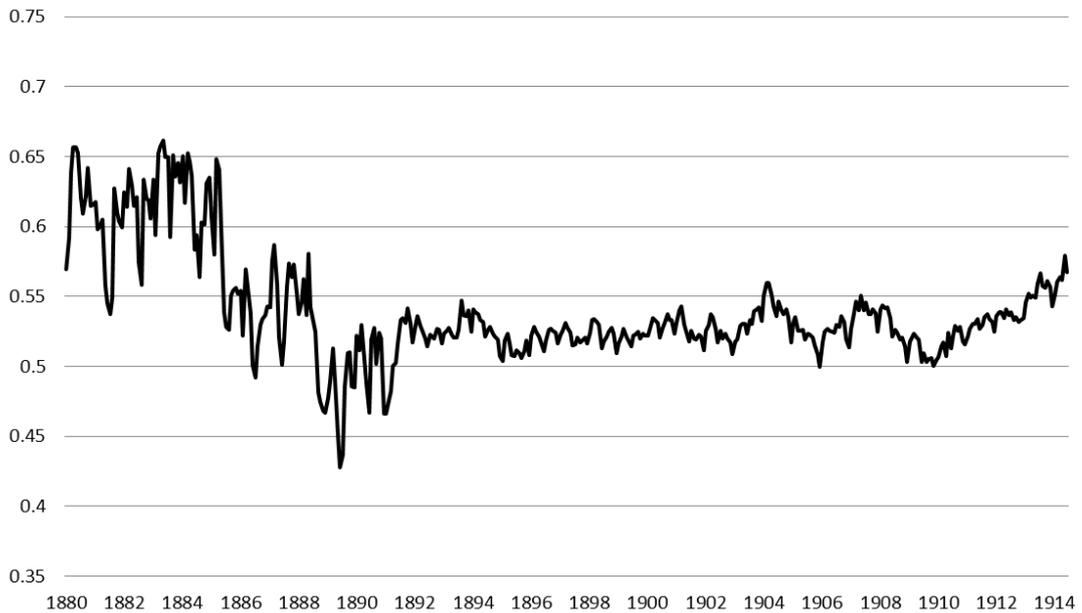
I classify private sector credit as bills of exchange and advances (items 4b and 5). The categorisation follows definitions in work by Baker and Collins.⁴⁹ These were typically the items that constituted loans to the private non-financial sector. These were also the riskiest and least liquid asset classes on bank balance sheets, so the ratio also serves as an indicator of bank risk-taking. To obtain the credit ratio, a bank's private sector credit is divided by its total assets. The ratios are then aggregated on an asset-weighted basis. The series is shown in figure 2.1.

The series exhibits considerable variance at the beginning of the sample, with occasional monthly fluctuations of 5%. The shifts are not driven by changes in the sample, but reflect the greater weight that individual banks had in the data before 1891. After 1891, when published figures of several additional banks becomes available, the credit ratio becomes more stable, and generally fluctuates between 0.5 and 0.55. This stability of the ratio in the 1890s is consistent with evidence from half-yearly balance figures from a large sample of contemporary joint-stock

48. This discussion relies largely on: Goodhart, *Business of Banking*; and Collins and Baker, 'Commercial Bank Liquidity'.

49. *Ibid.*

Figure 2.1: Monthly private sector credit ratio, 1880-1913



Source: see appendix 2.A.3.

banks.⁵⁰ Specifically, Collins and Baker find little long-term change in this ratio between 1890 and 1910. Nevertheless, the changing properties (and representativeness) of the sample further confirm the suitability of time-varying parameter methods to analyse this data. These methods mitigate considerably any potential bias caused by the high variability in the earlier part of the sample.

The classification of private sector credit is not perfectly accurate, because both advances and bills may have included *some* credit to government and financial institutions, although the percentage would have been small. Advances were typically short-term loans granted to firms. These could be further separated into overdrafts and loans, but few banks break these figures down in their internal reporting. Bills of exchange were certificates documenting one party's debt to another, along with a date on which the debt was to be paid. Firms could thus borrow from banks against writing them a bill of exchange, or by entering into a steadier credit relationship through overdrafts. Advances had become the predom-

50. Ibid.

inant method for financing domestic businesses already by 1880.⁵¹ Bills continued to be used, particularly when it came to foreign transactions.⁵²

The way in which banks reported their credit items was not consistent across the industry.⁵³ Bills and advances are often summed together in published accounts. This makes it more difficult to examine advances in isolation, as detailed data is only available for a smaller sample of banks. Bills were often reported as an aggregated figure, making it impossible to distinguish between bills that were used for domestic or foreign transactions, or bills held for investment purposes.

An important factor to keep in mind is that banks did engage in some manipulation of their published balance sheets. They would often depreciate real estate at a very aggressive rate, or price their holdings of investments slightly under their market value.⁵⁴ The disparity between the real value and the adjusted value would be moved to a bank's hidden reserves - reserves which were not reported publicly. Nevertheless, the impact of such distortions is likely to be mild in my sample, because property and consols made up a small share of a bank's total assets.

Moreover, the focus of the empirical procedure is to ascertain the impact of short-term changes in credit ratios. Balance sheet window-dressing practices are less consequential in a short run analysis, as they are likely to influence balance sheet figures only gradually, and to be near-constant over the short run. A similar logic applies to potential issues arising from trends in bills and advances: changes in their relative composition is likely to have been somewhat gradual, which is unlikely to bias my estimates considerably.

2.2.2 Monthly Economic Conditions

To examine the short-term impact of credit fluctuations, an indicator for changes in monthly economic conditions is needed. GDP estimates for prewar Britain are

51. Shizuya Nishimura, *The Decline of Inland Bills of Exchange in the London Money Market, 1855-1913* (Cambridge: Cambridge University Press, 1971).

52. Ibid.

53. Goodhart, *Business of Banking*, 17-20.

54. Ibid., 20-23.

only available at a yearly frequency. Faced with such issues, economic historians have often resorted to using a single proxy for GDP, such as data on railway freight receipts or industrial production.⁵⁵ Despite their usefulness, the risk of using such proxies in isolation is that they may capture only a part of the variation in economic conditions, which can generate a problem of so-called omitted variable bias in the estimates. Financial institutions are likely to look at a large set of economic indicators when making lending or investment decisions. Failure to account for this possibility might lead to less accurate estimates.

In the past two decades, factor models have become a standard methodology for summarising a large array of data on economic conditions.⁵⁶ The technical details are discussed in the next section, but the intuition behind factor models is that they summarise the movement of several time series into fewer series. This logic derives from the fact that a large share of the variance of several macroeconomic series can be explained by just a few common factors.⁵⁷ Factors are series which are specifically estimated to capture the co-movement of many time series. Factor models are commonly used for forecasting economic conditions, especially at a higher frequency.⁵⁸ In economic history, they have been used, for example, to construct monthly British GDP series for the interwar years.⁵⁹

Before discussing how these factors are estimated, I outline some of the series included in the model. Appendix 2.A.4 provides a list of all of the variables used in the factor model. Of the series used, many come only with slight weights

55. For a recent example, see: Masahiko Shibamoto and Masato Shizume, ‘Exchange Rate Adjustment, Monetary Policy and Fiscal Stimulus in Japan’s Escape from the Great Depression’, *Explorations in Economic History* 53 (2014): 1–18.

56. James H Stock and Mark Watson, ‘Dynamic Factor Models’, in *Oxford Handbook on Economic Forecasting*, ed. Michael P Clements and David F Hendry (Oxford: Oxford University Press, 2011).

57. A basic way of doing factor analysis is through principal components, although in this chapter I will utilise dynamic factor models to improve model fit.

58. S Borağan Aruoba, Francis X Diebold and Chiara Scotti, ‘Real-Time Measurement of Business Conditions’, *Journal of Business & Economic Statistics* 27, no. 4 (2009): 417–427; Domenico Giannone, Lucrezia Reichlin and David Small, ‘Nowcasting: The Real-Time Informational Content of Macroeconomic Data’, *Journal of Monetary Economics* 55, no. 4 (2008): 665–676; Marta Bańbura and Gerhard Rünstler, ‘A Look into the Factor Model Black Box: Publication Lags and the Role of Hard and Soft Data in Forecasting GDP’, *International Journal of Forecasting* 27, no. 2 (2011): 333–346.

59. James Mitchell, Solomos Solomou and Martin Weale, ‘Monthly GDP Estimates for Inter-War Britain’, *Explorations in Economic History* 49, no. 4 (2012): 543–556.

in either factor, and most could hardly be thought of representing the economy independently. However, there are a few variables which, even individually, are of special interest. The discussion about the validity of these series relies, to a significant extent, on work by Goodhart.⁶⁰

Goodhart chiefly discusses the following variables as proxies for British economic conditions:

1. Railway freight receipts;
2. Unemployment;
3. Bank clearings;
4. Stores of Cleveland pig iron in public warehouses.

Freight receipts is an indicator of the traffic of goods across the nation. More freight thus indicates a higher degree of business activity. The more goods were bought or sold, the more they needed to be transported. In his study, Goodhart argues that this is by far the best available proxy for the economy, noting that it is highly correlated with annual economic data.⁶¹ The main downside of the series is that it is biased towards goods which weigh more or take up a large volume on trains. While this might not cause a significant distortion in most years, the series becomes very unreliable as a proxy of aggregate economic activity around periods such as the coal strikes.⁶² But given that my model allows for structural change, temporary episodes of instability are unlikely to cause a significant bias in the results. Railway traffic has also been preferred in other studies when data on industrial production or GDP is not available.⁶³ Recently, Shibamoto and Shizume have used railway freight data as their high-frequency GDP proxy when examining the effects of inflation expectations and devaluation in Japan in the 1930s.⁶⁴ A similar approach has been taken by James *et al.* to study the effects of US banking

60. Goodhart, *Business of Banking*.

61. *Ibid.*, 73-74.

62. There was particularly severe coal strike in March, 1912.

63. Olivier Jeanne, 'Monetary Policy in England 1893-1914: A Structural VAR Analysis', *Explorations in Economic History* 32, no. 3 (1995): 302-326.

64. Shibamoto and Shizume, 'Exchange Rate Adjustment'.

crises.⁶⁵

Unemployment data is problematic in the present context, because there is no data on unemployment of non-unionised labour. The series is also not consistent over time, since the Board of Trade only began reporting aggregated unemployment figures in 1893. Before this year, the series consists of figures from a single trade-union.⁶⁶ Moreover, in several industries, such as textiles and mining, business contractions were met with reductions of hours worked instead of making workers redundant.⁶⁷ Problems also abound with using stores of pig iron as an economic indicator. First, it is strongly biased towards heavy industry. Additionally, the change in stocks can be assumed to partially depend on past expectations of demand, and on stocks accumulated in the past. It thus makes more sense to use it as a supplementary, rather than primary, indicator of economic conditions.

The volume of bank clearings is an indicator of the amount of goods traded domestically, as it measures the volume of payments settled between banks. However, the indicator's ability to proxy domestic economic conditions may have declined as the banking industry became more concentrated. Transfers of money within individual banks constituted mere accounting exercises, whereas only clearings between banks would be recorded in the official data. This is a significant issue in the present case. Bank mergers could plausibly lead to simultaneous changes in bank credit ratios and bank clearings. This is because financing an acquisition could significantly influence a bank's credit ratio in the short run: a bank's credit would remain constant, but its cash and reserves could decline. In the process of mergers, banks typically drew down on their reserves to reduce the capital of the merged entity, so as to avoid overcapitalising their bank and to achieve higher returns on equity.⁶⁸ Furthermore, the series may be clouded by purely financial transactions, such as stock exchange settlements, which are less relevant for a study focusing on domestic economic activity.

65. John A James, James McAndrews and David F Weiman, 'Wall Street and Main Street: The Macroeconomic Consequences of New York Bank Suspensions, 1866–1914', *Cliometrica* 7, no. 2 (2013): 99–130.

66. The Friendly Society of Iron Founders of England, Ireland and Wales.

67. Goodhart, *Business of Banking*, 72.

68. Joseph Sykes, *The Amalgamation Movement in English Banking, 1825-1924* (London: P.S. King & Son, 1926), 101-105.

The series discussed here are supplemented by a large array of additional data, which is listed in appendix 2.A.4. This includes series on trade, prices, stocks of commodities along with financial data. The inclusion of financial time series is supported by the fact that such data has been found to be informative when modelling and forecasting GDP using high-frequency data.⁶⁹

2.3 Econometric Evidence

2.3.1 TVP-FAVAR

This chapter uses an extension of the time-varying VAR model introduced in the previous chapter by augmenting it with factors. The factor-augmented vector autoregression with time-varying parameters (TVP-FAVAR) is a highly flexible model which improves the accuracy of VAR estimates, while still allowing for structural change.⁷⁰ The improvement in accuracy originates from the fact that the model incorporates a large array of data, thus lessening omitted variable bias, which occurs when the exclusion of important variables from a model causes misleading estimates. This bias is reduced when we replace one proxy for economic conditions, such as GDP, with the common components of a large number of macroeconomic series. The model then becomes more realistic, because agents in the financial sector are likely to have taken a host of data into account when making economic decisions. Factor-augmented VARs have become common following work by Bernanke, Boivin and co-authors, who show that these models often have

69. Bańbura and Rünstler, ‘Factor Model’. In a historical setting, Uebele and Ritschl demonstrate that financial data can be used to improve estimates of business cycle movements in pre-WW1 Germany. See: Martin Uebele and Albrecht Ritschl, ‘Stock Markets and Business Cycle Comovement in Germany before World War I: Evidence from Spectral Analysis’, *Journal of Macroeconomics* 31, no. 1 (2009): 35–57.

70. For technical details, see: Dimitris Korobilis, ‘Assessing the Transmission of Monetary Policy Using Time-Varying Parameter Dynamic Factor Models’, *Oxford Bulletin of Economics and Statistics* 75, no. 2 (2013): 157–179; and Colin Ellis, Haroon Mumtaz and Pawel Zabczyk, ‘What Lies Beneath? A Time-Varying FAVAR Model for the UK Transmission Mechanism’, *The Economic Journal* 124, no. 576 (2014): 668–699.

better forecasting ability than standard VARs.⁷¹

To augment a time-varying VAR model, we need to specify an equation for the factors. Let \mathbf{z}_t be a vector of M directly observed series at time t , which in the present case are: 1. the private sector credit ratio of banks; and 2. open market interest rates. \mathbf{x}_t is defined as a vector of N economic time series, which are incorporated into the factor model. Let \mathbf{x}_t^z denote a vector where \mathbf{x}_t and \mathbf{z}_t are stacked. Finally, let \mathbf{f}_t be the K common factors extracted from several economic time series. Note that K is much smaller than N .⁷²

With these definitions, we can specify the following relationship between the economic time series and the factors:

$$\mathbf{x}_t^z = \mathbf{\Lambda}^f \mathbf{f}_t + \mathbf{\Lambda}^z \mathbf{z}_t + \mathbf{e}_t; \quad \mathbf{e}_t \sim N(\mathbf{0}, \exp(\mathbf{\Sigma})) \quad (2.1)$$

Each element of the $(N + M) \times (K + M)$ matrix $\mathbf{\Lambda}_t^f$ denotes the extent of co-movement that a given economic series in \mathbf{x}_t has with other series, whereas \mathbf{e}_t captures the part of each economic series that moves independently of all the others. In the context of factor modelling, $\mathbf{\Lambda}^f$ is said to represent the *loadings* that each series takes in the common factors. It follows that $\mathbf{\Lambda}^f \mathbf{f}_t$ summarises the co-movement of the large array of series in \mathbf{x}_t . In a slightly more detailed form, we can write the equation as follows:

$$\begin{bmatrix} x_{1,t} \\ x_{2,t} \\ \vdots \\ x_{N,t} \\ z_{1,t} \\ z_{2,t} \end{bmatrix} = \begin{bmatrix} \lambda_{1,1} & \lambda_{1,2} & \cdots & \lambda_{1,K} & \Psi_{1,1} & \Psi_{1,2} \\ \lambda_{2,1} & \lambda_{2,2} & \cdots & \lambda_{2,K} & \Psi_{2,1} & \Psi_{2,2} \\ \vdots & \vdots & \ddots & \vdots & \vdots & \vdots \\ \lambda_{N,1} & \cdots & \cdots & \lambda_{N,K} & \Psi_{N,1} & \Psi_{N,2} \\ 0 & \cdots & \cdots & \cdots & 1 & 0 \\ 0 & \cdots & \cdots & \cdots & 0 & 1 \end{bmatrix} \begin{bmatrix} f_{1,t} \\ f_{2,t} \\ \vdots \\ f_{K,t} \\ z_{1,t} \\ z_{2,t} \end{bmatrix} + \begin{bmatrix} e_{1,t} \\ e_{2,t} \\ \vdots \\ e_{N,t} \\ 0 \\ 0 \end{bmatrix}$$

The factor model is assumed to be dynamic, in the sense that it depends on the past values of the factors. The advantage of the dynamic factor specifica-

71. Ben S Bernanke, Jean Boivin and Piotr Elias, ‘Measuring the Effects of Monetary Policy: A Factor-Augmented Vector Autoregressive (FAVAR) Approach’, *Quarterly Journal of Economics* 120, no. 1 (2005): 387–422; Boivin, Giannoni and Mihov, ‘Sticky Prices’.

72. This section largely follows the exposition of Korobilis, ‘Transmission of Monetary Policy’.

tion is that it is more likely to correctly specify the loading matrix, $\mathbf{\Lambda}^f$. This is especially important when the time series being studied exhibit autoregressive behaviour, which is commonplace for macroeconomic data. In practice, the dynamic factor specification is better able to separate the common co-movement and the idiosyncratic behaviour of each series.⁷³ It follows that the factors are assumed to evolve as follows:

$$\mathbf{f}_t = \phi_1 \mathbf{f}_{t-1} + \boldsymbol{\nu}_t \quad (2.2)$$

Where ϕ_1 contains the autoregressive coefficients and $\boldsymbol{\nu}_t$ are the error terms.

Identification is an important issue when estimating the factor model, as we want to make sure that we cannot get the same likelihood estimates with different combinations of rotations, scales or signs of the parameters. The FAVAR literature provides several ways to get around this problem.⁷⁴ Here I follow the approach by Bernanke *et al.*, whereby the upper $K \times K$ variables in $\mathbf{\Lambda}^f$ are specified as the identity matrix.⁷⁵ Alternatives highlighted in the literature, such as restricting factors only for given types of variables, would be likely to work well only if there was more data than what is available in the present case.

The TVP-FAVAR equation is as follows:

$$\mathbf{y}_t = \begin{bmatrix} \mathbf{f}_t \\ \mathbf{z}_t \end{bmatrix} = \sum_{i=1}^{\rho} \mathbf{B}_{i,t} \begin{bmatrix} \mathbf{f}_{t-i} \\ \mathbf{z}_{t-i} \end{bmatrix} + \mathbf{u}_t \quad (2.3)$$

The only change from a TVP-VAR model outlined in section 1.5.2 is that not all variables in \mathbf{y}_t are treated as directly observed due to the use of factors. If $\mathbf{y}_t = \mathbf{z}_t$, the equation would constitute a standard TVP-VAR model without

73. Stock and Watson, ‘Dynamic Factor Models’.

74. Pooyan Amir-Ahmadi, ‘Credit Shocks, Monetary Policy, and Business Cycles: Evidence from a Structural Time Varying Bayesian FAVAR’ (Manuscript, Goethe University, Frankfurt, 2009).

75. Bernanke, Boivin and Elias, ‘Factor-Augmented’. The identity matrix has 1’s on the diagonal and zeros elsewhere.

factors.

Identification in the vector autoregressive part of the model is done using Cholesky-decomposition. This refers to ordering the variables so that the model has an economic interpretation. Financial variables - the credit ratio and interest rates - are ordered before macroeconomic variables, which are included in the factors. This is a standard method in structural vector autoregression literature.⁷⁶ It reflects the observation that macroeconomic variables react to financial shocks only with a lag, whereas financial variables can respond to macroeconomic shocks instantly. With high-frequency data, this is not a highly restrictive assumption. Following the approach by Bernanke *et al.*, financial variables *within* the factors are specified as *fast-moving*, whereby they are allowed to respond contemporaneously to changes in interest rates and credit.⁷⁷ This makes the model even more flexible, and further improves its accuracy.

The TVP-FAVAR is estimated with Bayesian methods, which provide a natural and efficient way to achieve shrinkage for the parameter space. In practice, the Markov-Chain Monte Carlo (MCMC) estimation algorithm for the TVP-FAVAR is an extension of the algorithm used to estimate the TVP-VAR.⁷⁸ It only requires adding a block for sampling the factor loadings and their variances.⁷⁹ The estimation of a Bayesian model involves specifying prior distributions for model parameters, which in this instance also influence how much the parameters are allowed to change. Following previous literature on TVP-FAVARs, I use the same empirical Bayes (or Minnesota-style) priors as Korobilis.⁸⁰ These are outlined in appendix 2.A.2. The model estimates are based on 40,000 draws from the MCMC algorithm, from which the first 30,000 are discarded.

76. Ibid.

77. Ibid.

78. Giorgio E Primiceri, 'Time Varying Structural Vector Autoregressions and Monetary Policy', *The Review of Economic Studies* 72, no. 3 (2005): 821–852

79. Details on the Markov-Chain Monte Carlo (MCMC) estimation algorithm can be found in: Korobilis, 'Transmission of Monetary Policy', and the references therein. However, note that I do not include the variables J^{θ} in Korobilis' paper, which govern if the parameters are allowed to change in given months.

80. Ibid.

2.3.2 Model Selection

I use formal model selection criteria for selecting the number of lags and factors in the model. To determine the number of factors, I apply a method by Bai and Ng to determine that a minimum of two dynamic factors are required for explaining a sufficient amount of variance in the macroeconomic data.⁸¹ The number of dynamic factors estimated depends on the number of static factors found by using methods outlined in an earlier contribution by Bai and Ng, who in turn propose several different information criteria.⁸² Depending on the information criterion used, the end result is a model with either 2 or 3 dynamic factors. I choose the smaller number of factors in order to avoid excessive parameter proliferation in the VAR. The fact that model is time-varying further motivates a more parsimonious specification.

I then apply the by Deviance Information Criterion (DIC) for selecting the lag length of the model. The use of this type of model selection in the context of time-varying models is a very recent development.⁸³ While several other ways of comparing models in Bayesian statistics exist, many do not lead to accurate results. Chan and Grant show that the observed data likelihood, or integrated likelihood Deviance Information Criterion, performs well compared to other approaches.⁸⁴ The Deviance Information Criterion for VAR specification testing strongly suggests using 2 factors instead of 3, validating the choice of a smaller model. The criterion also suggests using a model with three lags.

2.3.3 Results

The results are presented as impulse responses. As discussed above, these show how one variable responds to an increase in another. The figures below show the

81. Jushan Bai and Serena Ng, ‘Determining the Number of Primitive Shocks in Factor Models’, *Journal of Business & Economic Statistics* 25, no. 1 (2007): 52–60.

82. Jushan Bai and Serena Ng, ‘Determining the Number of Factors in Approximate Factor Models’, *Econometrica* 70, no. 1 (2002): 191–221.

83. See: Joshua CC Chan and Angelia L Grant, ‘Fast Computation of the Deviance Information Criterion for Latent Variable Models’, *Computational Statistics & Data Analysis* 100 (2016): 847–859.

84. Ibid.

median response of macroeconomic variables to the credit ratio for each decade in the sample. The years 1880, 1890 and 1900 in the figures should thus be read as entire decades. It is standard practice in the FAVAR literature to show the responses of several important macroeconomic variables, rather than just those of the estimated factors.⁸⁵ Following the FAVAR literature, the data are transformed to deviations from the mean, scaled by their standard deviation. This is done to render the factor estimates as accurate as possible.⁸⁶ The results can be interpreted as the impact of a 1% increase in the standardised mean of the credit ratio to the standardised mean of an economic variable.⁸⁷ Because the factors include series which are allowed to respond instantly to changes in interest rates and credit, the contemporaneous responses of macroeconomic variables can be non-zero.⁸⁸ For purposes of statistical inference, one should focus on the responses after one or more months.

Figure 2.2 shows the impulse responses of the most important macroeconomic variables included in the model from increases in the private sector credit ratio. The horizontal axis represents the number of months from the shock.⁸⁹ A 1% increase in the credit ratio would have increased railway freights by roughly 0.07-0.1% and cotton consumption by 0.05-0.07% from their standardised means. In non-standardised terms, this impact would have been about 1-1.5% for either variable. The result is economically and statistically significant. As will be shown in figure 2.5, small shocks on the order of at least 0.5% to the credit ratio were common, even after factoring the possibility that the sample is not perfectly representative before 1891. Overall, this evidence indicates that credit played a major role in short-term economic fluctuations. The impact of credit shocks also transmitted to the economy quickly: already after 4 months, a credit shock had little further economic impact.

There is slight time-variation in these results. The impact of credit shocks on the economy becomes slightly stronger in 1900-1910, compared to the 1880s and the 1890s. The response of freight receipts grows from 0.07% to 0.1% over time.

85. Boivin, Giannoni and Mihov, ‘Sticky Prices’.

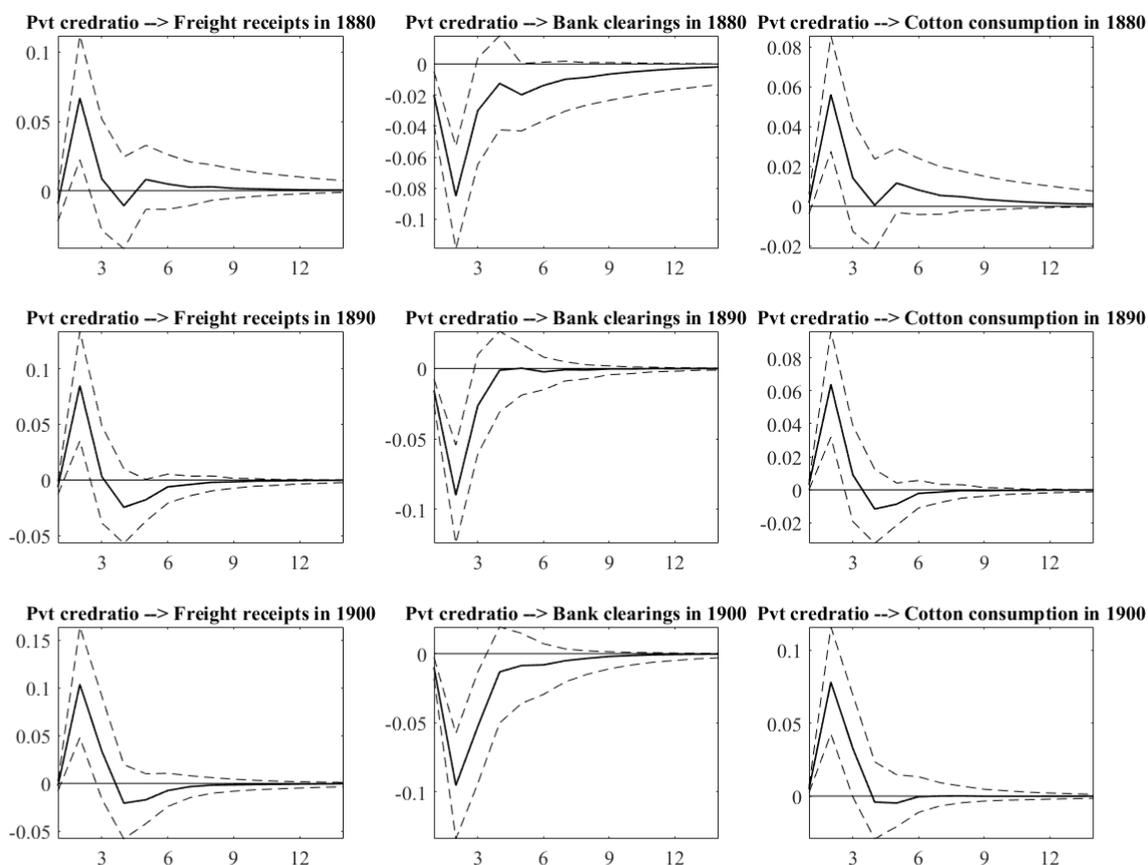
86. For more on the underlying logic behind doing this, see: Ibid.; and Bernanke, Boivin and Elias, ‘Factor-Augmented’.

87. Standardised so that the variable’s standard deviation is 1.

88. Bernanke, Boivin and Elias, ‘Factor-Augmented’.

89. These figures *do not* show the cumulative impact.

Figure 2.2: Impulse responses of real economic variables from shocks to private sector credit



This modest change indicates that there is little evidence of worsening credit constraints. Had the economy become more credit constrained over time, we should observe a progressively larger impact of shocks in private sector credit. At the very most, the evidence can be interpreted as *mild* evidence of *slightly* worsening credit constraints. But the fact that the pre-1891 data is less representative, combined with the relatively small increase in the impact, should temper any such claims.

It is surprising that bank clearings responded negatively to increases in credit. A potential reason for this is the indicator's ability to proxy macroeconomic conditions. One way to examine the validity of our series as economic indicators is to observe their responses to changes in interest rates. If they act as proxies of economic conditions and behave in accordance with macroeconomic theory, they

should respond negatively to unexpected increases in rates.⁹⁰ Such a ‘sanity check’ of the responses of the real variables to interest rates in figure 2.3 shows that bank clearings might indeed be a weaker proxy for the economy than freight receipts. The variable responds with the correct sign (negatively) to shocks in rates after 1 month, but the response is marginally positive thereafter.⁹¹ Another reason for the behaviour of bank clearings was outlined above: changes in credit ratios and bank mergers often occurred simultaneously. The amount of clearings after a bank merger would almost certainly drop, because a merged entity could settle more payments internally. In the process of mergers, banks would typically reduce the outstanding capital of a bank through a cash transaction. This would show up as a temporary reduction in the size of the balance sheet, while keeping the volume of credit constant, which in turn implies a larger credit ratio.⁹² Because of these issues, little importance should be attached to the relationship between bank clearings and credit. Indeed, the results in this chapter are robust to excluding data on bank clearings from the model.

The impact of private credit on trade strengthens the inferences drawn from the results for freight receipts and cotton consumption. Figure 2.4 shows that following an increase in credit, imports increased, while exports declined. We would expect exports to decline if domestic consumers and firms have increasing demand for goods that would otherwise be exported.⁹³ The responses of other macroeconomic variables are also often consistent with credit having a positive impact on economic conditions. These include, for example, the prices and stocks of various commodities. Figures on their impulse responses are shown in appendix 2.A.1.

A further way to examine the importance of credit shocks is to use forecast error variance decomposition (FEVD). This tells us how much variance in the forecast of a given variable is due to another, at a given forecast horizon. In the present context, it can tell us how much of the variance in the forecasts of economic conditions, after one year, is due to shocks in credit. This allows us

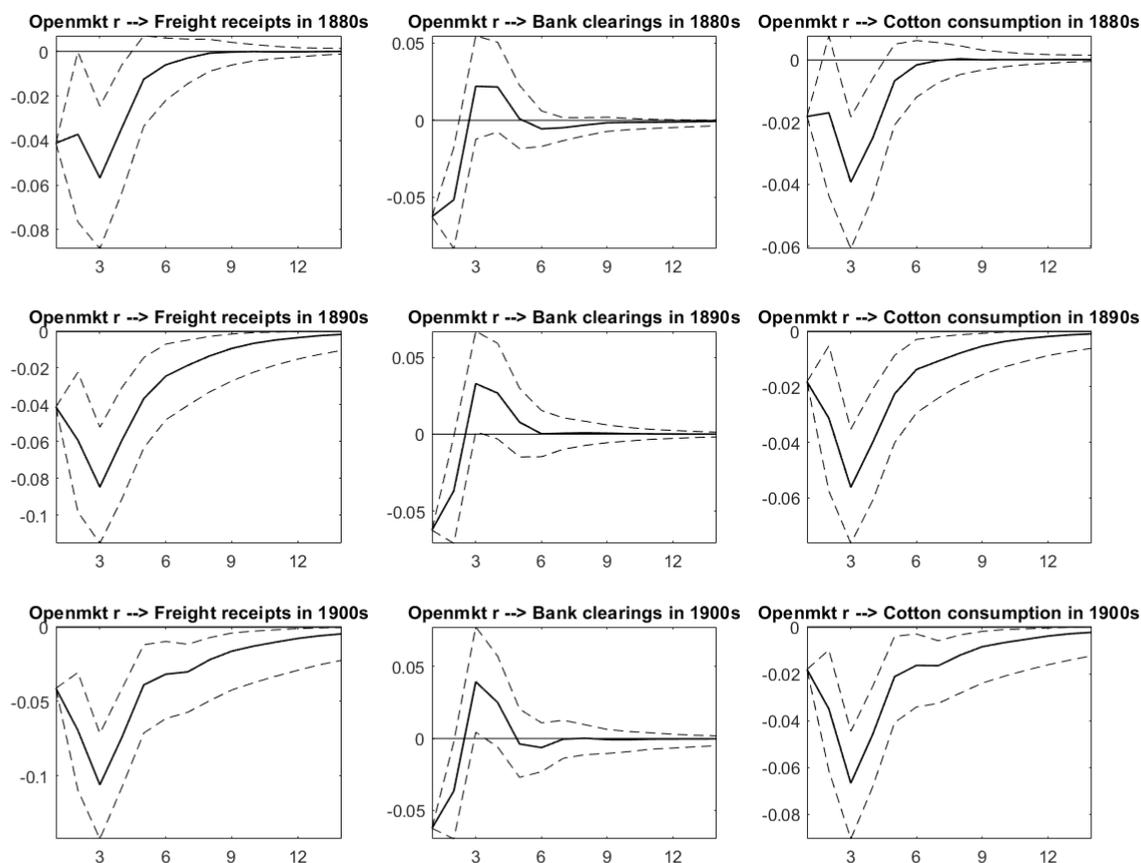
90. See, for example: Fabio Canova and Luca Gambetti, ‘Structural Changes in the US Economy: Is There a Role for Monetary Policy?’, *Journal of Economic Dynamics and Control* 33, no. 2 (2009): 477–490; Bernanke, Boivin and Elias, ‘Factor-Augmented’.

91. Recall that the contemporaneous impact should be ignored, because certain variables included in the factor estimates are allowed to respond contemporaneously to interest rate shocks.

92. Sykes, *Amalgamation*, 101-105.

93. Assuming foreign economic conditions are held constant.

Figure 2.3: Impulse responses of real economic variables from shocks to interest rates



to infer how important credit was in driving short-term growth. Table 2.1 shows that on average, after 12 months, credit accounted for 8.1% of the forecast error variance of the first factor, and up to 17.51% of the other. This adds further support to the argument that credit was an important driver of business cycles. Note also that the contribution of credit to the forecast error variance of the factors does not increase significantly after 6 months, which in turn reinforces the argument that shocks in credit were quickly transmitted to the economy.

The results presented so far indicate that the impact of shocks in bank credit ratios were economically and statistically significant, contributing to economic growth over the short run. However, there were few *major* shocks in credit ratios

Figure 2.4: Impulse responses of trade indicators from shocks to private sector credit

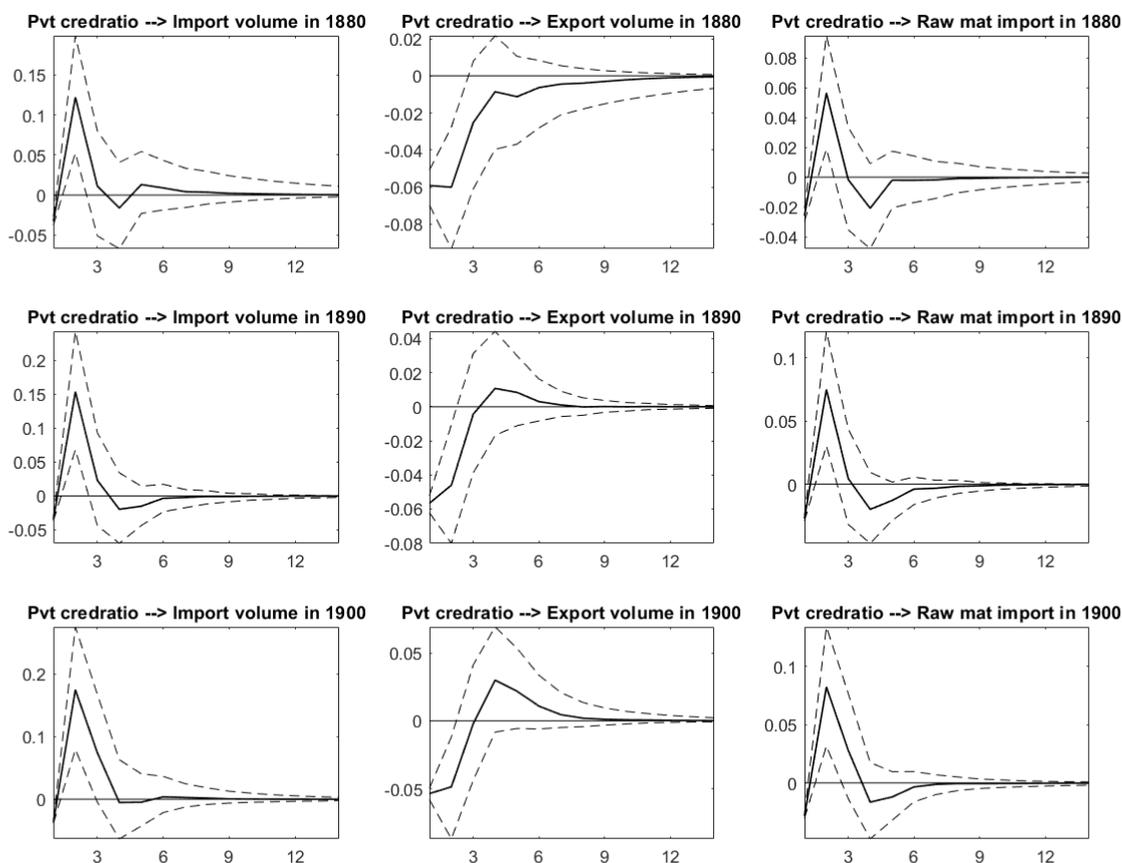


Table 2.1: Forecast error variance decomposition from credit shocks

Horizon (months)	3	6	12
Factor 1	6.31%	7.53%	8.10%
Factor 2	16.85%	17.21%	17.51%

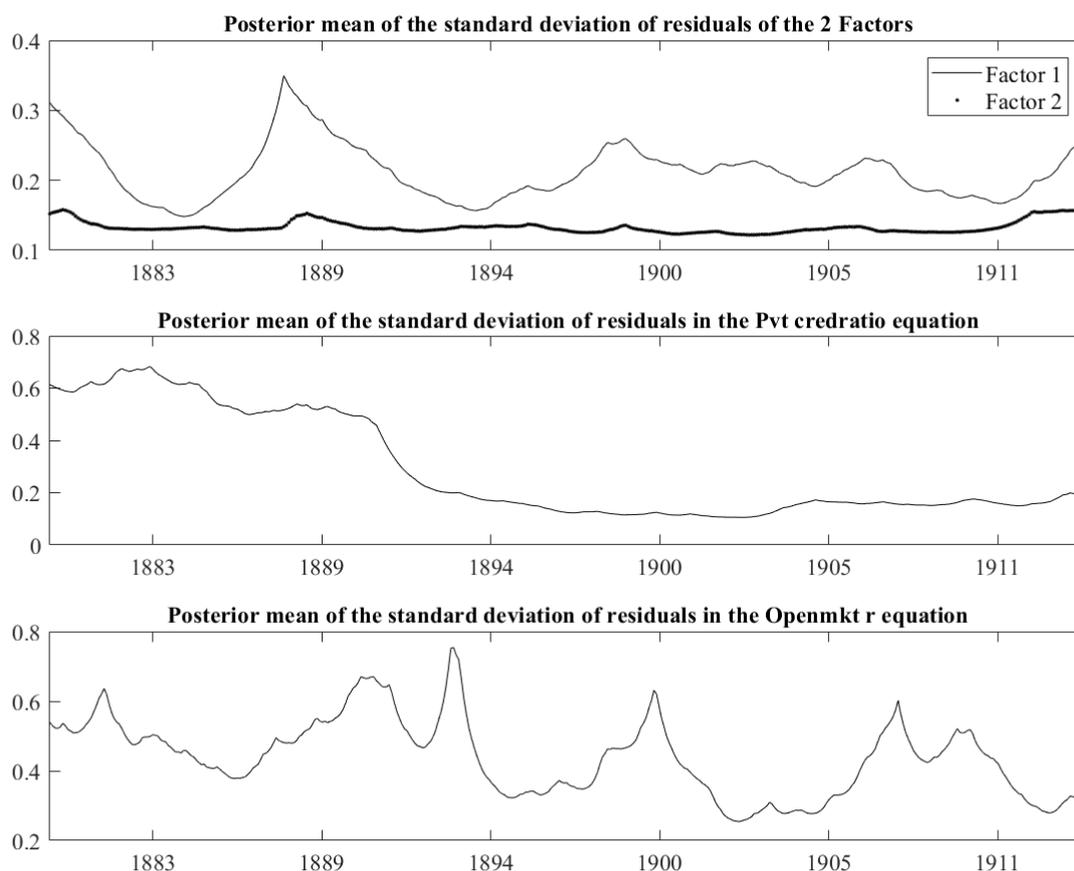
Note: Rows corresponding to ‘Factor 1’ and ‘Factor 2’ show the percentage of forecast error variance in the first and second factors that is due to shocks in credit.

after the 1880s.⁹⁴ Figure 2.5 shows the standard deviation of model residuals - the degree to which a variable deviated from its expected value. This is the standard

94. This is consistent with findings from yearly data and from a larger sample of banks. See: Michael Collins and Mae Baker, ‘Sectoral Differences in English Bank Asset Structures and the Impact of Mergers, 1860-1913’, *Business History* 43, no. 4 (2001): 1–28.

deviation of the shocks that occurred. Less formally, it can be thought of as the average deviation of a given indicator from what its value should have been, based on macroeconomic fundamentals.

Figure 2.5: Standard deviation of model errors for each variable



The upper panel of figure 2.5 shows the standard deviation of shocks to the factors that proxy economic conditions. The middle and the bottom figures show the standard deviations of the shocks to private sector credit and open market rates, respectively. There is evidence of time-varying volatility for all variables, which adds further support to the choice of the model. The standard deviation for the interest rate was around 0.3-0.7 in standardised terms, and around 0.1-0.3 for the factors that proxy the real economy. The standard deviation of shocks to the credit ratio were 0.5-0.6 for the less representative part of the sample (before 1891) and 0.1-0.2 subsequently. This indicates that meaningful, albeit not major, shocks to the credit ratios from their (standardised) predicted values would have occurred often throughout the sample.

The standard deviations of residuals in figure 2.5 also suggest that the private sector credit ratio was far less volatile than the open market interest rate, especially after 1890. This can be partially explained by the characteristics of the sample. It covers a larger set of banks after 1891, which means that idiosyncratic changes in any individual bank's credit receives less weight in the aggregated series. Nevertheless, it is also possible that once the banking system had become consolidated and prudent by the 1890s, banks were less vulnerable to economic and financial shocks. In such a case, banks would not have needed to respond to periods of strain on the money market or the financial system by constraining credit to the private sector. This brings us to the relationship between interest rates and bank credit.

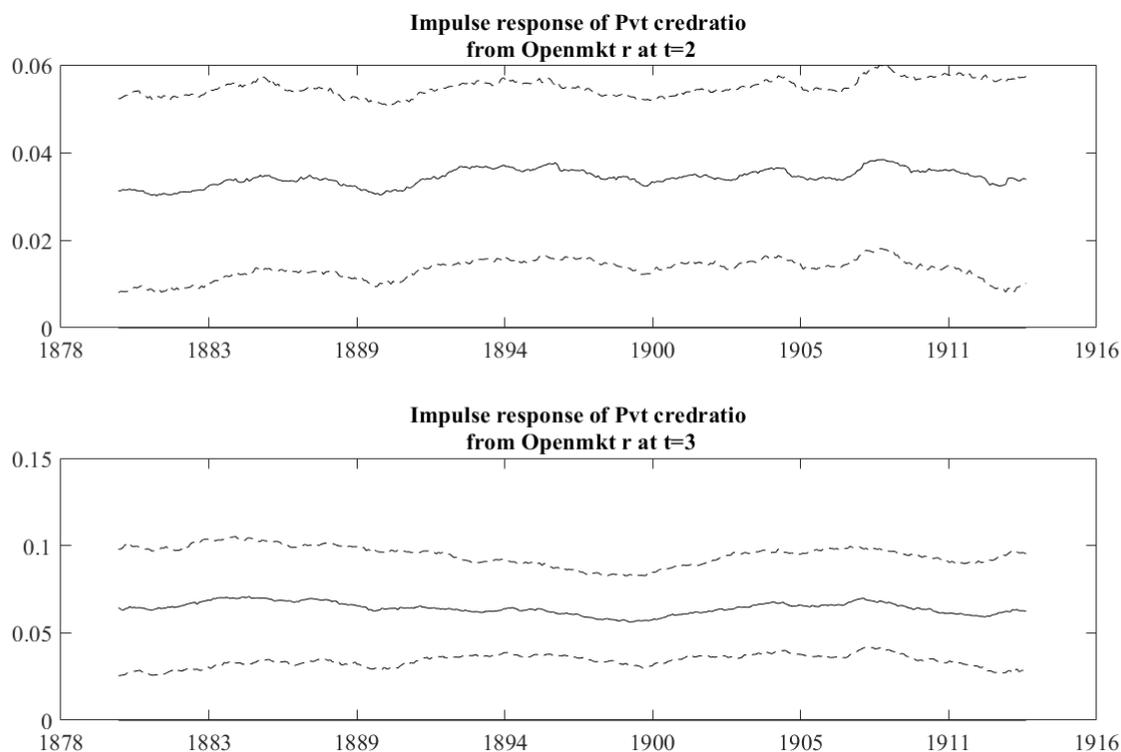
We should remember that today, interest rates are an important determinant of bank risk-taking.⁹⁵ In light of the banking practices that were prevalent in 1880-1913, it is interesting to empirically explore the link between interest rates and risk-taking during this period. The impulse response of the private sector credit ratio to interest rate shocks is shown in figure 2.6. The response is fairly modest, since a 1% increase in the interest rate only increased the ratio of private credit to assets by 0.03-0.07%, which translates to approximately 1% in non-standardised terms. This suggests that bank credit was not highly sensitive to fluctuations in interest rates. The sign of the response of credit from interest rate increases is positive, which contrasts with findings from modern cases. Today, *lower* interest rates tend to translate into significantly higher bank lending volumes and higher risk-taking.⁹⁶ Because banks in 1880-1913 focused mainly on short-term lending, their ability to profit from maturity transformation was smaller than what it is for today's financial institutions. Banks' funding costs were also less sensitive to interest rates, because they did not rely on liability management or wholesale funding, while they maintained interest rate agreements for deposits with other banks. Finally, banks' ability to maintain somewhat sticky rates on advances might have kept their customers' debt service costs less responsive to interest rates than they are today.

The result supports the notion that the business practices of British banks in

95. See the introduction to this chapter.

96. Jiménez *et al.*, 'Hazardous Times'.

Figure 2.6: Impulse response of private sector credit from shocks to interest rates



1880-1913 were prudent, which significantly lessened the impact of what today is a key factor in bank-risk-taking. It is also consistent with the findings of Dwarkasing, who shows that loan volumes of the North and South Wales bank were positively associated with interest rates. This is partially because lower rates induced less creditworthy firms to attempt to borrow more. Banks adjusted to this by reducing loan volumes, which is the exact opposite of what they have tended to do in recent times.⁹⁷

At face value, the evidence in figure 2.6 also indicates that commercial banks did not amplify fluctuations in the money market (the market for short-term debt) by constraining their lending. Considering the results in light of the fact that open market interest rates were determined by both domestic and international factors has further implications for our understanding of the banks' behaviour. The commercial banks' limited response to money market conditions could help explain why international financial disturbances were not transmitted more heavily to the domestic economy, even though the London money market linked the domestic

97. Dwarkasing, 'Essays on Historical Banking', 108-109.

and foreign financial systems.⁹⁸ This finding is not conclusive, but paves the way for further research into whether British commercial banks had a role in mitigating the impact of fluctuations in international financial markets to the domestic economy.

Figure 2.7: Impulse response of interest rates from shocks to private sector credit

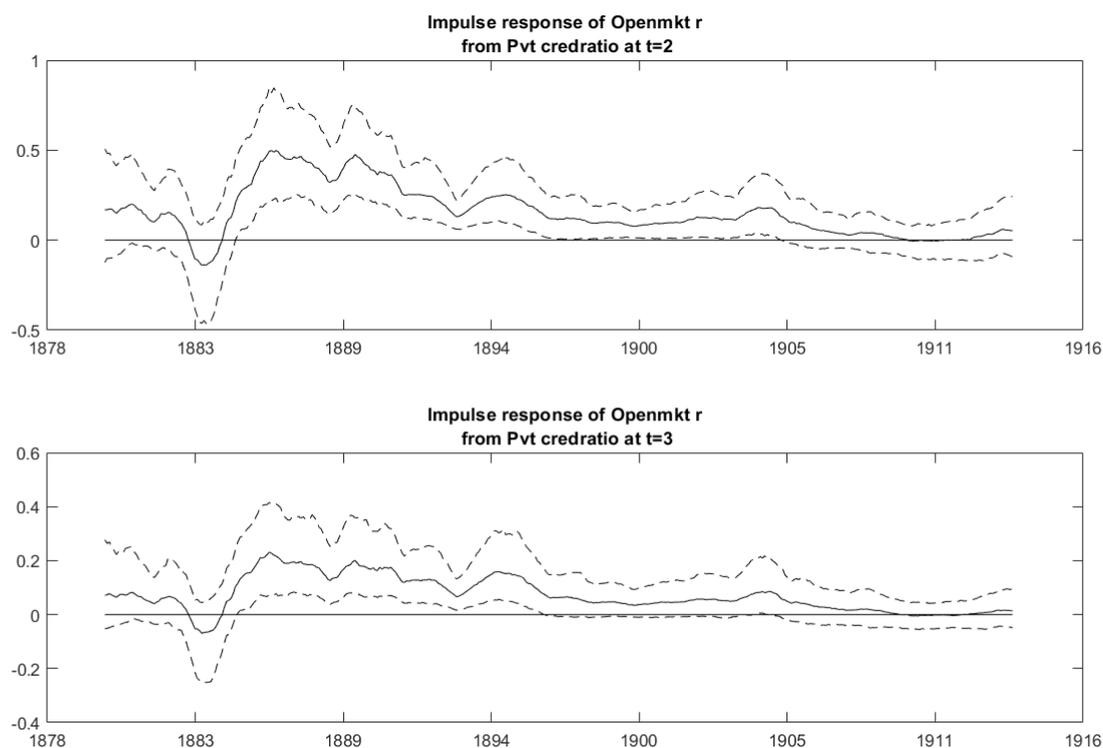


Figure 2.7 shows how changes in the private sector credit ratio impacted interest rates on the money market. The cost of short-term finance increased as bank credit grew. Commercial banks reallocating their resources away from the money market may have increased yields on bills due to reduced liquidity and demand. But regardless of the mechanisms involved, given that open market rates themselves were a determinant of the borrowing costs of a significant set of firms relying on bills of exchange, one might reasonably infer that changing conditions on the money market imposed constraints on the demand for bill finance.

98. Youssef Cassis, *Capitals of Capital: A History of International Financial Centres, 1780-2005* (Cambridge: Cambridge University Press, 2006), 83-86; Youssef Cassis, *Crises and Opportunities: The Shaping of Modern Finance* (Oxford: Oxford University Press, 2011), 5-20.

2.4 Conclusion

This chapter shows that in the short term, the growth of bank credit had a considerable influence on British economic growth. Credit shocks were fully diffused to the economy already after 6 months, but within this time frame, they explained a significant amount of the variation in economic conditions. Moreover, we observe that the link between the credit ratio and economic conditions grew relatively little over time, which implies that the suggestion of progressively worsening credit constraints is not supported.

There is a clear discrepancy between the results contained in the first chapter, showing little in the way of a relationship between finance and growth in the longer term (a horizon of 1 year and beyond), and those contained in this chapter analysing the relationship in the shorter term. At the very least, in light of this chapter's findings, the inferences drawn in the first chapter need to be softened and qualified. Banks did matter for the economy, but their impact on long run growth might have been limited.

Previous contributions to the literature on this topic have presented convincing evidence that bank lending practices changed from 1878 onwards, with banks becoming significantly more risk-averse.⁹⁹ The results in this chapter suggest that the economic impact of these changes may have been, at worst, mildly negative. Declines in bank credit ratios affected economic activity, but these effects were transitory. Over the long run, the resources that banks had available to lend increased, which might have counterbalanced the changes affecting credit/assets ratios. Indeed, because credit shocks were diffused to the economy in a matter of months, the results are consistent with findings that there were relatively few observable credit constraints over the longer term.¹⁰⁰

The limited evidence of progressively worsening credit constraints found in this study is difficult to reconcile with the notion that growing bank conservatism

99. Baker and Collins, 'Financial Crises and Structural Change'.

100. Forrest Capie and Michael Collins, 'Industrial Lending by English Commercial Banks, 1860s–1914: Why Did Banks Refuse Loans?', *Business History* 38, no. 1 (1996): 26–44; Collins and Baker, *Commercial Banks*, 203–217.

hurt the real economy over the long run. Therefore, arguments about negative consequences of bank conservatism in British banking need to be moderated and revised. At least in the short term, there was no substantial trade-off between the increasing stability of the banking system and its contribution to the economy. In a related fashion, the findings have implications for the prevalent views about the impact of lessening competition in the banking sector. Although banks may have constrained credit due to being subject to fewer competitive pressures, the results here suggest that such practices had limited consequences for the real economy. If they had, we should observe substantially tighter credit conditions as the banking sector became more concentrated.

Banks tended to decrease their private sector credit ratios following declines in interest rates. This contrasts with findings from modern data, which indicate that bank risk-taking increases when interest rates decline. In Britain in 1880-1913, several prudent contemporary banking practices reduced banks' ability to take advantage of lower interest rates to make more loans at a higher profit. Among the most important of these practices was a focus on short-term lending, which reduced the scope for maturity transformation, as well as a lack of liability management or reliance on wholesale funding. This result on the insensitivity of credit supply to the interest rate environment adds substantially to our understanding of the determinants of British banking stability in the years 1880-1913.¹⁰¹ The fact that credit was unconstrained with rising interest rates had implications for the real economy. It suggests that banks did not exacerbate the impact that fluctuations in the money markets had on the debt service costs faced by firms.

The observation that bank credit was relatively unresponsive to interest rates could have had wider implications for the functioning of the financial system. It indicates that a key mechanism through which monetary policy operates, the bank lending channel, may not have been significant in Britain over the three decades preceding WW1. The bank lending channel suggests that monetary policy can be effective through encouraging banks to lend more when faced with lower interest

101. Hotson, *Respectable Banking*, 163-173.

rates.¹⁰² This is one dimension in which the Bank of England might have differed from modern central banks in terms of what its policy could achieve, and our historical understanding of its role may need to be revised. Yet, given the high degree of financial stability in 1880-1913, it is also likely that the Bank's policy had different effects during the crisis episodes earlier in the 19th century.¹⁰³ An in-depth analysis of these factors is outside the scope of this chapter, but they certainly warrant further study.

A further finding of this chapter is that market interest rates increased following increases in bank credit. It is difficult to infer what the precise mechanisms behind this phenomenon were. But the fact that this occurred means that the borrowing costs of bank clients (at least via bill finance) would have increased as leverage in the system grew. Was this a consequence of the banking practice of maintaining caps on credit ratios, which could have led to constraints on bill finance specifically? Or did banks' reallocation of credit from money markets to the real economy itself strain the market for bills? Answering these questions constitutes an important research agenda for our understanding of British banking in this period.

The methodology used in this chapter could be fruitfully applied to several other aspects of macro-financial linkages in Britain. More focus on periods of financial strain would be particularly useful, as these are outside the scope of this chapter. Additionally, we need to understand better the extent and effects of financing constraints at a more general level. For this purpose, it would be useful to incorporate credit spreads - differences between the yields of government debt and riskier private sector bonds - into the econometric analysis.¹⁰⁴

102. Anil K Kashyap and Jeremy C Stein, 'What Do a Million Observations on Banks Say About the Transmission of Monetary Policy?', *American Economic Review*, 2000, 407-428; Ben S Bernanke and Alan S Blinder, 'The Federal Funds Rate and the Channels of Monetary Transmission', *The American Economic Review*, 1992, 901-921.

103. Nicholas Dimsdale and Anthony Hotson, 'Financial Crises and Economic Activity in the UK Since 1825', in *British Financial Crises Since 1825*, ed. Nicholas Dimsdale and Anthony Hotson (Oxford: Oxford University Press, 2014), 12-20.

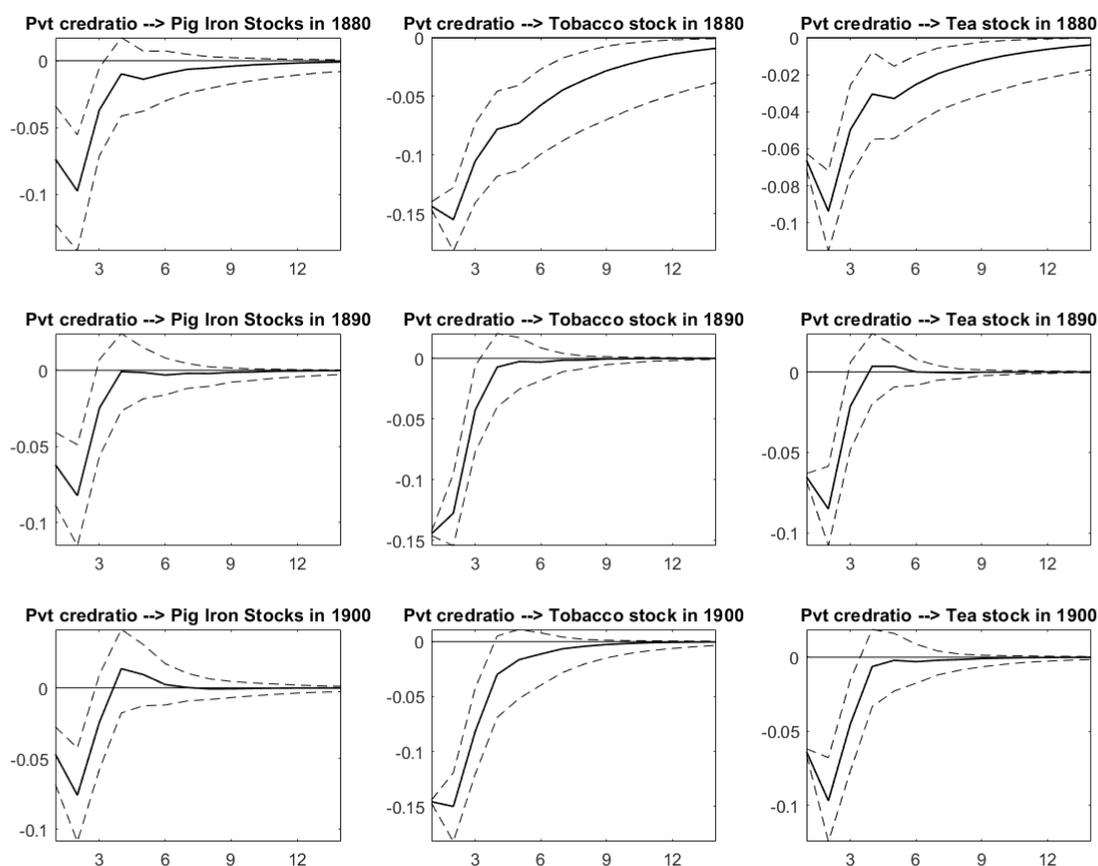
104. Simon Gilchrist and Egon Zakrajšek, 'Credit Spreads and Business Cycle Fluctuations', *The American Economic Review* 102, no. 4 (2012): 1692-1720.

2.A Appendix to Chapter 2

2.A.1 Additional Impulse Responses

It is reasonable to assume that an unexpected increase in domestic demand should reduce the stocks of commodities. This is precisely what we observe after an increase in private sector credit in figure 2.8.

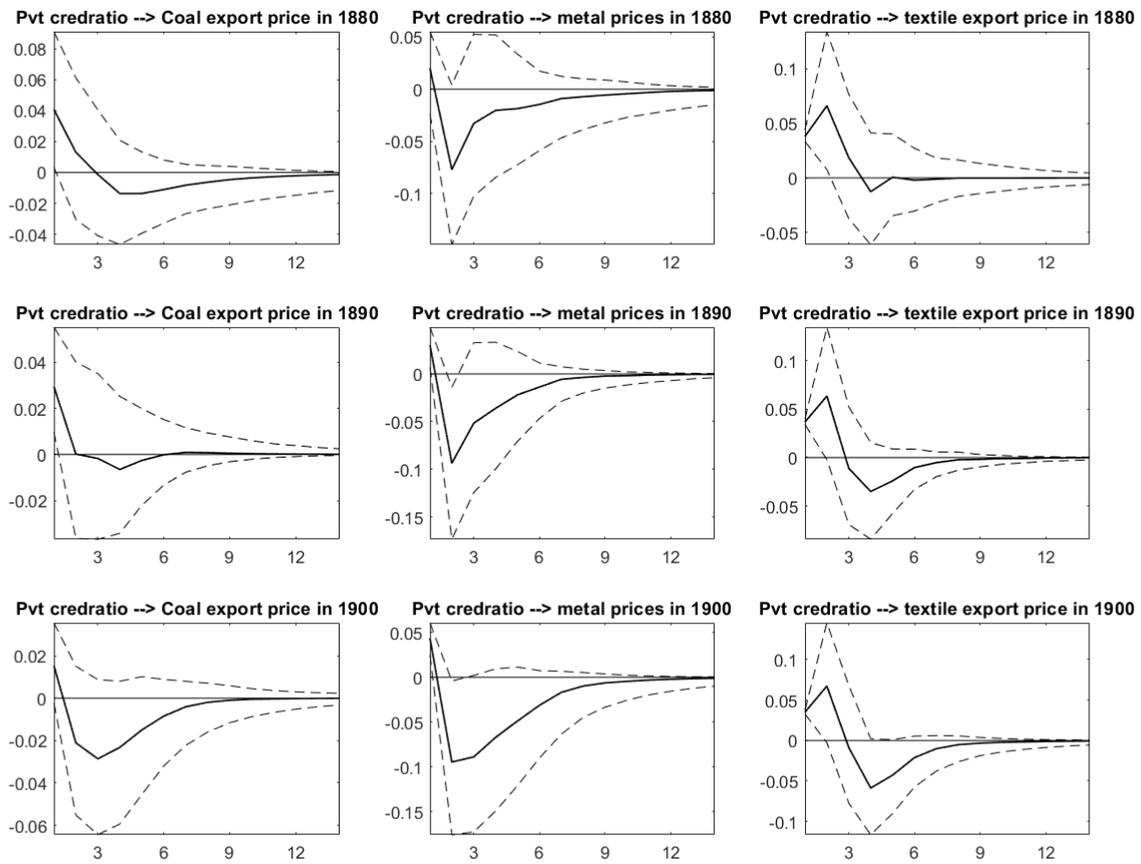
Figure 2.8: Impulse response of stocks of commodities from shocks to private sector credit



Consistency with macroeconomic theory ends, though, when we move to the impulse responses of prices. Theory suggests that increased bank credit has a positive impact on domestic demand. Consequently, we should observe a positive response of prices from a shock in credit. Yet, as seen in figure 2.9, the response of prices is often negative for metals, although textile prices exhibit a positive

response.

Figure 2.9: Impulse response of prices from shocks to private sector credit



2.A.2 Priors

The TVP-FAVAR priors are similar to those outlined for the TVP-VAR in section 1.A.2. The two additions to the priors of the TVP-VAR are $\mathbf{\Lambda}$ and $\mathbf{\Sigma}$, the latter being the variance of the errors in the factor equation. Let $\mathbf{\Lambda}$ be defined as:

$$\mathbf{\Lambda} = \begin{bmatrix} \mathbf{\Lambda}^f & \mathbf{\Lambda}^z \\ \mathbf{0}_{2 \times K} & \mathbf{I}_2 \end{bmatrix} \quad (2.4)$$

The priors of the parameters in the TVP-FAVAR can then be written as follows:

$$\mathbf{\Lambda}_0 \sim N(\mathbf{0}, c_\Lambda \cdot V(\hat{\mathbf{\Lambda}}_0)) \quad (2.5)$$

$$\mathbf{\Sigma}_0 \sim IG(a_\Sigma, b_\Sigma) \quad (2.6)$$

$$\boldsymbol{\beta}_0 \sim N(\hat{\boldsymbol{\beta}}_0, c_\beta \cdot V(\hat{\boldsymbol{\beta}}_0)) \quad (2.7)$$

$$\mathbf{H}_0 \sim N(\hat{\mathbf{H}}_0, c_h \cdot \mathbf{I}_N) \quad (2.8)$$

$$\mathbf{A}_0 \sim N(\hat{\mathbf{A}}_0, c_a \cdot V(\hat{\mathbf{A}}_0)) \quad (2.9)$$

$$\mathbf{Q} \sim IW(k_Q^2 \cdot V(\mathbf{Q}_{prior}) \cdot \kappa, \kappa) \quad (2.10)$$

$$\mathbf{W} \sim IW(k_W^2 \cdot N, \mathbf{I}_N) \quad (2.11)$$

$$\mathbf{S}_i \sim IW(k_S^2 \cdot (i+1) \cdot V(\mathbf{S}_{prior}), (i+1)) \quad (2.12)$$

The notation follows that given in sections 1.5.2 and 1.A.2. $N(\cdot)$; $IW(\cdot)$; $IG(\cdot)$ are the normal; inverse-Wishart; and inverse-Gamma distributions, respectively. Following Korobilis, I set $V(\hat{\mathbf{\Lambda}}_0) = 4 \times \mathbf{I}_N$; $a_\Sigma = 0.01$; and $b_\Sigma = 0.01$.¹⁰⁵ Additionally, following the suggestions of Korobilis, I use a Minnesota-style prior for $\boldsymbol{\beta}$.

The Minnesota-style prior adapted here is as follows. $\hat{\boldsymbol{\beta}}_0$ is set to 0.9 for the first lag of each dependent variable of itself, whereas all other elements are set to 0. Denote $V_{ij,l}^\beta$ as the element of $V(\hat{\boldsymbol{\beta}}_0)$ corresponding to the covariance between

105. Korobilis, ‘Transmission of Monetary Policy’.

variables i and j at lag l . The elements of the diagonal prior variance matrix are specified as:

$$V_{ij,l}^\beta = \begin{cases} \frac{1}{l^2} & \text{for own lags } (i = j) \\ \frac{0.001\sigma_i^2}{l^2\sigma_j^2} & \text{for own lags } (i \neq j) \end{cases} \quad \text{for lags : } l = 1, 2, \dots, \rho \quad (2.13)$$

The elements σ_i and σ_j are derived from the residual variances of $AR(\rho)$ models with variable i as the dependent variable and variable i or j as the independent variable: $y_{i,t} = \sum_{k=1}^{\rho} \gamma_k y_{j,k,t} + e_t$. This specification places relatively few *a priori* restrictions on the variables, except that it assumes that the terms in the covariance matrix shrink as the lag length increases. This is a desirable property especially in heavily parametrised models such as TVP-FAVARs, but have also been found to be successful in large-scale VAR models.¹⁰⁶

Because the dataset is considerably larger than in the previous chapter, we can also allow the data to have more freedom to determine the estimates for other parameters. In this regard, I also do not deviate significantly from the specification by Korobilis. I set: $c_\Lambda = 4$; $V(\hat{\mathbf{A}}_0) = \mathbf{I}_N$; $V(\mathbf{Q}_{prior}) = \mathbf{I}_{N \times (N\rho+1)}$; $V(\mathbf{S}_{prior}) = \mathbf{I}_N$. The other priors are also consistent with the TVP-VAR literature. They are specified as follows: $k_Q = 0.01$; $k_S = 0.1$; $k_W = 0.01$; $c_\beta = 4$; $c_a = 4$ and $c_h = 4$; $\kappa = (1 + N\rho) * N + 1$.¹⁰⁷

106. Marta Bańbura, Domenico Giannone and Lucrezia Reichlin, ‘Large Bayesian Vector Auto Regressions’, *Journal of Applied Econometrics* 25, no. 1 (2010): 71–92.

107. Primiceri, ‘Time Varying’; Timothy Cogley and Thomas J Sargent, ‘Drifts and Volatilities: Monetary Policies and Outcomes in the Post WWII US’, *Review of Economic Dynamics* 8, no. 2 (2005): 262–302. See also references in sections 1.5.2 and 1.A.2.

2.A.3 Banks Included in the Sample

Table 2.2 lists the banks that are included in the dataset.

Table 2.2: Banking data included in the sample

Bank name	Coverage	Archive	Reference
Metropolitan Bank	1880-1913	HSBC	Weekly balance sheet figures, UK R 0029 to 0036
North and South Wales Banking Co.	1880-1909	HSBC	Weekly general abstracts of balances, UK M 0079 to 0086
Nottingham Joint-Stock Bank	1880-1905	HSBC	Weekly balance sheet figures, UK N 0018
North Eastern Banking Co.	1880-1897	Barclays	Company statistics book, 0025-0386
Glyn Mills & Co.	1880-1913	RBS	Balance books, weekly, 1880-1913, GM 203/3 to 6
Pares Leicester-shire	1880-1902	RBS	Monthly statements, 1880-1902, PAR/2
Bank of Liverpool	1880-1888	Barclays	Record book no. 2 - statistics of ledger balances, 1167-0001
Bradford Banking Co.	1880-1905	HSBC	Balance statement book, UK B 0036
Leatham, Tew & Co.	1883-1906	Barclays	Monthly balances, 0003-1021; 0003-1024
Sheffield Union Bank	1893-1901	HSBC	Balance sheet figures, weekly, UK AD 0020 and 0021
Beckett & Co.	1880-1892	RBS	Statistics books, Bel/81/2
Lambton & Co.	1880-1907	Lloyds (London)	Monthly statements, ledger balances A/47/b/30 to 34
Martins Bank	1891-1913	Barclays	Weekly balance sheets, 0140-0047
Barclays	1896-1913	Barclays	Monthly balance books: 364/133 to 154 ; Statistics books, 0003-0133

Consolidated Bank	1892-1896	Published	Goodhart (1972)
City Bank	1891-1898	Published	Goodhart (1972)
Capital and Counties	1891-1913	Published	Goodhart (1972)
London and Midland	1891-1913	Published	Goodhart (1972)
Parr's	1891-1913	Published	Goodhart (1972)
Prescott Dimsdale	1891-1903	Published	Goodhart (1972)
Williams Deacon's	1891-1913	Published	Goodhart (1972)
London and County Bank	1891-1913	Published	Goodhart (1972)
London Joint Stock Bank	1901-1913	Published	Goodhart (1972)
Union bank of London	1891-1913	Published	Goodhart (1972)
National Provincial Bank	1891-1913	Published	Goodhart (1972)
London and South Western	1891-1913	Published	Goodhart (1972)
London and Westminster	1891-1909	Published	Goodhart (1972)
Lloyds	1891-1913	Published	Goodhart (1972)

Goodhart (1972) refers to the appendix of Goodhart, *Business of Banking*.

2.A.4 Data Used to Estimate Factors

Table 2.3 lists the monthly macroeconomic time series used to estimate the factors in the TVP-FAVAR. In the few isolated cases where gaps exist, these have been made up by using a model with local levels through the Kalman smoother. Following the FAVAR literature, the series are transformed to be stationary for factor

estimation. Series for unemployment, the credit ratio and series related to interest rates are in logarithms. All other series are log-differenced.¹⁰⁸ The series are also seasonally adjusted.¹⁰⁹

Table 2.3: Macroeconomic series used to estimate the factors

Series name	Source	Series ID and notes
Freight receipts	NBER	m03005
Currency in circulation	NBER	m14081
Bank clearings	NBER	m12021
Clearings on stock exchange settling days	NBER	m12024
Cotton consumption	Thomas <i>et al.</i>	
Import volume	NBER	m07029
Export volume	NBER	m07024
Balance of payments (current account)	GFD	TDGXGBRLM
Exports of railway materials	NBER	m07033a
Imports of raw materials	Thomas <i>et al.</i>	
Exports of cotton piece goods	NBER	m07036a
Exports of cotton yarn	NBER	m07034
Suez canal traffic bound for the UK	NBER	m03029
Tonnage entered	NBER	m03025
Tonnage cleared	NBER	m03024
Shipping prices	NBER and the Commercial and Financial Chronicle	m03034
Pig iron stocks	The Economist	
Tobacco stock	The Economist	
Tea stock	The Economist	

108. See: Bernanke, Boivin and Elias, ‘Factor-Augmented’; Boivin, Giannoni and Mihov, ‘Sticky Prices’.

109. This is done using the X-13 ARIMA method. See: U.S. Census Bureau, *X-13ARIMA-SEATS Reference Manual*, Washington, DC, 2016, <https://www.census.gov/srd/www/x13as/>, accessed: 18 June 2016.

Coffee stock	The Economist	
Cocoa stock	The Economist	
Unemployment	Thomas <i>et al.</i>	
Sauerbeck price index	Thomas <i>et al.</i>	
Wholesale prices	Klovland and NBER	Klovland (1993) before 1890, NBER series m04053 thereafter
Coal export price	NBER	m04102
Nonferrous metals export price	NBER	m04113
chemical export price	NBER	m04114
metal import prices	NBER	m04107
Iron and steel export price	NBER	m04112
Pig iron price	NBER	Before 1886: Price for Scotch pig iron, m04012a ; subsequently: Pig Iron Prices, Cleveland No. 3, m04012b.
Oils and seed oils import price	NBER	m04108
Textile import price	NBER	m04106
Textile Export price	NBER	m04110
Wheat price	NBER	m04002
Consol Yield	Thomas <i>et al.</i>	Based on Klovland (1994)
Excess of the New York commercial paper rate over the London open market rate	NBER	13018A
Excess of the Paris open market rate over that prevailing in the London	NBER	13018C
Excess of the Berlin private discount rate over the London open market rate	NBER	13018B
Bank of England: other deposits	NBER	m14085
Bank of England: reserves of notes and coin	Thomas <i>et al.</i>	

Bank of England: reserves to liabilities	NBER	m14087
Fixed income securities index	NBER	m11019
Railway share price index	GFD	GBLTRANM
Industrial share price index	NBER	m11012a
Bank of England discount rate	Thomas <i>et al.</i>	
Open market discount rate	NBER	m13016
Import value	NBER	m07029. Not used in the second chapter. Used in the fifth chapter instead of import volumes
Export value	NBER	m07024 Not used in the second chapter. Used in the fifth chapter instead of export volumes

Notes: NBER refers to the National Bureau of Economic Research Macrohistory Database, <http://www.nber.org/databases/macrohstory/contents/>, accessed: 22 January 2018. GFD refers to Global Financial Data, GFDATABASE, <https://www.globalfinancialdata.com/Databases/GFDatabase.html>, accessed: 20 January 2018. Thomas *et al.* refers to: Ryland Thomas and Nicholas Dimsdale, *A Millennium of UK Data*, Bank of England OBRA dataset, 2017, <https://www.bankofengland.co.uk/-/media/boe/files/statistics/research-datasets/a-millennium-of-macroeconomic-data-for-the-uk.xlsx>, accessed: 18 January 2018. The Economist refers to the following section that appeared regularly in various issues: ‘The Economist monthly trade supplement & official trade and navigation accounts of the United Kingdom’. Klovland (1993) refers to: Jan Tore Klovland, ‘Zooming in on Sauerbeck: Monthly Wholesale Prices in Britain 1845-1890’, *Explorations in Economic History* 30, no. 2 (1993): 195–228. Klovland (1994) refers to: Jan Tore Klovland, ‘Pitfalls in the Estimation of the Yield on British Consols, 1850–1914’, *The Journal of Economic History* 54, no. 1 (1994): 164–187.

Chapter 3

Banks and Local Growth, 1871-1911

Chapter Summary

This chapter explores the relationship between banks and economic growth in British counties from 1871 to 1911. During this period, banks expanded their branch networks at a rapid pace, while mergers increased banking sector concentration in several counties. The empirical investigation relies on a new dataset on bank offices and local income tax assessments, along with recent developments in spatial panel econometrics. The results suggest that an increase in the number of bank offices in English and Welsh counties had a positive impact on local economic growth. Scottish counties, on the other hand, did not benefit from an increase in branches. In contrast with previous studies, this chapter finds no evidence of banking concentration having an adverse impact on local economic performance.

3.1 Introduction

Can financial development help explain local economic growth patterns in Britain from 1871 to 1911? Studies in the field of regional finance and growth have typically shown, much like their cross-country counterparts, that the geographic spread and development of financial institutions contributes to local economic activity.¹ These findings are relevant to the case of Britain in the late-Victorian and Edwardian period, when both the financial sector and regional economic growth were unevenly distributed.² This chapter shows that banks had a positive impact on English and Welsh local economic growth in 1871–1911. Yet, this result does not apply to Scotland.

1. Sandra E Black and Philip E Strahan, ‘Entrepreneurship and Bank Credit Availability’, *The Journal of Finance* 57, no. 6 (2002): 2807–2833; Iftexhar Hasan, Michael Koetter and Michael Wedow, ‘Regional Growth and Finance in Europe: Is There a Quality Effect of Bank Efficiency?’, *Journal of Banking & Finance* 33, no. 8 (2009): 1446–1453.

2. See Ben Gardiner *et al.*, ‘Spatially Unbalanced Growth in the British Economy’, *Journal of Economic Geography* 13, no. 6 (2013): 889–928 for a historical perspective and overview of British regional growth disparities. For estimates of British regional GDP in the prewar era, see: Frank Geary and Tom Stark, ‘Regional GDP in the UK, 1861–1911: New Estimates’, *The Economic History Review* 68, no. 1 (2015): 123–144; and Nicholas Crafts, ‘Regional GDP in Britain, 1871–1911: Some Estimates’, *Scottish Journal of Political Economy* 52, no. 1 (2005): 54–64.

Why does local financial development matter? A central finding from studies on regional finance and growth is that even today, banks incur higher costs in evaluating and monitoring borrowers further afield. These information frictions arising from geographic distance play an important role in bank lending decisions and in the financing costs of firms.³ Accessibility and proximity, rather than just the size of the financial sector, are thus important for economic outcomes. In the case of Britain in the late 19th century, the importance of geographical proximity due to information asymmetries could be assumed to be even greater than it is today. Communications were more expensive, and banks had less access to information about their borrowers. Bankers may thus have been reluctant to lend to customers located far away.

Geographic proximity is not the only factor that determines how well banks are able to support local economic growth. A related strand of research has found that the degree of competition between financial intermediaries matters when it comes to the cost and ease of receiving financing.⁴ This is also relevant for understanding the degree to which British banks supported their customers. Recent research suggests that competition in the banking sector declined over the late 19th century, potentially reducing its contribution to economic growth.⁵

From an empirical perspective, studying the role of finance at a regional level has several advantages over the cross-country regression approach. For example, statistical results need not be biased by changing institutional or regulatory characteristics, which are difficult to account for in cross-national data.⁶ Hence, economic historians have begun studying finance and growth at a local level in 19th

3. Stephan Hollander and Arnt Verriest, 'Bridging the Gap: The Design of Bank Loan Contracts and Distance', *Journal of Financial Economics* 119, no. 2 (2016): 399–419; Sumit Agarwal and Robert Hauswald, 'Distance and Private Information in Lending', *The Review of Financial Studies* 23, no. 7 (2010): 2757–2788.

4. Hans Degryse and Steven Ongena, 'Competition and Regulation in the Banking Sector: A Review of the Empirical Evidence on the Sources of Bank Rents', in *Handbook of Financial Intermediation and Banking*, ed. Anjan V Thakor and Arnoud Boot, vol. 2008 (Amsterdam: Elsevier, 2008), 483–554.

5. Richard S Grossman, 'Rearranging Deck Chairs on the Titanic: English Banking Concentration and Efficiency, 1870–1914', *European Review of Economic History* 3, no. 3 (1999): 323–349; Fabio Braggion, Narly Dwarkasing and Lyndon Moore, 'Nothing Special About Banks: Competition and Bank Lending in Britain, 1885–1925', *The Review of Financial Studies*, 2017, 3502–3537.

6. In cross-national data, the relationship between finance and growth in a given country can depend on its regulatory and institutional setting.

and early 20th century economies, even though there are obvious issues with data availability. The preliminary conclusions reached by these initial historical investigations is that financial development was a significant contributing factor to local economic growth in the US, Germany and Japan.⁷

English and Welsh branch banking spread rapidly in the second half of the 19th century. The spread was accelerated by a rise in mergers and acquisitions in the 1880s, which for the first time led to the establishment of national branch networks. Having operated in a more permissive regulatory environment, Scottish banks had built large branch networks already by the mid 19th century. Mergers rendered the banking system more concentrated and dominated by large banks, whereas purely local banks ceased to exist. Several economic historians have argued that these developments led to growing conservatism and potential inefficiencies in lending practices.⁸ Nevertheless, the proliferation of bank offices might have improved access to finance for firms and individuals, as better proximity to bank branches could have reduced information asymmetries arising from geographic distance. Moreover, banks with large branch networks were able to economise on administrative overheads, and historical research has suggested that English banks with a national presence were typically more competitive than purely local banks.⁹ Indeed, I demonstrate that the benefits of large branch networks outweighed the potential costs associated with other developments in banking practices.

This chapter makes several contributions to the literature on finance and growth in economic history. It uses new developments in spatial panel econometrics to test if the expansion of bank branch networks was associated with

7. Matthew Jaremski, 'National Banking's Role in US Industrialization, 1850–1900', *The Journal of Economic History* 74, no. 01 (2014): 109–140; Sibylle Lehmann-Hasemeyer and Fabian Wahl, 'Savings Banks and the Industrial Revolution in Prussia: Supporting Regional Development with Public Financial Institutions', *Hohenheim Discussion Papers in Business, Economics and Social Sciences*, nos. 18-2017 (2017); John Tang, 'Financial Intermediation and Late Development in Meiji Japan, 1868 to 1912', *Financial History Review* 20, no. 02 (2013): 111–135.

8. Grossman, 'Rearranging'; Michael Collins and Mae Baker, *Commercial Banks and Industrial Finance in England and Wales, 1860-1913* (Oxford: Oxford University Press, 2003); Lucy Newton, 'Regional Bank–Industry Relations During the Mid-Nineteenth Century: Links between Bankers and Manufacturing in Sheffield, C. 1850 to C. 1885', *Business History* 38, no. 3 (1996): 64–83. See also section 1.2.2 of this thesis.

9. Joseph Sykes, *The Amalgamation Movement in English Banking, 1825-1924* (London: P.S. King & Son, 1926); Charles W Calomiris and Stephen H Haber, *Fragile by Design: The Political Origins of Banking Crises and Scarce Credit* (New Jersey: Princeton University Press, 2014), 101-102.

county-level economic growth, while also accounting for the impact of changes in the banking sector's concentration. These tests are based on a new dataset on the number of bank offices in each British county from 1870 to 1911, along with local measures of banking sector concentration. Furthermore, this dataset is supplemented with figures on yearly income tax assessments in British counties, which are used to proxy local economic conditions. In the appendix, archival data on the accounts of hundreds bank branches is used to reinforce the validity of this chapter's main findings. This exercise also provides new insights into how a county's financial and economic environment was associated with the business conduct of its bank offices.

3.2 Literature Review

3.2.1 Finance and Local Growth

Economic historians have taken a growing interest in the role of financial institutions in local economic growth. But given the scarcity of pre-WW1 data, studies on late 19th and early 20th century cases are limited to a few countries. To the best of my knowledge, there is only one econometric study incorporating data from Britain in the late 19th century. Hebllich and Trew study finance and growth using census data on the county and parish levels in England and Wales for the years 1817-1881.¹⁰ They find that the number of bank employees in 1817, along with the number of banks, influenced significantly the number of workers in the secondary sector (manufacturing) over 60 years later. A major weakness in their contribution is the failure to exploit the time-dimension of their data, as they use only two observations more than 60 years apart (1817 and 1881) for each parish. Research on an earlier period suggests that a higher number of banks in a given English or Welsh county narrowed the local interest rate differential with London in 1770-1820.¹¹ Brunt and Cannon argue that this led to increased local investment

10. Stephan Hebllich and Alex Trew, 'Banking and Industrialization', *University of St Andrews School of Economics and Finance Discussion Papers*, no. 1415 (2014).

11. Liam Brunt and Edmund Cannon, 'Do Banks Generate Financial Market Integration?' (2004), Unpublished paper, available at: gates.com.virginia.edu/LB6PG/bank10.pdf.

and economic growth.¹²

The empirical literature is considerably more developed in the case of the US. Bodenhorn and Cuberes study the effects of the banking sector's expansion on the growth of cities in the North East of the US from 1790 to 1870.¹³ Using several different econometric techniques, they find a relationship between the existence of a bank in a given city and its subsequent population growth. State-chartered banks also had a positive impact on manufacturing capital and urbanisation in US counties in 1850-1870.¹⁴ Furthermore, Jaremski shows that changes in the geographic distribution of banks, driven by differences in state-level bank legislation, were important for explaining the geographic distribution of US manufacturing industries in the late 19th century.¹⁵ The spread of US national banks, which were banks chartered by the federal government that mainly focused on short-term lending, increased the production of goods and the specialisation of economic activity in US counties from 1870 to 1900.¹⁶ Banks remained important contributors to state-level economic growth from 1900 to 1940, when states which allowed bank branching typically experienced higher manufacturing productivity and wage growth.¹⁷ Overall, there is thus strong evidence of finance-led growth in the US in the 19th and early 20th century.

Similarly, in one of the few non-US studies on 19th century finance and growth, Tang uses a spatially disaggregated dataset on firm creation in Meiji-era Japan, and finds that an increase in financial intermediation in a given prefecture was associated with a growth in the number of local industrial enterprises.¹⁸ Increased access to finance was particularly important for the growth of *less* capital intensive industries such as textiles, which have traditionally been considered important for the nation's industrialisation. Additionally, in a study on 19th century Prussia,

12. The authors derive the rate of return to capital from wheat prices, which makes their results less reliable.

13. Howard Bodenhorn and David Cuberes, 'Financial Development and City Growth: Evidence from Northeastern American Cities, 1790-1870', no. 15997 (2010).

14. Matthew Jaremski and Peter L Rousseau, 'Banks, Free Banks, and US Economic Growth', *Economic Inquiry* 51, no. 2 (2013): 1603-1621.

15. Jaremski, 'National Banking's Role'.

16. Scott L Fulford, 'How Important are Banks for Development? National Banks in the United States, 1870-1900', *Review of Economics and Statistics* 97, no. 5 (2015): 921-938.

17. Rajeev H Dehejia and Adriana Lleras-Muney, 'Why Does Financial Development Matter? The United States from 1900 to 1940', *NBER Working Paper*, no. w9551 (2003).

18. Tang, 'Financial Intermediation'.

Lehmann-Hasemeyer and Wahl show that savings banks were associated with city growth, primarily through their role in local business and infrastructure investment.¹⁹

Much of the historical literature discussed so far relies on somewhat crude proxies for regional economic and financial development. Nevertheless, research based on more comprehensive post-WW2 data also finds evidence of finance-driven growth at the local level. These studies demonstrate that the financial sector has contributed to regional economic development in both Europe and China.²⁰ In an influential study, Jayaratne and Strahan show that the liberalisation of interstate branch banking regulations in several US states since the 1970s increased their economic growth rates significantly.²¹ More efficient credit allocation favouring more productive investment projects constituted the main channel through which this happened. However, Acharya *et al.* suggest that improving access to banks through branch deregulation in the US increased production across industrial sectors, rather than driving growth because of sectoral specialisation in itself.²² Local financial development can thus have a significant positive impact on growth, regardless of local tendencies to specialise in individual industries.

Rich datasets on regional financial and economic conditions have become available in the last few decades, and these have been used for testing a large variety of channels through which local financial institutions impact growth. An increase in a region's bank offices has been found to promote process innovation and R&D investments of local firms, particularly in the cases of small and high-tech firms.²³ Similarly, better availability of finance in Chinese provinces has been associated

19. Lehmann-Hasemeyer and Wahl, 'Savings Banks'.

20. Hasan, Koetter and Wedow, 'Regional Growth'; Jin Zhang, Lanfang Wang and Susheng Wang, 'Financial Development and Economic Growth: Recent Evidence from China', *Journal of Comparative Economics* 40, no. 3 (2012): 393–412; Xiaoqiang Cheng and Hans Degryse, 'The Impact of Bank and Non-Bank Financial Institutions on Local Economic Growth in China', *Journal of Financial Services Research* 37, nos. 2–3 (2010): 179–199.

21. Jith Jayaratne and Philip E Strahan, 'The Finance-Growth Nexus: Evidence from Bank Branch Deregulation', *The Quarterly Journal of Economics*, 1996, 639–670.

22. Viral V Acharya, Jean Imbs and Jason Sturgess, 'Finance and Efficiency: Do Bank Branching Regulations Matter?', *Review of Finance* 15, no. 1 (2011): 135–172.

23. Luigi Benfratello, Fabio Schiantarelli and Alessandro Sembenelli, 'Banks and Innovation: Microeconomic Evidence on Italian Firms', *Journal of Financial Economics* 90, no. 2 (2008): 197–217.

with more innovation at the provincial level.²⁴ Indeed, evidence from the Great Depression era in the US suggests that disruptions to local banking conditions were especially troublesome for capital and R&D intensive firms, although a large share of such companies operated outside areas with distressed banks.²⁵ Additionally, evidence from Italian provinces suggests that a higher degree of local financial development encourages entrepreneurship more generally.²⁶ This evidence implies that access to financial intermediaries should ultimately translate into higher economic and productivity growth at the local level.

Information asymmetries that arise locally between banks and borrowers still play an important role in lending decisions, even in the presence of modern reporting standards and communications technology.²⁷ This is evidenced by interest rates on bank loans rising as the distance between the borrower and the bank grows. The amounts that banks lend to more distant customers also tend to be lower. Higher interest rates for distant borrowers reflect premia asked by banks from lending to customers about whom they possess less information.²⁸ This might be because lenders still place considerable emphasis on ‘soft’ information about customers and about local business conditions, which might be difficult to acquire from a distance.²⁹ As information frictions were larger in the 19th century than they are today, one would reasonably expect that local financial development mattered even more in prewar Britain.

24. Aoife Hanley, Wan-Hsin Liu and Andrea Vaona, ‘Credit Depth, Government Intervention and Innovation in China: Evidence from the Provincial Data’, *Eurasian Business Review* 5, no. 1 (2015): 73–98.

25. Ramana Nanda and Tom Nicholas, ‘Did Bank Distress Stifle Innovation During the Great Depression?’, *Journal of Financial Economics* 114, no. 2 (2014): 273–292.

26. Luigi Guiso, Paola Sapienza and Luigi Zingales, ‘Does Local Financial Development Matter?’, in *The Banks and the Italian Economy*, ed. Damiano Bruno Silipo (Heidelberg: Springer, 2009), 31–66.

27. Marcello Bofondi and Giorgio Gobbi, ‘Informational Barriers to Entry into Credit Markets’, *Review of Finance* 10, no. 1 (2006): 39–67; Matteo P Arena and Michaël Dewally, ‘Firm Location and Corporate Debt’, *Journal of Banking & Finance* 36, no. 4 (2012): 1079–1092.

28. Andrea Bellucci, Alexander Borisov and Alberto Zazzaro, ‘Do Banks Price Discriminate Spatially? Evidence from Small Business Lending in Local Credit Markets’, *Journal of Banking & Finance* 37, no. 11 (2013): 4183–4197; Hollander and Verriest, ‘Bridging the Gap: The Design of Bank Loan Contracts and Distance’.

29. Anzhela Knyazeva and Diana Knyazeva, ‘Does Being Your Bank’s Neighbor Matter?’, *Journal of Banking & Finance* 36, no. 4 (2012): 1194–1209; Agarwal and Hauswald, ‘Distance and Private Information in Lending’.

3.2.2 Banking Sector Competition and the Economy

A lack of banking sector competition can lessen the positive economic impact of local financial development. A vast literature examines how competition in the banking sector affects the way in which banks conduct their business.³⁰ This is important, as the growth of financial intermediaries might not influence economic outcomes if their services are uncompetitively priced, or if concentration leads to credit being constrained or misallocated. Concentration in the banking sector increases when a given set of banks increase their market share, for example when two banks combine. Concentration is often used to proxy for banking sector competition, because fewer banks competing in a given market can reduce competitive pressures, while making it easier to maintain collusive agreements.³¹

Empirical studies on the historical impact of banking concentration have started to emerge only recently. Braggion *et al.* show that British counties with a higher degree of banking sector concentration produced lower tax revenues and had worse employment outcomes in the period 1885-1925.³² Evidence from the US presents a more nuanced view about the effects of banking sector competition on growth. Ager and Spargoli show that in the mid 19th century US, states that increased the degree of competition within the banking sector through free banking laws experienced higher per-capita output growth.³³ Yet, Mitchener and Wheelock find that banking concentration in the US had *positive* effects on manufacturing growth in 1899-1929.³⁴ Specifically, concentration helped the types of firms that might be expected to depend heavily on bank financing: smaller firms which had limited access to capital markets.

Empirical studies on more recent data tend to support the view that more

30. For a review, see: Degryse and Ongena, 'Competition'.

31. Ibid.

32. Fabio Braggion, Narly Dwarkasing and Lyndon Moore, 'The Economic Impact of a Banking Oligopoly: Britain at the Turn of the 20th Century' (2014), Working paper, available at: <https://www.rse.anu.edu.au/media/592266/Moore-Paper.pdf>.

33. Philipp Ager and Fabrizio Spargoli, 'Bank Deregulation, Competition and Economic Growth: The US Free Banking Experience', *Tinbergen Institute Discussion Paper*, no. 13-210/IV/D5F69 (2013).

34. Kris James Mitchener and David C Wheelock, 'Does the Structure of Banking Markets Affect Economic Growth? Evidence from US State Banking Markets', *Explorations in Economic History* 50, no. 2 (2013): 161-178.

banking sector competition is better for the economy. Claessens and Laeven show that a higher degree of competition between banks at the national level improves the growth prospects of industries which depend the most on external finance.³⁵ Such findings have since been replicated at the regional level, although they come with some qualifications. For example, while the spread of banking itself has contributed to growth in Spanish provinces, bank market power has a nonlinear, inverse ‘U-shaped’ effect.³⁶ That is, a moderate amount of market power by banks actually enhanced their ability to foster growth, whereas too little competition hindered it. Bonaccorsi *et al.* reach similar conclusions in their study of Italian regional banking: a moderate degree of banking system concentration increases firm creation, but too much concentration reduces it.³⁷ These findings reflect the possibility that too much competition hinders the development of long-term client relationships, as suggested by the theoretical literature discussed below.

Theoretical studies on why too much competition might lead to worse credit allocation often focus on information asymmetries in banking, along the lines of seminal work by Stiglitz and Weiss.³⁸ Information asymmetries occur when borrowers know more about the prospects of their businesses than lenders do. Lending in the presence of such factors requires that a bank invests in gathering information about opaque firms, in order to assess the creditworthiness of its customers.³⁹ In a related vein, information is necessary for the monitoring of borrowers. After all, banks want to make sure that borrowers do not use their funds for unproductive or overly risky purposes. But gathering information is costly, and might be at risk when banks compete for the same customers.

An influential model by Petersen and Rajan states that returns to gathering customer information decrease with increasing competition between banks, lead-

35. Stijn Claessens and Luc Laeven, ‘Financial Dependence, Banking Sector Competition, and Economic Growth’, *Journal of the European Economic Association* 3, no. 1 (2005): 179–207.

36. Juan Fernandez de Guevara and Joaquin Maudos, ‘Regional Financial Development and Bank Competition: Effects on Firms’ Growth’, *Regional Studies* 43, no. 2 (2009): 211–228.

37. Emilia Bonaccorsi di Patti and Giovanni Dell’Ariccia, ‘Bank Competition and Firm Creation’, *Journal of Money, Credit, and Banking* 36, no. 2 (2004): 225–251.

38. Joseph E Stiglitz and Andrew Weiss, ‘Credit Rationing in Markets with Imperfect Information’, *The American Economic Review* 71, no. 3 (1981): 393–410.

39. Nicola Cetorelli and Philip E Strahan, ‘Finance as a Barrier to Entry: Bank Competition and Industry Structure in Local US Markets’, *The Journal of Finance* 61, no. 1 (2006): 437–461.

ing to credit market inefficiencies.⁴⁰ Increasing competition makes it less likely that borrowers would continue to be customers of any given bank. Incentives to invest in information gathering about customers therefore decline, leading to worse lending decisions being made. Credit is no longer channelled to customers with the best prospects, and no longer constrained for the ones that are least likely to succeed.⁴¹ At a larger scale, this means that too much competition between banks might lead to an economy that allocates its capital sub-optimally, leading to lower growth.

There are several countervailing forces which render a less competitive banking system worse for the economy. Just as monopolistic firms produce less and charge higher prices, banks in a less competitive environment can provide less credit and charge higher interest rates. This implies that small firms, which are especially dependent on bank financing, suffer disproportionately from an uncompetitive banking sector.⁴² Furthermore, when banks with market power charge higher interest rates on their loans, firm investment incentives can get distorted, leading them to choose riskier projects than they normally would, even though these projects might not have the highest expected returns.⁴³ And since banks with high degrees of market power can opportunistically demand higher interest rates from customers in need of credit, firms may become wary of entering close relationships with banks to begin with, instead resorting to more expensive sources of finance.⁴⁴ Contrasting these theoretical findings with those of Petersen and Rajan implies that the impact of bank market power is ambiguous. To some extent, however, these opposing views may be reconciled by assuming the existence of an inverse ‘U-shaped’ relationship between competition and growth. That is, *some* market power by banks might promote economic activity, whereas too much of it can constrain growth.

40. Mitchell A Petersen and Raghuram G Rajan, ‘The Effect of Credit Market Competition on Lending Relationships’, *The Quarterly Journal of Economics* 110, no. 2 (1995): 407–443.

41. Robert Hauswald and Robert Marquez, ‘Competition and Strategic Information Acquisition in Credit Markets’, *Review of Financial Studies* 19, no. 3 (2006): 967–1000.

42. Cetorelli and Strahan, ‘Finance as a Barrier to Entry’.

43. John H Boyd and Gianni De Nicolo, ‘The Theory of Bank Risk Taking and Competition Revisited’, *The Journal of Finance* 60, no. 3 (2005): 1329–1343.

44. Raghuram G Rajan, ‘Insiders and Outsiders: The Choice between Informed and Arm’s-Length Debt’, *The Journal of Finance* 47, no. 4 (1992): 1367–1400; Arnoud WA Boot and Anjan V Thakor, ‘Can Relationship Banking Survive Competition?’, *The Journal of Finance* 55, no. 2 (2000): 679–713.

Notwithstanding the ambiguity in the theoretical literature, it bears repeating that, for the most part, empirical evidence suggests that an absence of banking sector competition constrains economic activity. A rather comprehensive review of the literature suggests a lack of competition between banks is associated with higher costs of bank credit and lower interest rates on deposits.⁴⁵ A recent study using comprehensive loan-level Mexican data shows that banks with too much local market power in a given town tend to restrict finance to a broad set of customers, choosing only the most profitable ones.⁴⁶ Belgian banks have tended to deepen their relationships with customers in response to more competition, and engage in more relationship-based lending, indicating that competition can actually deepen banks' relationships with their customers and thus increase their investment in gathering information.⁴⁷ This contrasts with what the model by Petersen and Rajan predicts.

Besides constraining the availability of finance in general, the lack of banking competition in a locality can be particularly detrimental for new firms, potentially hampering competition in the real sector. Cetorelli and Strahan use geographically disaggregated data from the US to show that more competition in the banking sector is associated with both smaller average firm size and more firms in operation.⁴⁸ This suggests that competitive banking sectors promote entrepreneurship and innovation. In contrast, bank market power may create barriers to entry for new firms. The profitability of banks with established customer relationships depends on the success of those customers. Banks with deep relationships with clients, combined with significant market power, have an incentive to restrict credit to firms which might compete with their clients, or to grant credit to existing clients on favourable terms.⁴⁹ In short, a lack of competition in the banking system might hurt the dynamism of the real economy.

45. Degryse and Ongena, 'Competition'. For additional evidence from the US, see also: Tara Rice and Philip E Strahan, 'Does Credit Competition Affect Small-Firm Finance?', *The Journal of Finance* 65, no. 3 (2010): 861–889.

46. Rodrigo Canales and Ramana Nanda, 'A Darker Side to Decentralized Banks: Market Power and Credit Rationing in SME Lending', *Journal of Financial Economics* 105, no. 2 (2012): 353–366.

47. Hans Degryse and Steven Ongena, 'The Impact of Competition on Bank Orientation', *Journal of Financial Intermediation* 16, no. 3 (2007): 399–424.

48. Cetorelli and Strahan, 'Finance as a Barrier to Entry'.

49. Giacinta Cestone and Lucy White, 'Anticompetitive Financial Contracting: The Design of Financial Claims', *The Journal of Finance* 58, no. 5 (2003): 2109–2141.

Overall, most of the evidence suggests that the cost-efficiency and competition in regional banking, rather than merely lending volumes or access to finance, are important factors in determining the relationship between finance and growth.⁵⁰ The findings from the literature on banking competition and economic performance are also broadly consistent with the arguments of economic historians about the effects of banking system concentration in late 19th century Britain. The historical context of British regional banking, and competition therein, is discussed below.

3.2.3 British Local Banking

In 1870, the effects of earlier legislation were still reflected in the banking sector's structure in England and Wales. Only after 1826 could joint-stock banks be formed relatively freely, although restrictive legislation was imposed again from 1844 to 1857.⁵¹ Until the 1870s, the pace of branching in England and Wales was relatively slow, as early joint-stock banks tended to have few offices. They mainly branched regionally rather than nationally.⁵² Without the capital base of joint-stock banks, private banks were even more reluctant to establish branches. Several Scottish banks, on the other hand, had built extensive branch networks already by the 1850s.⁵³ On average, English joint-stock banks in 1875 had 11 branches, whereas Scottish banks had 84.⁵⁴

The fact that English banks lacked national branch networks until the 1880s forced them to rely on the London money market, either to lend funds which would otherwise have been left idle, or to meet demands for loans which could not be covered through local deposits.⁵⁵ A bank with several branches could transfer

50. Michael Koetter and Michael Wedow, 'Finance and Growth in a Bank-Based Economy: Is it Quantity or Quality That Matters?', *Journal of International Money and Finance* 29, no. 8 (2010): 1529–1545.

51. See the introduction of this thesis.

52. Victoria Barnes and Lucy Newton, 'How Far Does the Apple Fall from the Tree? The Size of English Bank Branch Networks in the Nineteenth Century', *Business History*, 2017, 1–27.

53. Ranald C Michie, *British Banking: Continuity and Change from 1694 to the Present* (Oxford: Oxford University Press, 2016), 77.

54. Ibid.

55. Michael Collins, *Money and Banking in the UK: A History* (London: Croom Helm, 1988), 22–25.

funds between its offices more efficiently, without incurring the cost of relying on the London agents to lend or borrow funds from afar. A more substantial advantage of branching was that customer and industry-specific risk could be diversified through serving a wider range of industries, while at the same time expanding the depositor base. In this respect, the English and Welsh banking system came to resemble that in Scotland and Ireland (which also had banks with large branch networks) over the late 19th century.⁵⁶ In 1913, the average English bank had 157 branches, against 156 for Scottish banks.⁵⁷

While increased branching in itself increases local firms' access to financial intermediaries, several historians have argued that there were drawbacks to the gradual disappearance of locally oriented banks. To understand what these were, it is necessary to review some features of branch banking before the 1880s. From the 1830s to the 1870s, English joint-stock banks tended to have close ties with their local business communities. Bank directors were often engaged with, or had backgrounds in, the industries that operated in their bank's vicinity. Owners of local firms would occasionally become shareholders of the banks that their firms did business with, which reinforced the relationships that banks had with their customers.⁵⁸

Relationships between banks and customers, coupled with the commercial expertise of bank directors, gave banks a large amount of tacit information which could be used to improve lending decisions.⁵⁹ The information that banks had on their customers allowed them to lend in a flexible manner. This could mean, for example, lending against little or no collateral when the borrower's other characteristics were favourable. Barnes and Newton argue that local information advantages were an important determinant of where most regional banks would expand before the 1880s, because insider knowledge constituted an important part of their risk management. Therefore, the same practices that deepened the relationships between banks and their customers also hindered branching until the 1880s.⁶⁰

56. Charles W Munn, 'The Emergence of Joint-Stock Banking in the British Isles a Comparative Approach', *Business History* 30, no. 1 (1988): 69–83.

57. Michie, *British Banking*, 77.

58. Lucy Newton, 'The Birth of Joint-Stock Banking: England and New England Compared', *Business History Review* 84, no. 01 (2010): 27–52.

59. *Ibid.*; Newton, 'Bank–Industry Relations'.

60. Barnes and Newton, 'How Far'.

Amidst the merger movements in the 1880s and 1890s, the largest banks in England and Wales formed national branch networks. Running such networks was a complex affair, and required an approach to risk management that differed from that which was prevalent among banks with only a few branches and fewer customers. Directors possessed less knowledge about borrowers in any specific locality, making direct monitoring of bank customers more difficult. Bank directors were also located further away from branch managers, which meant that they had less direct knowledge of the credit risk that was being taken. Inspectors of branches, bureaucratisation, and encoded lending rules thus came to replace the more flexible banking practices of smaller banks. Meanwhile, branch managers were becoming increasingly professionalised, instead of having backgrounds in industry or commerce.⁶¹ These developments could have made bank credit more difficult to obtain, because codified rules on lending meant that branch managers were forced to ignore relevant unobservable characteristics of their clients when making lending decisions, however informed they might have been.⁶²

Relative to banks with small branch networks, large national banks committed a smaller share of their assets to lending to firms.⁶³ At the turn of the century, joint-stock banks headquartered in London held nearly 45% of their balance sheets in liquid assets - assets which could be converted to cash at short notice.⁶⁴ Collins and Baker defined these as government bonds, cash or near-cash assets, such as short-term deposits at discount houses.⁶⁵ The corresponding figure for provincial banks (headquartered outside London) was only 35%, meaning that these banks committed a larger share of their resources to the financing of commerce and industry.⁶⁶ These differences might imply that banks with national networks did not finance local business activity to the same extent that provincial banks did, which might have had implications for their contribution to local economic growth. Based on balance sheet ratios alone, the absorption of provincial banks by national ones may thus have come at a cost in terms of growth rates of local economies.

61. Collins and Baker, *Commercial Banks*, 85-87.

62. Newton, 'Bank-Industry Relations'; Michael Collins and Mae Baker, 'Sectoral Differences in English Bank Asset Structures and the Impact of Mergers, 1860-1913', *Business History* 43, no. 4 (2001): 1-28.

63. Ibid.

64. See the second chapter of this thesis.

65. Collins and Baker, 'Sectoral Differences'.

66. Ibid.

It is likely that comparisons of credit ratios between different types of banks overlook numerous confounding factors, leading to an overly negative assessment of banks with a nationwide presence. The largest banks typically had a larger deposit base (from which loans could be made) than smaller banks, along with denser branch networks.⁶⁷ These two features are related: dense branch networks led the largest banks to gather more deposits, because smaller banks were more reluctant to establish branches.⁶⁸ Yet, a higher propensity to branch also led to the establishment of bank offices in areas where commercial activity was limited relative to the supply of deposits. Contemporary evidence from annual meetings at the turn of the century suggests that national banks had expanded their deposit base faster than the demand for commercial credit had increased, leading to complaints about lower profitability.⁶⁹ In this sense, the substantial expansion of branch networks, together with the growth of banks' resources, may have counteracted many of the downsides associated with the lending practices of large banks. And the pace of branching was very rapid indeed: the number of bank offices in England and Wales nearly doubled from 1,094 in 1850 to 1,959 in 1875. But as the large banks became increasingly dominant by 1900, the number of branches had expanded to 4,570, ultimately reaching 6,573 in 1913.⁷⁰

The fact that the largest banks had dense branch networks could make direct comparisons between balance sheet ratios by Collins and Baker less informative about the local availability of bank credit.⁷¹ There is compelling historical evidence suggesting that the trend in British banking was towards increasing conservatism, but balance sheet ratios alone are unlikely to capture the effects of this trend given the presence of the many confounding factors discussed above. Moreover, contemporary sources indicate that smaller, local banks were becoming increasingly rare for a reason: they were less competitive than the largest banks,

67. Newton, 'The Birth of Joint-Stock Banking: England and New England Compared'; Sykes, *Amalgamation*, 116-118, 131-135.

68. Barnes and Newton, 'How Far'.

69. Sykes, *Amalgamation*, 58-59, 130-135; Richard S Grossman, *Unsettled Account: The Evolution of Banking in the Industrialized World Since 1800* (Princeton: Princeton University Press, 2010), 185-189.

70. Michael Collins, 'The Growth of the Firm in the Domestic Banking Sector', in *Business Enterprise in Modern Britain: From the Eighteenth to the Twentieth Century*, ed. Maurice W Kirby and Mary B Rose (London: Routledge, 1994), table 10.5.

71. Collins and Baker, 'Sectoral Differences'.

which could better economise on several administrative costs.⁷² The flexibility and relationship-oriented approach by local banks might thus have come at a cost to their customers.

3.2.4 Competition and Concentration in British Banking

Just as in the modern cases reviewed above, increasing market power of individual banks may have had economic consequences in Britain in 1871-1911, which could have counteracted the benefits of the spread of bank offices. The banking sector's concentration increased substantially after the 1870s, especially in England and Wales during the merger waves in the 1880s and 1890s. As concentration increased, banks engaged in agreements to restrict competition in all parts of the UK. In practice, these agreements took the form of setting uniform interest rates on deposits, commonly 1-1.5% below the Bank of England rate.⁷³ In England, there was a degree of collusion in the sector by the late 19th century, while Scottish banks were engaging in explicit agreements for rate-fixing at the time.⁷⁴ There were no laws explicitly banning such agreements.

The creation of large branch networks may also have been related to competitive considerations. The amalgamation decisions of major banks after the 1880s could in theory be motivated by a search for economies of scale and diversification of risk. They could constitute a more efficient way of expanding branch networks than building completely new offices. Yet, Grossman provides evidence from Lloyds Bank suggesting that an important reason for amalgamation was often the restriction of competition.⁷⁵ The policy of Midland Bank, according to one of its directors, was also to 'destroy active competition' in certain areas through takeovers.⁷⁶ Therefore, the consequence of mergers was in several instances not the expansion of bank offices into new areas, but the elimination of competition in areas where the bank was already present.

72. Sykes, *Amalgamation*, 51-59.

73. Brian Griffiths, 'The Development of Restrictive Practices in the UK Monetary System', *The Manchester School* 41, no. 1 (1973): 5-6.

74. Collins, *Money and Banking*, 78-80.

75. Grossman, 'Rearranging'.

76. *Ibid.*

Significant progress has been made in assessing the effects of growing concentration in British banking. Braggion *et al.* study a dataset of over 30,000 loans granted from 1885 to 1925 in England and Wales. They find that in counties with more concentrated banking sectors, banks tended to give smaller loans, require more collateral, and lend to less risky customers.⁷⁷ Braggion *et al.* also analyse the balance sheets of the lending banks, and find that banks operating primarily in highly concentrated counties were more conservative, and may have constrained their lending. The authors do not directly assess what effects the spread of banking itself had on local economic outcomes, but these results imply that the lack of competition had negative effects for local economic performance.

Access to banking facilities certainly increased through a high level of branching by large commercial banks during the period at issue. Yet, it is also possible that the conservatism and collusive practices that these institutions engaged in rendered them less important for the growth of local economies. An important contribution of this chapter is to ascertain the economic impact of these factors by studying them jointly.

3.3 Data

3.3.1 Branches

To answer how the spread of provincial finance impacted growth, this chapter relies on a new dataset on the number of bank offices (branches) in British counties to proxy the level of local financial development. Specifically, the dataset contains the number of bank branches in each county, by year, for the period from 1870 to 1911. I refer to branches and offices interchangeably. Single-office banks (which were becoming increasingly rare by the 1870s), along with bank head offices, are counted as branches.

The data is collected from the *Banking Almanac* and the *Banker's Magazine*, which have previously been used by researchers to study bank branching, but for

⁷⁷ Braggion, Dwarkasing and Moore, 'Nothing Special'.

different periods. Braggion *et al.* along with Barnes and Newton, have created datasets on bank branching in England and Wales from 1885 to 1925 and 1826 to 1877, respectively.⁷⁸ The Banking Almanac provides a list of every branch and bank in the UK by town. After 1876, both the Banker's Magazine and the Banking Almanac list branch openings and closures in each town by year. I have collected data from the Banking Almanac for the years 1870-1880. For subsequent years, I have used data from the Banker's Magazine and the Banking Almanac on branch openings and closures for each year.⁷⁹ There were 10,532 such events between 1881 and 1911, although many of these refer to transfers of offices from one bank to another, which occurred due to bank mergers. To ensure consistency of the data over the years, I have not relied on the datasets by Braggion *et al.* or Barnes and Newton.

This chapter also improves upon the datasets of the studies mentioned above by including Scottish branches. The experience of Scotland is an interesting case in its own right, but to maintain a sufficient sample size, Scottish data is included in the econometric model alongside English and Welsh counties. It is important to keep in mind that the Scottish institutional framework was different from that in the rest of Britain, and the nation's banking sector had reached a higher degree of consolidation by the 1870s. The econometric examination takes this into account by running a subset of regressions on only English and Welsh counties.

Each branch location is matched to a historic county by using data from the Association of British Counties *Gazetteer of British Place Names*.⁸⁰ After initial matching, it was necessary to ensure manually that a place name maps to the correct county. For example, 'Hockley' can refer to places in four different counties in the Gazetteer data, and 'Highfield' can refer to 12 different places. The Banker's Magazine or the Banking Almanac would sometimes clarify in which county a branch in these cases is located. When the issue could not be resolved using these sources, I resorted to the *Economist*, where bank-specific advertisements

78. *Ibid.*; Barnes and Newton, 'How Far'.

79. The copies of the Banker's Magazine are available at the Cambridge University Library, whereas the Banking Almanac is available at the LSE library.

80. Association of British Counties, *Gazetteer of British Place Names*, <https://www.gazetteer.org.uk/>, accessed: 2 February 2017.

occasionally listed their branches.⁸¹ As a last resort, I used Orbell’s and Turton’s guide to British bank archives, which typically details the region in which a bank operated.⁸²

As a measure of the size of the banking sector in each county, I use either *bank branches per capita* or *bank branches per square kilometre*. These indicators have certain limitations: they do not measure the amount of credit that banks actually extended in various localities, and do not take into account the fact that branches differed from one another in terms of how much business they did. However, both economists and economic historians often rely on these types of indicators.⁸³ Theoretically, both of these measures proxies the accessibility and density of financial institutions in a given county. This assumption is supported by macroeconomic literature, where these indicators have been used to measure access to finance even in cross-national comparisons.⁸⁴ Moreover, because the data is at the county-level, a significant proportion of the heterogeneity between branches gets averaged out. Indeed, my findings in appendix 3.A.1, based on branch level balance-sheet data, largely support the validity of using these measures at the county-level.

Figure 3.1 shows maps of branches per 1000 capita across Britain for the years 1871, 1891 and 1911. The maps are created using the *QGIS* software.⁸⁵ The maps do not suggest that *branches per capita* captures entirely the level of local banking activity. Both Lancashire and Middlesex (which covers most of London) had relatively few branches per capita throughout the years, despite being by far the largest economies, as measured by income tax assessments. On the other hand, sparsely populated areas in Wales and the North of Scotland tended to have relatively high numbers of branches per capita by 1911.

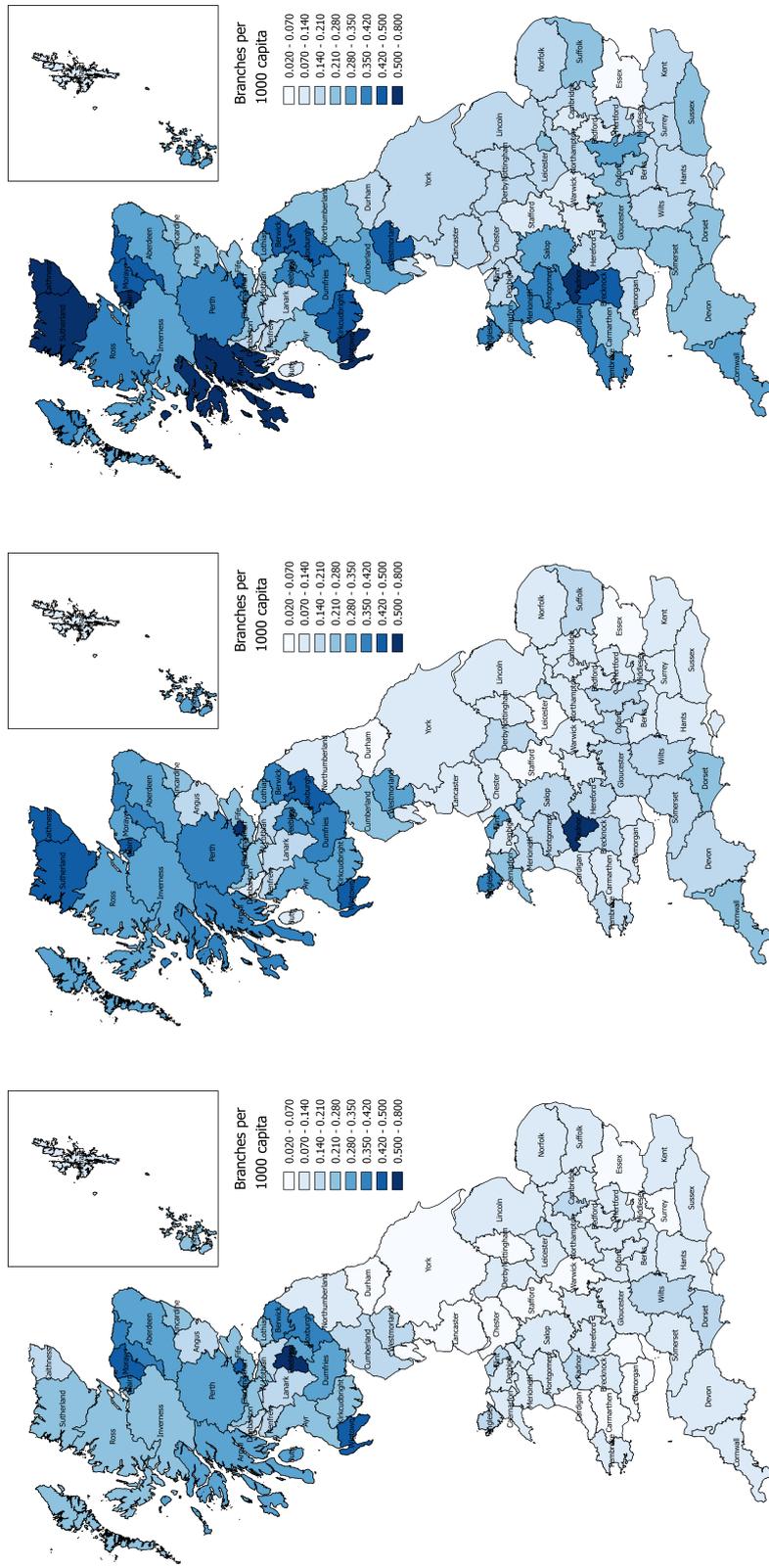
81. Available at: *The Economist Historical Archive, 1843-2014*, <http://find.galegroup.com/econ/>. accessed: 4 January 2018.

82. John Orbell and Alison Turton, *British Banking: A Guide to Historical Records* (Aldershot: Ashgate, 2001).

83. See, for example: Jaremski, ‘National Banking’s Role’; Tang, ‘Financial Intermediation’; Benfratello, Schiantarelli and Sembenelli, ‘Banks and Innovation: Microeconomic Evidence on Italian Firms’.

84. Thorsten Beck, Asli Demirguc-Kunt and Maria Soledad Martinez Peria, ‘Reaching Out: Access to and Use of Banking Services Across Countries’, *Journal of Financial Economics* 85, no. 1 (2007): 234–266; Martin Čihák *et al.*, ‘Financial Development in 205 Economies, 1960 to 2010’, *Journal of Financial Perspectives* 1, no. 2 (2013): 17–36.

85. QGIS Development Team, *QGIS Geographic Information System* (Open Source Geospatial Foundation, 2017), <http://qgis.osgeo.org>. GIS refers to ‘Geographic Information System’.



(a) Branches per 1000 capita in 1871 (b) Branches per 1000 capita in 1891 (c) Branches per 1000 capita in 1911

Figure 3.1: Branches per 1000 capita in Britain

The number of branches per capita grew significantly in all British counties from 1871 to 1911. Scotland tended to have more bank branches per capita throughout the period, both in the lowlands and in the rural counties in the highlands. This certainly conforms with our historical knowledge about the evolution of the British banking system: Scotland had developed a system of joint-stock banks relying extensively on large-scale branch networks already in the 1870s, whereas a similar system in England and Wales emerged only a few decades later.⁸⁶

A possible explanation for the relatively low number of branches per capita in densely populated counties, such as Middlesex and Lancashire, is that banks in urban areas could simply choose to expand their operations at existing branches instead of establishing new branches nearby. For example, if a bank in Manchester needed to expand its business, it might have made sense to hire more staff for an existing branch rather than to set up a new office in the same city. In more rural areas, where economic activity was less concentrated, such an approach would not have been optimal, given longer distances to customers. Unfortunately, there is no yearly data on the number of employees in banks at the county-level.⁸⁷

Notwithstanding the possibility that differences in population densities might explain disparities between branches per capita, *changes* in banks per capita can still be a valid proxy for how access to financial intermediaries changed. It will thus be used as an alternative measure of financial development, even though *branches per square kilometre* (discussed below) seems to be a better indicator. The use of county fixed effects in the econometric models can further ameliorate the issue with limited cross-county comparability of this measure, as long as branches per capita measures financial development *within* a given county. The included instrumental variables will also mitigate this issue.⁸⁸ Moreover, to test the robustness of the results based on this variable, I run regressions with branches scaled by a county's population density as an explanatory variable.

As an alternative measure of the development of the banking system, I use banks per square kilometre. The data is mapped in figure 3.2, where darker

86. Michie, *British Banking*, 75-80, 96-98.

87. The use of census records are too inaccurate for these purposes, and would only provide snapshots at 10-year intervals, which is not ideal for econometric testing.

88. Here I refer to the use of lagged values of banks per capita as instruments. These are discussed below.

shades indicate more bank offices per square kilometre. This measure appears to be higher in counties which had more economic activity. Figure 3.2a suggests that in England and Wales, only industrial counties in the North (primarily Lancashire) along with London (Middlesex) had a significant number of branches in 1871. Industrial counties in the West Midlands (Warwickshire and Staffordshire) also had a higher degree of banking activity. This was also the case in the southern parts of Yorkshire, but due to issues with the tax data in my sample, it was necessary to merge all the parts of Yorkshire into one.

Scottish banks appear to have been concentrated around Lothian (Edinburgh) and the West of Scotland (Glasgow) regions. But as early as the 1870s, there was also a relatively high concentration of bank offices in areas with smaller cities, such as Aberdeen and Dundee (Angus).⁸⁹ As in the English and Welsh cases, this measure of banking density seems to correlate better with the size of the economies of Scottish counties than branches per capita. Relative to branches per capita, however, it shows a significantly smaller disparity between the developments of the English and Scottish banking systems in 1891 and 1911.

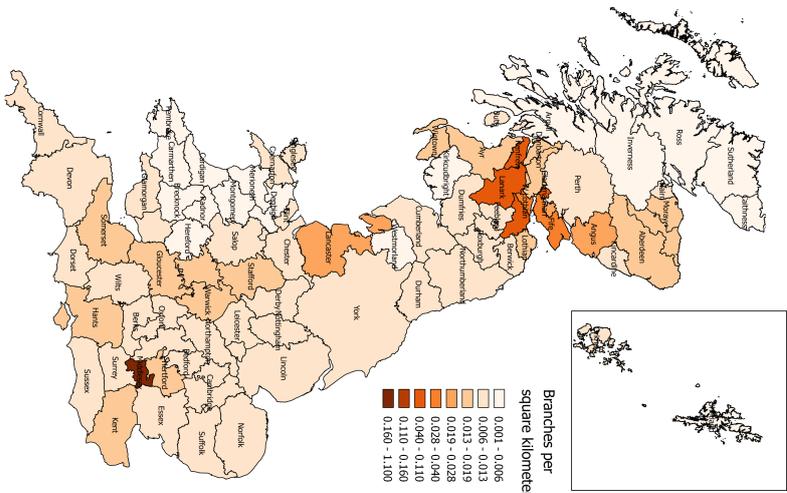
Over the four decades from 1871, banking primarily proliferated in the industrial north, the West Midlands and the south of England. Meanwhile, agricultural areas of the eastern parts of England and the north of Wales had a low number of branches even in 1911. The growth of bank offices was significantly lower in Scotland than in the rest of Britain, again conforming to the fact that the country already had a more developed banking sector in the 1870s.

3.3.2 Concentration of the Banking System

In addition to measuring the spread of bank offices, I calculate the Herfindahl-Hirschmann Index (HHI), which is a commonly used indicator of banking sector concentration.⁹⁰ This is used as proxy for the degree of competition that existed between banks in each county. The HHI is calculated using the following formula

89. Following the *Historic Counties Standard*, I treat Cromartyshire and Ross-shire as one county. See: The Historic Counties Trust, *The Historic Counties Standard*, <http://www.historiccountiestrust.co.uk/standard.html>, accessed: 10 February 2017, 2017.

90. Degryse and Ongena, 'Competition'.



(a) Branches per square kilometre in 1871 (b) Branches per square kilometre in 1891 (c) Branches per square kilometre in 1911

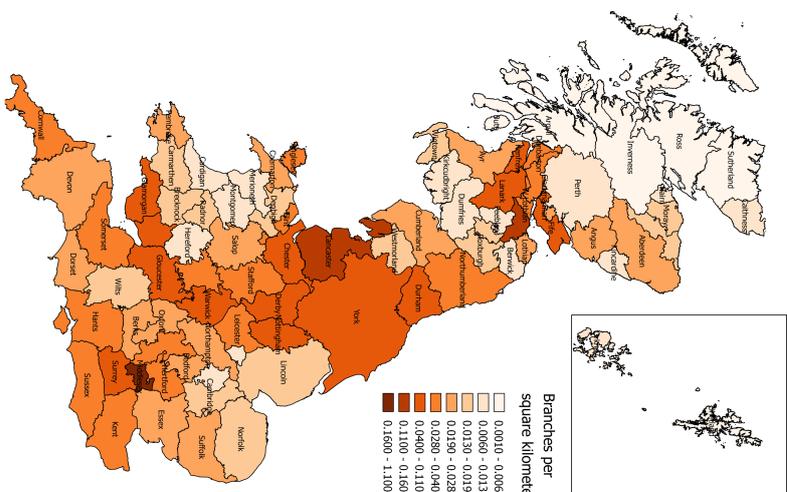
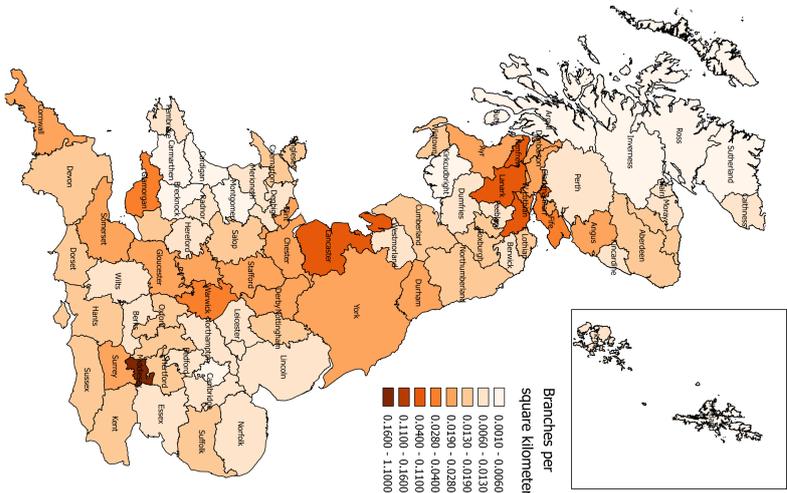


Figure 3.2: Branches per square kilometre in Britain

for each county in each year:

$$HHI = \sum_{i=1}^K \left(\frac{\text{Number of branches}_i}{\sum_{i=1}^K \text{Number of branches}_i} \right)^2 = \sum_{i=1}^K s_i^2 \quad (3.1)$$

where s_i is the market share of bank i , of a total of K banks, in a given county in a given year. The formula says that the market share of each bank is based on the number of branches of that bank divided by the total number bank branches (of all banks) in a given county. The HHI is the sum of squared market shares of all banks in a county. A high HHI indicates that a few banks held dominant positions in the a banking market.

Using HHI to measure the degree of concentration in the banking sector is subject to some caveats. Calculating the market share based on branches might lead to a degree of error, because bank branches were not always homogeneous units. Some branches were larger than others, some were serving a larger number of customers than others, and some might have been established in primarily rural areas chiefly for gathering deposits. Yet, it bears repeating that appendix 3.A.1 indicates that much of branch-level heterogeneity gets averaged out in the county-level data. And in the absence of better data, the HHI is difficult to improve upon as a measure of concentration.

There are other reservations for using concentration as a proxy for competition. Banks may gain market share precisely because they are more efficient and competitive.⁹¹ Therefore, even concentrated banking systems might have a high degree of competition between banks.⁹² Indeed, although HHI is still widely used as a proxy for competition, several researchers have recently favoured more direct ways of measuring competition based on structural econometric models.⁹³ Yet, these models usually require a large amount of inputs, which is not a luxury afforded by the century-old data used in this chapter. Moreover, the validity of HHI

91. See: Degryse and Ongena, ‘Competition’; and references therein on this point. It is possible to deal with this issue (at least partially) through the use of appropriate instrumental variables.

92. Allen N Berger *et al.*, ‘Bank Concentration and Competition: An Evolution in the Making’, *Journal of Money, Credit, and Banking* 36, no. 3 (2004): 433–451.

93. Claessens and Laeven, ‘Financial Dependence, Banking Sector Competition, and Economic Growth’; Degryse and Ongena, ‘Competition’.

as a measure of banking sector competition in Britain from 1871 to 1911 can be motivated by previous research. As mentioned above, Braggion *et al.* show that banks in counties with more concentrated banking systems acted less competitively.⁹⁴ We can thus infer that in the present case, HHI is inversely correlated with the degree of competition. Appendix 3.A.1 provides further supporting evidence of its use as a proxy for local banking sector competition.

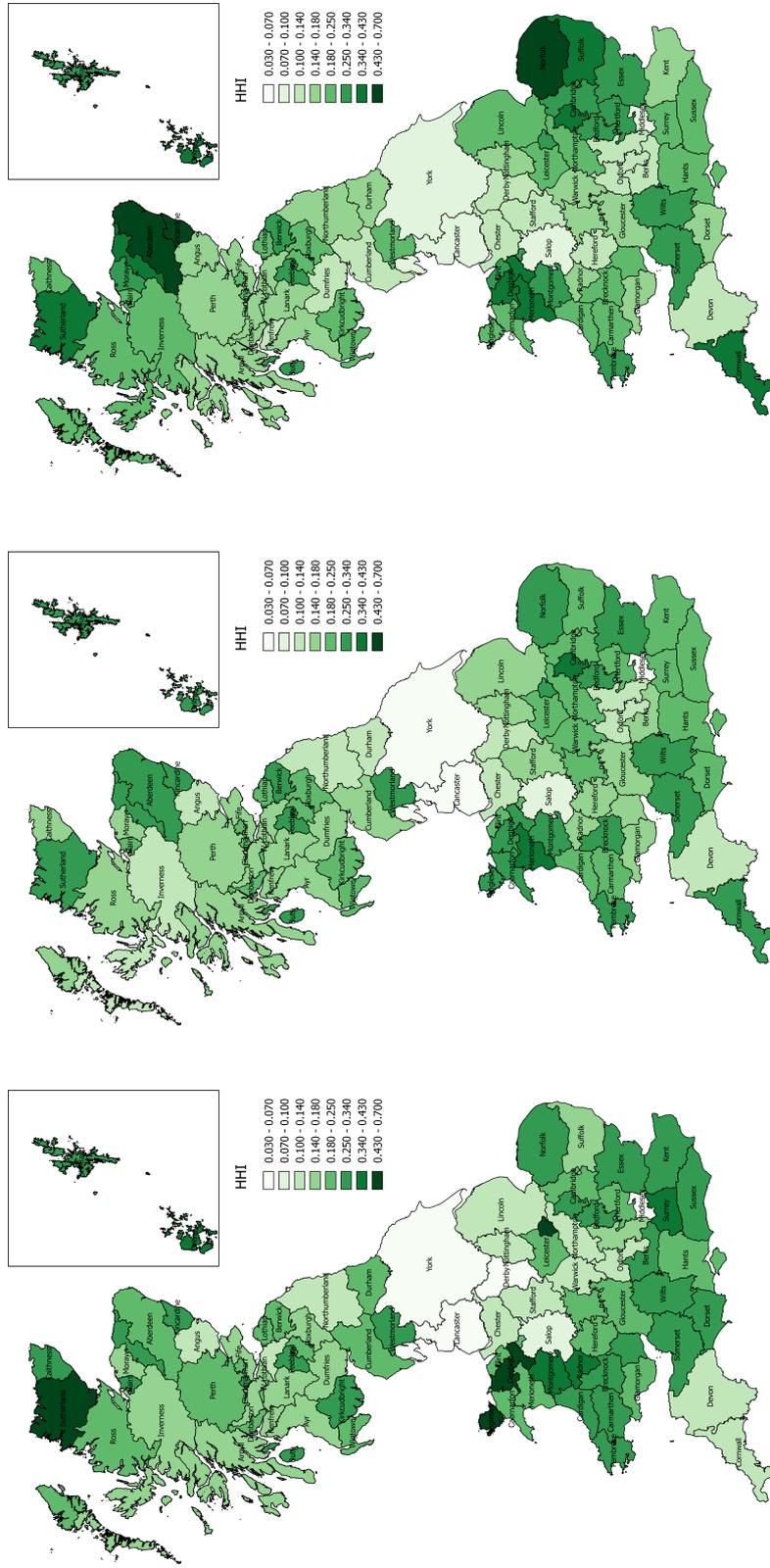
Figure 3.3 presents data on county-level HHI calculations. It seems that rural counties had, on average, far higher levels of concentration than did more urban or industrial ones, especially in England and Wales. In other words, industrial areas such as Lancashire and Yorkshire had relatively low levels of banking sector concentration, as did Staffordshire or Warwickshire. As far as HHI proxies banking sector competition, this shows that important industrial regions in Britain had higher levels competition between banks than existed in several rural regions.

HHIs of less than 0.1 or more than 0.18 are widely cited thresholds of competitive and concentrated banking systems, respectively.⁹⁵ By these measures, much of Britain did not have a highly competitive banking sector between 1871 and 1911. However, the degree to which concentration changed during the merger waves of the 1890s varies significantly between counties. Concentration in the East of England appears to have grown significantly higher, but in several other counties in England and Wales, the level of concentration changed relatively little or even declined. This is consistent with contemporary accounts presented by Sykes, which argue that the early stages of branching by large banks increased banking sector competition in rural counties.⁹⁶

94. Braggion, Dwarkasing and Moore, 'Nothing Special'.

95. Degryse and Ongena, 'Competition'.

96. Sykes, *Amalgamation*, 51-64.



(a) HHI in 1871

(b) HHI in 1891

(c) HHI in 1911

Figure 3.3: Herfindahl-Hirschman Index in British counties

3.3.3 Local Economic Growth

This chapter is concerned with explaining local economic growth, but no data on county-level GDP exists.⁹⁷ I therefore follow the example of Crafts by using the sum of income tax assessments for each county as a proxy of local economic conditions.⁹⁸ A central component of these assessments were ‘Schedule D’ taxes, which were taxes assessed yearly in each county for profits from private and public companies, along with income from highly paid professions. The tax was set nationally, which makes the indicator comparable across counties.

In their study of the impact of banking sector’s concentration on local economic conditions, Braggion *et al.* use tax revenues instead of tax assessments.⁹⁹ This is problematic, because tax rates were subject to change, whereas tax assessments are not subject to this problem during the period in question. Moreover Braggion *et al.* use an incomplete set of tax data by only relying on Schedule D assessments, which might bias their econometric results. For this chapter, I have collected both Schedule D and E income tax data from the National Archives at Kew.¹⁰⁰ I have also relied on Parliamentary papers for years for which the relevant schedule D data is available.¹⁰¹ This data is available at an annual frequency from 1870 to 1911.

Schedule E taxes consisted of wages paid to individuals working for corpora-

97. Geary and Stark have recently constructed estimates of *regional* GDP in the UK from 1861 to 1911. There are two problems with using this dataset for the present chapter. The first one is its low frequency: it provides observations at a 10-year intervals, because the estimates are based on census records. The second problem is that it is not available at a county-level, which reduces considerably the number of available cross-sectional observations. Instead of working with over 80 counties, the Geary and Stark data would limit us to 11 regions. See: Geary and Stark, ‘Regional GDP in the UK, 1861–1911: New Estimates’.

98. Crafts, ‘Regional GDP’.

99. Braggion, Dwarkasing and Moore, ‘Economic Impact’.

100. Land Tax. Income Tax (Schedules A, B, D and E) and Inhabited House Duty Assessments, 1870-1911, IR 16/30-129, Records of the Boards of Stamps, Taxes, Excise, Stamps and Taxes, and Inland Revenue, National Archives at Kew. Records for 1870-1911.

101. House of Commons (henceforth: H.C.), *Miscellaneous Statistics of the United Kingdom. (Part XI.)*, 1882, C.3423, (London: HMSO), <https://parlipapers.proquest.com/parlipapers/docview/t70.d75.1882-058898>, accessed: 5 August 2017. I used parts VIII-XI of this series. For 1883-1884, I used: H.C., *Return of Income Tax under Schedules (A.), (B.) and (D.) of Gross Amount of Property and Profits Assessed in Great Britain and Ireland, 1882-83*, 1884-1885, no. 25, (London: HMSO), <https://parlipapers.proquest.com/parlipapers/docview/t70.d75.1884-061468>, accessed: 5 August 2017.

tions, as well as government officials. Throughout the late 19th century, some of the tax assessments shifted from schedule D to schedule E as the public sector expanded, and more companies chose to incorporate. However, the public sector still accounted for a relatively minor share of total tax assessments, and its inclusion does not significantly influence the sum of schedule E and D assessments. In the tax year 1911-1912, taxes on public officials constituted approximately 17% of total schedule E assessments. Over 90% of the tax from public sector workers was assessed in London, where the share rises to approximately 32%. Compared to schedule D assessments, schedule E assessments were insignificant in the 1870s but reached 15-20% of schedule D assessments in many English counties in the last decade of the sample. Its exclusion would therefore impact meaningfully the trend of income tax growth across counties.

For the years before 1900 no schedule E data could be found for individual Scottish counties. It thus had to be estimated. This was done by multiplying a county's average share of schedule E assessments in 1900-1911 with Scotland's total schedule E assessments in a given year. The aggregate impact of the resulting estimation error is likely to be limited. For years for which schedule E data is available, the error of these types of estimates for schedule E assessments is around 15%, but on average below 10% for the 5 counties with the largest schedule E assessments. When summed with schedule D assessments, the resulting error is typically below 5%, because Scottish schedule E assessments were significantly smaller than schedule D ones. For earlier years, and especially for rural counties, the resulting measurement error of total income tax assessments should be even smaller, because the share of corporate and public sector employees in these counties was often insignificant. Scottish schedule E assessments were about 10% of those for schedule D in both 1880 and 1890, setting this as extreme upper bound for the potential errors for the typical county.¹⁰² The error's impact is further mitigated by setting the data into 5-year averages for econometric purposes. Nevertheless, these potential inaccuracies further motivate Scotland's exclusion from a subset of this chapter's regressions.

An advantage of the income tax data data is that we can rely on income *assess-*

102. Commissioners of H.M. Inland Revenue, *Twenty-Sixth Report*, 1883, C.3718, (London: HMSO), 44-48.; Commissioners of H.M. Inland Revenue, *Thirty-Sixth Report*, 1892, C.6731, (London: HMSO), 37-41.

ments instead of taxes that were actually paid. Tax assessments are not sensitive to changes in tax rates.¹⁰³ Moreover, there were no major changes in what schedule D or E income consisted of between 1870 and 1911.¹⁰⁴ However, the income tax assessments used here do not capture all county-level economic activity. Schedule D and E assessments exclude income from agriculture, even though the late 19th century saw a shift of employees from farming into manufacturing and services. The econometric methodology is able to mitigate this issue both through using fixed effects and relevant instrumental variables. Furthermore, there are advantages to omitting agriculture, because the variable measures more closely incomes from higher productivity sectors - the sectors we would expect to benefit the most from increased access to finance. In this sense, inclusion of agriculture would, if anything, serve to make the findings less interesting. Indeed, both historical and modern studies reviewed earlier often exclude agriculture entirely, using variables such as firm creation, along with manufacturing output or employment.¹⁰⁵

3.3.4 Railway Length

To reduce omitted variable bias in growth regressions, it is useful to include variables other than banking sector development which can explain local economic conditions. Such data is scarce for the 19th and early 20th centuries, but controlling for infrastructure can help reduce the most glaring omissions. Indeed, there is a long literature on the relationship between railways and growth in economic history. Among other things, railways played a role in lowering transportation costs between regions, enhancing inter-regional trade and the specialisation of local economic activity.¹⁰⁶ Data on yearly railway length by county has been

103. The use of assessments can also mitigate issues with tax evasion, because gross assessments incorporate income before any deductions are made. The existence of tax evasion would only bias the results if firms and individuals in some counties were better at evading taxes than in others.

104. For taxes in place from 1823-1913, see: H.C., *Taxes (England and Wales, Scotland, and Ireland)*, 1912-1913, no. 109, (London: HMSO).

105. Mitchener and Wheelock, 'Banking Markets'; Tang, 'Financial Intermediation'.

106. See, for example: Patrick O'Brien, *Railways and the Economic Development of Western Europe, 1830-1914* (New York: St. Martin's Press, 1983); Jeremy Atack *et al.*, 'Did Railroads Induce or Follow Economic Growth?', *Social Science History* 34, no. 02 (2010): 171-197; Abhijit Banerjee, Esther Duflo and Nancy Qian, 'On the Road: Access to Transportation Infrastructure and Economic Growth in China', *NBER Working Paper*, no. 17897 (2012); Dave Donaldson and Richard Hornbeck, 'Railroads and American Economic Growth: A "Market Access" Approach', *The Quarterly Journal of Economics* 131, no. 2 (2016): 799-858.

kindly provided by the Cambridge Group for the History of Population and Social Structure.¹⁰⁷

3.3.5 Summary of Variables Used in the Regressions

Table 3.1 provides a summary of the variables used in this chapter’s regressions. It also indicates how the variables are transformed. The variables for branches per capita and branches per square kilometre are multiplied by 1,000 and 1,000,000, respectively, and then transformed into natural logarithms. This multiplication does not influence the statistical inferences that are drawn from the estimates.

Table 3.1: Variables used in the regressions

Variable	Description	Transformation
Banks/sq. km	Bank offices per square kilometre.	$\text{Ln}(10^3 \times \text{Branches}/\text{km}^2)$
Banks pc.	Bank offices per capita. County-level population figures are log-linear interpolations of census data.	$\text{Ln}(10^6 \times \text{Branches}/\text{capita})$
HHI	Herfindahl-Hirschman index.	None
Railways/sq. km	Railway length in kilometres divided by county area in square kilometres.	Ln
Tax pc.	Schedule D and E income tax assessments per capita. These measure the incomes derived from businesses and certain highly paid occupations, along with wages from public companies. A small share of these assessments also derives from public offices.	Ln
Tax pc. growth	Growth rate of tax assessments per capita.	None
W * dtaxpc	Growth rate of tax assessments per capita in nearby counties, weighted by the distance to them. The sum of the distance to neighbours is standardised to one. See section 3.4.2.	None

The data is transformed into 5-year averages. This is motivated in section 3.4.

107. <https://www.campop.geog.cam.ac.uk/>. For related work and a discussion of the data, see: Eduard Alvarez *et al.*, ‘Railways and Growth: Evidence from Nineteenth Century England and Wales’ (2017), Working Paper, available at: https://www.campop.geog.cam.ac.uk/research/projects/transport/railwaysoccupations_jan202017.pdf.

3.4 Empirical Methodology

Studies on finance and growth need to distinguish causality from correlation, as the relationship between the growth of the financial sector and that of the economy can be mutually reinforcing. While the expansion of a county's banking sector might foster economic development, it is also possible that the county's banking sector expands because of higher realised or expected economic growth, and the consequent expansion in business opportunities that arise from it. In other words, the expansion of a county's banking sector is endogenous to its growth.

A further factor influencing a bank's entry into a county is competition. If there is a high degree of competition between a county's banks, a bank might be discouraged from entering the market, as it is expected to make less profit by competing with several other banks. On the other hand, the degree of competition in a county's banking sector might be low because its economic prospects are limited. Dealing with all these confounding factors motivates the choice of the econometric method, along with the importance of studying jointly the impact of the growth of the banking sector on one hand and its competitive dynamics on the other.

I use methods from dynamic panel econometrics to make causal inferences about finance and growth. Panel data is defined as encompassing both different cross-sectional units (counties) and time-periods (years). The advantage of these estimators is that they can make use of lagged dependent and independent variables as instruments (in addition to allowing for the use of other instruments), which addresses issues with endogeneity. These models are discussed below.

Besides endogeneity, spatial economic linkages may confound the econometric results if they are not factored in. This is because a county's economic growth is likely to depend significantly on the economic growth of surrounding counties. Factoring in the possibility of economic spillovers across county borders requires the use of spatial econometric techniques. Such methods not only mitigate omitted variable bias, but also strengthen instrumental variables and yield more accurate

results.¹⁰⁸ The use of models which deal with both endogeneity and spatial linkages represents a substantial advantage of this chapter's methodology.

This chapter follows a common practice in the finance and growth literature by transforming the data into non-overlapping five-year averages.¹⁰⁹ This methodology allows us to capture long term growth effects, unaffected by the vagaries of the business cycle. Additionally, the dynamic panel estimators discussed below are intended to analyse datasets where the cross-sectional dimension is large (i.e. there are several counties) and where the time dimension is small (i.e. the sample contains relatively few time periods).

3.4.1 Dynamic panels

Dynamic panel regressions have become commonly used econometric tools in the finance and growth literature. Influential studies by Beck, Levine and Loayza use these models to study the impact of financial development on economic growth in cross-national panels.¹¹⁰ The same methods have since been used for regional panels, for example to study the impact of banking on historical US city and county-level growth.¹¹¹

The dynamic panel regression equation is as follows:

$$\Delta y_{i,t} = \alpha + \mathbf{x}'_{i,t} \boldsymbol{\beta} + \gamma y_{i,t-1} + \mu_i + \lambda_t + \epsilon_{it} \quad (3.2)$$

$\Delta y_{i,t}$ is the growth of the economy in county i at time t . $y_{i,t}$ is the state of the

108. Spatial econometric techniques alter the standard errors of the regression model, which directly influence the t-statistics and p-values. The standard errors from these models provide a more rigorous alternative to more *ad hoc* assumptions, such as the regional clustering of errors.

109. Thorsten Beck and Ross Levine, 'Stock Markets, Banks, and Growth: Panel Evidence', *Journal of Banking & Finance* 28, no. 3 (2004): 423–442; Ross Levine, Norman Loayza and Thorsten Beck, 'Financial Intermediation and Growth: Causality and Causes', *Journal of Monetary Economics* 46, no. 1 (2000): 31–77.

110. Ibid.; Thorsten Beck, Ross Levine and Norman Loayza, 'Finance and the Sources of Growth', *Journal of Financial Economics* 58, no. 1 (2000): 261–300.

111. Bodenhorn and Cuberes, 'Financial Development and City Growth'; Jaremski and Rousseau, 'Free Banks'.

economy in county i at time t , while $\mathbf{x}_{i,t}$ is a vector of explanatory variables. β is a vector of the corresponding coefficients. α is a constant, μ_i represents county fixed effects, λ_t represents time effects, and ϵ_{it} is the residual. What makes this model dynamic is the addition of the lagged dependent variable, $y_{i,t-1}$ (tax assessments in the preceding 5-year interval) and the corresponding coefficient γ .¹¹²

The variables to be included in $\mathbf{x}_{i,t}$ are selected from those outlined in table 3.1: bank offices per square kilometre; banks offices per capita; HHI; and the length of railways per square kilometre. The use of these variables has already been motivated in section 3.3. The lagged dependent variable $y_{i,t-1}$ is included in the model in accordance with standard practice in growth regressions.¹¹³ One reason for the variable's inclusion is that it accounts for the possibility that less economically developed counties grow faster, as their economies converge to those of richer counties. This is a standard feature of macroeconomic growth models.¹¹⁴ Another, related reason for the variable's inclusion is statistical, as it allows for the possibility that a county's growth depends on its past growth.¹¹⁵

Because of the addition of lagged dependent variables into the regression equation, estimates using ordinary least squares (OLS) are inconsistent and yield unreliable results when the time-dimension of the sample is limited. The use of Generalised Method of Moments (GMM) estimators yields more reliable results for two reasons. First, we can adjust for heteroskedasticity and autocorrelation of the errors.¹¹⁶ Second, we can use instruments - both lagged variables from the regression and other variables - to deal with endogeneity and to correct for the bias. The difference-GMM estimator by Arellano and Bond and the system-GMM estimator outlined by Arellano and Bover as well as Blundell and Bond

112. Note that an equivalent specification is to use $y_{i,t}$ as the dependent variable and to replace $\gamma y_{i,t-1}$ with $(1 + \gamma)y_{i,t-1} = \psi y_{i,t-1}$ on the right-hand side.

113. See: Thorsten Beck, 'The Econometrics of Finance and Growth', in *Palgrave Handbook of Econometrics*, ed. T Mills and K Patterson, vol. 2 (Basingstoke: Palgrave Macmillan, 2009), 1180–1209 and references therein.

114. Daron Acemoglu, *Introduction to Modern Economic Growth* (New Jersey: Princeton University Press, 2008), chapters 1-3. Such convergence between countries has typically been found to be dependent upon several conditioning factors, such as human capital and the quality of institutions.

115. In other words, growth is autocorrelated.

116. Heteroskedasticity refers non-constant variance of the errors. The variance of errors is not the same for all counties.

have become especially common in macroeconomic modelling.¹¹⁷ Despite their advantages, these estimators can yield biased standard errors in small samples, which I correct for by using robust standard errors outlined by Windmeijer.¹¹⁸

The purpose of instrumental variables is to help extract the exogenous component of any given element of $\mathbf{x}_{i,t}$ (for example banks per capita) in equation 3.2. The instrument is supposed to correlate with bank offices per capita (or bank offices per square kilometre), but it should not have a direct independent impact on the dependent variable (growth of tax assessments per capita). More formally, we want a set of instruments for $\mathbf{z}_{i,t}$ to have a non-zero correlation with $\mathbf{x}_{i,t}$, but also the property that $E(\mathbf{z}'_{i,t}\epsilon_{i,t}) = 0$. The latter is called a *moment condition* based on which the model is estimated: GMM estimates require that the errors are orthogonal to the instruments.

The Arellano-Bond estimator uses equation 3.2 in differences, and lagged dependent and independent variables in levels as instruments. However, lagged variables in levels have been found to provide weak instruments in this specification.¹¹⁹ The Blundell-Bond system-GMM estimator addresses this issue. This method estimates equation 3.2 both in levels and in differences. For the equation in levels, it uses lagged differences of the dependent variable as instruments, while for the differenced equation it uses lagged levels of the dependent variable.¹²⁰

In terms of instruments, I use the first lag of all variables in $x_{i,t}$ as well as $y_{i,t-2}$. In the context of my regressions, these refer to 5-year lags. Further lags are not used as instruments as long as the Arellano and Bond AR(2) test for residual autocorrelation does not warrant them.¹²¹ This is because a proliferation

117. For details on how to estimate these models, see: Manuel Arellano and Stephen Bond, 'Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations', *The Review of Economic Studies* 58, no. 2 (1991): 277–297; Richard Blundell and Stephen Bond, 'Initial Conditions and Moment Restrictions in Dynamic Panel Data Models', *Journal of Econometrics* 87, no. 1 (1998): 115–143; Manuel Arellano and Olympia Bover, 'Another Look at the Instrumental Variable Estimation of Error-Components Models', *Journal of Econometrics* 68, no. 1 (1995): 29–51.

118. Frank Windmeijer, 'A Finite Sample Correction for the Variance of Linear Efficient Two-Step GMM Estimators', *Journal of Econometrics* 126, no. 1 (2005): 25–51.

119. Blundell and Bond, 'Initial Conditions'.

120. Additional variables can also be included to the set of instruments.

121. Arellano and Bond, 'Tests'.

of instruments can bias the model estimates.¹²² The validity of the instruments is also confirmed using Hansen’s J-tests.¹²³

3.4.2 Spatial dynamic panels

Equation 3.2 can be extended to take spatial linkages into account, which address the possibility that a given economy is likely to be affected by conditions in neighbouring economies. This is of particular relevance when modelling county-level data, where the geographic units are close to each other. The omissions of spatial economic linkages could lead to model misspecification and to inaccurate hypothesis tests. A straightforward spatial extension of equation 3.2 is as follows:

$$\Delta y_{i,t} = \alpha + \delta \mathbf{W}_i \Delta \mathbf{y}_t + \mathbf{x}'_{i,t} \boldsymbol{\beta} + \gamma y_{i,t-1} + \mu_i + \lambda_t + \epsilon_{it} \quad (3.3)$$

Let N be the number of counties. The term $\mathbf{W}_i \Delta \mathbf{y}_t$ is the i th row of a $N \times N$ spatial weights matrix \mathbf{W} multiplied by the economic growth in each county at time t . All other variables are as previously specified. In practice, $\mathbf{W}_i \Delta \mathbf{y}_t$ measures how much nearby counties grew, giving less (or no) weight to counties further away.

An illustration of a spatial weight matrix \mathbf{W} is given below. A typical specification for row i of the spatial weights matrix \mathbf{W} is the distance from county i to other counties, standardised so that the terms sum to one.¹²⁴ The diagonal of the matrix is set to zero, so that no county can be its own neighbour. The closer a given county is to county i , the more the economies of these two counties are assumed to correlate. For example, the weight given to the link between Bedfordshire and Buckinghamshire in matrix 3.4 is higher than the weight between Buckinghamshire and Anglesey, as the latter two are further apart. Following

122. David Roodman, ‘A Note on the Theme of Too Many Instruments’, *Oxford Bulletin of Economics and statistics* 71, no. 1 (2009): 135–158.

123. Lars Peter Hansen, ‘Large Sample Properties of Generalized Method of Moments Estimators’, *Econometrica: Journal of the Econometric Society*, 1982, 1029–1054.

124. For more on this point and alternative specifications, see: Jean Paul Elhorst, *Spatial Econometrics: From Cross-Sectional Data to Spatial Panels* (London: Springer, 2014), 5–34.

standard practice in the literature, I use a maximum distance of 200km beyond which direct spatial dependence between two counties ceases to exist (the spatial weight goes to zero).¹²⁵ Increasing the maximum distance to 300km does not change the results significantly.

$$\mathbf{W} = \begin{matrix} & \begin{matrix} \textit{Anglesey} & \textit{Bedford} & \textit{Berks.} & \textit{Brecknock} & \textit{Bucks.} & \dots \end{matrix} \\ \begin{matrix} \textit{Anglesey} \\ \textit{Bedfordshire} \\ \textit{Berkshire} \\ \textit{Brecknockshire} \\ \textit{Buckinghamshire} \\ \vdots \end{matrix} & \left[\begin{array}{cccccc} 0 & 0.0114 & 0.0117 & 0.0214 & 0.0116 & \dots \\ 0.0073 & 0 & 0.0278 & 0.0110 & 0.0677 & \dots \\ 0.0084 & 0.0314 & 0 & 0.0157 & 0.0532 & \dots \\ 0.0152 & 0.0122 & 0.0154 & 0 & 0.0136 & \dots \\ 0.0076 & 0.0693 & 0.0481 & 0.0125 & 0 & \dots \\ \vdots & \vdots & \vdots & \vdots & \vdots & \ddots \end{array} \right] \end{matrix} \quad (3.4)$$

Most developments in the field of dynamic spatial panel econometrics have only been made in the last decade, and the field is by no means fully mature.¹²⁶ Nevertheless, these models have already been used for studying the effects of financial liberalisation on growth.¹²⁷ Although several proposed methods for estimating dynamic spatial panel models exist, many of these are quasi-maximum likelihood based, and currently unsuitable for dealing with endogeneity of several independent variables.¹²⁸

It is possible to estimate equation 3.3 using the system-GMM of Blundell and Bond with a spatial lag of the dependent variable, but the resulting estimates can be slightly biased in smaller samples.¹²⁹ A more rigorous approach than the simple extension of the system-GMM with spatial effects has been suggested re-

125. See: *Ibid.* and references therein.

126. *Ibid.*, 95-117.

127. Paul Elhorst, Eelco Zandberg and Jakob De Haan, ‘The Impact of Interaction Effects Among Neighbouring Countries on Financial Liberalization and Reform: A Dynamic Spatial Panel Data Approach’, *Spatial Economic Analysis* 8, no. 3 (2013): 293–313.

128. For a review, see: Lung-fei Lee and Jihai Yu, ‘Some Recent Developments in Spatial Panel Data Models’, *Regional Science and Urban Economics* 40, no. 5 (2010): 255–271.

129. Madina Kukuena *et al.*, ‘Spatial Dynamic Panel Model and System GMM: A Monte Carlo Investigation’, *IRENE Working Papers*, no. 09–01 (2009).

cently by Lee and Yu, who specify a GMM estimator for dynamic panels with fixed effects.¹³⁰ They show that their estimator has both good asymptotic (large sample) and finite sample properties, and allows for several types of moment conditions. The method is also able to deal with the endogeneity of several variables in the regression (such as branches per square kilometre or the HHI), while being suitable for samples with a relatively few observations across time. Because of these advantages, this approach is used in this chapter. Lee and Yu propose a forward orthogonal difference (FOD) transformation of the variables to eliminate the county-fixed effects. The transformation is carried out as follows:

$$x_{i,t}^* = \left(\frac{T-t}{T-t+1} \right)^{1/2} \left(x_{i,t} - \frac{1}{T-t} \sum_{h=t+1}^T x_{i,h} \right) \quad (3.5)$$

For a given variable x . Here, T is the total number of time periods, and t is a given point of time in the sample. In essence, this transformation sets the variables to deviations from their future averages. It can be used as an alternative to first-differencing. Differencing can induce autocorrelation to the regression errors, whereas the FOD transformed errors do not have this problem. Consequently, Arellano and Bover highlight this as a viable approach to use in a dynamic panel context.¹³¹ Simulation studies suggest that with typically recommended (parsimonious) instrument specifications, the FOD transformation leads to more accurate estimates than differencing.¹³²

After the FOD transformation, we can also eliminate the time-effects from the regression equation by taking mean-deviations of the variables. This can be done by multiplying each vector $\mathbf{y}_i^* = [y_{i,1}^*, y_{i,2}^* \dots y_{i,T}^*]'$ by the matrix $\mathbf{J} = \mathbf{I}_T - \mathbf{v}_T \mathbf{v}_T'$. Here, \mathbf{I}_T is a $T \times T$ matrix with ones on the diagonal and zeros elsewhere, whereas \mathbf{v}_T is a vector of ones of length T . Following this transformation, all constant regressors have been eliminated, and thus do not need to be estimated. Let $\tilde{x}_{i,t}$ denote given variables $x_{i,t}$ that have been transformed in this fashion.

130. Lung-fei Lee and Jihai Yu, 'Efficient GMM Estimation of Spatial Dynamic Panel Data Models with Fixed Effects', *Journal of Econometrics* 180, no. 2 (2014): 174–197.

131. Arellano and Bover, 'Another Look'.

132. Kazuhiko Hayakawa, 'First Difference or Forward Orthogonal Deviation - Which Transformation should be Used in Dynamic Panel Data Models?: A Simulation Study', *Economics Bulletin* 29, no. 3 (2009): 2008–2017.

The resulting equation to be estimated is as follows:

$$\Delta \tilde{y}_{i,t}^* = \delta \mathbf{W}_i \Delta \tilde{\mathbf{y}}_t^* + \tilde{\mathbf{x}}_{i,t}^{*'} \boldsymbol{\beta} + \gamma \tilde{y}_{i,t-1}^* + \tilde{\epsilon}_{i,t}^* \quad (3.6)$$

This model can be estimated via GMM. We can use the same instruments that we would use in a non-spatial dynamic panel model. However, these can be supplemented with the spatial lags of the explanatory variables, which means multiplying them by \mathbf{W} . This has been shown to significantly strengthen the validity of the instruments, thereby addressing a concern expressed frequently about non-spatial dynamic panel estimators.¹³³ The instrument set for each county i can thus be specified as follows: $\mathbf{z}_{i,t} = [\tilde{y}_{i,t-2}, \mathbf{W} \tilde{\mathbf{y}}_{t-2}, \tilde{x}_{i,t-1}, \mathbf{W} \tilde{\mathbf{x}}_{t-1}]$, where $\tilde{\mathbf{y}}_{t-2}$ and $\tilde{\mathbf{x}}_{t-1}$ are vectors of lagged dependent and other explanatory variables, respectively, incorporating data from all counties at the specified time. Therefore, the results are derived using instruments consisting of a single time lag and a single spatial lag of all explanatory variables. This is consistent with the recommendation that we should avoid using too many instruments, as doing so can bias the results of GMM estimators.¹³⁴

The main advantage of using spatial instruments is that their inclusion addresses the issue of endogeneity better than instruments that are typically used in dynamic panel GMM models. We thus come closer to observing the exogenous components of changes in the number of bank offices and in the HHI. Spatially lagging the instrument for banks can also help account for the fact that, for the most part, banks expanded their branch networks close to where they already had offices.¹³⁵ In a similar fashion, spatial instruments can mitigate the possible bias arising from banks locating to a county primarily to gather deposits that would be lent in neighbouring counties.

133. Harry H Kelejian and Ingmar R Prucha, ‘A Generalized Spatial Two-Stage Least Squares Procedure for Estimating a Spatial Autoregressive Model with Autoregressive Disturbances’, *The Journal of Real Estate Finance and Economics* 17, no. 1 (1998): 99–121. For a discussion about the validity of instruments in dynamic panel models, see also: Maurice Bun and Vasileios Sarafidis, ‘Dynamic Panel Data Models’, in *The Oxford Handbook of Panel Data*, ed. Badi H Baltagi (Oxford: Oxford University Press, 2015), 76–110.

134. Roodman, ‘Note’.

135. Narly Ratna Devi Dwarkasing, ‘Essays on Historical Banking’, CentER, Center for Economic Research (PhD diss., Tilburg University, School of Economics and Management, 2014), 17-21.

3.5 Results

3.5.1 Baseline Results: Spatial Models

This subsection reports results from the Lee and Yu spatial dynamic panel GMM regression.¹³⁶ As argued above, this is the best available method for estimating the impact of bank offices on county-level growth using our dataset. Regressions which do not allow for economic linkages across county borders can suffer from severe omitted variable bias. The results therefore ought to be considered significantly more reliable than those derived from the system-GMM without spatial effects, reported in the subsection below.

Table 3.2 displays results from the spatial dynamic panel regression for a sample including all counties in England and Wales. According to the estimates, more bank offices per square kilometre had a positive impact on local tax assessments, as did the number of branches per capita. This result is economically highly significant. A 10% increase in the number of branches per 1000 square kilometres would have increased the growth rate of income tax assessments by 0.2-0.25% on average. With branches per (1 million) capita, the corresponding figure would have been 0.33-0.42%. A 10% increase in branches per 1000 square km over a 5-year interval was a fairly common occurrence towards the last two decades of the sample: in 1895-1900, this occurred in more than 40% of counties in Britain. The overall conclusion from these results is that banks had a positive impact on economic growth in English and Welsh counties.

In specifications 2 to 4 in table 3.2, a higher level of concentration in the banking sector appears to have had a mildly positive impact on economic growth. However, one must note that the result is not statistically strong, because the HHI coefficient is only significant at the 10% level in these columns, while it is insignificant in the first column. Nevertheless, there is no evidence of excessive concentration hurting economic outcomes in England and Wales. The result in columns 2 to 4 is consistent with literature arguing that *some* degree of concen-

136. Lee and Yu, 'Efficient GMM'.

Table 3.2: Spatial dynamic panel regression results. The sample includes counties in England and Wales, from 1871 to 1911

	1	2	3	4
Banks per sq km	0.024 (0.008)***		0.020 (0.006)***	
Banks pc		0.041 (0.011)***		0.032 (0.009)***
HHI	0.134 (0.084)	0.148 (0.082)*	0.161 (0.090)*	0.159 (0.080)*
Tax pc, lag 1	-0.082 (0.028)***	-0.107 (0.031)***	-0.086 (0.024)***	-0.108 (0.025)***
W * dtaxpc	0.275 (0.194)	0.164 (0.176)	0.686 (0.278)**	0.493 (0.264)*
Railway per sq km			-0.054 (0.044)	-0.034 (0.043)
Hansen's J-statistic	4.988	2.649	4.808	4.828
p-value of J-statistic	0.917	0.734	0.814	0.815

The dependent variable is the growth in income tax assessments per capita. The sample includes all counties in England and Wales. The data is in 5 year averages, and in non-overlapping 5 year intervals. Windmeijer (2005) robust standard errors in parentheses. *, **, and *** indicate a p-value of less than 0.1; 0.05; and 0.01, respectively.

tration can have a positive impact on the economy.¹³⁷ For most of the period 1871 to 1911, it is possible that concentration in English and Welsh counties was below the level at which it would have started to hinder economic growth.

The results in table 3.2 also indicate that regional economic spillovers played a large and significant role in explaining local economic growth (columns 3 and 4). This is highlighted by the term $W^*dtaxpc$, which measures the growth in income tax assessments in nearby counties, weighted by distances to neighbours. The omission of spatial linkages can thus be highly problematic when trying to local economic outcomes, which should be considered in future work on regional economic growth. Finally, higher tax assessments in the previous period tended to lower a county's prospective growth. This is consistent with a catch-up effect predicted by standard macroeconomic growth models.

137. See: section 3.2.2.

Results based on a sample that includes Scottish counties are shown in table 3.3. In this case, the number of bank offices per capita, or branches per square kilometre, are not associated with economic growth, and neither is bank concentration. A possible reason for the results concerning branches is that branch banking had spread considerably further in Scotland already by 1870, than it had in England and Wales. The average Scottish county may thus have gained little from additional branches. This would be consistent with studies showing that the growth of an already highly developed financial sector might contribute little to the real economy.¹³⁸ However, it also bears repeating that the tax data for Scotland is less accurate than that for England and Wales, making these results less reliable.

Table 3.3: Spatial dynamic panel regression results. The sample includes counties in England, Wales and Scotland, from 1871 to 1911

	1	2	3	4
Banks per sq km	-0.009 (0.014)		-0.013 (0.014)	
Banks pc		0.000 (0.018)		0.002 (0.014)
HHI	0.100 (0.070)	0.104 (0.064)	0.052 (0.064)	0.085 (0.063)
Tax pc, lag 1	-0.133 (0.020)***	-0.135 (0.019)***	-0.144 (0.023)***	-0.133 (0.020)***
W * dtaxpc	1.143 (0.311)***	0.979 (0.317)***	0.902 (0.244)***	0.728 (0.222)***
Railway per sq km			0.066 (0.029)**	0.058 (0.028)**
Hansen's J-statistic	2.666	3.645	3.926	7.739
p-value of J-statistic	0.736	0.838	0.73	0.948

The dependent variable is the growth in income tax assessments per capita. The sample includes all counties in England, Wales and Scotland. The data is in 5 year averages, and in non-overlapping 5 year intervals. Windmeijer (2005) robust standard errors in parentheses. *, **, and *** indicate a p-value of less than 0.1; 0.05; and 0.01, respectively.

While the results in table 3.2 on the positive impact of a higher HHI are not extremely strong, it is possible that the impact becomes less significant in the results in table 3.3 owing to a higher level of concentration in the Scottish

138. See: section 1.3.

banking sector, which could have had negative effects on the economy.¹³⁹ In other words, this could imply that Scotland had *too much* concentration in the banking sector, counterbalancing any positive effect accruing to the rest of Britain from an increase in this measure.

The results on the impact of railways in tables 3.2 and 3.3 reveals a striking contrast. When only English and Welsh counties are examined, more railways appear to have had an insignificant impact on economic growth, whereas the inclusion of Scottish counties makes the same relationship positive. The result might be due to features specific to the sample period, since by 1880, developed areas in Britain already possessed large railway networks. According to the data used in this chapter, it was mainly more remote and agricultural areas that received significant extensions to their railway networks. In this fashion, Scottish growth could have benefited disproportionately from new railways.

Table 3.4 demonstrates that the results in this section are robust to using bank offices scaled by population density as an explanatory variable. Whereas the regressions shown above are able to account for unobserved county-level heterogeneity, both through the instrumental variables and the use of fixed-effects specifications, incorporating data on branches scaled by population density could more directly control for the possibility that branches proliferated as a function of population density. It is therefore reassuring that specifications in columns 1 and 2, based on English and Welsh data, are consistent with the results of finance-driven growth in table 3.2. The results in columns 3 and 4 incorporate Scottish data into the sample, and indicate that findings in table 3.3 are not driven by differences in population densities.

3.5.2 Alternative Specifications: System-GMM and OLS Fixed-Effects

This section shows results from dynamic panel models without spatial effects. This is done primarily for comparative purposes, because these models have thus far dominated the literature on finance and local growth. The results differ sig-

139. See: section 3.3.2.

Table 3.4: Spatial dynamic panel regression results with bank offices scaled by population density as an explanatory variable

	1	2	3	4
Sample	E&W	E&W	GB	GB
Banks/density	0.042 (0.011)***	0.033 (0.009)***	0.000 (0.018)	-0.009 (0.011)
HHI	0.145 (0.077)*	0.152 (0.075)**	0.104 (0.064)	0.077 (0.067)
Tax pc, lag 1	-0.107 (0.030)***	-0.110 (0.025)***	-0.135 (0.019)***	-0.138 (0.020)***
W * dtaxpc	0.161 (0.172)	0.470 (0.260)*	0.979 (0.317)***	0.882 (0.155)***
Railway per sq km		-0.031 (0.043)		0.065 (0.029)**
Hansen's J-statistic	2.586	4.82	5.957	14.788
p-value of J-statistic	0.725	0.815	0.949	0.998

For notes, see table 3.3. The dependent variable is the growth in income tax assessments per capita. Columns 1 and 2 show results for a sample that includes only English and Welsh counties, whereas specifications in columns 3 and 4 also include Scottish counties. The sample covers the years 1871-1911.

nificantly from those shown above, which further motivates the need to control for spatial economic spillovers (and possibly the use of spatial instruments) when studying British growth on a geographically disaggregated level. They also suggest that some scepticism is warranted when interpreting the evidence of literature which uses county-level data, but does not control for spatial linkages.

Table 3.5 presents the results from regressions that use data on English and Welsh counties. The first two columns show results from standard OLS (ordinary least squares) fixed-effects panel regressions, which do not correct for endogeneity in any way, and can be biased when lagged dependent variables are used as regressors. The third and fourth columns present results from system-GMM regressions. These two specifications have a causal interpretation. While there is some evidence of a positive correlation between bank offices per capita and growth (column 2), there is no evidence of banks having a causal impact on local economic development (columns 3 and 4). These models therefore indicate that the number of bank offices in a given county did not contribute to economic growth. The

coefficients related to the HHI are also insignificant in the GMM specifications.

Table 3.5: Sys-GMM and OLS results, counties in England and Wales.
Dependent variable: growth in income tax assessments per capita

	OLS FE	OLS FE	SGMM	SGMM
	1	2	3	4
Banks/sq km	0.000 (0.007)		0.013 (0.010)	
Banks pc		0.026 (0.010)***		0.006 (0.009)
HHI	-0.001 (0.032)	0.027 (0.029)	0.008 (0.035)	-0.009 (0.026)
Tax pc, lag 1	-0.054 (0.013)***	-0.063 (0.012)***	-0.002 (0.011)	-0.003 (0.013)
Railway/sq km	0.019 (0.021)	0.016 (0.023)	-0.027 (0.012)**	-0.023 (0.013)*
Constant	0.020 (0.097)	-0.084 (0.111)	0.133 (0.045)***	0.121 (0.087)
Hansen's J-statistic			48.1	44.28
p-value of J-statistic			0.178	0.296
AR(2) test p-value			0.141	0.143

The dependent variable is the growth in income tax assessments per capita. The instruments in specifications 3 and 4 include the first lags of all explanatory variables, except for railways, along with year dummies for the difference equation. Heteroskedasticity and autocorrelation robust standard errors in parentheses. For the GMM specifications, these follow the specification by Windmeijer (2005). *, **, and *** indicate p-values of less than 0.1; 0.05; and 0.01, respectively. The AR(2) test refers to the test for residual autocorrelation proposed by Arellano and Bond (1991). A p-value higher than 0.1 suggests that the model is valid.

Note that the coefficients corresponding to railways in columns 3 and 4 are negative, but this result is mainly driven by the exclusion of the variable for railways from the set of instruments, and therefore is not robust. Including the length of railways to the set of instrumental variables makes the coefficient insignificant again. The length of railways was excluded from the set of instruments for England and Wales in order to avoid problems associated with too many instruments, which was evidenced by an unrealistically high value for Hansen's J-statistic. Removing the variable for railways from the regression equations (instead of the instrument sets) does not lead to a significant change in the coefficients for bank offices or HHI.

There is no significant change in the GMM results when Scotland is included in the sample, as show in table 3.6. Columns 3 and 4 indicate that bank branches per capita, as well as branches per square kilometre, had no impact on the growth of tax assessments. There is not even evidence of correlation between the growth of tax assessments and bank offices (columns 1 and 2), which contrasts with findings in table 3.5. Although the consolidation of the banking system had progressed further in Scotland, the impact of banking concentration does not appear to be more significant than in the estimates obtained without Scottish data.

Table 3.6: Sys-GMM and OLS results, all counties in Britain. Dependent variable: growth in income tax assessments per capita

	OLS FE	OLS FE	SGMM	SGMM
	1	2	3	4
Banks/sq km	-0.009 (0.006)		-0.003 (0.009)	
Banks pc		0.011 (0.008)		0.004 (0.006)
HHI	0.019 (0.030)	0.039 (0.029)	0.038 (0.035)	0.043 (0.035)
Tax pc, lag 1	-0.077 (0.012)***	-0.072 (0.011)***	-0.012 (0.011)	-0.021 (0.012)*
Railway/sq km	-0.011 (0.008)	-0.013 (0.009)	-0.001 (0.007)	0.002 (0.005)
Constant	0.200 (0.044)***	0.125 (0.057)**	0.058 (0.015)***	0.028 (0.043)
Hansen's J-statistic			60.61	65.57
p-value of J-statistic			0.281	0.156
AR(2) test p-value			0.221	0.15

For details, see table 3.5. The instruments in specifications 3 and 4 include the first lags of all explanatory variables, along with year dummies for the difference equation.

Overall, the models in this subsection provide little evidence of banking-led growth in British counties. As argued above, the difference in findings from the system-GMM models and the spatial models is largely due to misspecification. Non-spatial models have not only worse sets of instruments, but also ignore economic spillovers across county borders. It follows that results presented in subsection 3.5.1 should be preferred.

3.5.3 Regressions using Regional Data

What was the banking system's impact on regional growth? This section examines finance and growth at a more aggregated level. Table 3.7 reports regression results using regional (as opposed to county-level) data for Britain. Working with regional data means that there are 14 cross-sectional units, which constitutes a very small sample. The first two columns show results from standard fixed-effects panel regressions. The remaining columns show results of GMM regressions where the equation is transformed to forward orthogonal deviations. The model uses two lags of the explanatory variables in backward orthogonal deviations, because an instrument set consisting of only one lag would not have been valid according to the Hansen-test.¹⁴⁰ Due to these transformations, the constants get eliminated from the specifications. The instruments are also collapsed in order to reduce the instrument count, as outlined by Roodman.¹⁴¹ The specification was selected in order to minimise the bias arising from using GMM methods in small samples.¹⁴² Nevertheless, the results should be considered far less reliable than those obtained using county-level data.

The OLS panel regression in column 2 of table 3.7 suggest that an increase in bank offices per capita had a positive relationship with regional economic growth. Yet, no such relationship is found when the number of banks offices per square kilometre is used to proxy financial development (column 1). When it comes to causal inference, the results are also rather weak. Banks per square kilometre and banks per capita only had a positive impact on growth if the length of railways is *not* controlled for, as shown in columns 5 and 6. Although not robust, the coefficients are economically very large: a 10% increase in bank offices would have spurred growth by 0.57-0.91%. At most, this can be taken as weak and not robust evidence of finance-led growth at the regional level. Consistent with results from county-level data, there is no evidence of banking system concentration influencing economic growth.

140. The backward orthogonal transformation is discussed in Kazuhiko Hayakawa, 'A Simple Efficient Instrumental Variable Estimator for Panel AR (p) Models when both N and T are Large', *Econometric Theory* 25, no. 3 (2009): 873–890.

141. For more details, see: Roodman, 'Note'.

142. Hayakawa shows that the FOD transformation reduces the bias of the estimates relative to a system-GMM in limited samples. See: Hayakawa, 'First Difference'.

Table 3.7: Bank offices and growth: regressions using regional data. Dependent variable: growth in income tax assessments per capita

All regions	OLS FE	OLS FE	GMM	GMM	GMM	GMM
	1	2	3	4	5	6
Banks/sq km	0.011 (0.009)		0.041 (0.024)		0.057 (0.028)*	
Banks pc		0.020 (0.008)**		0.056 (0.042)		0.091 (0.038)**
HHI	0.072 (0.083)	0.073 (0.073)	0.434 (0.252)	0.434 (0.285)	0.280 (1.410)	0.138 (0.480)
Tax pc, lag 1	-0.004 (0.003)	-0.005 (0.003)*	-0.042 (0.046)	-0.036 (0.054)	-0.083 (0.046)*	-0.085 (0.046)*
Railway/sq km	-0.002 (0.009)	-0.075 (0.053)	0.063 (0.088)	0.066 (0.077)		
Constant	0.000 (0.055)	-0.164 (0.042)***				
Hansen's J-statistic			2.31	2.76	4.63	4.25
p-value of J-statistic			0.679	0.598	0.201	0.236

The dependent variable is the growth in income tax assessments per capita. The set of instruments in columns 3-6 includes two lags of all explanatory variables, transformed to backward orthogonal deviations and with the instrument matrix in 'collapsed' form following Roodman (2009). Heteroskedasticity and autocorrelation robust standard errors in parentheses. For the GMM specifications, these follow the specification by Windmeijer (2005). * and ** indicate p-values of the corresponding t-statistics of less than 0.1 and 0.05, respectively.

3.6 Discussion and Conclusion

This chapter investigates the impact of the spread of bank offices (branches), and of decreased competition in the banking sector, on local British economic growth. Being the first study on this topic for the years 1871-1911, it presents a significant amount of new data on British local banking, which is supplemented with newly collected material on local tax assessments. Results from dynamic panel models, traditionally used in the finance-growth literature, give no indication of banks having had an impact on local economic growth. However, by applying recent advances in spatial econometrics, I find that the spread of bank branches influenced economic growth in English and Welsh counties, but not in Scotland. There is no evidence that increasing concentration in the banking system had a negative

impact on local economic growth. In fact, results for England and Wales indicate that a higher degree of concentration increased local economic growth, although this finding is not statistically strong.

This chapter explains the benefit of spatial models for studying local economic growth, and shows how in this case they yield different results from simpler models. A plausible reason for the sensitivity of the results to spatial effects is that economic linkages between counties were an important determinant of their economic growth, and not controlling for them leads to biased estimates. Another potential reason is that there were cross-county economic spillovers from more bank offices. The spatial models are partially able to account for such factors, as they use branches in neighbouring counties as instrumental variables. More generally, spatial instruments strengthen the instruments in the regressions, thus having a significant impact on the estimates. Additionally, these partially control for the fact that banks often expanded their branch networks into adjacent counties.

The finding that the spread of bank offices had a positive impact on economic growth in England and Wales implies a need to re-evaluate and revise certain arguments in the literature on British finance and growth. Several historical studies highlight potentially negative consequences resulting from the formation of large banks with national branch networks. They point out that such banks were more conservative and less committed to local customers.¹⁴³ While this might be the case, it seems that these factors were not sufficient to offset the positive economic effects of increased branching. At the same time, the fact that Scotland did not appear to benefit from the availability of more branches indicates that its banking market was more saturated than that of England and Wales.

The result that banks were important for local growth is consistent with findings from other historical cases, such as Japan and the US. It is also similar to findings from an earlier period in England and Wales, which indicate that financial development had a positive impact on local economic conditions.¹⁴⁴ More broadly,

143. Mae Baker and Michael Collins, 'Financial Crises and Structural Change in English Commercial Bank Assets, 1860–1913', *Explorations in Economic History* 36, no. 4 (1999): 428–444; Collins and Baker, 'Sectoral Differences'; Barnes and Newton, 'How Far'; Newton, 'Bank–Industry Relations'.

144. Heblich and Trew, 'Banking and Industrialization'; Brunt and Cannon, 'Do Banks'.

the results conform with both theory and with recent empirical findings on the local impact of banks. To the extent that the underlying mechanisms through which banks contributed to growth in Britain are similar to those found in modern countries, the results support the notion that bank branching reduced costs related to information asymmetries arising out of geographic distance. Proximity to local borrowers makes the monitoring of customers easier, which leads to more credit being extended to more promising firms.

Britain as a whole was, of course, a leading industrial nation in 1870-1913. But employment in the manufacturing and service sectors, along with urbanisation, was unevenly distributed.¹⁴⁵ A part of this is naturally due to regional specialisation. But given the results, it is also possible that financial development increased the pace of structural change from agriculture towards the manufacturing and service sectors in British counties. After all, the proxy used for economic growth - taxes assessments - largely captures activity in the manufacturing and service sectors. The bank branch networks expanded the fastest in more industrial counties, however, which also implies that finance could have played a role in exacerbating regional inequalities. This constitutes an interesting area of future research.

This chapter also confirms the need to examine the spread of banking and the sector's competitive dynamics jointly. A vast literature highlights the economic importance of both the level of competition in the banking sector, and the proximity of financial institutions. Ignoring either factor can lead to incorrect empirical inferences. Yet, so far, studies on finance and local growth in economic history have largely focused on just one of these factors.

The result that concentration had an insignificant or mildly positive economic impact contrasts with previous studies on this topic. Researchers have argued that excessive concentration may have hurt the economy in England and Wales.¹⁴⁶ In particular, it seems that the results by Braggion *et al.* - that concentration had negative effects on local economic conditions in England and Wales - are par-

145. For an overview of differences in employment based on census data, see: Clive Howard Lee, *British Regional Employment Statistics, 1841-1971* (Cambridge: Cambridge University Press, 1979); and Clive Lee, 'Regional Structure and Change', in *Atlas of Industrializing Britain, 1780-1914*, ed. John Langton and Robert John Morris (London: Methuen, 1986), 30-3.

146. Grossman, 'Rearranging'; Braggion, Dwarkasing and Moore, 'Economic Impact'.

tially driven by their use of interwar and wartime data, by problems with their tax data, or by the fact that they do not consider spatial economic linkages.¹⁴⁷ This chapter's results also present an important caveat to interpreting more recent findings by Braggion *et al.* that banks in counties with more concentrated banking sectors constrained their lending.¹⁴⁸ It appears that the credit constraints arising from banking concentration were insufficient to create a significant drag on county-level economic activity.¹⁴⁹ Moreover, the finding that concentration had a mildly positive impact on growth in England and Wales can be taken to mean that concentration improved credit allocation through encouraging banks to invest in information gathering. This would be consistent with recent empirical findings, which suggest an inverse 'U-shaped' relationship between concentration and economic growth. In this light, it can be argued that for much of the period in question, the local banking sectors in England and Wales were not sufficiently concentrated to constrain economic activity.

It is also clear from the data that industrialised counties in the North of England and West Midlands did not have high levels of banking system concentration. This was first and foremost an issue affecting Scotland and several rural counties in England and Wales. It is therefore unclear whether banking concentration can explain economic outcomes at the national level, since borrowers in the economically most significant areas were probably the least affected by a lack of competition between banks. The existing narrative of banking sector concentration in Britain might thus need to be revised, in that the impact of regional variation in the HHI needs to be taken into account. A related question is whether the HHI is a useful measure overall. If banks operated a (somewhat successful) cartel, does HHI really proxy the competition in the banking system?¹⁵⁰ Based on my findings in appendix 3.A.1 and the findings by Braggion *et al.*, it probably does.¹⁵¹ While banks probably did not compete on deposit rates, they could compete on service and loan terms. Nevertheless, more research into how banks competed and colluded would certainly be useful.

147. Ibid.

148. Braggion, Dwarkasing and Moore, 'Nothing Special'.

149. It is worth noting, however, that the authors focus on a slightly later period (1885-1925) than the present study, when the banking system was more concentrated.

150. Grossman, 'Rearranging'.

151. Braggion, Dwarkasing and Moore, 'Nothing Special'.

3.A Appendix to Chapter 3

3.A.1 Branch-level Data

In this section, I use new data from the accounts of a large number of bank offices to demonstrate that several important branch-level characteristics were not, on average, correlated with a county's income tax assessments. This means that conducting the analysis on the county level averages out many branch-level idiosyncrasies, which strengthens the validity of my results in section 3.5.

I also present results from multilevel regressions, showing that after branch-level characteristics are controlled for, the impact of county-level characteristics on bank branch conduct can be teased out. In particular, I show that the Herfindahl-Hirschmann Index (HHI) is correlated with branch-level profitability, which serves to validate its use as a proxy for competition.

The data consists of over 7000 yearly observations from branch-level accounts in England and Wales, which have been collected from archives. Table 3.8 lists the banks included in the sample, along with the years that the data covers. The sample is constructed based on the availability of records.

For all banks in the sample, it is possible to get a figure on deposits to or from the head office, which refers to transfers of money between branches. In other words, any excess funds in a branch were recorded as deposits to the head office, even though they could subsequently be lent to other branches. Figures on expenses and revenue are also available for all banks with income statements, whereas data on loans on current accounts (short-term loans) is available for banks with balance sheet records.

Figure 3.4a shows correlation plots between characteristics of bank offices, which are averaged at the county-level, and per capita income tax assessments. The figure is based on data from 1900-1911, when the sample's coverage is the most

Table 3.8: Branch-level data

Bank	Years covered	Type of data available & number of observations	Archive and reference
Barclays	1899-1908	Income statement and deposits to/from head office; 325	Barclays: 0140-0253; 0140-0256; 0140-0258
District	1877-1913	Income statement and balance sheet; 2113	RBS: DIS/89
Midland	1895-1911	Income statement ^a ; 4156	HSBC: UK 0548-0001 to UK 0548-0009
Nottingham & Nottinghamshire	1907-1913	Balance sheet; 138	RBS: NOT/3
United Counties ^b	1902-1913	Income statement and balance sheet; 1164	Barclays: 0003-1156

Note: the last column lists the archive and the reference of the relevant branch-level accounting records. The comprehensiveness of balance sheets varies significantly. What can be derived from all of them are the deposits to (or loans from) the head office, and loans to customers.

a. Net deposits to head office are derived from figures on income from a branch's head office loans. I divide this figure by the average Bank of England rate for the year, thus obtaining a balance. I base this choice on information from material from Midland Bank archival collections: Analysis book containing details of profit and loss, 1895-1911, UK 0548-0003, Midland Bank, HSBC Archives, London.

b. Named *Birmingham District and Counties Bank* before 1907.

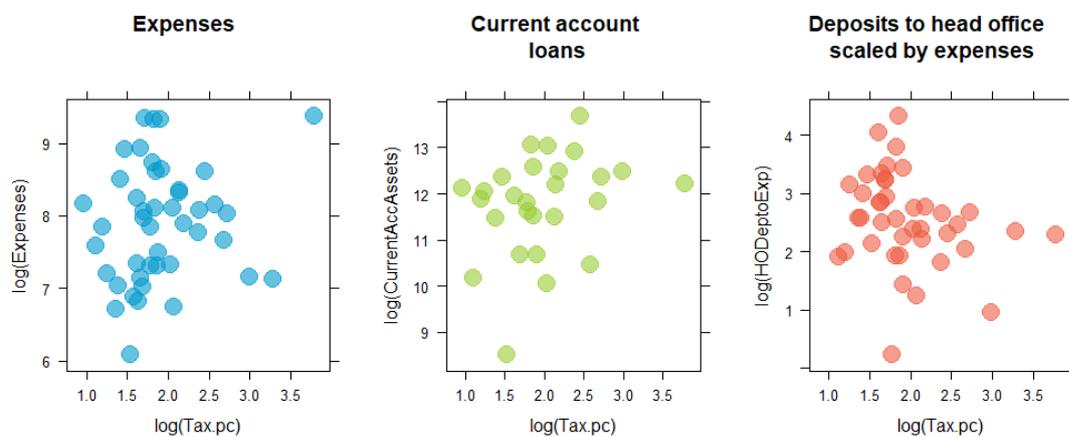
comprehensive.¹⁵² It shows that on average, branch expenses, current account credit, and loans from (or deposits to) their head offices, were *not* correlated with income tax assessments. Therefore, characteristics of bank offices did not systematically vary between richer and poorer counties once they are averaged at the county-level.

Figure 3.4b repeats the exercise by showing associations between a county's bank office characteristics and bank offices per square kilometre. The figure on expenses reinforces the notion that branch expenses did not differ between counties with more or less offices. Moreover, the profitability (income to expenditure) of branches did not, *on average*, differ between counties with many branches and

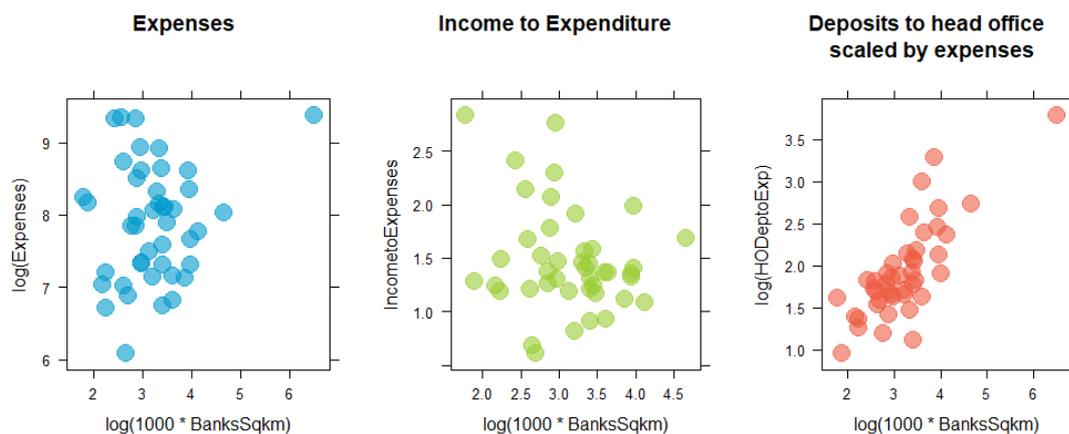
¹⁵². Approximately 6400 observations are available for these years for items pertaining to the income statements.

Figure 3.4: Correlation plots of average branch-level characteristics with per capita income tax assessments and bank offices per square kilometre, 1900-1911

(a) Income tax assessments



(b) Bank offices per square kilometre



Note: The figures are based on data for the years 1900-1911, for which the sample coverage is the most comprehensive.

counties with few branches. Of course, it is possible that a new branch might initially have been profitable, but that excess profits got competed away within a 10-year span. The only characteristic that seems to be correlated with the number of branches in a county is the amount of deposits transferred to the head office. This needs to be kept in mind when interpreting the results. It likely that the areas with more activity by the largest commercial banks had more branches but also more deposits transferred between bank offices. Indeed, as evidenced by correlations in figure 3.4a, this effect was not driven by the wealth of different counties. On balance, figure 3.4 reinforces the validity of the regressions outlined

in section 3.4.

I have shown that examining the data at the county-level averages out much of the heterogeneity in the business conduct of bank offices. But examining business conduct at the branch level, where we do not aggregate the branch data to the county level, can be used to gain further insights into what determined the behaviour of bank branches. To do this, I use multilevel panel regressions. This approach is necessary for analysing hierarchical data. Branch-level data is grouped within counties, and counties constitute a higher hierarchical layer of the data. Ignoring this structure would lead to a loss of statistical power, along with potentially biased estimates of coefficients and standard errors.¹⁵³

Multilevel analysis is thus suitable for modelling the impact of branch and county-level variables on given branch's business practices. In the regression equation, we separate the two levels of variables as follows:

$$y_{ijt} = \alpha + \beta'_{branch} \mathbf{x}_{ijt} + \beta'_{county} \mathbf{z}_{jt} + \gamma_t + \epsilon_{ijt} \quad (3.7)$$

where the dependent variable is y_{ijt} is an indicator for a bank office's business conduct. It is indexed by branch i , county j , and time t . The vector \mathbf{x}_{ijt} contains branch-specific variables observed each year, whereas \mathbf{z}_{jt} contains county-specific variables, which are common to all branches within the same county. ϵ_{ijt} is the random disturbance, and γ_t represents year fixed effects.

Table 3.9 shows results from regressions on factors associated with a branch's net deposits to other branches (first and second columns), profitability (third and fourth columns) and credit extended. I control for the size of a branch's business by either its expenses or the amount of credit extended. As for the county-level factors, I include per capita tax assessments; branches per square kilometre; and the HHI. All of the data, except for HHI, income/expenditure and the head office net deposits ratios are in logarithms. The random effects part of the regression can be used to infer to what extent y_{ijt} was influenced by factors on the county and branch-levels. The LR-test (results not shown) run against

153. See, for example: Joop J Hox, *Multilevel Analysis: Techniques and Applications*, 2nd ed. (New York: Routledge, 2010), Chapters 1 and 2.

a regression without hierarchical error components indicates that the multilevel mixed effects specification is appropriate.

Table 3.9: Factors associated with branch business conduct

Dependent variable	Head office net deposits / expenses	Head office net deposits / credit	Net profit	Income to expenditure	Credit
Branch-level variable (control for size)					
Expenses	-5.176 (0.894)***		1.245 (0.040)***	0.151 (0.041)***	0.745 (0.112)***
Credit		-0.393 (0.137)***			
County-level variables					
Tax pc	1.465 (2.863)	0.397 (0.146)***	-0.142 (0.196)	-0.072 (0.165)	-0.191 (0.242)
HHI	2.637 (17.570)	-2.367 (2.086)	1.336 (0.705)**	0.688 (0.399)*	4.529 (0.844)***
Banks/sqkm	-2.558 (3.094)	-0.324 (0.180)*	-0.057 (0.138)	-0.002 (0.115)	-0.003 (0.165)
Constant	43.489 (16.378)***	4.456 (1.982)**	-2.469 (0.462)***	0.982 (0.225)***	5.900 (1.060)***
Random effects parameters					
County-level					
var(Const.)	83.249 (38.477)	0.089 (0.034)	0.155 (0.058)	0.034 (0.012)	0.239 (0.116)
Branch-level					
var(Const.)	383.729 (57.116)	0.479 (0.122)	0.694 (0.117)	0.330 (0.113)	1.064 (0.370)
Residual					
var(Resid.)	57.205 (6.214)	0.086 (0.031)	0.317 (0.030)	0.136 (0.035)	0.161 (0.025)
Effects SE. cluster	Year County	Year County	Year County	Year County	Year County

Note: Cluster-robust standard errors in parentheses.

From the first two columns, we obtain limited evidence that taxes per capita and branch density were associated with net deposits to the head office. The associated coefficients are significant when head office deposits is scaled by branch-

level credit. However, credit data is available for fewer branches than data on expenditure, making the sample size in the second column significantly smaller. The more reliable results are those in the first column, which indicate that these county-level variables were irrelevant for determining flows of resources to and away from branches.

Results on factors associated with branch-level profitability are reported in the third and fourth columns. Both specifications indicate that HHI was positively correlated with branch profitability. The coefficients for HHI are large and significant: an increase in HHI by 0.01 points would increase profits by 1.3% and the income/expenditure ratio by 0.7%. This supports the claim that HHI is associated with the degree of competition in a banking market, and that bank offices were able to generate higher profits when they faced fewer competitors nearby. Nevertheless, based on the results in the chapter, it does not appear that the effects of concentration were large enough to translate into county-level economic growth.

Another interesting, albeit unexpected finding is that bank offices in counties with less competition tended to extend more credit, even when the scale of their operations is controlled for by expenses. This is difficult to explain. A viable (but speculative) explanation is that there was an inverse ‘U-shaped’ pattern for concentration and credit, which is discussed in the literature review above. A very high degree of concentration might lead banks to constrain credit while demanding high rates. But if the starting point is a high level of competition, then a slight decrease in the competitiveness of the local banking market increases the incentives for banks to gather information. Better information on customers, in turn, leads to higher lending.

Despite evidence that county-level factors impacted branch business conduct, it is still clear from the ‘random effects’ part of the panel that most of the variation in branch conduct in a given year could be explained by branch-specific factors. This is highlighted by the $var(Const.)$ lines, which indicate how much of the variance of the constant term occurred at each level of the equation. The variance explained at the branch-level was far higher than that at the county-level.

Chapter 4

Provincial Stock Markets and Local Growth, 1870-1911

Chapter Summary

This chapter tests if provincial stock exchanges played a role in the economic growth of British counties from 1870 to 1911. Econometric results suggest that they did not. This is surprising, because several stock exchanges outside London during this period provided markets for securities of local commercial enterprises. Historians have previously hypothesised that this may have made them important for their local economies, but this chapter is the first to test these hypotheses empirically. The analysis is based on new data on the paid-in capital of securities listed on provincial exchanges, along with new geographically disaggregated data on provincial stockbrokers.

4.1 Introduction

This chapter continues on the theme of regional finance and growth, focusing on provincial stock markets instead of the banking system. The literature surveyed in the previous chapter suggests that the growth of the local banking sector matters for local economic development. Information asymmetries arising from geographic distance play a significant role in the financing decisions by lenders, since it becomes more difficult to monitor a borrower's actions and evaluate a firm's prospects as distance increases. Similar phenomena have been found to exist in the context of modern stock markets.¹ According to this literature, being located near stock markets makes it easier for firms to obtain financing, which ultimately contributes to local economic growth. It follows that there are reasonable grounds to expect that British provincial exchanges contributed to economic development. This chapter is the first to formally test this hypothesis. It finds no evidence of stock markets influencing the economies of British counties.

1. Tim Loughran and Paul Schultz, 'Liquidity: Urban Versus Rural Firms', *Journal of Financial Economics* 78, no. 2 (2005): 341–374; Ulf Nielsson and Dariusz Wójcik, 'Proximity and IPO Underpricing', *Journal of Corporate Finance* 38 (2016): 92–105; Dariusz Wójcik, 'Financial Centre Bias in Primary Equity Markets', *Cambridge Journal of Regions, Economy and Society* 2, no. 2 (2009): 193–209.

British capital markets consisted of several stock exchanges from the early 19th century until the 1970s. The London Stock Exchange (LSE) was by far the largest of these institutions. It focused primarily on the trading of government debt and the securities of large domestic and foreign companies. So far, the literature on the role and development of British stock markets has focused on the LSE, while relatively little has been written about the role of provincial markets.² What makes the latter exchanges interesting is that they provided markets for the securities of smaller, local companies.³ The local nature of much of their activity, in turn, makes it feasible to study the provincial exchanges' impact on local economies.⁴ A study of provincial exchanges also contributes to a more comprehensive assessment of the capital market's role in the British economy from 1870 to 1911.

Although there are no empirical studies on the economic impact of British provincial exchanges, historians have highlighted their potential importance for local industry. Thomas and Michie provide useful accounts of how these exchanges functioned, along with their historical features.⁵ Michie suggests that provincial exchanges encouraged investment in local companies, which might have increased economic growth.⁶ Thomas made a similar argument, although he was careful to note the lack of empirical evidence on their economic role.⁷ More recently, Campbell *et al.* have used a new database to argue that both the size of the provincial exchanges and the types of firms listed therein could have rendered

2. Ranald C Michie, 'The London Stock Exchange and the British Securities Market 1850–1914', *The Economic History Review* 38, no. 1 (1985): 61–82; Ranald C Michie, *The London Stock Exchange: A History* (Oxford: Oxford University Press, 1999).

3. Ranald C Michie, 'The London and Provincial Stock Exchanges, 1799–1973: Separation, Integration, Rivalry, Unity', in *Enterprise and Management: Essays in Honour of Peter L. Payne*, ed. Peter Lester Payne, Derek Howard Aldcroft and Anthony Slaven (Aldershot: Scolar Press, 1995), 200–202.

4. Securities which were not purely local were also traded on these exchanges. Perhaps the most prominent category of such securities were railway stocks. These are excluded from this chapter's analysis.

5. William Thomas, *Provincial Stock Exchanges* (London: Cass, 1975); Michie, 'British Securities'. Michie's PhD thesis and related work gives a fairly comprehensive account on Scottish stock exchanges in the 19th century. See: Ranald C Michie, 'The Scottish Stock Exchanges in the Nineteenth Century' (PhD diss., University of Aberdeen, 1978) ; Ranald C Michie, *Money, Mania and Markets: Investment, Company Formation and the Stock Exchange in Nineteenth-Century Scotland* (Edinburgh: John Donald, 1981).

6. *Ibid.*, 234–235.

7. Thomas, *Provincial*, 129–139.

them important for financing domestic enterprises.⁸

Why might provincial stock exchanges matter for economic growth? In a world where investors are perfectly informed about all investment opportunities, and firms can easily access the capital markets regardless of their location, the location of stock markets should not matter. Yet, even today, information asymmetries arise through geographic distance, introducing distortions in capital markets. This has meaningful implications for capital mobility and inequalities in regional development.⁹

Wójcik outlines several factors relating to informational asymmetries, which render firms located outside financial centres less likely to receive public equity financing.¹⁰ Investors, who are disproportionately clustered around financial centres, find it difficult to acquire insider knowledge about potential investments outside these centres. Initial public offerings (IPOs) involve the collection of a large amount of tacit information - information that cannot be easily transferred over a distance through impersonal channels. This matters not just for the prospective investor, who needs to have confidence in a company's prospects, but also for whoever is bringing a company public. The 19th century company promoter had to understand the latent demand for a security, and perhaps to have a circle of customers who had agreed to buy the issue. All this required information which might not have been easily available to investors located far away from the company or the provincial stock exchange.

Tacit information probably played an even larger role in investment decisions before WW1 than it does today, because financial reporting requirements were very light.¹¹ At a time when fraud relating to promotional activities were common, investors had every reason to be suspicious of new companies being promoted, particularly if they were far away. Impersonal information that investors received

8. Gareth Campbell, Meeghan Rogers and John D Turner, 'The Rise and Decline of the UK's Provincial Stock Markets, 1869-1929', *Queen's University Centre for Economic History Working Paper*, no. 03 (2016).

9. Britta Klage and Ron Martin, 'Decentralized Versus Centralized Financial Systems: Is There a Case for Local Capital Markets?', *Journal of Economic Geography* 5, no. 4 (2005): 387–421; Wójcik, 'Financial Centre Bias'.

10. Ibid.

11. Julian Franks, Colin Mayer and Stefano Rossi, 'Ownership: Evolution and Regulation', *Review of Financial Studies* 22, no. 10 (2009): 4009–4056.

about existing companies consisted of opaque accounts, which often provided limited information about the soundness of a firm's business practices or its leadership.¹²

The principal-agent problem is also exacerbated by geographic distance.¹³ How can a firm's owners induce managers to act in their best interests, when the two are separated by a long distance, which renders monitoring more difficult? This is an important topic in economic history.¹⁴ While several mechanisms to align the interests of managers with those of owners have been devised throughout history, these mechanisms have tended to be increasingly costly as the distance between the two increases.¹⁵ A local investor base, built through provincial capital markets, could reduce these problems by bringing the principals (owners) close to the agents (company managers).

It is well documented today that investors show not only considerable bias in favour of domestic companies and against foreign ones, but that they also prefer local companies to distant (albeit domestic) ones.¹⁶ This might have to do with geographical constraints on the spread of information. Investors who are located near a company's headquarters or other operations tend to earn higher returns

12. See section 1.2.1.

13. Wójcik, 'Financial Centre Bias'. This problem exists when the principal (a firm owner, manager) cannot ensure that an agent (e.g. employee) is acting in his or her best interest.

14. For prominent examples, see e.g. Avner Greif, 'Contract Enforceability and Economic Institutions in Early Trade: The Maghribi Traders' Coalition', *The American Economic Review*, 1993, 525–548 and Ann M Carlos, 'Principal-Agent Problems in Early Trading Companies: A Tale of Two Firms', *The American Economic Review* 82, no. 2 (1992): 140–145.

15. In the context of 19th century joint-stock companies, this issue was often mitigated to the extent that company directors retained large ownership shares even after a firm went public.

16. Joshua D Coval and Tobias J Moskowitz, 'Home Bias at Home: Local Equity Preference in Domestic Portfolios', *The Journal of Finance* 54, no. 6 (1999): 2045–2073; Mark Grinblatt and Matti Keloharju, 'How Distance, Language, and Culture Influence Stockholdings and Trades', *The Journal of Finance* 56, no. 3 (2001): 1053–1073; Loughran and Schultz, 'Liquidity: Urban Versus Rural Firms'.

from that company's shares due to local information advantages.¹⁷ An important source of these advantages arises through social interactions, which intensify with geographic proximity, thus facilitating the transfer of tacit or insider knowledge.¹⁸

The theme of local information advantages and local bias is implicit in the historical literature on regional finance. During the railway mania in 1845-1846, local investors and insiders contributed a disproportionate amount of capital to local railway undertakings.¹⁹ Before the 1880s, the shareholders of regional banks were often local, because they may have had a better understanding of the bank's business prospects and of its customers, due to their involvement with the local business community.²⁰ Using a large sample of investors in 1870-1930, Rutterford *et al.* provide evidence of a substantial preference for local shares in historical investor portfolios, both in London and the provinces.²¹ Investors thus appear to have been more willing to invest in nearby undertakings, which might indicate that they possessed information that investors elsewhere lacked.

By studying an under-researched part of the British financial sector, this chapter contributes to our understanding of Britain's regional financial development and the impact thereof. It also links to the broader historical literature on regional stock exchanges, which has interesting parallels in the cases of Ger-

17. Joshua D Coval and Tobias J Moskowitz, 'The Geography of Investment: Informed Trading and Asset Prices', *Journal of Political Economy* 109, no. 4 (2001): 811-841; Zoran Ivković and Scott Weisbenner, 'Local Does as Local is: Information Content of the Geography of Individual Investors' Common Stock Investments', *The Journal of Finance* 60, no. 1 (2005): 267-306; Gennaro Bernile, Alok Kumar and Johan Sulaeman, 'Home Away from Home: Geography of Information and Local Investors', *Review of Financial Studies*, 2015, 2009-2049. However, Seasholes and Zhu find no evidence of excess returns generated by local investors: Mark S Seasholes and Ning Zhu, 'Individual Investors and Local Bias', *The Journal of Finance* 65, no. 5 (2010): 1987-2010.

18. Lauren Cohen, Andrea Frazzini and Christopher Malloy, 'The Small World of Investing: Board Connections and Mutual Fund Returns', *Journal of Political Economy* 116, no. 5 (2008): 951-979; Harrison Hong, Jeffrey D Kubik and Jeremy C Stein, 'Thy Neighbor's Portfolio: Word-Of-Mouth Effects in the Holdings and Trades of Money Managers', *The Journal of Finance* 60, no. 6 (2005): 2801-2824.

19. Gareth Campbell and John D Turner, 'Dispelling the Myth of the Naive Investor During the British Railway Mania, 1845-1846', *Business History Review* 86, no. 01 (2012): 3-41.

20. Lucy Newton, 'Regional Bank-Industry Relations During the Mid-Nineteenth Century: Links between Bankers and Manufacturing in Sheffield, C. 1850 to C. 1885', *Business History* 38, no. 3 (1996): 64-83.

21. Janette Rutterford, Dimitris P Sotiropoulos and Carry van Lieshout, 'Individual Investors and Local Bias in the UK, 1870-1935', *The Economic History Review* 70, no. 4 (2017): 1291-1320.

many, France and the US.²² Moreover, this chapter contributes a novel dataset on the membership of provincial stock exchanges and the number of stockbrokers in British counties (including brokers not affiliated with stock exchanges). Combined with figures on the paid-in capital of companies traded at provincial exchanges, this data is used to provide the first econometric tests on whether the development of provincial stock markets contributed to the economies of British counties.

4.2 Provincial Stock Exchanges

Provincial stock exchanges started forming in the early 19th century, spurred by high stock market valuations and a flurry of IPOs. The railway manias of the 1830s and 1840s, which entailed several new railway flotations, were particularly important in this regard.²³ The first railway mania in the 1830s gave rise to the Manchester and Liverpool exchanges, and the second railway boom in the 1840s supported the establishment of exchanges in most major cities.²⁴ After the speculative mania in railway shares came to a halt in 1846, trading activity on the exchanges became subdued. But many of the exchanges remained intact, providing markets for existing railway shares and some corporate securities.²⁵ It could thus be argued that in this case, short term speculative bubbles had long term effects on the UK's financial landscape.

The UK had 11 provincial exchanges in 1873, and 23 by 1913. Most exchanges formed in cities where a substantial amount of industrial capital had been created during the country's early industrialisation.²⁶ These cities had often a large investor base and several firms looking to have their securities traded publicly. Fol-

22. Carsten Burhop, David Chambers and Brian Cheffins, 'Regulating IPOs: Evidence from Going Public in London, 1900–1913', *Explorations in Economic History* 51 (2014): 60–76; Pierre-Cyrille Hautcoeur and Angelo Riva, 'The Paris Financial Market in the Nineteenth Century: Complementarities and Competition in Microstructures', *The Economic History Review* 65, no. 4 (2012): 1326–1353; Eugene N White, 'Competition Among the Exchanges before the SEC: Was the NYSE a Natural Hegemon?', *Financial History Review* 20, no. 01 (2013): 29–48.

23. John R Killick and William Thomas, 'The Provincial Stock Exchanges, 1830—1870', *The Economic History Review* 23, no. 1 (1970): 96–111.

24. Thomas, *Provincial*, 28–29, 50–69. Stock exchanges were formed most notably in: Bristol; Hull; Leeds; York; Birmingham; Nottingham; and Newcastle.

25. Killick and Thomas, 'Provincial'.

26. *Ibid.*

lowing the railway manias, exchanges did indeed facilitate the raising of capital for new firms, but they would more commonly provide a market for the shares of already established firms.²⁷ Secondary markets for shares were in growing demand after new legislation was passed in 1858, which made it possible for firms to be converted to the limited liability joint-stock form.²⁸ Conversions of firms to a new form, along with a public placements of shares, would commonly happen after previous owners had died or decided to diversify their interests. By the late 19th century, it was inevitable that many firms founded during the industrial revolution or the mid-Victorian period would see the first (or second) generation of owners die, without finding family members able or willing to continue their business.²⁹ These mature companies had been formed during a time when legislation discouraged joint-stock enterprise, potentially creating latent demand for the services of provincial exchanges once altering a firm's legal structure became easier.

Converting a private company to a public one does not in itself lead to new capital being mobilised for investment. For example, large coal companies during the late 19th century typically converted to the joint-stock limited liability form in order to reduce the risks arising from unlimited liability to a small circle of owners, rather than to raise new capital.³⁰ Several companies issuing shares could thus remain relatively tightly controlled by the original owners even when the number of minority shareholders grew, which led to few changes in their management practices.³¹ In such cases, floating shares to the public would not have led to improved corporate governance, thereby limiting the contribution that stock exchanges made to productivity growth. Yet once listed, companies would commonly use the stock exchanges as venues for raising additional capital.³² Michie argues that merely having traded securities on the secondary market encouraged new investment into companies, because investors would find it easier to sell their shares onwards.³³

27. Michie, *London Stock Exchange*, 116-118.

28. Michael Edelstein, 'Rigidity and Bias in the British Capital Market, 1870-1913', in *Essays on a Mature Economy: Britain after 1840*, ed. D N McCloskey (New Jersey: Princeton University Press, 1971), 83-105.

29. Marianne V Pitts, 'Did Dividends Dictate Depreciation in British Coal Companies 1864-1914?', *Accounting History* 3, no. 2 (1998): 37-67.

30. *Ibid.*

31. William Kennedy, *Industrial Structure, Capital Markets, and the Origins of British Economic Decline* (Cambridge: Cambridge University Press, 1987), Ch. 5.

32. Edelstein, 'Rigidity', 86-88.

33. Michie, *Money*, 235.

Companies which were already quoted also faced fewer institutional obstacles to raising additional capital from the public. Minutes from the Birmingham stock exchange show that new issues from existing firms could start trading easily, with few deliberations by the managing committee of the exchange.³⁴

By 1870, a substantial amount of provincial capital had been raised for railway, banking and insurance companies. Throughout the subsequent period preceding WW1, their securities constituted a large share of the capital that was quoted on the provincial exchanges. Over time, however, the trading of these securities gradually moved to London. This process was catalysed by companies growing large enough to warrant sufficient interest in London, or by them merging with London-based firms.³⁵ In the latter case, provincial exchanges would often continue listing the shares of the London-based entities, but from the 1880s, a growing share of new listings consisted of local commercial, industrial and mining enterprises.³⁶ As this specialisation occurred, provincial markets became increasingly distinct from London in the types of securities they traded.³⁷

In the late 19th century, the cost of issuing shares was lowered by intensifying competition between a growing number of company promoters.³⁸ This provided further encouragement for firms to issue shares to the public. Breweries became a staple industry on several exchanges after seeing a wave of mergers and new issues in the 1880s.³⁹ Other industries, such as car and bike manufacturers, along with electrical and lighting companies, also constituted a significant share of new listings around the turn of the century. Besides listing local shares, provincial exchanges could also specialise on certain industries. For example, Manchester tended to focus on textile firms, and Cardiff on coal companies.⁴⁰ In this vein, some provincial listings could include companies that were not merely local. Particularly

34. Minutes, Birmingham Stock Exchange, April 2, 1901, MS 1598/1/4/8, Birmingham Stock Exchange Collection, Library of Birmingham Archives.

35. Campbell, Rogers and Turner, 'Rise'.

36. Michie, *Money*, 212-220.

37. Michie, 'London and Provincial', 200-202.

38. Edelstein, 'Rigidity', 88-89, 94.

39. Katherine Watson, 'The New Issue Market as a Source of Finance for the UK Brewing and Iron and Steel Industries, 1870-1913', in *The Evolution of Financial Institutions and Markets in Twentieth-Century Europe*, ed. Youssef Cassis, Gerald D Feldman and Ulf Olsson (Aldershot: Scolar Press, 1995), 211-248.

40. Thomas, *Provincial*, Ch. 6.

in Scotland, stock exchanges also provided markets for foreign securities. *The Economist* wrote:

In Scotland, Glasgow is, of course, the most important exchange. It deals freely in most Scotch stocks, especially, perhaps, in oil shares... Indian gold and several copper mining shares also find a congenial home at Glasgow. In bank, insurance, and [typically American] land and cattle shares Edinburgh probably does most business [in Scotland]. The first-named form a really important market, since the paid-up capital of the ten banks officially quoted amounts to over nine millions, and the market value to between three and four times as much. The shares of the Scottish insurance companies also form a large and important class of securities... As a whole, Edinburgh is a more important centre for local stocks than Glasgow...⁴¹

The securities of local companies found their place on provincial exchanges for several reasons. Small issues were often unmarketable in London, because few brokers specialised in them, and they would be unlikely to attract much attention. On larger exchanges such specialisation could draw certain types of securities from afar. As *The Economist* wrote:

Those who regard our provincial Stock Exchanges as simply local markets for the circulation of local securities misjudge their position greatly. Glasgow and Edinburgh, Manchester, Liverpool, and Dublin do, it is true, afford facilities for local investments which London does not afford, but they do much more than this, for there are many classes of securities which London has never been induced to take up, or only to take up with an altogether lukewarm advocacy, and they have consequently found a home in the provinces.⁴²

Indeed, obtaining quotations on the provincial markets was typically far easier than in London, as fewer requirements were put on companies seeking to be listed.⁴³ Local stock exchange members, who were brokers, were mainly concerned with how actively a stock was traded, rather than its quality. After all, the brokers' income depended on transaction volumes. With the safest and most well-known stocks being traded in London, provincial brokers could not be as selective with regards to their sources of commissions.

41. 'Provincial Stock Exchange Securities.' *The Economist*, Saturday, October 2, 1886; p. 1223; Issue 2249.

42. 'The Stock Markets of the United Kingdom.' *The Economist*, Saturday, April 19, 1884; p. 480; Issue 2121.

43. Thomas, *Provincial*, 34.

As mentioned above, local investors were better able to assess the quality of nearby issues than investors in London were. This is supported by evidence on contemporary shareholder clientèles, and the preference that investors exhibited for the shares of companies that operated in their vicinity.⁴⁴ Although the London Stock Exchange was linked by telegraph to virtually all the major British cities by the 1850s, personal connections within the local business community would have given provincial investors a distinct advantage in assessing the quality of a security.⁴⁵ Yet, if a firm's owner's circle of acquaintances found the firm particularly good, this would naturally lead to smaller markets (or no public markets) for the stock. As Francis Hirst, the editor of *The Economist* put it in 1913:

A really good thing from Glasgow or Yorkshire, or Lancashire, or the Midlands, seldom comes to London to be floated on the public. The insiders naturally keep it to themselves and their friends.⁴⁶

Of course, provincial stock exchanges were not exempt from the institutional weaknesses outlined in the first chapter. The practices of dishonest promoters could have increased public mistrust of new share issues, whereas a lack of reporting requirements and shareholder protection constrained investors' ability to improve corporate governance.⁴⁷ Yet, despite possible institutional weaknesses, provincial exchanges expanded rapidly over the late 19th century, which made them an important part of the national capital market. Indeed, while they complemented the London stock exchange through their specialisation, provincial exchanges also became increasingly integrated with the exchange in London and with each other. This integration was spurred by better communications, which led to more trading between exchanges, thereby increasing the liquidity of provincial markets

44. Graeme G Acheson, Gareth Campbell and John D Turner, 'Who Financed the Expansion of the Equity Market? Shareholder Clienteles in Victorian Britain', *Business History* 59, no. 4 (2017): 607–637; Rutterford, Sotiropoulos and Lieshout, 'Individual Investors and Local Bias'.

45. Michie, *London Stock Exchange*, 66, 71.

46. Francis W Hirst, *The Stock Exchange* (London: Willard & Norgate, 1913), 216. Quoted in: Leslie Hannah, 'Pioneering Modern Corporate Governance: A View from London in 1900', *Enterprise and Society* 8, no. 3 (2007): 642–686.

47. For a discussion, see: section 1.2.1. See also: Pitts, 'Dividends'; Philip L Cottrell, *Industrial Finance, 1830-1914: The Finance and Organization of English Manufacturing Industry* (London: Methuen, 1980), 148-154; John Armstrong, 'The Rise and Fall of the Company Promoter and the Financing of British Industry', in *Capitalism in a Mature Economy: Financial Institutions, Capital Exports and British Industry, 1870-1939*, ed. J J van Helten and Y Cassis (Cambridge: Edward Elgar, 1990), 115–138.

while broadening their investor base.⁴⁸ Campbell *et al.* substantiate these claims by showing that the largest provincial exchanges had a relatively good levels of liquidity, which contrasts with arguments contained in earlier contributions.⁴⁹ This evidence of the provincial exchanges' importance in the financial system underscores the need to understand their role in the economy more generally.

4.2.1 International Comparisons

The British provincial exchanges had many similarities with those in other countries in the 19th century. Findings from these cases can help us understand the challenges faced by the British exchanges, especially as they became a part of an increasingly integrated market, with London at its centre. Germany had 23 stock exchanges in 1913, and as in Britain, smaller firms tended to be listed at provincial exchanges. Larger firms were commonly listed in Berlin regardless of their location, suggesting a role for local information advantages mainly in the cases securities pertaining to small companies.⁵⁰ A similar pattern emerged in 19th and early 20th century French and US financial markets, where markets were becoming increasingly integrated, but where provincial exchanges retained their vitality by focusing on providing markets for securities of smaller companies.⁵¹ These features indicate that the British stock markets' specialisation in different types of securities reflected a general pattern that did not arise from factors specific to the nation's financial system.

Institutional factors could also contribute to the growth of provincial markets. While the activity on the US stock markets tended to become increasingly concentrated to the New York Stock Exchange (NYSE), the ascent of companies in new industries drew a large volume of trading to peripheral markets.⁵² This is partially

48. Michie, 'London and Provincial', 205-209.

49. Campbell, Rogers and Turner, 'Rise'. Cottrell had argued that illiquidity might have been a significant problem at these exchanges. See: Cottrell, *Industrial Finance*, 148-154.

50. Carsten Burhop and Sibylle Lehmann-Hasemeyer, 'The Berlin Stock Exchange and the Geography of German Stock Markets in 1913', *European Review of Economic History* 20, no. 4 (2016): 429-451.

51. White, 'Competition'; Jérémy Ducros and Angelo Riva, 'The Lyon Stock Exchange: A Struggle for Survival (1866-1914)', *Paris School of Economics Working Papers*, nos. 2014-9 (2014).

52. White, 'Competition'.

because the NYSE had strict listing standards, often requiring a track record of profitability and quarterly reports. At competing exchanges, requirements were less stringent. White suggests that this has parallels with the British case, where shares of riskier companies were often listed on the provincial exchanges, which had lower listing requirements than the LSE.⁵³ In this sense, provincial markets functioned as a market for riskier and younger enterprises, akin to the LSE's Alternative Investment Market (AIM) today.

In contrast to White's study, Burhop and Lehmann-Hasemeyer find that differences in the rules and regulations of provincial exchanges had little impact on listing decisions in Germany.⁵⁴ Instead, firm size tended to be the best predictor of where firms were listed. In terms of information advantages, geographical factors also made firms more likely to list on nearby German stock exchanges, but location ceased to be a good predictor of listing decisions in the early 1900s. This suggests that advances in communication made distance less of a factor in listing decisions. Contrasting these findings with the British case is interesting. While data on paid-in capital shows that London was becoming more dominant, membership figures of provincial exchanges suggest that they retained their vitality till the very end of the pre-WW1 era. One possible explanation for this discrepancy could be that from the 1880s onwards, the LSE proved slower than some of its counterparts in adopting new communications technologies.⁵⁵

4.3 Data

4.3.1 Stock Exchange Members and Provincial Brokers

This chapter contributes new data on the number of members of British provincial stock exchanges from 1875 to 1913. To the best of my knowledge, comprehensive membership data has previously been collected only for the years 1911 and 1912.⁵⁶

53. Ibid.

54. Burhop and Lehmann-Hasemeyer, 'Berlin Stock Exchange'.

55. Michie, 'British Securities'.

56. Philip L Cottrell, 'Banking and Finance', in *Atlas of Industrializing Britain, 1780-1914*, ed. John Langton and Robert John Morris (London: Methuen, 1986), 154-155.

Stock exchange members were stockbrokers by their primary occupation.⁵⁷ They were either working individually or as partners of small firms.⁵⁸ The membership data presented here refers to the number of individual brokers affiliated with a given stock exchange, not the number of firms.

Since members were brokers, membership figures can provide a rough indicator of the level of activity that took place at each exchange. Someone whose sole occupation was stockbroking needed to generate sufficient revenue to stay in business, although some brokers may have been wealthy enough to ignore such constraints. The membership figures are therefore likely to indicate a lower bound for the activity on a stock market over the longer term. The data does not capture the yearly variance of activity on a particular stock exchange, as the number of brokers was presumably somewhat unresponsive to yearly swings in trading activity.

Several primary sources were used to create the dataset, but two sets of records were particularly important. First, archival records of the *Council of Associated Stock Exchanges* (henceforth also referred to as CASE) provide yearly figures of members of most of the large stock exchanges from 1890 onwards.⁵⁹ Second, the *Banker's Almanac* reports the membership of a different set of exchanges from 1892 to 1914. It provides figures of several smaller stock exchanges which were not affiliated with the Council.⁶⁰

For the years before 1890, the data is less comprehensive and contains gaps for several exchanges. The archival collections of some provincial exchanges (Manchester, Liverpool, Birmingham, Bristol, Sheffield and Leeds) provide yearly figures on

57. Thomas, *Provincial*, 17-24.

58. Figures from the *United Kingdom Stock and Sharebrokers Directory* suggest that brokerages rarely exceeded 3 people who were members of an exchange.

59. Minutes, Council of Associated Stock Exchanges, 1890-1913, MS 332/LSE/4/2/1, Records of the Liverpool Stock Exchange, Liverpool Record Office.

60. A few larger exchanges, such as Manchester, were also unaffiliated with the Council when it was founded in 1890.

membership, which have been gathered from 1870 onwards.⁶¹ For other exchanges, data was collected from the *United Kingdom Stock and Sharebroker's Directory* from 1881 onwards, and *The Country Stock Brokers Directory* for 1875.⁶² For most stock exchanges, the data thus covers the years 1875-1913. For exchanges which were not members of CASE, the data is yearly from 1897. Before 1890, observations from directories are available for the years 1875, 1880-1881 and 1885. A glance at local trade directories suggested that these gaps would be difficult to fill for the 1870s and 1880s. Indeed, Edelstein seems to have been able to compile a very limited set of figures based on such sources.⁶³

The membership figures are comparable across exchanges, given that most of these institutions operated under similar rules. After 1890, rules were increasingly set after consultations with the *Council of Associated Stock Exchanges*, which was a body composed of provincial stock exchange committees, with the purpose of standardising rules across exchanges.⁶⁴ Two factors might affect this comparability. First, outside (non-member) brokers were typically allowed to deal in exchanges if they came from an area without a stock exchange. These outsiders were generally seen as bringers of new business, and not as mere free-riders.⁶⁵ Second, in some towns, a significant amount of trading happened outside formal exchanges.⁶⁶

Table 4.1 shows the number of members of the largest stock exchanges.⁶⁷ It indicates that most exchanges retained their vitality over the two decades preced-

61. Committee Minutes, 1870-1913, MS 1598/1/4/1-13, Birmingham Stock Exchange Collection, Library of Birmingham; Bristol Stock Exchange Monthly List, 1876-1903, MS 3810/6W/S/9, Sir George White Papers, Bristol Archives; Minutes, 1870-1913, B18/1/1/4-10, Records of the Manchester Stock Exchange, Manchester Archives; Association Minutes, 1870-1909, WYL543/2/2, Records of the Leeds Stock Exchange, West Yorkshire Archives, Leeds; Minutes of the Committee, 1870-1913, MS 332/LSE/1/2/8-24, Records of the Liverpool Stock Exchange, Liverpool Record Office; Minutes and Annual Statements of Accounts, 1870-1912, LD2007/1/1-2, Records of the Sheffield Stock Exchange, Sheffield Archives.

62. *The Country Stock Brokers' Directory* (London: E. W. Allen, 1875); *The United Kingdom Stock and Sharebrokers' Directory* (London: W. J. Adams & Son). Various years, 1881-1913.

63. Edelstein, 'Rigidity', Table 1.

64. Minutes, Council of the Associated Stock Exchanges, May 9, 1890, Records of the Liverpool Stock Exchange, 332 LSE/4/2/1, Liverpool Record Office.

65. Thomas, *Provincial*, 198.

66. *Ibid.*, 148-149.

67. Belfast did not have a formal exchange before 1897, but it still had a group of brokers who regularly met in order to trade securities.

ing WW1. The major exchanges in Glasgow, Edinburgh, Birmingham, Liverpool and Manchester experienced an increase in brokers in 1897-1913. Some smaller ones, such as Leeds and Newcastle, grew very quickly, albeit from a low starting point.

Table 4.1: Membership of provincial stock exchanges, 1875-1913

Exchange	1875	1885	1897	1905	1913	Growth 75-97	Growth 97-13
Glasgow	61	118	166	226	263	172%	58%
Liverpool	102	152	140	153	175	37%	25%
Manchester	50	79	90	101	106	80%	18%
Dublin	47	61	80	89	88	70%	10%
Edinburgh	24	45	57	74	69	138%	21%
Birmingham	11	18	37	48	63	236%	70%
Sheffield	26	29	34	32	42	31%	24%
Newcastle	9	8	5	14	33	-44%	560%
Bristol	10	11	27	30	31	170%	15%
Belfast	12	19	32	33	30	167%	-6%
Leeds	22	13	15	20	30	-32%	100%
Cork	4	8	26	24	23	550%	-12%
Dundee	8	10	11	16	19	38%	73%
Cardiff	0	5	14	26	17	NA	21%
Huddersfield	3	6	10	8	17	233%	70%
Aberdeen	11	15	15	13	14	36%	-7%
Greenock	2	5	5	12	12	150%	140%
Bradford	7	9	16	14	11	129%	-31%
Halifax	11	6	13	9	8	18%	-38%
Total	420	617	793	942	1051	89%	33%
London	1979	2608	3962	5463	4855	100%	23%

The exchanges are ordered by the number of members in 1913.

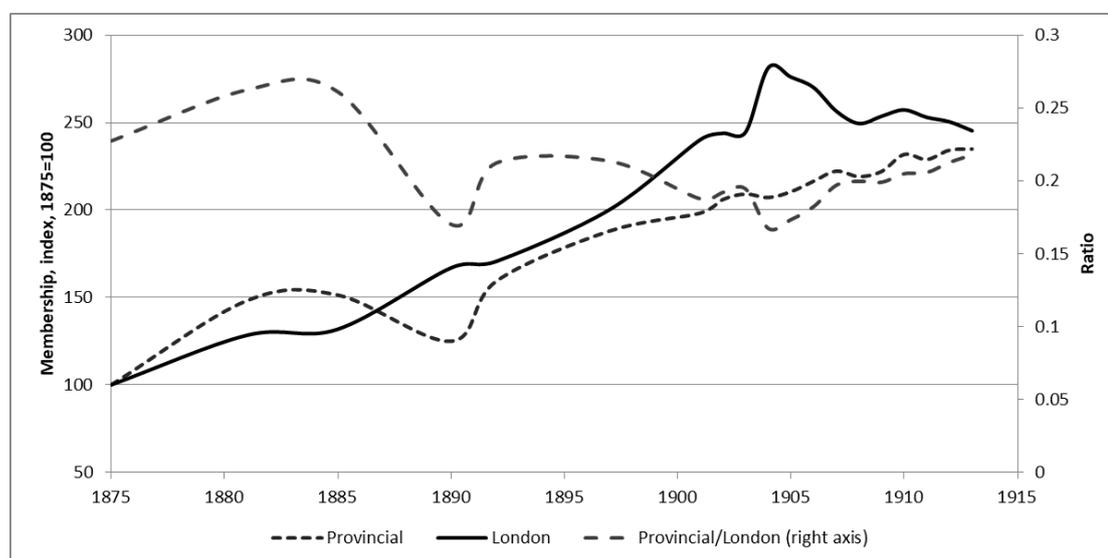
Sources: *The Banking Almanac*, issues between 1892-1913. *Stock Exchanges of The United Kingdom*. Supplemented by records of the *Council of Associated Stock Exchanges* for years after 1890. *The United Kingdom Stock and Sharebrokers Directory* was used for the years 1885 to 1892, and *The Country Stock Brokers Directory* for the year 1875. No issue of the former is available for 1895 so 1897 was used instead.

In aggregate, the membership of provincial and London exchanges grew at roughly the same rate, although London started from a significantly higher position. This is shown in figure 4.1. The line corresponding to the right axis shows the ratio of provincial stock exchange members to members of the LSE. It indic-

ates that throughout 1875-1913, the LSE's membership was approximately four to five times larger than that of the provincial stock exchanges. There was no easily discernible trend in this ratio. It can thus be concluded that provincial exchanges did not fade into irrelevance during the period, but grew in line with the (remarkable) growth rate of the LSE at least until 1913.

This finding is at odds with previous arguments about the activity and relative importance of provincial exchanges. Thus far, it has been thought that their decline began around 1900. This is when telephones linked provincial brokers with the LSE. Although better communications contributed to the integration of provincial and London markets, they also helped channel more business to London.⁶⁸ Campbell *et al.*, in turn, argue that the relative decline after 1900 was caused by the trading of larger companies - such as banks and railways - moving to London.⁶⁹ However, to the extent that membership data is a better measure of trading activity than stock exchange listings, the findings in figure 4.1 suggest a need to revise these arguments.

Figure 4.1: Comparison of membership of London and provincial exchanges, 1875-1913



Source: See text. The lines are smoothed for purposes of clarity and missing observations in the earlier part of the sample.

68. Michie, 'British Securities', 70-75.

69. Campbell, Rogers and Turner, 'Rise'.

A further contribution of this chapter is data on provincial stockbrokers in general - including ones unaffiliated with formal exchanges. The sources used for this are the *United Kingdom Stock and Sharebrokers Directory* for the years 1881 to 1913, and *The Country Stock Brokers Directory* for 1875. As is the case with stock exchange membership figures, the data does contain gaps before 1897, as directories were not published annually. Moreover, the data in 1875 covers significantly fewer British towns than data after 1881.

Table 4.2 shows the number of stockbrokers in counties with more than 20 brokers in 1913. It tells two stories. First, it reinforces the notion that most counties did not have very active stock markets in the 1870s or the 1880s. Only a handful of counties had more than 10 stockbrokers in 1875, and these tended to be the ones with existing stock exchanges. On the other hand, it shows a significant expansion in the number of brokers in most of these counties from 1875 to 1913. The number of brokers in Glamorgan (Cardiff) grew significantly after a local stock exchange was formed in 1886. On the other hand, the increase in brokers in Fife and Dumfries appears to have occurred largely in the absence of formal stock exchanges.

Little is known about brokers who were unaffiliated with stock exchanges. According to the data, most British counties had at least a few local stockbrokers by the 1890s, even though they did not have an exchange. It is difficult to answer to what extent these individuals were engaged in local informal securities markets, which Michie considers to have been important in this period.⁷⁰ For example, Dundee in the 1870s had a significant market for locally held shares without a centralised exchange.⁷¹ Yet, had a local informal market been illiquid, we would expect fewer specialised intermediaries (brokers) to have been active, since there would have been a limited pool of commission fees to support their incomes. In illiquid markets, it is more probable that many provincial brokers acted also as conduits for the investment of local capital into larger and more distant markets. As communication links improved, investors could rely on brokers in financial centres, but may still have preferred local brokers due to the personal contact or

70. Ranald C Michie, *The London and New York Stock Exchanges 1850-1914* (London: Allen & Unwin, 1987), 108-109.

71. Michie, *Money*, 171.

Table 4.2: Number of stockbrokers by county, 1875-1913

	1875	1885	1897	1905	1913	Growth 75-97	Growth 97-13
Lancaster	182	314	362	434	503	99%	39%
Lanark	61	127	169	232	269	177%	59%
York	103	107	161	192	223	56%	39%
Dublin	47	61	80	91	86	70%	8%
Warwick	16	28	46	81	84	188%	83%
Edinburgh	24	45	54	77	76	125%	41%
Gloucester	11	16	40	52	55	264%	38%
Northumberland	9	9	16	23	44	78%	175%
Glamorgan	1	9	20	48	43	1900%	115%
Fife	1	0	1	30	40	0%	3900%
Belfast	12	19	35	40	39	192%	11%
Forfar	11	14	23	34	39	109%	70%
Perthshire	3	2	6	24	35	100%	483%
Durham	9	11	16	24	31	78%	94%
Cumberland	12	13	23	28	27	92%	17%
Dumfriesshire	1	2	2	18	27	100%	1250%
Hampshire	4	7	14	21	27	250%	93%
Cork	4	8	18	26	25	350%	39%
Aberdeen	11	15	17	19	22	55%	29%
Lincoln	5	5	7	12	20	40%	186%
Nottingham	10	7	9	17	20	-10%	122%
Renfrewshire	3	6	11	20	20	267%	82%

The table shows the number of brokers in all counties, which had more than 20 brokers in 1913.

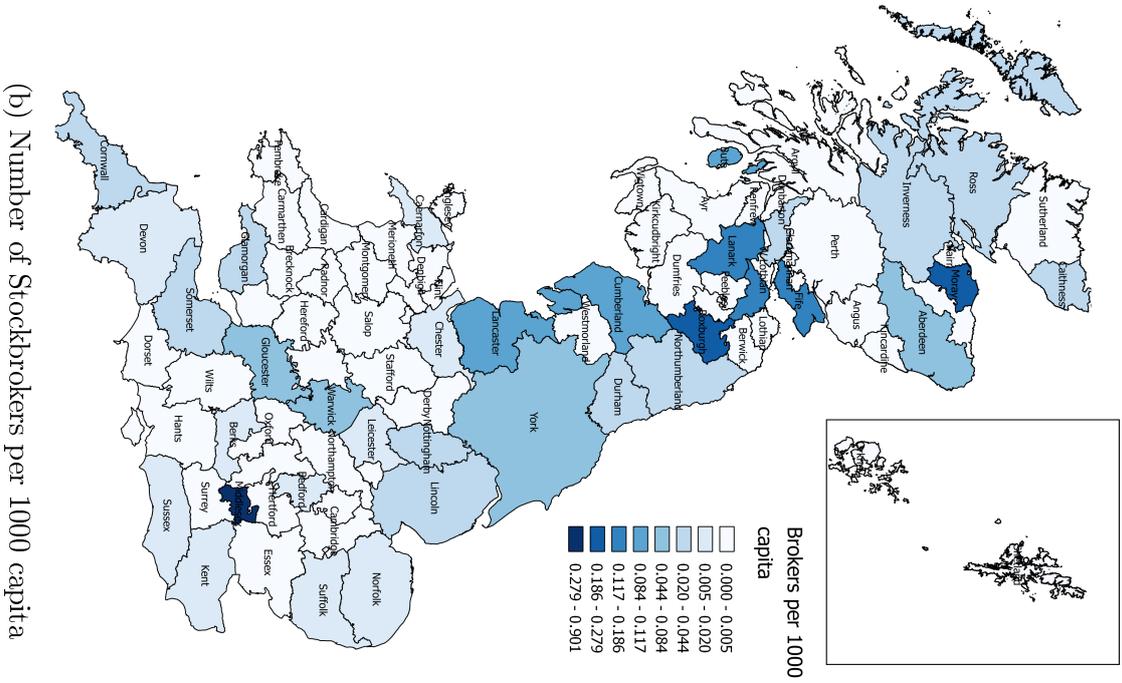
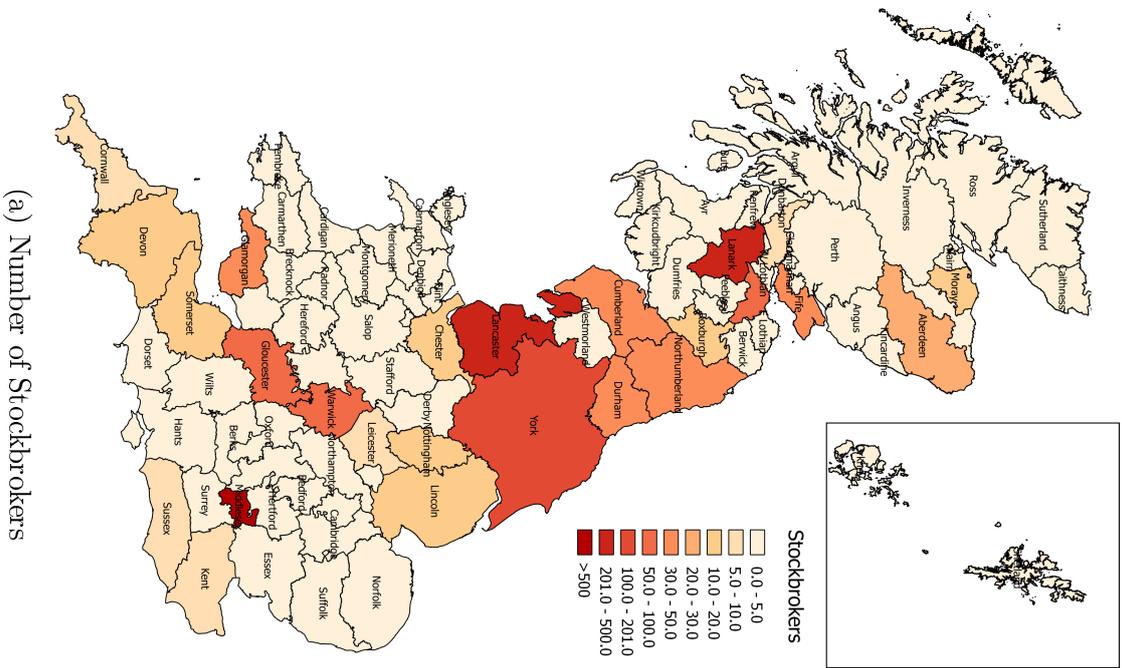
Sources: *United Kingdom Stock and Sharebrokers Directory* for the years 1881 to 1912, and *The Country Stock Brokers Directory* for the year 1875. No issue of the former is available for 1895, so data for 1897 is presented instead.

the convenience that they provided.⁷²

Panel (a) in figure 4.2 maps the number of provincial brokers in each county in 1910.⁷³ The brokers are concentrated in the counties with formal stock exchanges. Agricultural regions, such as Wales outside Cardiff (Glamorgan), along with the East of England and South Eastern regions all tended to have very few brokers.

72. Ibid., 172-174.

73. There are no major differences in the spatial distribution of stockbrokers between 1890 and 1910. Before 1890, the data may not be entirely representative.



(a) Number of Stockbrokers

(b) Number of Stockbrokers per 1000 capita

Figure 4.2: Stockbrokers in British counties, 1910

Given the high variation in population densities between Scottish counties, it is not surprising that most of the activity concentrated around Edinburgh, Glasgow and Aberdeen. On a per capita basis, however, even relatively sparsely populated counties in Scotland tended to have more brokers than rural counties in England and Wales. This is shown in panel (b) of figure 4.2.

4.3.2 Paid-in Capital

In addition to the membership data, this chapter also uses paid-in capital as a measure of the development of provincial exchanges. Paid-in capital is the amount of capital that a company has raised from its shareholders. The series has the advantage of being available at a yearly frequency from 1870, which makes it suitable for an alternative econometric approach. It also allows us to focus on classes of securities which might have been particularly important for local economies.

The data source on paid-in capital of stocks listed on each exchange is the Investor's Monthly Manual (IMM), which is used in the first chapter above.⁷⁴ Data from this publication is made available by the Yale International Center for Finance.⁷⁵ Besides paid-in capital, the IMM provides information on the exchanges where given securities were primarily traded. It is likely that the IMM omits exchanges where a share had a secondary listing, but did not have active markets. This can render the data more informative about the activity on individual markets.⁷⁶

The IMM data has been used by Campbell *et al.* to describe characteristics of the provincial markets, such as the number of shares listed on each exchange and the market capitalisation thereof.⁷⁷ According to the authors, the IMM contains the most comprehensive available statistics on securities listed on provincial

74. See the first chapter for details about how the data was cleaned.

75. Yale International Center for Finance, *London Stock Exchange Project*, Yale School of Management, 2017, <https://som.yale.edu/faculty-research/our-centers-initiatives/international-center-finance/data/historical-financial-research-data/london-stock-exchange>, accessed: 22 December 2017.

76. Campbell, Rogers and Turner, 'Rise'.

77. Ibid.

exchanges. But the figures are not complete. Official lists of provincial stock exchanges often contain slightly wider sets of securities, although these are not available for all years or all exchanges.⁷⁸ Additionally, the trading of the securities of several smaller firms was done by special settlement, even though these securities were not regularly quoted on the exchanges. Special settlement refers to cases where a non-listed firm seeks to have its shares quoted on a stock exchange.⁷⁹ On provincial exchanges, firms could seek to have their shares traded for a certain period, and all transactions would be settled on specific days. Even with these caveats, the IMM appears to be by far the best available source of the listings on provincial exchanges.

The following categories of stocks are excluded from the statistical analysis:

1. Foreign companies;
2. British companies operating mostly or solely abroad (e.g. mining or land investment companies);
3. Banks and insurance companies;
4. Railroads

The securities that are included are referred to as ‘industrial and commercial’ securities, following the LSE’s definitions.

Banks, insurance and railway companies are excluded, because these industries went through a waves of mergers during the period in question, which drew much of the dealing in these firms’ securities away from the provinces to London. As mentioned above, it was common for the securities of the new, merged, entities to remain listed in the provinces for some time, even though the primary market moved to London.⁸⁰ Including railway and banking securities would show up as a series of large and abrupt declines in the paid-in capital of the provincial markets.⁸¹ Multiple large breaks in the series, in turn, would render this chapter’s

78. Monthly Share Lists, 1884-1894, WYL543/7/1, Records of the Leeds Stock Exchange, West Yorkshire Archives, Leeds; Bristol Stock Exchange Monthly List, 1876-1903, MS 3810/6W/S/9, Sir George White Papers, Bristol Archives.

79. Burhop, Chambers and Cheffins, ‘Regulating IPOs’.

80. Campbell, Rogers and Turner, ‘Rise’.

81. This is because, as mentioned earlier, the IMM only lists the markets where a stock was actively traded.

econometric results highly inaccurate.

An additional reason for excluding the aforementioned classes of securities has to do with the scope of their operations. Banks and railways may have operated only locally when they were formed. But as many of these companies started operating at a national scale in the late 19th century, it becomes less clear how their growth contributed to the economies in their counties of origin. For example, if a bank being listed and operating in Liverpool were to merge with a bank in Leicester, its paid-in capital could increase substantially. Yet, this increase in paid-in capital would probably not be commensurate with either how the Liverpool Stock Exchange functioned, or the expansion of local economic activity in Lancashire

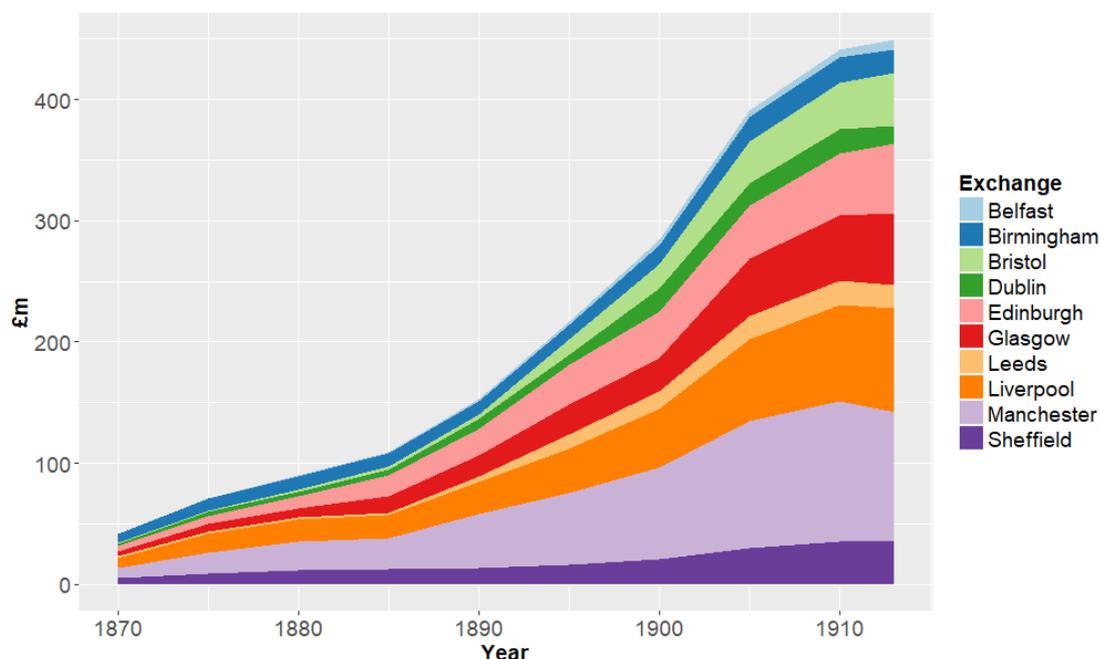
Some foreign entities were also listed on provincial exchanges, although much of the dealing in these securities took place in London. They are excluded, because the way in which these companies could contribute to local economic growth in Britain is unclear. The motivation follows that given in the first chapter, along with the similar line of reasoning in a study by Nieuwerburgh *et al.* on the historical economic impact of the Belgian stock market.⁸²

Figure 4.3 shows the paid-in capital of industrial and commercial companies on the 10 largest provincial stock exchanges from 1870 to 1913. The source of this data only lists where a given company's shares were 'chiefly traded'. This means it did not attach certain securities to markets where they were listed, but did not have active markets. Securities could be chiefly traded on several exchanges, and the data in the figure is not adjusted for this.

Figure 4.3 suggests that the markets for commercial and industrial shares experienced strong growth on most exchanges only from the 1880s or the 1890s onwards. Based on this observation, it is difficult to argue that these securities played an important role on most exchanges in the 1870s. In 1870, the combined paid-in capital of domestic industrial and commercial firms on provincial exchanges was about £45 million. Tax assessments on that year's profits from businesses and highly paid occupations in Lancashire alone (schedules D and E)

82. Stijn Van Nieuwerburgh, Frans Buelens and Ludo Cuyvers, 'Stock Market Development and Economic Growth in Belgium', *Explorations in Economic History* 43, no. 1 (2006): 13–38.

Figure 4.3: Paid-in capital of commercial and industrial companies on the main provincial exchanges, 1870-1913



Note: Data in 5-year intervals starting from 1870 for the sake of clarity, although data from 1913 is included. The figures include securities which are listed on multiple exchanges. Belfast did not have a formal stock exchange before 1897.

was about £27.5m.⁸³ We may therefore question the relevance of these exchanges for local growth before the 1880s. However, it should also be noted that before the 1890s, a substantial amount of activity on these exchanges took place in securities not included in the commercial and industrial category.⁸⁴

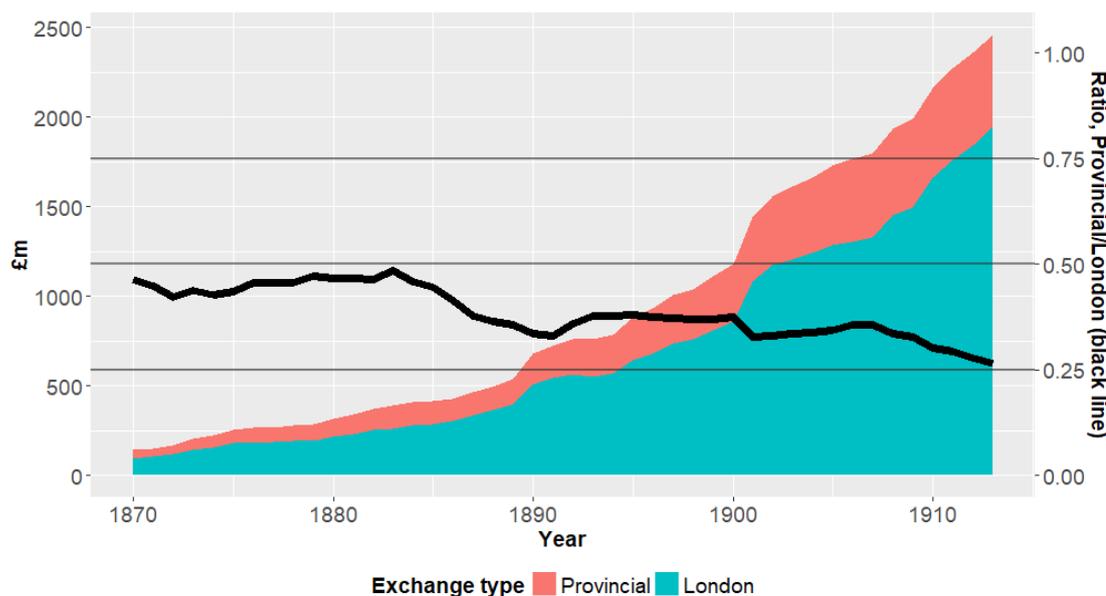
Figure 4.4 compares the paid-in capital of industrial and commercial securities on London and the Provincial Exchanges. The growth of the LSE was very substantial indeed, but provincial exchanges were by no means suddenly sidelined by it before 1913 when it came to domestic industrial securities. Nevertheless, their importance relative to London declined gradually. The paid-in capital of industrial and commercial securities on provincial exchanges was between 40 and 50% of that listed in London before 1885; 30 to 40% until 1910; and less than 30% subsequently. On the other hand, data on stockbrokers (discussed above) gives no

83. See previous chapter for discussion on tax schedules.

84. Sheffield Stock Exchange Monthly List, 1884-1914, SY583/B1/1-4, Records of the Sheffield Stock Exchange, Sheffield Archives. See also: Campbell, Rogers and Turner, 'Rise'.

indication of a relative decline: the ratio of stockbrokers in the provinces relative to London remained constant at around 0.2-0.25.⁸⁵

Figure 4.4: Paid-in capital of commercial and industrial companies on the London and provincial stock exchanges, 1870-1913



Note: The figures include securities which are listed on multiple exchanges. The black line is the ratio between provincial and London stock exchanges.

The membership data in section 4.3.1 also diverges from the paid-in capital series in some other respects. For example, the paid-in capital of Manchester's commercial and industrial companies was substantially larger than that of Liverpool, although Liverpool had more members. Of course, this might in part be due to deficiencies in the underlying data. But this divergence is more likely to be the result of differences in the features of these stock exchanges. Liverpool listed several railway, financial and even some overseas securities, which are excluded from my sample. Manchester did so to a much lesser extent.⁸⁶ More broadly, the divergence between the figures on membership and the paid-in capital in the 1870s and 1880s can be explained by similar factors: provincial stock exchanges tended to focus on provincial financial and infrastructure-related securities before commercial and industrial shares became listed to a greater extent in the 1890s.⁸⁷

85. See: figure 4.1.

86. Liverpool Stock Exchange, *The Centenary Book of the Liverpool Stock Exchange, 1836-1936* (Liverpool, 1936); Thomas, *Provincial*, 118-120.

87. Campbell, Rogers and Turner, 'Rise'.

4.4 Empirical Methodology and Results

This section consists of two parts. The first part shows that the number of provincial brokers did not matter for local economic growth in British counties. The second part is based on an empirical examination of new data on paid-in capital for a narrower sample of counties with large stock exchanges. The results indicate that provincial stock exchanges did not influence local economic growth.

4.4.1 The Role of Provincial Brokers

This section examines the link between provincial brokers (including brokers unaffiliated with exchanges) and local economic growth. As a proxy for county-level economic growth, I use income tax assessments per capita, used also in the previous chapter.⁸⁸ The results are derived using dynamic panel methods, which are also applied (and described) in the chapter above.⁸⁹ The approach mitigates the problem of endogeneity in the growth of stock markets. An obvious source of endogeneity is that areas with less active stock markets may have fewer promising firms, leading to less investor interest. Alternatively, a county may have had fewer brokers because its firms had less demand for external finance. These possibilities make it difficult to distinguish causality from correlation using simpler models.

Because the data on provincial brokers represents most British towns only from 1881 onwards, the regressions below use data from 1881 to 1911. In the sample, only 16 counties in England and Wales had more than 5 stock brokers in 1885. Only these counties are included in the first set of regressions on brokers and local tax assessments. Aside from stockbrokers, the data used in these regressions is as described in the previous chapter, summarised in table 3.1. The variable for the number of stockbrokers per capita in each county is defined as $\text{Ln}(\text{number of stockbrokers}/(\text{population} * 10^6))$.

As in the previous chapter, the dynamic panel regression equation is as follows:

88. See section 3.3.3 for a discussion.

89. See section 3.4.

$$\Delta y_{i,t} = \alpha + \mathbf{x}'_{i,t}\boldsymbol{\beta} + \gamma y_{i,t-1} + \mu_i + \lambda_t + \epsilon_{it} \quad (4.1)$$

$\Delta y_{i,t}$ is the growth of per capita income tax assessments in county i at time t . $\mathbf{x}_{i,t}$ includes: stock brokers per capita; banks per square kilometre; and the length of railways per square kilometre.

Columns 1 and 2 in table 4.3 report findings from fixed effects panel regressions (abbreviated as ‘OLS FE’), which do not account for endogeneity. The findings in these columns thus lack a causal interpretation, and the results are biased due to the inclusion of lagged dependent variables. The results reported in columns 3 and 4 are derived from models which correct for this issue using GMM estimation. In these models, the data is transformed into forward orthogonal deviations, and the matrix of instruments is collapsed to reduce small-sample bias.⁹⁰

The results in table 4.3 provide no evidence of stock market-led growth. The number of brokers correlated with county-level growth, as suggested by column 1. However, results in columns 3 and 4 show that the number of brokers did not have a causal impact on local growth. The sample here is truncated - we essentially test ‘how much do stock brokers matter for growth, *given* that a county already has 5 brokers at the start of the sample’. As a robustness check, it is worth examining stock markets and growth across all counties - even ones without brokers.

Table 4.4 displays regression results based on data from all counties in England and Wales, from 1881 onwards. Here, the number of brokers in counties without brokers in a given year has been set to 1. This exercise yields findings similar to those reported in table 4.3. There is now stronger evidence for correlation between the number of stockbrokers per capita and county-level growth (columns 1-2), but no evidence of causality (columns 3-4). However, one must keep in mind that we

90. David Roodman, ‘A Note on the Theme of Too Many Instruments’, *Oxford Bulletin of Economics and statistics* 71, no. 1 (2009): 135–158; Kazuhiko Hayakawa, ‘First Difference or Forward Orthogonal Deviation - Which Transformation should be Used in Dynamic Panel Data Models?: A Simulation Study’, *Economics Bulletin* 29, no. 3 (2009): 2008–2017; Manuel Arellano and Olympia Bover, ‘Another Look at the Instrumental Variable Estimation of Error-Components Models’, *Journal of Econometrics* 68, no. 1 (1995): 29–51.

Table 4.3: Stockbrokers and county-level economic growth. Regressions on data covering 16 counties in England and Wales, 1881-1911

	1	2	3	4
Brokers pc	0.023 (0.013)*	0.021 (0.015)	0.029 (0.039)	-0.026 (0.093)
Railways per sq km	0.061 (0.046)	0.039 (0.054)	0.080 (0.268)	0.953 (0.850)
Tax pc, lag 1	-0.060 (0.026)**	-0.064 (0.027)**	-0.088 (0.075)	-0.026 (0.093)
Banks per sq km		0.009 (0.014)		-0.280 (0.307)
Constant	-0.258 (0.203)	-0.156 (0.248)		
Hansen's J-statistic			7.83	9.17
p-value of J-statistic			0.166	0.164
Specification	OLS FE	OLS FE	GMM	GMM

The dependent variable is the growth in income tax assessments per capita. The data is in 5-year non-overlapping averages. Standard errors in parentheses. * and ** indicate p-values of the corresponding t-statistics of less than 0.1 and 0.05, respectively. The sample includes 16 counties in England and Wales. Columns 1-2 are results from fixed-effects panel regression, with heteroskedasticity-robust standard errors. Columns 3-4 are GMM regressions where the equation is transformed to forward orthogonal deviations. The instrument matrix, based on the explanatory variables, is collapsed and in backward orthogonal deviations. Windmeijer (2005) robust standard errors are reported for GMM estimators.

are dealing with data with a few gaps on the number stockbrokers in more rural counties, which can lower the reliability of the inference.

Expanding the sample to include Scottish counties provides still stronger evidence of correlation between the number of stock brokers and the growth of tax assessments per capita. These results are reported in table 4.5. But as with previous tables, the results do not indicate that this association was causal, as shown in columns 3 and 4.

Table 4.4: Stockbrokers and county-level economic growth. Regressions on data covering all counties in England and Wales from 1881 to 1911

	1	2	3	4
Brokers pc	0.019 (0.007)**	0.017 (0.007)**	0.004 (0.011)	0.003 (0.014)
Railways per sq km	0.083 (0.021)***	0.027 (0.031)	-0.049 (0.091)	-0.068 (0.184)
Tax pc, lag 1	-0.056 (0.011)***	-0.066 (0.011)***	0.082 (0.075)	0.058 (0.101)
Banks per sq km		0.021 (0.009)**		0.005 (0.032)
Constant	-0.349 (0.096)***	-0.111 (0.135)	0.106 (0.370)	0.225 (0.701)
Hansen's J-statistic			1.3	2.940
p-value of J-statistic			0.728	0.567
AR(2) test p-value			0.071	0.072
Specification	OLS FE	OLS FE	SGMM	SGMM

The dependent variable is the growth in income tax assessments per capita. Standard errors in parentheses. *, ** and *** indicate p-values of the corresponding t-statistics of less than 0.1, 0.05, and 0.01, respectively. Columns 1-2 are results from fixed-effects panel regression, with heteroskedasticity-robust standard errors. Columns 3-4 report System-GMM regressions with the first lags of dependent variables used as instruments. Windmeijer (2005) robust standard errors are reported for GMM estimators.

4.4.2 Provincial Exchanges and Growth

Did formal stock exchanges have different effects on local economies, beyond what markets composed of individual brokers had? This subsection focuses only on counties with significant stock exchanges. I define 'significant' exchanges as ones with at least £1 million of paid-in capital throughout 1870-1911, in securities not relating to railways, firms operating abroad, banks or insurance companies. I also add Warwickshire to the sample, where the paid-in capital of the Birmingham stock exchange crossed this threshold in the early 1870s. The econometric results are robust to the exclusion of this county. The criterion leaves us with 7 counties: Lanarkshire (Glasgow) and Edinburgh in Scotland; along with Lancashire; Northumberland; Gloucester; Warwickshire; and Yorkshire in England.

Table 4.5: Stockbrokers and county-level economic growth. Regressions on data covering all counties in Britain from 1881 to 1911

	1	2	3	4
Brokers pc	0.011 (0.004)***	0.010 (0.004)***	0.013 (0.014)	0.007 (0.008)
Railways per sq km	0.045 (0.014)***	0.031 (0.014)**	0.041 (0.048)	0.024 (0.059)
Tax pc, lag 1	-0.033 (0.007)***	-0.040 (0.008)***	0.084 (0.062)	0.032 (0.064)
Banks per sq km		0.015 (0.006)**		-0.031 (0.022)
Constant	-0.171 (0.060)***	-0.132 (0.057)	-0.340 (0.309)	-0.090 (0.408)
Hansen's J-statistic			2.810	2.120
p-value of J-statistic			0.423	0.347
AR(2) test p-value			0.293	0.077
Specification	OLS FE	OLS FE	SGMM	SGMM

Specifications are as in table 4.4.

There are advantages to focusing on large stock exchanges. First, it makes it possible to use annual data on paid-in capital, rather than data on stock exchange membership, to examine the economic role of provincial exchanges. Compared to the membership data, the higher annual variance in paid-in capital allows us to make better use of the time series dimension of the data. Second, these were the only places where a large volume of transactions in a wide variety of securities could take place. Third, the function of stockbrokers in smaller towns is somewhat ambiguous: to what extent did they support local capital markets versus channelling business to larger exchanges? Organised stock markets may therefore have differed significantly from informal stock markets in terms of their economic role.

The dynamic panel GMM methods used in the previous section are not applicable here given the smaller sample of counties. This is because the GMM estimators are mainly intended for cases where the number of cross-sectional observations relative to the time-dimension is large (i.e. large N, small T cases). These methods would yield very biased estimates in samples of less than 10 cross-

sectional units (counties).

An alternative approach is to make greater use of the time-dimension of the data. This can be done by working with tools from multiple time series econometrics applied to panel data, which make it possible to deal with endogeneity in a convenient way. The panel VAR approach has been used by several authors in the finance-growth literature.⁹¹ This chapter uses the Dumitrescu and Hurlin test for Granger-causality in heterogeneous panels.⁹² The intuition of this method is the same as for Granger-causality for individual time-series.⁹³ That is to say, if past information about stock markets helps predict subsequent economic growth, then stock markets are said to Granger-cause growth.

Paid-in capital divided by tax assessments is used as the indicator for stock market development. The data is in nominal terms, as deflating the data for each county with the same price index would introduce artificial co-movement between series pertaining to different counties. This would bias our results from models which take cross-sectional dependence into account. The results are also robust to using paid-in capital divided by a county's population as the indicator for stock markets.

The model on which the panel Granger-causality tests are based is constructed as follows. Let $Taxpc_{i,t}$ be the per capita income tax assessment in county i at time t , and $KtoTax_{i,t}$ be the paid-in capital on a county's stock exchanges divided by the county's income tax assessments.⁹⁴ Let $\mathbf{y}_{i,t} = [Taxpc_{i,t}, KtoTax_{i,t}]'$ be the vector of dependent variables. For each county $i = 1, 2, \dots, N$ we estimate the following vector autoregressive (VAR) model with ρ lags:

91. See, for example: Dimitris K Christopoulos and Efthymios G Tsionas, 'Financial Development and Economic Growth: Evidence from Panel Unit Root and Cointegration Tests', *Journal of Development Economics* 73, no. 1 (2004): 55–74; Inessa Love and Lea Zicchino, 'Financial Development and Dynamic Investment Behavior: Evidence from Panel VAR', *The Quarterly Review of Economics and Finance* 46, no. 2 (2006): 190–210; Nikolay Hristov, Oliver Hülsewig and Timo Wollmershäuser, 'Loan Supply Shocks During the Financial Crisis: Evidence for the Euro Area', *Journal of International Money and Finance* 31, no. 3 (2012): 569–592.

92. Elena-Ivona Dumitrescu and Christophe Hurlin, 'Testing for Granger Non-Causality in Heterogeneous Panels', *Economic Modelling* 29, no. 4 (2012): 1450–1460.

93. See section 1.5.1 in the first chapter.

94. The tax assessments are defined in section 3.3.3.

$$\mathbf{y}_{i,t} = \boldsymbol{\alpha}_{i,t} + \sum_{j=1}^{\rho} \mathbf{B}_{i,j} \mathbf{y}_{i,t-j} + \mathbf{u}_{i,t} \quad (4.2)$$

Where $\mathbf{B}_{i,j}$ is a 2×2 matrix of coefficients, $\boldsymbol{\alpha}_{i,t}$ is a corresponding vector of constants and $\mathbf{u}_{i,t}$ are the error terms. In system 4.2, the equation for taxes per capita can be written as follows:

$$Taxpc_{i,t} = a_{1,i,t} + \sum_{j=1}^{\rho} b_{11,i,j} Taxpc_{i,t-j} + \sum_{j=1}^{\rho} b_{12,i,j} KtoTax_{i,t-j} + u_{1,i,t} \quad (4.3)$$

Define $\mathbf{b}_{12,i} = [b_{12,i,1} \dots b_{12,i,\rho}]'$. This is the vector of coefficients for paid-in capital divided by taxes, that enters the equation for tax assessments per capita. If the coefficient is zero, for all lags and counties, then we say that *stock markets did not Granger-cause local income tax assessments*. This is the null hypothesis (H_0) of the causality test. The alternative hypothesis (H_1) is that stock markets Granger-caused tax assessments at least in *some* counties.

The hypotheses can be written more formally as follows. Let the number of counties in which Granger-causality does not exist be denoted by N_1 , and the total number of counties by N . Dumitrescu and Hurlin define the null hypothesis (H_0) and the alternative (H_1) as:

$$H_0 : \mathbf{b}_{12,i} = 0 \quad \forall i = 1, \dots, N \quad (4.4)$$

$$H_1 : \mathbf{b}_{12,i} = 0 \quad \forall i = 1, \dots, N_1 \quad (4.5)$$

$$\mathbf{b}_{12,i} \neq 0 \quad \forall i = N_1 + 1, N_1 + 2, \dots, N \quad (4.6)$$

Where \forall denotes ‘for all’. The null hypothesis says that we infer non-causality if paid-in capital could not predict tax assessments anywhere.

A distinct advantage of panel Granger-causality testing is that it has higher

statistical power relative to a test based on a single county. The likelihood of arriving at the correct inference is thus higher. The approach has seen widespread use in recent years, especially in the context of energy economics.⁹⁵ The Dumitrescu and Hurlin test allows for heterogeneity in the finance-growth relationships between counties, and has good small-sample properties.⁹⁶ According to the authors' results from Monte-Carlo simulations, the test has high power in samples similar to the one used here, where the number of cross-sectional units is larger than 5, and where the number of time periods is higher than 25.

Before testing for panel Granger-causality, it is necessary to test whether the time series have unit roots, or if they display explosive behaviour. When the cross-sectional dimension is small and the time-dimension of the panel is reasonably large, we can apply standard unit root tests for single time series.⁹⁷ Both the Augmented Dickey-Fuller and Phillips–Perron tests reject the null hypothesis of stationarity for all counties at a p-value below 0.05. Therefore, the data is converted into differences for the Dumitrescu and Hurlin test, which requires the series to be stationary.

The number of cross-sectional observations in the dataset limits the applicability of panel unit root tests. For example, the widely used test by Pesaran would have low power in a sample with less than 10 counties.⁹⁸ However, the Costantini and Lupi panel unit root test is applicable even in the present case.⁹⁹ This test does not reject the null hypothesis that the series have unit roots, yielding a p-value of 0.36 for the tax series and 0.39 for the paid-in capital series. The test is able to deal with potential correlation between the tax incomes or stock markets across various counties, thereby yielding more reliable results than standard unit root tests applied to individual counties. The result thus reinforces the need to

95. See, for example: Mita Bhattacharya *et al.*, 'The Effect of Renewable Energy Consumption on Economic Growth: Evidence from Top 38 Countries', *Applied Energy* 162 (2016): 733–741; Wendy N Cowan *et al.*, 'The Nexus of Electricity Consumption, Economic Growth and CO₂ Emissions in the BRICS Countries', *Energy Policy* 66 (2014): 359–368 and references therein.

96. Dumitrescu and Hurlin, 'Granger Non-Causality'.

97. Jörg Breitung and M Hashem Pesaran, 'Unit Roots and Cointegration in Panels', in *The Econometrics of Panel Data*, 3rd ed., ed. Mátyás Lázsló and Patrick Sevestre (Berlin: Springer, 2008), 279–322.

98. M Hashem Pesaran, 'A Simple Panel Unit Root Test in the Presence of Cross-Section Dependence', *Journal of Applied Econometrics* 22, no. 2 (2007): 265–312.

99. Mauro Costantini and Claudio Lupi, 'A Simple Panel-CADF Test for Unit Roots', *Oxford Bulletin of Economics and Statistics* 75, no. 2 (2013): 276–296.

use the data in differences for causality testing.

Testing for cointegration is also necessary before testing for causality. Cointegration implies a common long run equilibrium between tax assessments and paid-in capital, in which case modelling the processes as a vector error correction model (VECM) would be appropriate. The panel cointegration test by Pedroni does not provide strong evidence of cointegration.¹⁰⁰ The standardised panel ρ and Phillips-Perron statistics are both insignificant at the 10% level, indicating no cointegration.¹⁰¹ The VAR-based Granger-test outlined above is thus appropriate. Moreover, to make sure that the results are not driven by cointegration that the Pedroni test could not detect, models which allow for this feature are used for robustness testing.

Table 4.6 shows the results from Dumitrescu and Hurlin panel causality tests. If the test statistic is larger than the critical value, Granger-causality runs from one variable to another. Since the test statistics are well below the critical values, there is no causality at a statistically significant level. There is thus no evidence of provincial stock markets playing a significant role in local economic growth.

Table 4.6: Dumitrescu and Hurlin (2012) test for Granger-causality in panels

Test	Test statistic	Critical value (p<0.05)	Inference
Stock markets \rightarrow Tax	-1.621	3.801	No causality
Tax \rightarrow Stock markets	-1.677	3.801	No causality

The test statistic refers to the $Z_{N,T}^{Hnc}$ statistic in Dumitrescu and Hurlin (2012), equation 9. Critical values correspond to a p-value of 0.05.

An important robustness check for the results in table 4.6 is to factor in cross-sectional correlation when testing for Granger-causality in panels. If the growth of provincial exchanges (or economies) of different counties were intertwined, the results from the Dumitrescu and Hurlin test might be biased. Granger-causality testing in the presence of cross-sectional dependence can be performed by using

100. Peter Pedroni, 'Panel Cointegration: Asymptotic and Finite Sample Properties of Pooled Time Series Tests with an Application to the PPP Hypothesis', *Econometric theory* 20, no. 3 (2004): 597–625.

101. The ρ and PP test statistics are 0.12 and -0.20, respectively. Allowing a trend term to the test equations leads to even weaker evidence. For further details, see: Peter Pedroni, 'Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors', *Oxford Bulletin of Economics and statistics* 61, no. S1 (1999): 653–670.

the method by Emirmahmutoglu and Kose.¹⁰² Their bootstrap panel causality test builds upon the approach by Toda and Yamamoto by augmenting the VAR with additional lags, which improves the asymptotic properties of the test when variables have unit roots.¹⁰³ Besides being robust to nonstationary and cointegrated series, the panel causality test has the additional benefit of allowing the VAR equations for each county to have different lag lengths.¹⁰⁴

To fully account for potential cross-sectional dependence, Middlesex is included in the sample. This controls for the possibility that the growth of provincial exchanges was linked to the growth of the London stock exchange. Moreover, it helps factor in potential economic linkages between London and other counties. In this vein, allowing for cross sectional correlation makes the results more robust to spatial economic spillovers, whereby a significant source of potential omitted variable bias is controlled for.

Table 4.7 shows the result from Granger-causality tests allowing cross-sectional correlation. The test does not provide any evidence of finance-led growth, as the test statistics are below the critical values. These findings thus strengthen the conclusions drawn from the Dumitrescu-Hurlin test. The results are also robust to excluding Middlesex from the sample.

Table 4.7: Panel Granger-causality test for finance and growth, robust to cross-sectional correlation

Test	F-statistic	5% cr. val.	10% cr. val.	Inference
Stock markets \rightarrow Tax	17.114	32.489	28.359	No causality
Tax \rightarrow Stock markets	15.107	33.567	29.291	No causality

‘cr. val’ refers to critical value. Critical values are derived from 10,000 bootstrap replications using the methodology by Emirmahmutoglu and Kose (2011). For each county, the lag length is selected using the Akaike Information Criterion.

Did a provincial stock exchange foster economic growth in any individual county? This question can be answered by implementing a Toda-Yamamoto test

102. Furkan Emirmahmutoglu and Nezir Kose, ‘Testing for Granger Causality in Heterogeneous Mixed Panels’, *Economic Modelling* 28, no. 3 (2011): 870–876.

103. Hiro Y Toda and Taku Yamamoto, ‘Statistical Inference in Vector Autoregressions with Possibly Integrated Processes’, *Journal of Econometrics* 66, no. 1 (1995): 225–250.

104. Because of its robustness to nonstationary data, the series are not differenced for this test.

for each county.¹⁰⁵ Middlesex (London) has been added to the sample for the purposes of this test. The results in table 4.8 suggest that stock markets were not important for the economic growth of any county, except perhaps for Lancashire (home to the Manchester and Liverpool exchanges), for which the result is significant at the 5% level.¹⁰⁶

Table 4.8: Toda-Yamamoto tests for non-causality between local paid-in capital and tax assessments

Test	County	Chi-squared	p-value	Inference
Stock markets → Tax	Edinburgh	0.397	0.82	No causality
Tax → Stock markets	Edinburgh	4.265	0.119	No causality
Stock markets → Tax	Gloucester	2.001	0.157	No causality
Tax → Stock markets	Gloucester	0.004	0.950	No causality
Stock markets → Tax	Lanark	1.264	0.261	No causality
Tax → Stock markets	Lanark	0.37	0.543	No causality
Stock markets → Tax	Lancaster	4.298	0.038**	Causality
Tax → Stock markets	Lancaster	0.225	0.635	No causality
Stock markets → Tax	Middlesex	3.771	0.152	No causality
Tax → Stock markets	Middlesex	2.65	0.266	No causality
Stock markets → Tax	Northumberland	0.144	0.931	No causality
Tax → Stock markets	Northumberland	0.307	0.858	No causality
Stock markets → Tax	Warwick	2.698	0.61	No causality
Tax → Stock markets	Warwick	4.759	0.313	No causality
Stock markets → Tax	York	0.59	0.744	No causality
Tax → Stock markets	York	2.126	0.345	No causality

Because the data shown in the previous section suggests that the provincial exchanges experienced considerable growth only from the 1880s, all tests in this subsection have been repeated without data from the 1870s. The results based on a shorter dataset do not change significantly. As suggested above, the results are also robust to using paid-in capital per capita (as opposed to paid-in capital divided by tax assessments) as a proxy for stock market development.

105. Toda and Yamamoto, ‘Statistical Inference’.

106. The lag length was selected using the AIC for each county.

4.5 Discussion and Conclusion

This chapter is the first econometric study on the effects of British provincial stock markets on county-level economic growth. The empirical results are obtained using new data on local stockbrokers and paid-in capital of provincial exchanges. The findings indicate that the growth of local stock markets was not important for the economic development of British counties.

Results from panel regressions show that the number of local stockbrokers per capita correlated with the growth of local tax assessments. However, dynamic panel models suggest that the effect is not causal. Even when the sample is restricted to counties with potentially significant local markets, no evidence can be found of a causal impact of stock markets on local economic development.

Panel Granger-causality tests yield similar results. The growth of stock exchanges, as measured by paid-in capital divided by the income tax assessments in a given county, did not help predict the subsequent growth of per capita income tax assessments. The only exception to this finding is Lancashire, in which case there is some evidence of the stock exchanges helping the county develop economically. The Manchester and Liverpool stock exchanges were by far the largest provincial exchanges in England. It is thus possible that this was the only county (besides Middlesex) where capital markets were sufficiently large to have a significant impact on growth. Their ability to draw on a broader investor base also meant that these exchanges could support a large class of firms seeking to have their securities traded, whereas smaller provincial exchanges may have catered to a more limited set of companies.

How do these results compare with previous studies on provincial stock markets? Campbell *et al.* argue that provincial stock exchanges were an important source of capital for local companies.¹⁰⁷ Both Thomas and Michie made similar statements about their importance for local investment.¹⁰⁸ This remains a possibility, but the results of this chapter do not suggest that provincial stock exchanges were important or irreplaceable enough to make a substantial difference to local

107. Campbell, Rogers and Turner, 'Rise'.

108. Michie, *Money*, 234-235; Thomas, *Provincial*, 139-147.

economic outcomes. Indeed, Thomas also noted that the provincial exchanges' importance was lessened by the ease of raising capital privately through informal channels, although he provided little hard evidence to substantiate this claim.¹⁰⁹

In light of studies which demonstrate how information asymmetries arise due to geographic distance, the results are somewhat surprising. If investors were reluctant to invest in companies located far away, nearby stock markets should have served an important economic function. One might expect that the alleviation of financing constraints arising from geographic distance would have been particularly important in cases where companies grew large, and personal connections were no longer sufficient sources of finance.

Perhaps the most straightforward explanation for the insignificant economic impact of local stock markets is that county-level growth was driven by several more important factors. But with regards to capital markets, it is possible that many provincial exchanges were too small to make a meaningful contribution to local economic growth. Additionally, it is useful to consider the demand for the services offered by these exchanges. Companies benefiting the most from provincial exchanges were presumably ones which needed a significant amount of external capital, and could not raise it privately or from London at a low cost. In many counties, and for much of the period at issue, the size of this segment of firms might have been modest. Finally, although the extent to which firms and investors relied on informal channels for the raising and trading of capital is not precisely known, it is possible, as mentioned above, that informal capital markets were highly substitutable for the services provided by formal stock markets.¹¹⁰

Data in this chapter reinforces the view that provincial stock exchanges were generally rather inactive in the 1870s compared to subsequent decades. We should therefore not expect these to have played a large role in the 1870s or early 1880s. The membership of most exchanges more than doubled between the 1870s and the 1890s. The amount of capital raised by domestic industrial and commercial enterprises increased at an even faster pace, albeit from a low starting point. In this sense, their experience mirrors that of the LSE, where listings of domestic

109. Thomas, *Provincial*, 139-142.

110. Robert Cull *et al.*, 'Historical Financing of Small-and Medium-Size Enterprises', *Journal of Banking & Finance* 30, no. 11 (2006): 3017-3042.

industrial securities grew rapidly after the 1880s.¹¹¹

This chapter's results suggest several avenues for further research. Most obviously, better data on the trading activity on provincial stock markets would be helpful to better understand their evolution. It would also be useful to have aggregated measures of the functioning of informal financial markets in the provinces. For small businesses, to what extent was finance through personal connections a viable alternative to issuing shares to the public? Considerable uncertainty also exists about the role played by provincial stock brokers who were unaffiliated with stock exchanges. To what extent did they focus on trading securities of local companies?¹¹² Or did they merely act as conduits between local investors and larger stock exchanges?

111. See section 1.2.1.

112. We know that markets for local stocks formed in larger Scottish towns without exchanges, such as Dundee (where an exchange formed only in 1879) and Greenock. See: Michie, *Money*, 172-173.

Chapter 5

Merchant Bank Acceptances and the Economy, 1870-1913

Chapter Summary

This chapter examines the role of an important type of instrument in international trade financing - the merchant bank acceptance - in the British economy from 1870 to 1913. It contributes to British financial history in two ways. First, it presents a new dataset on merchant bank acceptances from 1870 to 1913. Second, it examines econometrically how acceptances were linked to British trade performance and economic growth. The results indicate that the growth of merchant banks acceptances had a significant positive impact not only on British trade, but also on the domestic economy. The British economy thus benefited from having London as a hub for global trade financing.

5.1 Introduction

International trade credit has been given little attention in economic history, and rigorous studies of its role in the British economy from 1870 to 1913 do not currently exist. More broadly, Bordo and Rousseau note how little attention has been given to the nexus between trade, finance and economic growth.¹ Based on primarily qualitative evidence, however, economic historians have argued that trade financing played a central role in the British financial system in the late 19th and early 20th centuries, and that it was linked closely to British international trade. Indeed, a key dimension of London's functioning as an international financial centre was its market for short-term funds, which in turn was connected tightly to trade financing.²

Payments related to long-distance trade in the 19th century were commonly

1. Michael D Bordo and Peter L Rousseau, 'Historical Evidence on the Finance-Trade-Growth Nexus', *Journal of Banking & Finance* 36, no. 4 (2012): 1236–1243.

2. Youssef Cassis, *Capitals of Capital: A History of International Financial Centres, 1780-2005* (Cambridge: Cambridge University Press, 2006), 61-62; Barry Eichengreen and Marc Flandreau, 'The Federal Reserve, the Bank of England, and the Rise of the Dollar as an International Currency, 1914–1939', *Open Economies Review* 23, no. 1 (2012): 57–87; Marc Flandreau and Stefano Ugolini, 'Where it All Began: Lending of Last Resort and the Bank of England During the Overend-Gurney Panic of 1866', nos. 2011/03 (2011).

settled using bills of exchange, which were documents acknowledging the debt of one party to another. Accepting a bill of exchange is the act of guaranteeing that a bill will be paid. This was primarily done by merchant banks, which would lend their reputation and accept a potential liability for a commission. Through having payment insurance from a third party, a bill became more secure and easier to discount on the money market - the market where short-term debt obligations were traded.³ In this way the accepted bill became a standardised and liquid financial instrument backed by a reputable financial institution. A seller of goods could receive immediate payment by selling an accepted bill, known as an acceptance, onwards.⁴

Merchant bank acceptances may have been important for enabling trade. In the 19th century, the slow movement of goods tied up a considerable amount of working capital of those buying and selling goods abroad, while problems with contract enforcement and information asymmetries were major obstacles for engaging in international transactions due to their inherent riskiness.⁵ Having reputable institutions guaranteeing payments could mitigate these problems. In a world without acceptances, an exporter of goods would be reluctant to send goods abroad before being certain of receiving a payment, whereas an importer would be reluctant to send a payment on credit without certainty of receiving the goods.⁶ Santarosa notes how having several endorsers for bills of exchange in 18th century France mitigated problems with adverse selection and moral hazard in long-distance trade, and thus made such transactions more likely.⁷ Nevertheless, the quality of the endorsers remained a significant source of risk until the emergence of merchant bankers.⁸

Through the mitigation of risk, acceptances expanded the markets for mer-

3. Stanley D Chapman, *The Rise of Merchant Banking* (London: Taylor & Francis, 1984), 6-7.

4. Eichengreen and Flandreau, 'Federal Reserve'. The seller's bank would commonly provide funds from a sale immediately in exchange for the accepted bill.

5. Mark Casson, 'The Economic Analysis of Multinational Trading Companies', in *Multinational Traders*, ed. Geoffrey Jones (London: Routledge, 1997), 16.

6. Erik Banks, *The Rise and Fall of the Merchant Banks* (London: Kogan Page, 1999), 48.

7. Veronica Aoki Santarosa, 'Financing Long-Distance Trade: The Joint Liability Rule and Bills of Exchange in Eighteenth-Century France', *The Journal of Economic History* 75, no. 03 (2015): 690-719.

8. Ibid.

chants: instead of confining activities to ports where they had trusted counterparts, they could use acceptances of prominent bankers to make purchases anywhere.⁹ Without reputable acceptors, it is reasonable to assume that the volume of British international trade would have been smaller, as payments on credit and transactions between strangers might have been less common. Indeed, firms routinely refused foreign orders entirely unless payments (via bills) were guaranteed by reputable merchant banks.¹⁰ An accepted bill, being easy to convert to cash, would also provide the exporter with the working capital required for long-distance trade.¹¹

Another interesting dimension of acceptances was their role in the financial system. Before maturity, accepted bills could be bought by financial institutions such as discount houses, which would provide most of the liquidity to the bill market.¹² Discount houses were analogous to money market funds today.¹³ These houses invested short-term funds (deposits) from other financial institutions - call money - into bills, and they could also resell the bills to British or foreign commercial banks.¹⁴

It was the liquidity of the London money market that made acceptances of the leading merchant banks near-cash assets, which could be readily used for international business transactions.¹⁵ When high quality bills did not find buyers on the money market during periods of financial stress, they could be offloaded at the Bank of England at the Bank's discount rate, or be posted as collateral against the Bank's advances.¹⁶ Indeed, as they were cash substitutes, operations

9. Edwin J Perkins, *Financing Anglo-American Trade: The House of Brown, 1800-1880* (Cambridge, MA: Harvard University Press, 1975), 9-11.

10. Chapman, *Rise*, 6-7.

11. Manuel Llorca-Jaña, 'Shaping Globalization: London's Merchant Bankers in the Early Nineteenth Century', *Business History Review* 88, no. 03 (2014): 469-495. The exporter's bank could make an immediate payment against an acceptance related to a given transaction.

12. Lance E Davis and Robert E Gallman, *Evolving Financial Markets and International Capital Flows: Britain, the Americas, and Australia, 1865-1914* (Cambridge: Cambridge University Press, 2001), 129-131.

13. Flandreau and Ugolini, 'Where it all Began'.

14. Youssef Cassis, *Crises and Opportunities: The Shaping of Modern Finance* (Oxford: Oxford University Press, 2011), 19.

15. Wilfred T C King, *History of the London Discount Market* (London: Routledge, 1936), 264; Davis and Gallman, *Evolving Financial Markets*, 129-131.

16. Eichengreen and Flandreau, 'Federal Reserve'.

using these bills were a central aspect of the Bank's policy.¹⁷ They were 'the ultimate liquid asset' of the time.¹⁸

It was largely through acceptances, along with bills unconnected to goods trade, that the London discount market functioned as the primary destination for the world's short-term funds.¹⁹ Having London as an outlet for short-term funds, in turn, was important for British commercial banks, which were concerned with investing a portion of their surplus funds into relatively liquid and secure assets.²⁰ Foreign financial institutions would also channel their funds to this market for similar purposes.²¹ While the market for London bills was becoming more international, London acceptances themselves were also increasingly used for financing non-British trade. Before the Federal Reserve was established in 1913, it was typical for US banks to help their customers with acceptance finance through London correspondents.²²

The importance of acceptances was recognised by contemporaries. In the early 1900s, several policymakers and observers working with the US National Monetary Commission saw the acceptance as central to the success of the British money market. They considered the volume and liquidity of the acceptances, together with the central bank's willingness to provide additional liquidity by rediscounting bills during problematic times, to have been an important contributor to British financial stability.²³ The Federal Reserve made substantial efforts to make the dollar acceptance competitive, but such trade credit only became prevalent after WW1.²⁴ Britain had built a substantial head start, and Cassis argues that a significant factor in making London a global centre for trade credit originated from

17. Stefano Ugolini, 'Liquidity Management and Central Bank Strength: Bank of England Operations Reloaded, 1889-1910', *Norges Bank Working Paper*, no. 10 (2016).

18. Nicholas Dimsdale and Anthony Hotson, 'Financial Crises and Economic Activity in the UK Since 1825', in *British Financial Crises Since 1825*, ed. Nicholas Dimsdale and Anthony Hotson (Oxford: Oxford University Press, 2014), 47.

19. Cassis, *Capitals*, 100.

20. Michael Collins and Mae Baker, *Commercial Banks and Industrial Finance in England and Wales, 1860-1913* (Oxford: Oxford University Press, 2003), 62-68, 74-76; Michael Collins, 'English Bank Lending and the Financial Crisis of the 1870s', *Business History* 32, no. 2 (1990): 198-224.

21. Charles A E Goodhart, *The Business of Banking, 1891-1914* (London: Weidenfeld / Nicolson, 1972), 218.

22. Eichengreen and Flandreau, 'Federal Reserve'.

23. Flandreau and Ugolini, 'Where it all Began'.

24. Eichengreen and Flandreau, 'Federal Reserve'.

Britain's primacy in world trade, and from the associated demand for trade finance that came from it.²⁵

This chapter presents a new dataset on acceptances from leading merchant banks at a yearly and monthly frequency from 1870 to 1913. It allows us to gain a clearer picture of the evolution of the industry from the 1870s onward. New data from a contemporary discount house provides further evidence of the importance of merchant bank acceptances for the London money market. Furthermore, this is the first study to use time series econometrics to explore the role of acceptances in the prewar British economy. The empirical results show that acceptances were not only important for British trade, but that they also influenced the growth of the domestic economy. This could have been due to substantial spillovers from the traded sector to the rest of the economy, or due to acceptances being used as a bank credit substitute for a subset of firms, thus alleviating credit constraints in the economy more broadly. Additionally, acceptances retained their economic importance, even though they were used increasingly to finance non-British trade.

5.2 The Macroeconomics of Trade Credit

While there are several differences between trade finance today and in the 19th century, there is no doubt that firms still rely extensively on financial institutions for the provision of trade credit insurance. Moreover, sales on credit are still predominant in transactions between firms. As in the 19th century, acceptance-like instruments are used by firms to insure themselves against the credit risk of their customers, a risk which they may not be able to assess in full.²⁶

Beginning with the seminal contribution of Meltzer, research has shown that trade credit can be used as a substitute for bank credit.²⁷ This is the case especially when there are constraints on bank finance, or if a country's banking system

25. Cassis, *Capitals*, 61.

26. Mary Amiti and David E Weinstein, 'Exports and Financial Shocks', *The Quarterly Journal of Economics* 126, no. 4 (2011): 1841–1877.

27. Allan H Meltzer, 'Mercantile Credit, Monetary Policy, and Size of Firms', *The Review of Economics and Statistics*, 1960, 429–437; Mitchell A Petersen and Raghuram G Rajan, 'Trade Credit: Theories and Evidence', *Review of Financial Studies* 10, no. 3 (1997): 661–691.

is not well-developed.²⁸ Trade credit can thus be used to alleviate tight credit conditions, and its use allows well-resourced firms to make funds available for credit constrained companies.²⁹

The phenomenon of substituting trade credit for other types of finance is also relevant in a historical setting. For example, Deloof's and van Overfelt's study of Belgian firms in 1905-1909 shows that trade credit was a means for firms with better access to bank financing to transfer credit to firms with weaker bank relationships.³⁰ In the context of early 19th century Britain, Collins argues that more domestic trade credit was issued when money market conditions were tight.³¹ Trade financing may thus have reduced credit constraints already before WW1.

Trade credit can be easier to obtain than bank credit, because suppliers of trade credit have better information about their customers due to the higher frequency of transactions.³² Additionally, it is difficult for a borrower to use inputs bought on trade credit (such as machinery or raw materials) irresponsibly, whereas it would be easy to divert cash from a bank loan. The supplier of trade credit can thus be more confident of being repaid.³³ Trade credit may also be extended because a seller can find it much easier to liquidate goods covered by a trade credit agreement (in case of default) than a bank would.³⁴ This was probably an advantage of 19th century merchant banks. They often retained a small side-business of buying and

28. Mike Burkart and Tore Ellingsen, 'In-Kind Finance: A Theory of Trade Credit', *American Economic Review*, 2004, 569-590; Inessa Love, Lorenzo A Preve and Virginia Sarria-Allende, 'Trade Credit and Bank Credit: Evidence from Recent Financial Crises', *Journal of Financial Economics* 83, no. 2 (2007): 453-469; Raymond Fisman and Inessa Love, 'Trade Credit, Financial Intermediary Development, and Industry Growth', *The Journal of Finance* 58, no. 1 (2003): 353-374.

29. Simona Mateut, Spiros Bougheas and Paul Mizen, 'Trade Credit, Bank Lending and Monetary Policy Transmission', *European Economic Review* 50, no. 3 (2006): 603-629; Eddie Casey and Conor M O'Toole, 'Bank Lending Constraints, Trade Credit and Alternative Financing During the Financial Crisis: Evidence from European SMEs', *Journal of Corporate Finance* 27 (2014): 173-193.

30. Marc Deloof and Wouter Van Overfelt, 'Trade Credit and Bank Relationships: Evidence from Pre-World War I Belgium', *Applied Economics* 43, no. 13 (2011): 1647-1655.

31. Michael Collins, 'Monetary Policy and the Supply of Trade Credit, 1830-1844', *Economica*, 1978, 379-389.

32. Bruno Biais and Christian Gollier, 'Trade Credit and Credit Rationing', *Review of Financial Studies* 10, no. 4 (1997): 903-937.

33. Burkart and Ellingsen, 'In-Kind Finance'.

34. Daniela Fabbri and Anna Maria C Menichini, 'Trade Credit, Collateral Liquidation, and Borrowing Constraints', *Journal of Financial Economics* 96, no. 3 (2010): 413-432.

selling commodities, which made it easier to liquidate goods used as collateral if their customers defaulted.³⁵

The literature discussed above implies that firms can rely on trade credit as a form of working capital. Fluctuations in the extension of trade credit could thus affect the performance of exporting industries, and of industries which are highly reliant on imported intermediate goods. Moreover, if trade credit is substitutable for bank credit, increased availability of trade finance may lead to lower costs of capital for firms in general. However, the extension of international trade credit, and the benefits that come with it, are often conditional on having credit insurance for default risk. This is typically the part in the trade credit issuing process in which financial institutions play an important role.³⁶ Recent research shows that the availability of export credit insurance has a significant positive impact on firm-level export performance.³⁷ The use of trade credit insurance is especially prevalent when exporting to riskier destinations, and when macroeconomic risks make trading partners less likely to repay their debts.³⁸

The link between credit conditions and exports was highlighted during the financial crisis in 2007-2009. Sectors in which the need for trade credit and external finance were the greatest saw the largest drops in exports during the ‘credit crunch’.³⁹ In this environment, firms demanded an increasing amount of contracts from banks to guarantee their trade credits.⁴⁰ But the health and development of the financial sector largely dictates the extent to which it can support importers or exporters. Manova demonstrates this by showing that credit constrained firms are both less likely to export, and export smaller quantities.⁴¹ Amidst the crisis, fin-

35. Richard Roberts, *Schroders: Merchants & Bankers* (Basingstoke: Macmillan, 1992), 90-94.

36. Irena Asmundson *et al.*, ‘Trade and Trade Finance in the 2008-09 Financial Crisis’, *IMF Working Papers*, 2011, 1–65.

37. Harald Badinger and Thomas Url, ‘Export Credit Guarantees and Export Performance: Evidence from Austrian Firm-Level Data’, *The World Economy* 36, no. 9 (2013): 1115–1130; Gabriel J Felbermayr and Erdal Yalcin, ‘Export Credit Guarantees and Export Performance: An Empirical Analysis for Germany’, *The World Economy* 36, no. 8 (2013): 967–999.

38. Friederike Niepmann and Tim Schmidt-Eisenlohr, ‘International Trade, Risk and the Role of Banks’, *Journal of International Economics* 107 (2017): 111–126.

39. Davin Chor and Kalina Manova, ‘Off the Cliff and Back? Credit Conditions and International Trade During the Global Financial Crisis’, *Journal of International Economics* 87, no. 1 (2012): 117–133.

40. Niepmann and Schmidt-Eisenlohr, ‘International Trade, Risk and the Role of Banks’.

41. Kalina Manova, ‘Credit Constraints, Heterogeneous Firms, and International Trade’, *The Review of Economic Studies* 80, no. 2 (2013): 711–744.

ancial institutions cut their trade financing activities, which ultimately compelled OECD governments to increase the provision of public export credit insurance.⁴²

5.3 The Merchant Bank Acceptance Business in 1870-1913

Despite the potential relevance of acceptances for the economy and financial system in Britain in 1870-1913, very little empirical research exists on these links. Acceptances tend also to attract little attention in the business historical literature on merchant banking in this period. This is surprising, given that this was a central component of the typical merchant bank's business.⁴³ Instead, these historical accounts tend to focus on the more glamorous aspects of merchant banks, such as their involvement with issuing government and railway bonds, or with the politics of the time, or the collective biographies of the owning families.⁴⁴ Chapman's work remains perhaps the most authoritative book on the merchant banking industry as a whole, but even here, the discussion on acceptances is overshadowed by a focus on debt issues.⁴⁵

The literature on merchant banking for the years 1870-1913 pays even less attention to the industry's links with the money markets and the financial system. As noted above, acceptances were a popular form of short-term investment among financial institutions. Cassis argues that these bills were at the *centre* of the London money market.⁴⁶ The discount market linked the merchant banks to the commercial banks, which invested in acceptances either directly or through

42. Pamela Blackmon, 'OECD Export Credit Agencies: Supplementing Short-Term Export Credit Insurance During the 2008 Financial Crisis', *The International Trade Journal* 30, no. 4 (2016): 295–318.

43. Work by Perkins is an important exception. See: Perkins, *Financing*.

44. On some of the most prominent families and banks, see: Joseph Wechsberg, *The Merchant Bankers* (New York: Bedminster Press, 1966). For histories of individual banks, see, for example: Roberts, *Schroders*; Jehanne Wake, *Kleinwort Benson: The History of Two Families in Banking* (Oxford: Oxford University Press, 1997); Roger Fulford, *Glyn's, 1753-1953: Six Generations in Lombard Street* (London: Macmillan, 1953); Niall Ferguson, *The House of Rothschild: Volume 2: The World's Banker: 1849-1999* (London: Penguin, 2000).

45. Chapman, *Rise*.

46. Cassis, *Capitals*, 84-86.

discount houses. Banks goes even as far as maintaining that the increase in bank lending, especially against bills of exchange as collateral, could create instability in the financial system whenever there was a disruption in the bill market.⁴⁷ Indeed, Accominotti has recently shown that there was a link between acceptances and credit conditions in the UK in the interwar period, when the relative importance of merchant banks in this field had already begun to decline.⁴⁸

The activities of merchant banks can be divided into two main functions: trade credit (acceptances) and the issues of financial securities (such as government bonds). However, there were differences between merchant banks in terms of how much weight they would put on either of these areas. Moreover, some of these institutions dealt in insurance, commodities trade, foreign exchange, securities brokerage, and other areas more typical of modern investment banks.⁴⁹ Yet, most of these firms had similar origins. Merchant banks evolved typically from merchant houses - which traded goods - to firms which focused on international finance.⁵⁰ Having developed networks of contacts through their trading activities, they would be in an advantageous position when deciding whether to guarantee a payment between two distant parties trading with each other. Furthermore, they would often be familiar with the markets of the goods that were traded by their customers.⁵¹

The London acceptance market grew at a rapid pace in the late 1800s, with the volume of acceptances increasing from an estimated figure of £60 million in 1875 to about £140 million in 1913.⁵² Acceptance facilities obviously arise in response to a demand for them. It follows that it is reasonable to posit that the growth of

47. Banks, *Rise*, 43. The second chapter of this thesis raises certain doubts about this claim, while acknowledging that a more in-depth study about this subject is required.

48. Olivier Accominotti, 'London Merchant Banks, the Central European Panic, and the Sterling Crisis of 1931', *The Journal of Economic History* 72, no. 01 (2012): 1-43. Some caution is necessary when trying to relate his results to my thesis, because the shock of 1931 was presumably much bigger than ordinary trade credit fluctuations, as the July moratorium put a stop on all credit payments by German customers.

49. Chapman, *Rise*, 57; Kathleen Burk, *Morgan Grenfell 1838-1988: The Biography of a Merchant Bank* (Oxford: Oxford University Press, 1989), 48-52. Indeed, many merchant banks either became, or were absorbed by, investment banks or investment management firms in the post-WW2 era.

50. Banks, *Rise*, 58-90.

51. *Ibid.*, 48, 53.

52. Cassis, *Capitals*, 85-87.

acceptances simply followed the expansion of trade. But there are several reasons to believe that at least in the short term, there were constraints on the supply of acceptances. Merchant banks habitually turned away customers due to their perceived riskiness.⁵³ For example, the Kleinworts appear to have closed even significant accounts because of mildly unfavourable reports from their agents.⁵⁴ Brown, Shipley & Co. rejected almost any account whose business seemed 'speculative', no matter what collateral they could offer.⁵⁵ Additionally, most banks spread their risk exposure by preferring to have many smaller acceptance accounts to a few large ones, thus constraining the amount of acceptances issued to any one customer.⁵⁶

A further factor constraining the supply of acceptances results from the fact that merchant banks were private partnerships (with the exception of Baring after 1890). The capital base of these banks was not stable, as partners died or withdrew funds. Because banks wanted to avoid having excessive ratios of acceptances to capital, capital withdrawals were often followed by reductions in acceptances.⁵⁷ And these capital withdrawals constituted an important driver of fluctuations in acceptances, especially over the short term.⁵⁸ For example, a nearly 50% contraction of Schroder's acceptances in 1877-1883 was, to a significant extent, due to a substantial withdrawal of capital from the firm after a partner died.⁵⁹ Similarly, Rothschild's acceptances fell by nearly 75% in a year in 1878, when a considerable amount of capital was withdrawn, while the partners tried to maintain a steady ratio of acceptance liabilities to capital.⁶⁰

Although an under supplied market might have led to more entrants vying for this business, the structure of the acceptance market constrained entry. Payment insurance would have been useless unless the seller of the goods had confidence in the insurer, so new accepting houses needed time to build their reputations. A further barrier to entry was the need to build networks of international contacts, through which information on the creditworthiness of customers could be

53. Perkins, *Financing*, 130-133.

54. Wake, *Kleinwort Benson*, 118-119.

55. Perkins, *Financing*, 130-133.

56. *Ibid.*, 145-146; Roberts, *Schroders*, 46-48.

57. Wake, *Kleinwort Benson*, 123-128.

58. Banks, *Rise*, 156.

59. Roberts, *Schroders*, 82, 110-111.

60. Capital and Profit & Loss Accounts, 1876-1884, 000/77, boxes 3 and 4, Records of N M Rothschild & Sons, Rothschild Archive, London.

gathered.⁶¹ For example, Baring Brothers, a leading merchant bank, had over 1200 correspondents around the world already in the 1850s.⁶²

The lack of the overseas contacts needed for effective risk management made the business unappealing to several contemporary commercial bankers, before they could better rely on modern communications.⁶³ British overseas banks proved able to enter this business with relative ease in the somewhat narrow context of new colonies. Yet, it was only around the turn of the century that domestic commercial banks made significant inroads into the global acceptance business.⁶⁴ Merchant houses engaged in the goods trade also granted acceptances for a narrow range of customers, but compared to merchant banks, the extent of their activities were minuscule.⁶⁵ Even at the eve of the First World War, London-based merchant banks held an estimated 70% of this market in Britain.⁶⁶ Indeed, still in 1931, when the role of accepting houses had declined meaningfully, the Committee on Finance and Industry reported:

In contrast with most other countries, the function of accepting and discounting bills of exchange is very largely performed in this country by highly specialised firms [merchant banks] and companies instead of by the commercial banks, although the latter do a not unimportant share of the business.⁶⁷

Reputation mattered greatly for merchant banks. Not only was it important so that exporters of goods would feel confident about being eventually paid, but also in relation to the re-saleability of bills on the discount market. The bills of the most reputable houses could be sold at the best rates on the money market, whereas a premium was demanded for bills from acceptors that the market deemed less safe. Whereas the banks did not typically publish accounts, they had to avoid flooding

61. Banks, *Rise*, 46. See also: Olivier Accominotti, 'International Banking and Transmission of the 1931 Financial Crisis', *CEPR Discussion Papers*, no. 11651 (2016) on a discussion on these points.

62. Chapman, *Rise*, 30-31.

63. William M Scammell, *The London Discount Market* (London: Elek, 1968), 30; Cassis, *Capitals*, 19-20.

64. Some German and French joint-stock banks had gained a modest market share already in the 1890s.

65. Cassis, *Capitals*, 89.

66. Chapman, *Rise*, 105-7, 209.

67. Macmillan Committee, *Report of the Committee on Finance and Industry*, Cmnd. 3897, 1931, 40.

the money market with bills they had accepted. This meant keeping their acceptances to capital ratios at sufficiently low levels. A common benchmark for this ratio, that several houses adhered to, was 4:1.⁶⁸ Major and noticeable deviations from these standards had repercussions on the discount market. For example, the Kleinworts' were forced to temporarily reduce their outstanding acceptances in 1907 after several discount houses stopped buying the firm's bills.⁶⁹

The discussion on the constraints affecting the supply of acceptances serves to motivate the subsequent econometric analysis. If the supply of acceptances deviated significantly from the demand for them, it should be easier to ascertain whether fluctuations in acceptances had implications for British trade or economic performance at large.

5.4 Observations from the Data

This chapter contributes new data on the outstanding acceptance credit of large merchant banks from 1870 to 1913. The accounts of the most important merchant banks have survived, but those of several smaller houses have not. However, the acceptance business was highly concentrated, so the data covers a significant share of total outstanding acceptances. Therefore, the data should be especially representative when looking at fluctuations rather than at the absolute size of the market.

My data on acceptances builds upon work by Chapman.⁷⁰ Chapman collected yearly data on the acceptances of 7 merchant banks from 1890 to 1914.⁷¹ The series presented here runs from 1870 to 1913, it covers 9 banks, and is at a monthly frequency for the period 1870-1913 for 7 of the banks. From 1880 to 1913, the monthly data contains some gaps for the two remaining banks, which have been interpolated at a monthly frequency using estimates described in section 5.4.2. Higher frequency data is important for formal hypothesis testing, because accept-

68. Wake, *Kleinwort Benson*, 124-125.

69. Ibid.

70. Chapman, *Rise*.

71. Yearly acceptance data from an earlier period is collected for Schrodgers by: Roberts, *Schrodgers*; and for Kleinwort by: Wake, *Kleinwort Benson*.

ances typically had a three or four month maturity. One would therefore expect yearly data to hide several short-term fluctuations in this business. The data also corrects for a few errors contained in Chapman's series. Namely, his figures for the William Brandt's Sons & Co. merchant bank are wrong.⁷²

There is no way to estimate accurately the precise representativeness of the sample, because we do not know the amount of outstanding acceptances on bills related to the goods trade. An often cited figure for the amount of outstanding acceptances in 1913 is £140 million, which comes from Robert Kindersley, who was a director of a merchant bank in the 1930s.⁷³ According to this figure, my sample would cover approximately 40% of the market. Yet the £140m figure is a very rough approximation: Kindersley was 'told this on what [he] believe[d] to be very good authority', without elaborating further.⁷⁴ Subsection 5.4.3 provides further evidence in support of the representativeness of the sample. Including data from a number of commercial and overseas banks might improve the sample's coverage, but not greatly, given that merchant banks held an estimated 70% of the acceptance market in 1913.⁷⁵

The reason for focusing exclusively on merchant banks is simple: they were concerned with financing trade rather than accepting purely financial bills. Acceptances by large joint-stock banks, on the other hand, were often against securities, and did not play the same role in the money market or the economy. These 'finance bills' lacked several features that made acceptances attractive: self-liquidation, goods as collateral, and the eligibility for discount at the Bank of England.⁷⁶ Consequently, finance bills were riskier, and were not considered appropriate for merchant banks to deal in.⁷⁷ If one were to be completely indiscriminate about what types of bills to add to the sample, an appropriate approach would probably be to use stamp duty records, which record duties collected on any types

72. Chapman's figures represent the amount of new acceptances that Brandt granted in December of each year, instead of the amount of bills the house had outstanding.

73. Macmillan Committee, *Report of the Committee on Finance and Industry, Minutes of Evidence*, Cmnd. 3897, 1931, Q. 1273.

74. *Ibid.*

75. Chapman, *Rise*, 105–7, 209.

76. Cassis, *Capitals*, 86.

77. Wake, *Kleinwort Benson*, 125–127.

of bills. This is the approach taken by Nishimura.⁷⁸ However, Nishimura himself suggests that to understand the market for bills related to foreign trade, a study of the records of merchant banks would be fruitful.⁷⁹

Limiting the acceptance data to merchant bank accounts does introduce a certain bias, because their operations in British colonies and dominions were less significant than they were, for example, in Latin America, continental Europe or the US. Trade in colonies such as Australia, New Zealand and Canada was often financed by British overseas banks.⁸⁰ The problem with adding colonial banks to the sample is largely the same as with adding commercial banks: their acceptance figures may include a considerable amount of finance bills, which would lead to a new source of bias.

5.4.1 Merchant Bank Accounts

Figure 5.1 plots the acceptances on the balance sheets of the merchant banks in the sample at the end of each year from 1870 to 1913. There are several apparent breaks in the series, such as a drop in 1878, the Baring crisis 1890 (which was preceded by a substantial growth in Baring's acceptances), and a sharp increase in 1904-1906. These will be discussed briefly below.

Baring was clearly the dominant accepting house by a large margin until 1890. After the Baring crisis of 1890, when the bank nearly failed and had to be rescued, Schroder and Kleinwort expanded aggressively and captured a large share of the market.⁸¹ However, Baring still remained an important acceptor until WW1, and the volume of its business grew significantly in the early 20th century. It appears that no bank in the sample made up for Baring's decline instantly, and that it took several years for the industry to compensate for the shock to the market for acceptances that arose from the firm's near collapse.

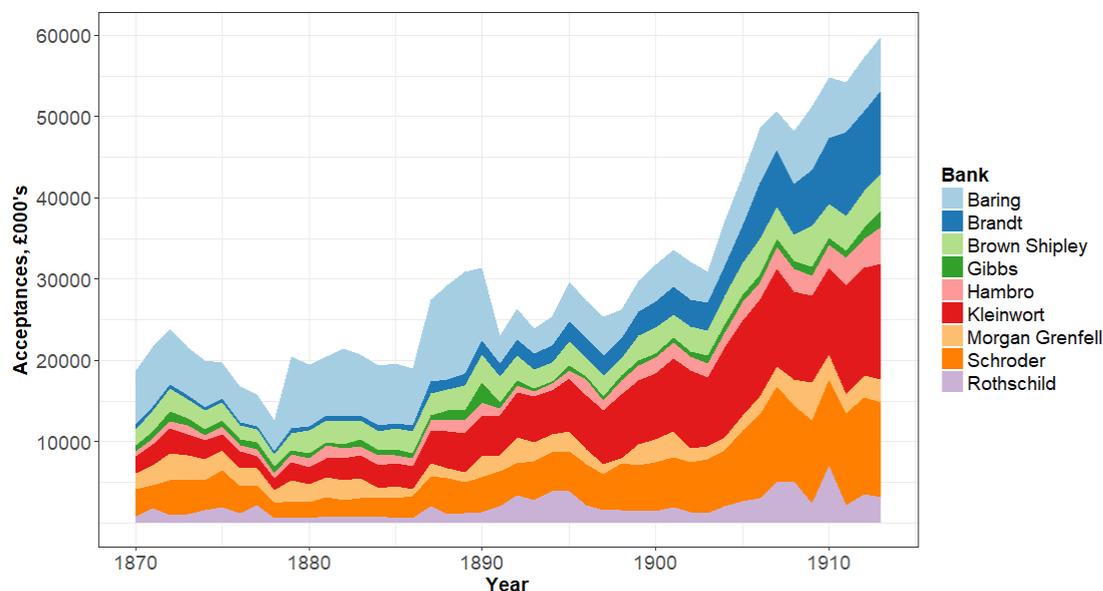
78. Shizuya Nishimura, *The Decline of Inland Bills of Exchange in the London Money Market, 1855-1913* (Cambridge: Cambridge University Press, 1971).

79. *Ibid.*, 18.

80. Geoffrey Jones, *British Multinational Banking, 1830-1990* (Oxford: Oxford University Press, 1995), 16-17.

81. Banks, *Rise*, 202-204.

Figure 5.1: Acceptances of merchant banks in the sample, 1870-1913



Sources: see appendix 5.A.1.

From a business historical perspective, it is also interesting to note how another Anglo-German house alongside Kleinwort and Schroder, W.M. Brandt's Sons & Co., became one of the largest accepting houses in the early 1900s. To the best of my knowledge, the rise of this house has not been documented properly in the literature on merchant banking. As noted above, the figures provided by Chapman on this bank's acceptances are wrong.⁸²

Growth in merchant bank acceptances appears to have been slow until the early 1890s, when the business began to expand at a rapid pace. The upper panel of figure 5.2 shows that until the early 1900s, the growth of acceptances is not entirely dissimilar to that of British trade. After 1900, these similarities break down, with the growth of the volume of outstanding acceptances far outpacing that of trade. Roberts argues that while the expansion of British trade may have contributed to this growth in the acceptance business, the main impetus for the expansion came from the growth of the world economy, and the consequent increase in non-British trade.⁸³ For example, 45% of Schroder's acceptance revenues in

82. They consist of the amount of new acceptances in December of each year, rather than the outstanding amount. See: Chapman, *Rise*, 121, 208.

83. Roberts, *Schroders*, 115.

1900-1910 came from its US operations, although the acceptances were discounted in London.⁸⁴ However, figure 5.1 indicates that it is difficult to generalise Roberts' argument to all banks, as some houses were better able to capitalise on the business opportunities created by the expansion trade. The acceptances of Brown, Shipley & Co., a prominent Anglo-American house, appear to have stagnated in 1880-1913, despite the rapid growth of US trade.⁸⁵ The same appears to hold true for Morgan Grenfell & Co., which was another firm with strong links to the US.⁸⁶

A comparison of the series on acceptances with data on world trade does not provide clear support for the notion that the growth of acceptances was driven by the growth of world trade. Using the estimates of Lewis and Yeats on world trade, the lower panel of figure 5.2 suggests that whereas world trade more than quadrupled in value from 1870 to 1914, the volume of acceptances only tripled.⁸⁷ There are confounding factors, besides a possible bias in my data, which could help explain this disparity. For example, alternative ways to finance trade, such as cheque payments via telegraph, may have grown faster than acceptances, or the entry of firms other than merchant banks into the business of accepting bills might progressively have lessened the correlation between world trade and the acceptance series.

The 1878 Crisis

The first significant drop in the acceptance series (plotted in figures 5.1 and 5.2) appears around 1877-1879. The literature on merchant banking is largely silent on this episode, although the acceptances of nearly all the merchant banks in the sample declined in 1877-78 and then jumped sharply from 1878 to 1879. Nevertheless, the severity of the decline of acceptances varied significantly by bank. Schroder's and Hambro's acceptances declined by more than 30%. Rothschild's acceptances contracted by over 70%, from roughly £2.2 million in 1877 to £0.6

84. Ibid., 129.

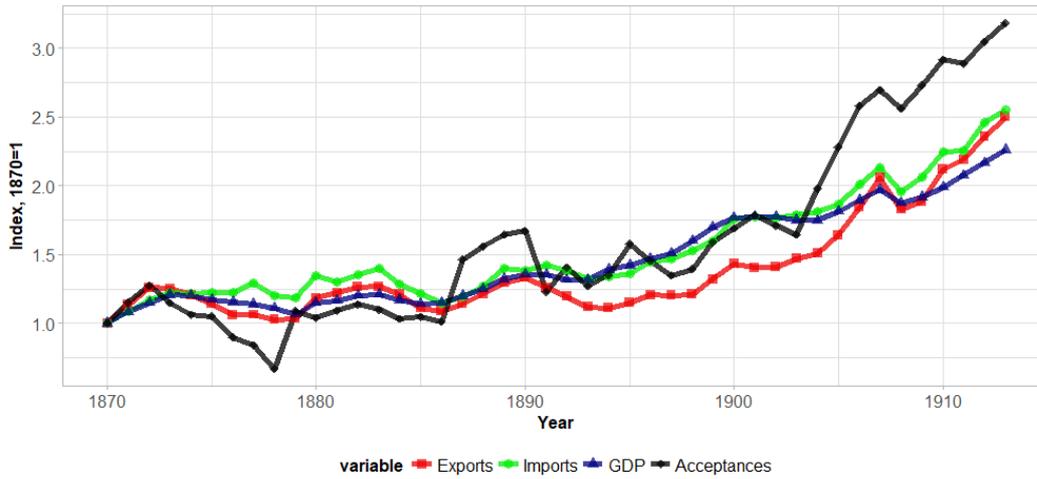
85. Perkins, *Financing*, 78-81.

86. Vincent P Carosso, *The Morgans: Private International Bankers, 1854-1913* (Cambridge, MA.: Harvard University Press, 1987), 133-147, 277-284.

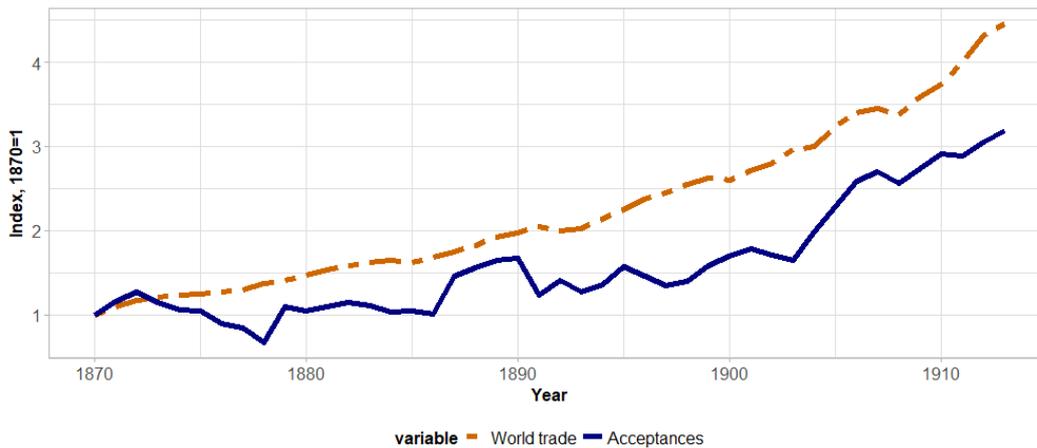
87. Arthur Lewis and Alexander Yeats, 'The Rate of Growth of World Trade, 1830-1973', in *The World Economic Order*, ed. Sven Grassman and Erik Lundberg (London: Palgrave Macmillan, 1981), 11-81.

Figure 5.2: Acceptances and trade

(a) Acceptances, trade, and GDP from 1870 to 1913



(b) Acceptances and world trade from 1870 to 1913



Source: Export and Import data from: Ryland Thomas and Nicholas Dimsdale, *A Millennium of UK Data*, Bank of England OBRA dataset, 2017, <https://www.bankofengland.co.uk/-/media/boe/files/statistics/research-datasets/a-millennium-of-macroeconomic-data-for-the-uk.xlsx>, accessed: 18 January 2018. GDP data from: Solomos Solomou and Martin Weale, ‘Balanced Estimates of UK GDP 1870–1913’, *Explorations in Economic History* 28, no. 1 (1991): 54–63. World trade data from: Arthur Lewis and Alexander Yeats, ‘The Rate of Growth of World Trade, 1830–1973’, in *The World Economic Order*, ed. Sven Grassman and Erik Lundberg (London: Palgrave Macmillan, 1981), 11–81.

million in 1878, reaching their 1877 level only ten years later. However, this can be attributed almost entirely to a withdrawal of capital from the firm in 1877. In this year the firm’s capital dropped from £6.2m to £4.2m, and the house consequently reduced the amount of contingent liabilities it had against a smaller capital base.⁸⁸

88. Capital and Profit & Loss Accounts, 1876–1884, 000/77, boxes 3 and 4, Records of N M Rothschild & Sons, Rothschild Archive, London.

The City of Glasgow Bank failed in October, 1878. This event occurred in conjunction with a contraction in monetary and financial conditions. The open market interest rate went from 2% in June, 1878, to 4.92% in December, falling to 1.38% a year later. Tightening monetary conditions could have led to a contraction in outstanding acceptances, since higher rates would make trade credit more expensive. On the other hand, the recovery in the market for acceptances in 1878-1879 might have been spurred by the Bank of England acting as a lender of last resort, which contributed to the recovery of the financial sector more broadly.⁸⁹ An expansion of lending to financial institutions could also have increased the demand for bills eligible for discount, such as acceptances. It seems implausible that there was any other exogenous shock to the merchant banking industry in general in 1878. The Russo-Turkish war might have led to a mild contraction in a few banks' acceptances, although data by Feinstein confirms that British trade did not drop significantly in these years.⁹⁰ The data contributed by this chapter provides a good starting point for a more detailed historical analysis of this episode from the perspective of the money markets and the merchant banks.

The Baring Crisis of 1890

The near-failure of Baring in 1890 constitutes another major break in the series on outstanding acceptances. The bank had issued a large amount of Argentine debt securities in the 1880s, but was burdened with a large quantity of unmarketable securities on its balance sheet after 1888, once investor appetite for these waned.⁹¹ In the autumn of 1890, the Argentinian government could no longer meet its debt obligations without more credit from Baring, while the Russian government was trying to withdraw over £2 million of deposits from its account with the bank. With an illiquid balance sheet (owing to securities it could not sell), Baring was

89. Michael Collins, 'The Banking Crisis of 1878', *The Economic History Review* 42, no. 4 (1989): 504-527.

90. Charles Hilliard Feinstein, *National Income, Expenditure and Output of the United Kingdom, 1855-1965*, vol. 6 (Cambridge: Cambridge University Press, 1972). Available in: Ryland Thomas and Nicholas Dimsdale, *A Millennium of UK Data*, Bank of England OBRA dataset, 2017, <https://www.bankofengland.co.uk/-/media/boe/files/statistics/research-datasets/a-millennium-of-macroeconomic-data-for-the-uk.xlsx>, accessed: 18 January 2018.

91. Philip Ziegler, *The Sixth Great Power: Barings 1762-1929* (London: Harper Collins, 1988), 236, 239-240.

close to failing. It could not meet obligations arising from its business, such as acceptances. The Bank of England assumed that Baring's failure would disrupt the entire financial system, and consequently began organising a rescue. Baring was eventually saved by a consortium of other merchant banks, the Bank of England, and a number of commercial banks.⁹² Indeed, what motivated several banks to participate in the rescue was the fact that Baring's acceptances were so widely held, that the house's failure would have led to significant losses on the commercial banks' liquid assets, and to severe problems on the money markets more broadly.⁹³

Baring had expanded its acceptance business by nearly 50% from 1885 to 1890, and at one point of 1890 it had liabilities on acceptances in excess of £15 million (see figure 5.1). This indicates that Baring did not act imprudently just with regards to its involvement with Argentine debt securities, but that it was also overly aggressive with its acceptances. From the perspective of the bank's risk management, the acceptance and the loan businesses should not be considered separate. Both the issuance of securities and acceptances could put a bank's capital at risk, and banks commonly had to balance how much capital they would put at risk in each line of business.⁹⁴ It follows that the narrative of the Baring crisis that does not include acceptances cannot be considered complete.⁹⁵

In 1890, problems for accepting houses were compounded by Bank of England's actions, which were partially due to anxiety over Baring. The Bank raised the discount rate from 3 to 6% from June to November in order to stem gold outflows. This put pressure on the money market. Among discount houses, it was rumoured not only that Baring had a substantial amount of illiquid securities on its balance sheet, but that it had increased the amount of acceptances in circulation, further increasing investor's risk-aversion towards the bank.⁹⁶ These rumours proved to

92. Ziegler, *Sixth*, 243-255.

93. John D Turner, 'Holding Shareholders to Account: British Banking Stability and Contingent Capital', in *British Financial Crises Since 1825*, ed. Nicholas Dimsdale and Anthony Hotson (Oxford: Oxford University Press, 2014), 150.

94. Burk, *Morgan Grenfell*, 71. However, acceptances would only require a commitment of resources from the acceptor if a customer failed to meet its commitments, or if the acceptor also granted a short-term loan to the customer.

95. Marc Flandreau and Stefano Ugolini, 'The Crisis of 1866', in *British Financial Crises Since 1825*, ed. Nicholas Dimsdale and Anthony Hotson (Oxford: Oxford University Press, 2014), 87; Chapman, *Rise*, 121.

96. Wechsberg, *The Merchant Bankers*, 133.

be correct.

In the short term, the crisis episode caused a temporary disruption in the entire market of acceptances.⁹⁷ The problem was compounded by financial instability in Australia and the US in the same year. Pressure was particularly severe for banks with exposure to Latin America. Acceptances of Gibbs, a medium-sized merchant bank with links to Latin America, fell by 71%. Those of Hambro, a house with significant operations in Northern Europe and Russia along with Latin America, fell by 53%. This highlights the point that the Baring crisis did not constitute a problem for just one bank in isolation, but that several other merchant banks saw their business contract.⁹⁸ This is not surprising, given that especially the Argentinian economy contracted significantly. But merchant banks also had to tie up capital when they contributed to the guarantee fund for Baring, which might have temporarily reduced their willingness to increase their acceptances.⁹⁹ Although Baring eventually recovered from the crisis, its leading position on the acceptance market was clearly lost for good.¹⁰⁰

Growth and Crisis in 1903-1907

The literature on merchant banking does not discuss the rapid growth of acceptances in 1903-1906. This is surprising, because the pattern of expansion and subsequent stagnation of acceptances seems remarkably consistent among banks. The growth of acceptances between 1903 and 1906 coincides with substantial, albeit slowing, economic growth in both Britain and the US. In the second half of 1906, the Bank of England raised its discount rates to prevent gold outflows. Both the higher interest rates and economic weakness in the US led to constraints on the market for international bills, on which American financial trust companies were active. This tightening proved particularly destabilising in the New York money market. By the beginning of 1907, the US was in the grips of a severe financial panic. Several trust companies that operated in New York and which

97. Cassis, *Capitals*, 85.

98. Wake, *Kleinwort Benson*, 118-119.

99. Roberts, *Schroders*, 105.

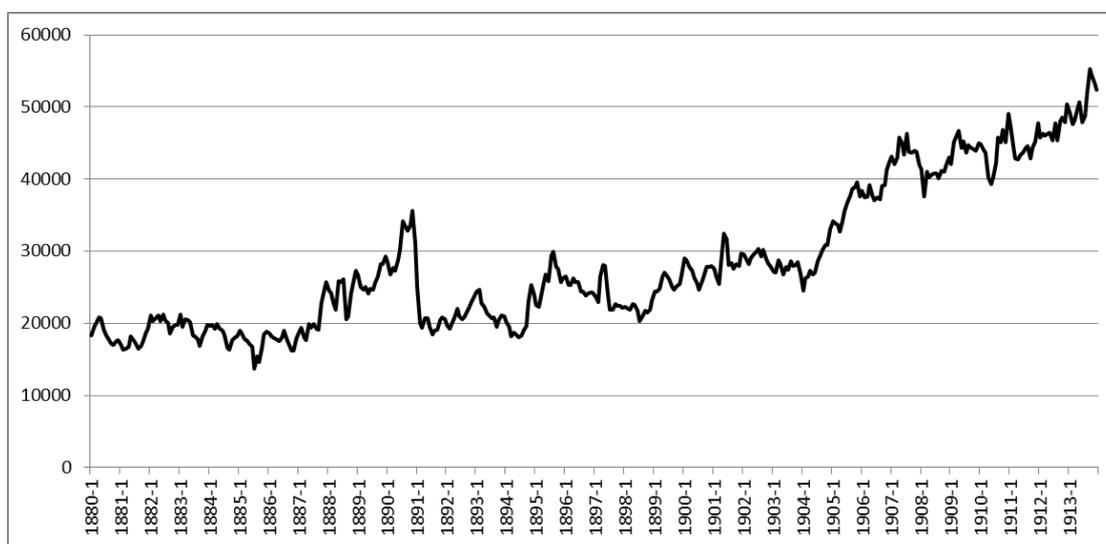
100. Ziegler, *Sixth*, 280-290.

held inadequate reserves suffered runs by depositors.¹⁰¹ An additional sharp increase in the Bank of England interest rate in late 1907 - partially in response to developments in the US - may have further affected the British economy.¹⁰² All of these developments could also have constrained both the supply and demand for acceptances, which is borne out by the data presented above.

5.4.2 Monthly Acceptance Data

For econometric purposes, this chapter makes use of monthly data on acceptances, which is plotted in figure 5.3. Data at this frequency is most likely to capture the exogenous fluctuations in the acceptance business, which were discussed above. Monthly data is available for most banks between 1880 and 1913. In the cases of William Brandt's Sons & Co. (Brandt) and Brown, Shipley & Co. there are a few gaps. This section briefly describes how these gaps were filled, in order to incorporate series on these banks into the econometric model outlined below.

Figure 5.3: Monthly acceptance data, 1880-1913



The figures are in thousands of pounds. Sources: see appendix 5.A.1.

101. Jon Moen and Ellis W Tallman, 'The Bank Panic of 1907: The Role of Trust Companies', *The Journal of Economic History* 52, no. 03 (1992): 611-630.

102. Olivier Jeanne, 'Monetary Policy in England 1893-1914: A Structural VAR Analysis', *Explorations in Economic History* 32, no. 3 (1995): 302-326.

For Brandt, only quarterly data is available before 1904. This bank's acceptance business was of relatively modest importance before this year, reaching £1.5m only in 1890 and £3.5m in 1904. Nevertheless, the firm's business subsequently reached a very significant size (for this period, though, we do have monthly data), and thus ought to be included in the sample. In order to capture the general trend in Brandt's acceptances without unduly biasing the aggregated acceptance series, the quarterly series was interpolated using monthly data on acceptances for all the other banks. This was performed by fitting a mixed-frequency model with local levels and a monthly regressor (the acceptances of other banks) via the Kalman filter, as outlined by Harvey.¹⁰³ Apart from the available quarterly observations, the bank's acceptances are thus assumed to fluctuate in line with those of other banks.

For Brown, Shipley & Co., monthly data on London acceptances is only available from 1880 to 1888. After 1903, yearly figures are available. This Anglo-American firm would primarily finance transatlantic trade by British and US firms. Most of the trade credit it granted in the US would be matched by British acceptances in its London Offices, as explicitly stated in the bank's internal reports.¹⁰⁴ Archival records in New York could thus be used to create a monthly credit series for the bank.¹⁰⁵ By assuming a 1-to-1 relationship between the bank's US commercial credits (used for trade) and London acceptances (for insuring and securitising these trade credits), the missing months were extrapolated from 1888 and then interpolated from 1903.

103. Andrew C Harvey, *Forecasting, Structural Time Series Models and the Kalman Filter* (Cambridge: Cambridge University Press, 1990), 309-315.

104. Annual Report of the Bills Payable Department, November 30, 1911, CLC/B/032/MS20148, Records of Brown, Shipley and Company Limited, London Metropolitan Archives.

105. For a list of records used, see: table 5.4 in appendix 5.A.1.

5.4.3 Merchant Bank Acceptances on the Discount Market: Evidence from the Gillett Brothers & Co. Discount House

This section provides evidence of the importance of merchant bank acceptances on the British money market by examining archival data from Gillett Brothers & Co. (henceforth also referred to as ‘Gillett’), a medium-sized discount house. Gillett’s main line of business was similar to that of a modern money market fund: buying short-term debt instruments (in this case bills of exchange) on which it would earn interest. Against these bills, it would take short-term deposits from financial institutions, such as British commercial banks, on which it would pay a lower interest.¹⁰⁶ The data presented here shows the amount of bills discounted by Gillett Brothers, classified by a bill’s acceptor. This makes it possible to show that the data presented in section 5.4.1 is representative, as the Gillett series includes acceptors which are not covered by my sample. The data can also be used to get a sense of the importance of various merchant banks as acceptors compared to other institutions. The data is available at a monthly frequency from 1892, but short-term fluctuations in each acceptor’s bills tend to be large. It is therefore presented in yearly averages.

25 merchant banks could be identified based on lists of banks provided by Chapman and the *Banking Almanac*.¹⁰⁷ Out of the 25, table 5.1 ranks the top 10 merchant banks by the share of bills held by Gillett. By this measure, the acceptance data in this chapter includes the most important merchant banks: Kleinwort; Schroder; Brown & Shipley; Brandt; and Baring. It is remarkable that in 1903-1913, the top 5 merchant banks accounted for nearly half of the discount house’s investments in merchant bank bills.¹⁰⁸ This reinforces the notion that the acceptance business was highly concentrated.¹⁰⁹ It also suggests that this chapter’s data on acceptances is representative.

106. Richard Sidney Sayers, *Gilletts in the London Money Market 1867-1967* (London: Clarendon Press, 1968).

107. Chapman, *Rise*, 209-211; *The Banking Almanac*, 1911, 46-64.

108. Their share might be somewhat lower, however if smaller merchant banks could be identified in the Gillett data.

109. Assuming, of course, that Gillett’s holdings of each bank’s acceptances were commensurate with the volume the acceptor’s business.

Table 5.1: Share of total bills discounted by Gillett & Co. ranked by acceptor, 1892-1913

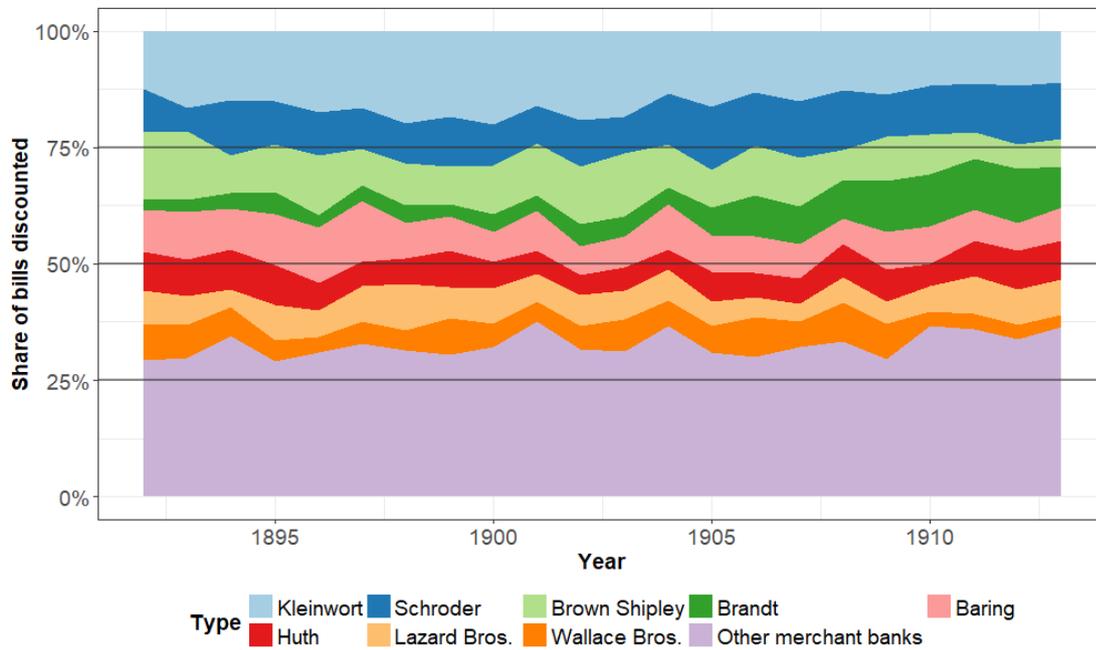
Firm	Share 1903-1913 (avg.)	Share 1892-1902 (avg.)
Kleinwort	13.43%	7.13%
Schroder	11.17%	3.78%
Brown Shipley	8.49%	4.60%
Brandt	8.45%	1.42%
Baring	7.39%	3.79%
Huth	6.35%	2.73%
Lazard Bros.	5.98%	2.88%
Wallace Bros.	5.36%	2.28%
Koenig Bros.	4.88%	0.01%
Matheson	4.00%	1.66%

Source: Monthly Figures for each Principal Acceptor, Giving Total Values of Bills held by Gillett Brothers, 1892-1913, CLC/B/100/MS24688, Records of Gillett Brothers Limited, London Metropolitan Archive.

Figure 5.4 provides an alternative view of the relative importance of different merchant banks. The figure shows the share of each bank's acceptances of all merchant bank acceptances held by Gillett Brothers & Co. The series contrast with those given in figure 5.1. The relative shares of Gillett discounts by acceptor do not fluctuate as much as the market shares that various banks had of the acceptance market. A possible reason for this is that Gillett would seek to reduce its exposure to any individual acceptor. Looked over the span of several years, however, the market shares of acceptors in my data are generally commensurate with those represented in the Gillett series.

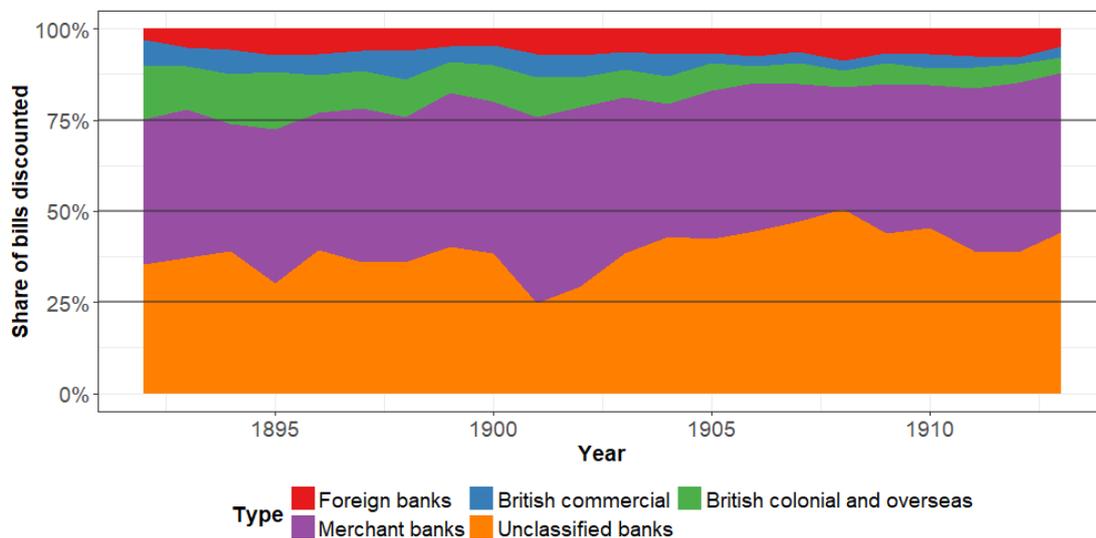
Figure 5.5 can be used to gauge the importance of merchant banks in the issuance of high-quality bills relative to other financial institutions. Merchant banks *which could be identified by name* continued to account for approximately 30-40% of the bills discounted by Gillett Brothers. While this in itself is a significant amount, the real figure is likely to be much larger, because the 'unclassified' part of the figure primarily includes several partnerships, many of which might have been merchant banks. In addition, as mentioned above, the bills of several other types of institutions constituted finance bills, which were unconnected to the goods trade.

Figure 5.4: Discounts of merchant bank bills by Gillett & Co., 1892-1913



Source: See table 5.1

Figure 5.5: Discounts of bills by Gillett & Co., classified by type of acceptor, 1892-1913



Source: See table 5.1

Overall, this section clearly demonstrates the importance that merchant banks had for the money market and the acceptance of bills. It also goes against the

findings of Flandreau and Ugolini, who use Bank of England discounts to suggest that British commercial banks were important acceptors of foreign bills already in the 19th century.¹¹⁰ It is possible that bills accepted by foreign or commercial banks would be less likely to be bought by discount houses, whereby they would be under-represented in the Gillett data. However, it is not entirely clear why this would be the case.

5.5 Econometric Evidence

This chapter tests the following hypotheses:

1. Were acceptances important for the British economy?
2. Did changes in acceptances have an impact on trade?
3. Did the relationship between acceptances, trade and the economy change over time?

The hypotheses will be tested in two stages. Results from Granger-causality tests, based on yearly data from 1870 to 1913, are presented first. This is followed by results based on monthly data and more advanced models. Overall, the econometric evidence suggest that the answer to all of these questions is ‘yes’.

5.5.1 Granger-causality Tests

This section presents results from Granger-causality tests, outlined in the first chapter.¹¹¹ The Toda-Yamamoto test is applied to a VAR model with the following variables: GDP; acceptances; and exports. A lag length of 2 is selected using the Akaike Information Criterion. The data is annual, converted to logarithms and transformed to real, per capita terms. Exports are in volumes based on data

110. Flandreau and Ugolini, ‘Where it all Began’.

111. See: Hiro Y Toda and Taku Yamamoto, ‘Statistical Inference in Vector Autoregressions with Possibly Integrated Processes’, *Journal of Econometrics* 66, no. 1 (1995): 225–250 and section 1.5.1 of this thesis.

from Feinstein's work.¹¹² The acceptances are deflated using the price index by O'Donoghue *et al.*, although the results do not change if they are deflated by export prices instead.¹¹³ The GDP series is taken from work by Solomou and Weale, which has been converted into market prices by Thomas *et al.*¹¹⁴

Results from Granger-causality tests are reported in table 5.2. The model in panel (a) of the table includes data on British export volumes, whereas the model in panel (b) uses data on total trade volumes (exports + imports). The results suggest that acceptances were important for the economy. This is highlighted in the Granger-causal relationship from acceptances to subsequent GDP growth in both model specifications. The relationship means that past changes in acceptances could predict the evolution of GDP, whereas the reverse was not the case. Acceptances thus contributed independently to the nation's economic performance, regardless of how their supply was influenced by macroeconomic fundamentals. In fact, yearly changes in acceptances appear to have been driven, to a significant extent, by factors other than British trade or economic conditions, which is consistent with the notion that fluctuations in the supply of acceptances were not merely driven by demand.¹¹⁵

Curiously, however, the tests in table 5.2 give no evidence of a causal link between acceptances and British exports. These results are puzzling. If acceptances were primarily intended to finance international trade, they should also have been Granger-causally related to British exports and imports. And had acceptances only been important for the domestic economy through their role in promoting trade, in light of the insignificant link between British trade and acceptances, we should also observe a less significant causal link between acceptances and GDP. But this is clearly not the case. It follows that the importance of acceptance credit might have extended beyond its role as an instrument for financing international trade. This would be consistent with the notion that trade credit was used as a substitute for other types of financing. Even though such credit was only used by

112. Feinstein, *National Income*. Available in spreadsheet format by: Thomas and Dimsdale, *Millenium*, Sheet 35.

113. Jim O'Donoghue, Louise Goulding and Grahame Allen, 'Consumer Price Inflation Since 1750', *ONS Economic Trends*, no. 604 (2004).

114. Solomos Solomou and Martin Weale, 'Balanced Estimates of UK GDP 1870–1913', *Explorations in Economic History* 28, no. 1 (1991): 54–63; Thomas and Dimsdale, *Millenium*.

115. See: section 5.3.

Table 5.2: Toda-Yamamoto tests for Granger-causality between GDP, trade and acceptances

(a) Model with export data			
Test	Chi-squared	p-value	Inference
Exports \rightarrow GDP	0.839	0.657	No causality
Acceptances \rightarrow GDP	9.832	0.007***	Causality
GDP \rightarrow Exports	1.89	0.389	No causality
Acceptances \rightarrow Exports	0.47	0.791	No causality
GDP \rightarrow Acceptances	0.371	0.831	No causality
Exports \rightarrow Acceptances	2.273	0.321	No causality
(b) Model with data on trade volumes			
Test	Chi-squared	p-value	Inference
Trade \rightarrow GDP	0.055	0.973	No causality
Acceptances \rightarrow GDP	17.243	0.001***	Causality
GDP \rightarrow Trade	0.315	0.854	No causality
Acceptances \rightarrow Trade	0.682	0.711	No causality
GDP \rightarrow Acceptances	0.34	0.844	No causality
Trade \rightarrow Acceptances	0.822	0.663	No causality

a subset of firms involved with external trade, the effects of fluctuations in acceptances could impact credit conditions more widely, which would have a positive influence on the domestic economy.

Yet, before placing too much emphasis on these results, it is important to remember that acceptances had typical maturities of less than 4 months. Therefore, the high degree of aggregation in the yearly data may make it difficult to ascertain where causal linkages existed. Additionally, the several fluctuations in the acceptance series, discussed in section 5.4.1, may bias the results, given that the Toda-Yamamoto test assumes linear relationships between variables. To better understand the role of acceptances, the sections below use monthly data together with more flexible models.

5.5.2 TVP-FAVAR

To examine how monthly changes in acceptance credit impacted the economy, this chapter applies the time-varying parameter factor-augmented vector autoregression (TVP-FAVAR) outlined in the second chapter.¹¹⁶ Recall that this model extends the ordinary VAR by: **1.** allowing for the relationship between variables to change over time; **2.** allowing for the possibility of time-varying macroeconomic volatility without biasing the estimates; and **3.** summarising a large amount of economic data into their common components. It follows from the third point that the model has the advantage of capturing the variation in a broad array of economic indicators, which makes it more accurate. Likewise, the second point implies that the model does not confound temporary economic instability with changes in the structural relationship between acceptances and the economy.

As explained in section 2.3.1, the equation for the TVP-FAVAR is as follows:

$$\mathbf{y}_t = \begin{bmatrix} \mathbf{f}_t \\ \mathbf{z}_t \end{bmatrix} = \sum_{i=1}^{\rho} \mathbf{B}_{i,t} \begin{bmatrix} \mathbf{f}_{t-i} \\ \mathbf{z}_{t-i} \end{bmatrix} + \mathbf{u}_t ; \text{var}(\mathbf{u}_t) = \mathbf{R}_t \quad (5.1)$$

In the present case, \mathbf{f}_t are 2 factors extracted from several economic time series, while \mathbf{z}_t is a vector such that: $\mathbf{z}_t = [\Delta \text{acceptances}_t; \text{open market rate}_t]$. In other words, the ‘observed’ variables of interest are the change in the logarithm of outstanding acceptances, and the open market interest rate. The data has also been seasonally adjusted using the X-13-ARIMA methodology of the US Census Bureau.¹¹⁷ As in the second chapter, the lag order of the model is set to three. The model priors are the same as in the second chapter, which are outlined in section 2.A.2. The underlying macroeconomic data is also the same (outlined in table 2.3), except that the trade data is in values, not in volumes, which makes it consistent with the acceptance series (which is also in values). This is important, because the value of acceptances outstanding would depend on the nominal value of goods traded over a given period, rather than on their real value.

116. See section 2.3.1.

117. U.S. Census Bureau, *X-13ARIMA-SEATS Reference Manual*, Washington, DC, 2016, <https://www.census.gov/srd/www/x13as/>, accessed: 18 June 2016.

The equation for the factors which capture macroeconomic conditions is: $\mathbf{x}_t = \mathbf{\Lambda}^f \mathbf{f}_t + \mathbf{e}_t$. Recall that the matrix $\mathbf{\Lambda}^f$ links the several macroeconomic time series in the vector \mathbf{x}_t to their common components, \mathbf{f}_t .¹¹⁸ This matrix tells us how large the weight, or the *loading*, of each macroeconomic series is in each common factor. The larger the loading of a given macroeconomic time series, the more important it is in explaining overall macroeconomic fluctuations.

To make the interpretation of the results more straightforward, $\mathbf{\Lambda}^f$ is specified so that freight receipts (the best available monthly economic indicator) has a loading of 1 in the first factor, whereas exports takes a loading of 1 in the second factor. This means that the first factor should strongly proxy domestic economic conditions, whereas the second one should proxy external trade. These minimal restrictions are convenient, because they also ensure that the model is identified, whereby the results are not indeterminate and have an economic interpretation.¹¹⁹

5.5.3 Results from the TVP-FAVAR

This section presents results from the TVP-FAVAR. The model uses monthly data running from 1880 to 1913. The scarcity of monthly macroeconomic data from the 1870s makes it necessary to shorten the period under study based on the monthly acceptances series.

Figure 5.6 reports the average error volatilities of the equations in the VAR model.¹²⁰ For example, the bottom graph tells us to what extent market interest rates for high-quality bills deviated from their predicted value, based on macroeconomic data (incorporated in the factors), and acceptances. The figures indicate that the use of a model which allows for stochastic volatility seems warranted due to significant changes in volatility in the second factor, acceptances, and open market rates. These figures also suggest that both money market conditions and acceptances frequently deviated from their macroeconomic fundamentals, which

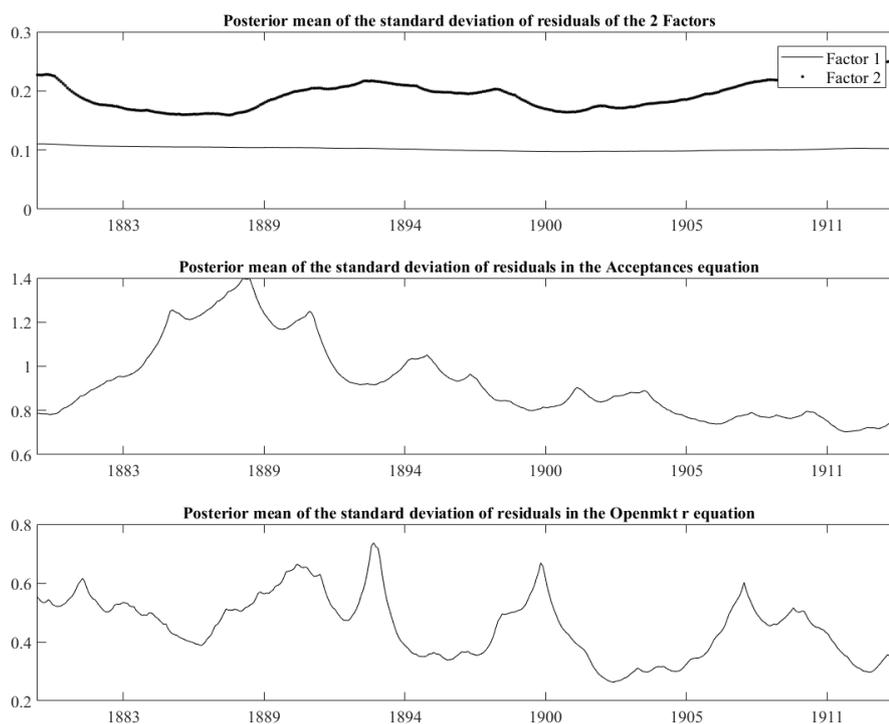
118. For further details, see section 2.3.1 and references therein.

119. Ben S Bernanke, Jean Boivin and Piotr Elias, ‘Measuring the Effects of Monetary Policy: A Factor-Augmented Vector Autoregressive (FAVAR) Approach’, *Quarterly Journal of Economics* 120, no. 1 (2005): 387–422.

120. In more technical terms, these are the means of the posterior draws of the error volatilities.

is consistent with the discussion in section 5.3. On the other hand, the estimated residual standard deviations are not unduly high for any of the equations, indicating that the model is able to fit the data reasonably well. Note that the data is normalised so that the standard deviation of each series is one, following the approach by Bernanke *et al.*¹²¹

Figure 5.6: Posterior means of the standard deviations of the residuals



The error volatility of the equation for acceptances (the chart in the middle) peaks in the years surrounding the Baring crisis of 1890, suggesting that the amount of acceptances extended at this time could not be explained solely by the prevailing macroeconomic or financial conditions. This lends support to the notion that the industry's, or at least Baring's, behaviour with regards to acceptances over the period 1885-1890 deviated considerably from what was warranted by economic fundamentals. The finding further stresses the need for the historical literature on the Baring crisis to take into consideration the firm's trade credit activities.

On the other hand, the low volatility of residuals in the acceptance equation

121. Bernanke, Boivin and Elias, 'Factor-Augmented'.

during the period 1903-1907 suggests that the rapid growth in acceptances in these years can be explained by economic and financial fundamentals, and that it was not due to excessive risk-taking by merchant banks. Instead, shocks in the money markets appear to have been particularly severe in 1906-1907 as indicated by the chart at the bottom. It is thus likely that the US financial panic (along with the preceding economic expansion) and its impact on Anglo-American trade was behind the fluctuations in acceptances in these years.

Figures 5.7-5.9 display impulse responses. These tell us how a one percent shock to a given variable affects another over different horizons. By a ‘shock’, we refer to an increase or a decrease in a variable that is not accounted for by the model. Put more concretely, the model states that acceptances are determined in part by past economic and financial conditions, and a shock in acceptances is a change in the series that is *not* predicted by these fundamentals.

Figure 5.7: Impulse response of trade from acceptances

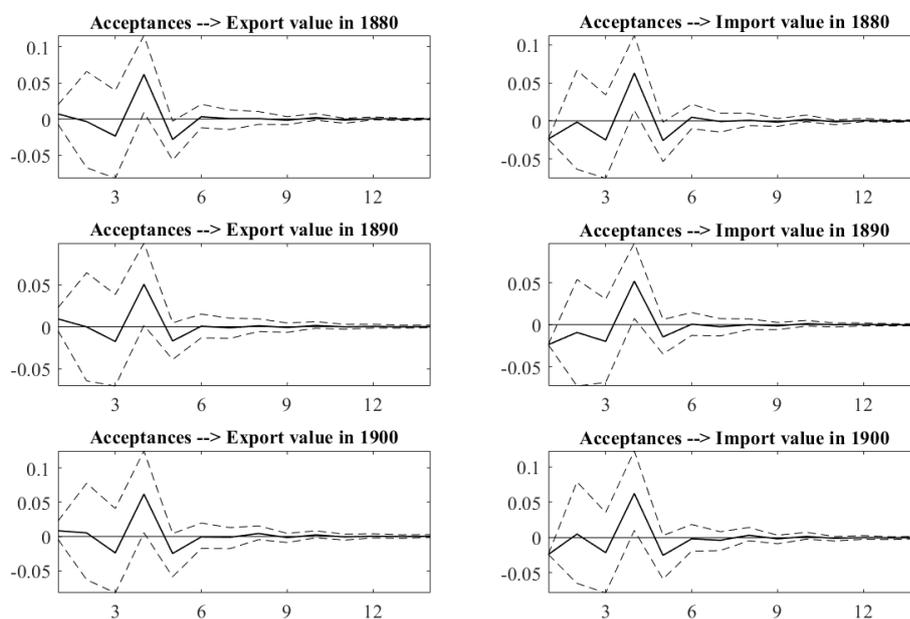


Figure 5.7 presents impulse responses from a shock to acceptances to British trade in each decade from 1880 to 1910, with each graph representing the median response in that decade. The results indicate that the growth of acceptances had a positive effect on exports and imports until WW1. The impact is also economically significant: a 1% shock to acceptances could increase exports or imports

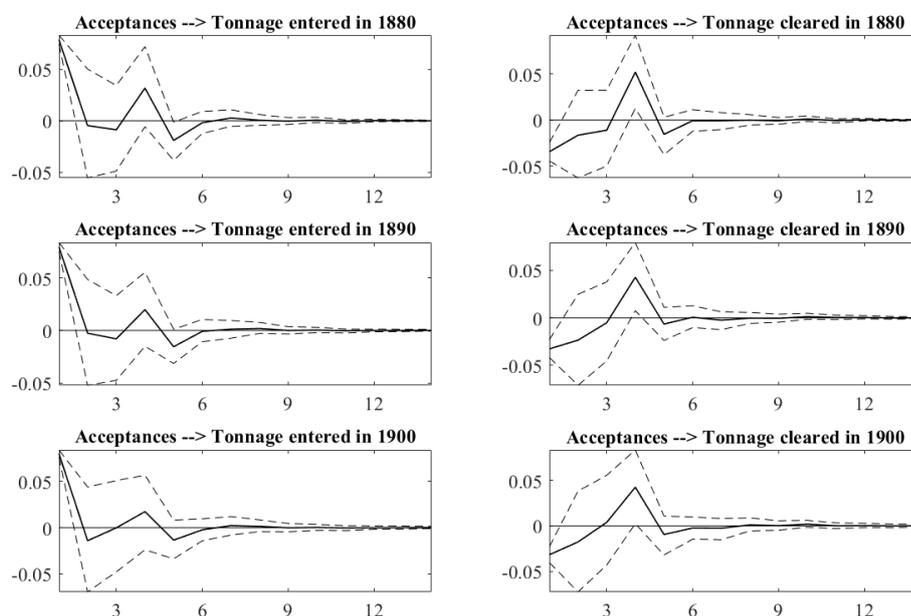
by about 0.05% in standardised terms. In non-standardised, actual terms, this would translate to an impact of roughly 0.6%, which constitutes an economically important relationship between acceptances and trade. Moreover, as implied by figure 5.6, 1% shocks in acceptances would have been a common occurrence during the period at issue. Throughout the sample period, the evidence is thus consistent with modern macroeconomic literature on the linkages between trade finance and exports. British trade appears to have benefited significantly from a better availability of trade credit.

Notwithstanding the benefits that accrued from the growth of the volume of acceptances over the long run, these results also indicate that over the short term, British trade was affected whenever there were constraints on trade credit insurance. Any exogenous decrease in acceptances would thus have impacted trade negatively, as it did during the Baring crisis. Many of these short-term constraints arose through the accepting houses' exposure to international factors, such as crises abroad and fluctuations on the money markets. However, the structure of the merchant banking industry, along with the prudence of certain merchant banks, may have also contributed to these constraints.

Figure 5.8 provides further evidence of the importance of acceptances for British trade. The figures show how shipping volumes were influenced by the growth of acceptances. Whereas the response of tonnage entered to British ports is not significant, the growth of acceptances increased the volume of shipping that was outbound from Britain (tonnage cleared). In this light, the results highlight the role of acceptances in driving British exports. Moreover, they provide an important robustness check for the results in figure 5.7. They indicate that the positive impact of acceptances on trade values was not merely driven by changes in the prices of commodities, but in trade volumes themselves. Note also that a shock to acceptances had its most significant impact both on trade values and shipping volumes after four months. This corresponds to the three to four month maturity of the typical acceptance, after time taken to arrange an order is factored in.

One would not expect merchant banks to have retained their role in promoting trade if, as previous historical literature has argued, these institutions lost a significant share of the market in the business of British trade financing, or if ac-

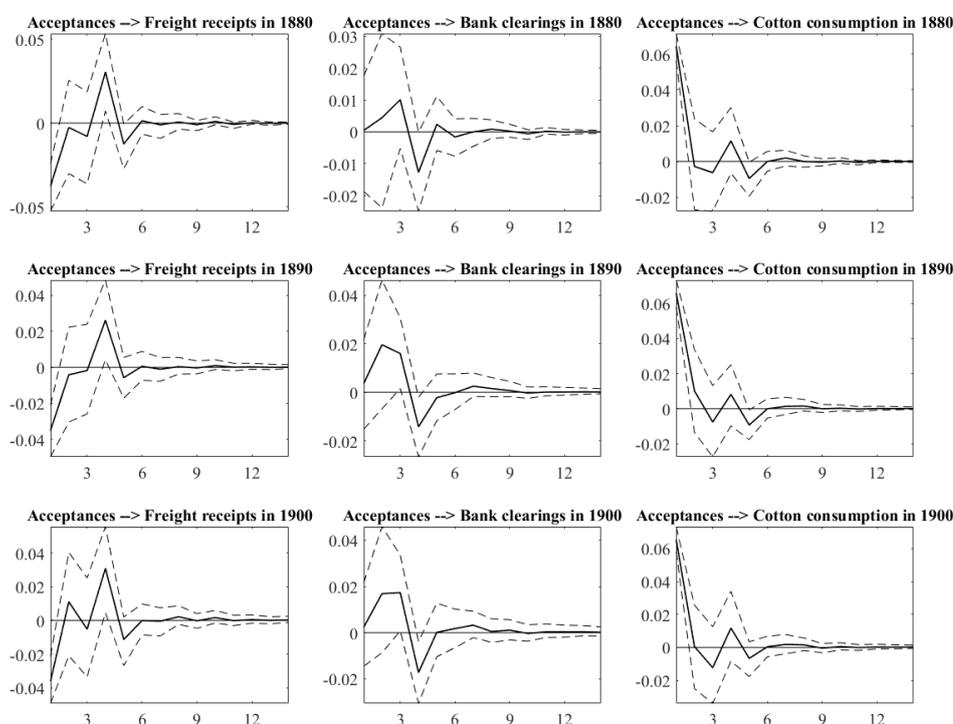
Figure 5.8: Impulse response of shipping volumes from acceptances



ceptances were increasingly being used to finance non-British trade. Nevertheless, the results above suggest that the impact of these changes were limited before WW1, and that merchant banks were not sidelined during this period. Instead, British exporters benefited from merchant bank acceptances throughout the years 1880-1913.

The economic importance of acceptances extended beyond their role in fostering trade. Figure 5.9 shows that domestic economic conditions responded positively to the growth of acceptances. Freight receipts, the best available indicator of economic conditions, responded positively throughout the period 1880-1910. In non-standardised terms, it grew by nearly 1% following a 1% shock in acceptances. This constitutes clear evidence of an economically important relationship between trade credit and the economy. The impact of acceptances on bank clearings (a proxy for the amount of goods traded) was mildly positive albeit more ambiguous, and insignificant in the 1880s. The response was positive after three months from 1890 onwards, but it turned marginally negative in the fourth month. As discussed in section 2.3.1, however, one should put less weight on results based on this indicator, given its lower ability to proxy economic conditions.

Figure 5.9: Impulse response of macroeconomic variables from acceptances



These results are consistent with the notion that trade credit can ease credit constraints in the economy. Specifically, one should recall that trade financing can substitute for other types of credit. It is often used to finance working capital expenditures, whereby changes in the availability of such credit can influence the production and trade of goods.¹²² Although domestic firms in the non-tradable sector did not use merchant bank acceptances, acceptances issued to exporters and importers could have eased credit conditions elsewhere in the economy.

There are, of course, more direct ways in which acceptances could have influenced economic growth through their impact on the traded sector. Firms which engage in international trade and those engaged in purely domestic activity are interdependent, both in terms of buying their inputs and in terms of selling their outputs. It follows that the impact of acceptances on the traded sector could have influenced domestic economic activity through sectoral spillovers. This channel would be especially important in an open economy such as Britain from 1870 to 1913, where the value of foreign trade equalled approximately half of economic

122. Fabbri and Menichini, 'Trade Credit'.

output.¹²³

5.6 Conclusion

This chapter is the first empirical study on the role of acceptances in the pre-WW1 British economy. Its original contribution to British financial history stems from the analysis of a new dataset on merchant bank acceptances from 1870 to 1913. The data reveals that the volume of bills guaranteed by the largest merchant banks generally fluctuated in line with British trade until the turn of the century. However, there were significant departures from this relationship, such as the years surrounding the Baring crisis in 1890. In the early 20th century, it seems that the growth of acceptances was considerably faster than that of British trade. This is consistent with merchant banks taking on an increasingly international role in financing trade between foreign countries. Furthermore, new data from the Gillett Brothers discount house shows that merchant bank acceptances played a central role on the money markets throughout the pre-WW1 years - there is little evidence that they had been sidelined by other institutions.

The relationship between acceptances and the economy is examined through the lens of recent developments in time series econometrics. The results suggest that the growth of acceptances had a significant effect on British trade throughout the period 1880-1913, even as London acceptances were increasingly used for non-British trade, and alternative means for trade financing became more widespread. Moreover, increases in acceptances had a positive impact on British domestic economic conditions throughout the period 1870-1913. This is borne out by Granger-causality tests, along with more advanced models. The impact is also economically significant, suggesting that the operations of these firms constituted an important dimension through which the British financial sector was linked to the real economy. The British economy as a whole thus benefited from having the City of London as the foremost centre for international trade financing.

123. Guillaume Daudin, Matthias Morys and Kevin H O'Rourke, 'Globalization, 1870-1914', in *The Cambridge Economic History of Modern Europe*, vol. 2 (Cambridge: Cambridge University Press, 2010), 5-29.

A straightforward channel through which acceptances could have increased British economic activity is through facilitating international trade, which constituted a substantial share of British GDP. Access to acceptance facilities meant that exporters could expand the markets to which they exported, whereas importers could buy their inputs at a lower cost. The possibility that acceptances helped firms in the traded sector produce more could have led to spillovers to the non-traded sector, as far as the two sectors were interdependent.

It is also useful to consider this chapter's results in light of the macroeconomic literature on trade credit. An insight supported by recent studies is that trade finance can substitute for other types of credit, thereby easing domestic credit constraints. It allows firms themselves to increase financial intermediation and reduce credit market imperfections. Even if only a subset of firms - exporters and importers - use trade credit, the expansion trade financing can improve credit conditions in the domestic economy more broadly. This channel is especially relevant to Britain in 1870-1913, where acceptances were a central component of the money markets. If acceptances contributed to the liquidity of the discount market, they could have affected the availability of short-term credit independently of their role in trade.

A further insight offered by the macroeconomic literature is that trade credit can be used to facilitate transactions and improve the efficiency at which working capital is used, as its use mitigates agency problems. Firms engaging in international trade therefore had a cheap substitute to bank credit, which also functioned as a near-cash asset. The results in this chapter are consistent with all of these channels, although further work is needed to confirm their validity.

As for the historical literature on individual merchant banks, the findings in this chapter raise new questions. How did Brandt, typically considered a fairly small financier of trade, manage to become one of the largest acceptors in the decade preceding WW1? Why did not Hambro's, Morgan Grenfell or Gibbs expand their business as significantly? With regards to the history of merchant banking more generally, the large fluctuations in outstanding acceptances in 1878 and in the period 1903-1907 need to be explained in more detail, as they could shed further light on how various components of the British financial sector were

linked. And although this chapter pays some attention to the Baring crisis, it also suggests that studying this episode with a closer focus on acceptances, and the operations of other merchant banks, is now warranted.

Interactions between acceptances, the discount market and the financial system more broadly is an area in need of further study. If possible, it would also be interesting to match firm-level data to acceptors to understand better how disruptions in acceptances impacted the operations of importers and exporters. Such a study would also be able to shed light on potential substitutes for acceptance credit, on which our knowledge is limited.

It would be difficult to gather more merchant bank acceptance data, as very few comprehensive archival collections survive in addition to the ones used in this chapter. However, we know that several foreign, colonial and domestic commercial banks expanded their trade financing business over the late 19th century. Their archives may provide a useful source for further research on British trade financing.

5.A Appendix to Chapter 5

5.A.1 Acceptance Data

The yearly acceptance data is presented in table 5.3. Table 5.4 provides the sources of the yearly and monthly acceptance series. The monthly figures for Schroders are estimated from the volume of new acceptances that the bank accepted each month, by assuming a 3 month maturity. These estimates come very close to the bank's yearly balances of outstanding acceptances.¹²⁴ Acceptance figures for Brown & Shipley are available only for the years 1871-1887 and from 1903 onwards. The house's acceptance liabilities for other years was estimated using data from the ledgers of the American branches. The accounts of the US branches provide figures on the amount of commercial credit granted, which was the predominant constituent of the house's acceptances. Yearly acceptances for the firm for 1870-1872 was estimated from the firm's US commercial credits, drawn from ledgers, by assuming that a commercial loans had a 3 month maturity. See section 5.4.2 for further discussion on the data for Brown & Shipley and Brandt.

Table 5.3: Acceptance data in £millions

Year	Baring	Brandt	Brown Shipley	Gibbs	Hambro	Kleinwort	Morgan Grenfell	Schroder	Rothschild	Total
1870	6.7	0.6	2.0	0.7	0.7	2.3	2.0	3.2	0.9	19.0
1871	7.4	0.5	2.6	0.8	0.7	3.0	2.5	2.8	1.8	22.1
1872	6.9	0.5	2.8	1.3	0.8	3.1	3.3	4.2	1.0	24.0
1873	5.9	0.5	2.3	0.8	1.1	2.6	3.1	4.1	1.2	21.6
1874	5.7	0.4	2.3	0.7	0.7	2.1	2.5	3.7	1.6	19.8
1875	4.4	0.5	2.2	0.8	0.9	1.8	2.5	4.6	1.9	19.5
1876	4.5	0.4	1.7	0.8	0.7	1.4	2.2	3.4	1.2	16.3
1877	3.9	0.3	1.7	0.8	0.8	1.3	2.1	2.4	2.2	15.6
1878	3.8	0.4	1.5	0.8	0.6	1.4	1.6	1.8	0.6	12.5

124. To clarify, yearly data on the bank's outstanding acceptances are available.

1879	8.8	0.6	2.1	0.6	0.9	2.1	2.5	2.1	0.7	20.4
1880	7.6	0.5	2.9	0.5	1.1	2.1	2.2	2.0	0.6	19.5
1881	7.3	0.5	2.7	0.4	1.5	2.3	2.6	2.3	0.9	20.5
1882	8.3	0.7	2.7	0.5	1.3	2.7	2.4	2.1	0.7	21.4
1883	7.5	0.6	2.4	0.8	1.1	2.9	2.5	2.3	0.7	20.7
1884	7.4	0.7	2.4	0.5	1.3	2.8	1.1	2.3	0.9	19.4
1885	7.4	0.6	2.6	0.7	1.0	2.8	1.4	2.5	0.6	19.7
1886	7.0	0.8	2.6	0.6	1.0	2.9	0.9	2.7	0.6	19.0
1887	10.1	1.4	2.8	0.6	1.3	3.9	1.6	3.7	2.1	27.5
1888	11.6	1.2	2.7	1.2	1.4	4.5	1.2	4.4	1.1	29.3
1889	12.6	1.4	3.1	1.3	1.6	4.8	1.2	3.8	1.2	30.9
1890	8.9	1.8	3.3	2.4	1.8	4.9	2.6	4.3	1.4	31.4
1891	3.5	1.6	3.2	0.7	0.9	4.8	2.0	4.3	2.1	23.1
1892	3.9	2.0	3.1	0.6	0.8	5.5	3.2	4.0	3.4	26.4
1893	3.0	2.0	2.3	0.4	0.6	5.6	2.4	4.8	2.8	23.9
1894	3.6	2.1	2.3	0.2	0.9	5.3	2.3	4.8	3.9	25.4
1895	4.9	2.4	2.9	0.7	0.9	6.6	2.3	5.0	3.9	29.6
1896	4.5	2.5	2.3	0.5	2.0	6.6	1.9	5.1	2.1	27.3
1897	4.7	2.5	2.6	0.5	1.2	6.6	1.2	4.5	1.6	25.3
1898	3.6	2.5	2.1	0.6	1.7	7.8	0.7	5.8	1.5	26.2
1899	3.9	2.9	3.0	0.6	1.9	7.8	2.6	5.7	1.4	29.9
1900	4.5	3.1	3.2	0.6	1.9	8.2	2.7	6.1	1.5	31.8
1901	4.5	3.4	2.8	0.6	2.0	8.9	3.1	6.2	1.9	33.6
1902	4.7	3.3	3.0	0.6	1.7	9.5	1.8	6.0	1.4	32.2
1903	3.8	3.5	3.0	0.9	1.7	8.6	1.5	6.7	1.2	30.9
1904	5.5	3.7	3.6	0.9	1.8	11.1	1.5	6.8	2.1	37.2
1905	6.2	4.6	3.9	0.9	2.3	11.7	1.8	8.8	2.7	42.9
1906	6.7	6.9	4.5	0.9	2.1	11.9	2.2	10.3	3.1	48.5
1907	4.7	7.0	3.9	1.0	2.6	12.1	2.5	11.7	5.0	50.7
1908	6.5	6.2	3.3	1.0	2.8	10.8	3.2	9.3	5.1	48.2
1909	7.9	6.9	4.9	1.2	2.4	10.8	4.6	10.2	2.4	51.3
1910	7.5	8.0	4.2	0.9	2.8	10.7	3.0	10.6	7.1	54.8
1911	6.1	10.4	4.2	0.9	3.4	13.4	2.3	11.3	2.2	54.2
1912	6.7	9.7	4.6	1.4	3.5	13.4	2.7	11.9	3.5	57.3
1913	6.6	10.2	4.6	2.0	4.5	14.2	2.8	11.7	3.2	59.8

Table 5.4: Sources of the acceptance data

Bank	Archive	Sources of yearly and monthly data
Baring Brandt Brown Shipley	Baring Archive LSE LMA; NYHS	Yearly: Green books, 1870-1913; Monthly: General ledgers, 1870-1913 Monthly and quarterly: Ledgers of William Brandt's Sons and Co., BRANDT Yearly: Annual Reports of the Bills Payable Department, 1911-1913, CLC/B/032/MS20148, LMA; Monthly: Weekly and Monthly Returns, 1872- 1888, CLC/B/032/MS20142, LMA; Annual Reports Including Department Re- ports and Managers' Comments, 1897-1913 Series 2, boxes 79-83, NYHS; Gen- eral Ledgers, 1880-1913, Series 3, subseries A., L1-27, NYHS; Ledgers, 1870- 1879, MssCol 410 vols.78-85, NYPL
Gibbs	LMA	Monthly: General Ledgers, first series, 1870-1882, CLC/B/012/MS11053; Gen- eral Ledgers, second series, 1883-1914, CLC/B/012/MS11054
Hambro	LMA	Yearly: Annual Balance Accounts, 1864-1878, 1880-1906, CLC/B/110/MS19033; Monthly: Synopsis of Journals, 1867-1916, CLC/B/110/MS19034
Morgan Grenfell	LMA	Yearly: Summary Balance Sheets, 1900-1913, CLC/B/163/MS28188; Monthly: J. S. Morgan & Co: Ledgers, Main Series, CLC/B/163/MS21769 1864-1909 ; Monthly balances of accounts, 1889 - 1923, CLC/B/163/MS21768A, ; Monthly summary balance sheets, 1910-1913, CLC/B/163/MS28190/1
Kleinwort	LMA	Monthly: Monthly Balances of Accounts , 1870-1913, CLC/B/140/KS04/11/01/MS22035/001-009
Rothschild	Rothschild Archive	Yearly: Balance Sheets of the London House, 000/77, 1870-1913; Monthly: General ledgers, 1870-1913, VI/10/26-117
Schroders	Schroders, Lond	Yearly: Balance sheets. Monthly: Commissions books

Abbreviations: LMA: London Metropolitan Archive; LSE: LSE Library Archives and Special Collections; NYPL: New York Public Library; NYHS: New York Historical Society.

Conclusion

This thesis improves and revises our understanding of the financial sector's role in British economic growth in the late 19th and early 20th centuries. It demonstrates that commercial banks played a significant role in the British economy. Credit extended by these banks was an important driver of monthly economic fluctuations and business cycles. The spread of bank offices had a substantial positive impact on economic activity at the local level. Yet, over a horizon of one year and longer, their influence on the trajectory of Britain's economic development was less significant. At most, the long-run growth of the banking sector and that of the real economy was mutually reinforcing. Merchant banks, on the other hand, through their central role in trade financing, had a positive influence both on British trade and domestic economic performance. In contrast, stock markets had no impact on economic growth, either at the national or at the local level.

The history of British banking in 1850-1913 is one of significant regime change, especially in the case of England and Wales. The banking sector became increasingly concentrated, banks lent a progressively smaller share of their assets to firms outside the financial sector, and their relationships with customers became more transactional in nature. The stock markets, meanwhile, evolved from being markets for public debt to becoming important institutions for the financing of a growing number of domestic firms. However, using new methods in time series econometrics, I show that the economic impact of these institutional developments was considerably smaller than previously thought.

The finding that finance did not drive long-run growth differs from empirical results on other historical cases, where much of the evidence indicates that financial intermediaries played a causal role in economic development. I posit that this divergence in findings stems from the fact that the British financial sector, along with the economy, was relatively mature. Macroeconomic research suggests that it is precisely such countries - with large financial systems and developed economies - that stand to gain less from further financial development. Seen in this light, British growth could be reasonably expected to have been less dependent

on finance. The findings also suggest that the careful view that historians have taken about the economic role of the British stock markets and banks in 1850-1913 is justified, although they offer little support for the view that their growth was merely driven by increasing demand for financial services. This, in itself, raises new questions about the underlying forces behind British financial development during the period.

Despite their limited long term impact, a new insight offered by the thesis is that banks were important drivers of economic growth over the short run. Put differently, commercial bank credit was a central determinant of business cycles. This finding is surprising, because the banking sector in the late 19th century was remarkably stable. In the absence of financial instability, developments in bank credit could thus foster growth, rather than constrain it. Interestingly, changes in bank credit were rapidly diffused to the economy, instead of having a lingering effect over a longer horizon. This result is important, because to the extent that there were disturbances in the credit markets, their impact on growth was likely to have been transitory.

The effects of changing banking practices, along with the transformation of the banking sector after 1870s, have been important topics in British financial history. My results support the notion that banks behaved prudently. Banking practices at the time rendered lending volumes remarkably insensitive to interest rates when compared to financial institutions today, whose risk-taking is significantly influenced by lower interest rates. Yet, despite the growing conservatism of British banks, credit constraints did not become significantly worse over the three decades before WW1. Prudent business conduct by banks therefore did not translate into deteriorating economic conditions over the long run, although declines in bank lending may have had a temporary impact. These findings should serve to revise and moderate the negative assessments of changes that took place in the British banking sector in the late 19th century. At the same time, they enrich our views about the causes of British financial stability at the time.

New data, examined through the lens of recent developments in spatial econometrics, shows that the growth in the number of bank offices had a positive impact on economic growth in English and Welsh counties from 1871-1911, but

not in Scotland. These findings suggest that there is a need to reconsider our views of how changes in British banking impacted the economy. A prevalent view among economic historians is that the consolidation of the banking industry might have constrained credit by encouraging collusive practices between banks, by increasing their market power, and by making lending practices more rigid. My results imply that these effects were outweighed by the increased access to financial intermediaries afforded by the rapid expansion of branch networks. Indeed, I demonstrate that the degree of concentration in the banking sector did not hinder local economic growth. The thesis therefore challenges the view that collusive practices in banking were a significant constraint on the British economy.

Whereas historical research on the local dimension of banking has increased in recent years, provincial stock exchanges remain an under-researched area of British economic history. Historians have nevertheless hypothesised that these exchanges were important for their local economies, because they listed securities of smaller, local enterprises. My thesis tempers such claims through the first empirical study on their economic role. It finds no evidence that provincial stock markets had a positive causal impact on county-level economic growth. The findings are consistent with prevalent views that private capital was easily available through informal means, and may have been substitutable for more formal channels for raising capital.

This thesis also sheds new light on another under-researched part of the British financial sector: merchant banks and the financing of trade. I show that merchant bank acceptances were important for the growth of British exports and imports, and that they also contributed to domestic economic growth. Growth in the supply of acceptance credit thus led to positive spillovers from the traded sector to the economy more broadly. A part of this could be explained by the economic interdependence between the traded and non-traded sectors of the economy. Yet, trade credit could also act as a substitute for other types of finance for a significant number of firms, thereby easing credit conditions on a more general level. The findings imply that Britain derived important economic benefits from having London as a global financial centre, a key dimension of which was the financing of international trade. Indeed, acceptances remained important for the domestic economy throughout the three decades before WW1, even though they were increasingly

used to finance non-British trade.

I have already outlined some specific suggestions for future research in the context of each chapter. I will therefore close with more general thoughts on steps one might take to improve our understanding of the financial sector's role in historical economic growth. The topic certainly deserves significant attention, because what ultimately makes the financial sector highly relevant to economic historians generally is its role in the economy. More broadly, research within this field can yield policy-relevant insights to wider audiences.

There is scope to expand our understanding of the historical relationship between finance and growth at a more granular level. In the case of Britain after 1870, branch-level balance sheet data is available for several banks, which could be linked to other highly localised economic, or even firm-level data. And herein lies a limitation of this thesis: it does not make use of more disaggregated data to study the finance-growth nexus, because such an endeavour would require a substantial and generously funded collaborative effort. Nevertheless, using highly granular data, such as that gathered at the firm-level, has important benefits. It would lead to more accurate estimates of the effects of finance on growth by mitigating the influence of several confounding factors found in aggregated data, while at the same time providing a detailed setting to study more closely the channels through which the finance-growth nexus operated.

Economic spillovers from neighbouring areas were a central determinant of British county-level growth. In terms of methodology, I argued that my contribution constitutes a substantial improvement over previous historical studies in the field of finance and local growth. By taking spatial economic linkages between counties into account both in the regressions and the set of instruments, omitted variable bias is significantly mitigated, the instruments are strengthened, and the fact that banks mainly branched to neighbouring counties is partially controlled for. Historians should therefore build on this research by making greater use spatial models to better understand factors underlying local economic growth.

New developments in time series econometrics - namely, time-varying parameter models - should also be applied in economic history more frequently for studying links between financial and real variables. Over several decades, finan-

cial systems typically undergo meaningful developments, which may change their relationship with the economy. And there is no reason to expect that the behaviour of the economy more broadly would remain constant. Applying constant parameter models in these types of studies is thus unnecessarily restrictive. Indeed, because recent evidence suggests that relationships between financial and economic variables tend to strengthen during periods of financial instability, the importance of applying these models becomes even clearer. Not accounting for these shifts in studies on finance and growth risks confounding the negative economic impact of financial instability with the potentially growth-inducing effects of financial development. In the context of less liberal legal environments than the one studied in this thesis, these models can also be used to study how different regulatory environments influenced the relationship between financial institutions and the real economy. As such, they could lend further insight into another growing field of research, which investigates the institutional or macroeconomic settings under which financial intermediaries foster economic growth, and what types of settings may reduce their economic importance.

While it is always questionable how much a historical study such as this thesis can tell us about the present, the case of Britain in 1850-1913 has several appealing qualities as a laboratory for testing economic theories and addressing questions of current interest. Having a relatively unregulated financial sector after the 1860s meant that the business conduct of banks was not as highly constrained by legal or regulatory factors as it is today. Likewise, the economy was composed of relatively unregulated, and small, firms. The way in which banks conducted their business was thus presumably not distorted by excessive bargaining power of individual customers. Finally, the banking sector experienced significant consolidation over time. These features make it an especially interesting setting to study policy-relevant topics, such as the impact of bank mergers or bank competition on lending and economic outcomes.¹²⁵

Following the financial crisis of 2007-2009, a growing amount of attention is being devoted to understanding the short-term impact of financing constraints,

125. See also: Fabio Braggion, Narly Dwarkasing and Lyndon Moore, 'Nothing Special About Banks: Competition and Bank Lending in Britain, 1885-1925', *The Review of Financial Studies*, 2017, 3502-3537 .

credit supply shocks, and determinants of bank risk-taking.¹²⁶ Yet, disentangling the channels through which the financial sector affects the economy remains a challenge, partially because of the complexity of today's financial institutions. The functional specialisation of British financial intermediaries makes it more straightforward to test how changes in various functions of the financial system related to economic conditions. Moreover, the international orientation of parts of the British financial system increases its similarities with modern financial sectors, alongside its attractiveness as a case study. This thesis is therefore an initial contribution to what promises to be a fruitful area of research.

126. James Morley, 'Macro-Finance Linkages', *Journal of Economic Surveys* 30 (2015): 698–711; Gabriel Jiménez *et al.*, 'Hazardous Times for Monetary Policy: What Do Twenty-Three Million Bank Loans Say About the Effects of Monetary Policy on Credit Risk-Taking?', *Econometrica* 82, no. 2 (2014): 463–505; Simon Gilchrist and Egon Zakrajšek, 'Credit Spreads and Business Cycle Fluctuations', *The American Economic Review* 102, no. 4 (2012): 1692–1720.

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Guildhall Library, London	Records of the London Stock Exchange, CLC/B/004
London Metropolitan Archive	Anthony Gibbs and Sons Limited, CLC/B/012 Brown, Shipley and Company Limited, CLC/B/032/MS20142 Hambros Bank Limited , CLC/B/110/MS19033 Gillett Brothers Limited, CLC/B/100/MS24688 Kleinwort Benson Group, CLC/B/140
LSE Library Archives and Special Collections, London	William Brandt's Sons and Co, Ltd., GB 97 BRANDT

Library of Birmingham	Birmingham Stock Exchange Collection, MS 1598
Liverpool Records Office	Records of the Liverpool Stock Exchange, 332 LSE
Lloyds Banking Group Archives, London	Lambton & Company, A/47
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