The Financial Development and Growth Nexus: A Meta-Analysis

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Abstract: We conduct a meta-analysis of the literature of financial development and economic growth. We cover a large number of empirical studies and estimations that have been published in journal articles. We measure the degree of heterogeneity and indentify the causes of the observed differentiation. Our results suggest that although evidence of publication bias is present, a genuine effect exists between financial development and economic growth.

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1. Introduction

The role of the financial system in the process of economic growth has been an issue of inquiry for a long time and under various contexts. The literature typically traces the articulation of the argument that finance facilitates growth in the works of Bagehot (1873) and Schumpeter (1912), while the modern empirical literature follows the work of King and Levine (1993a,b). Nevertheless, this hypothesised nexus has not been unchallenged. Robinson (1952) suggests that the expansion of the economy creates the need for more financial services and therefore financial development should not be regarded as a determinant of growth; while more recently Lucas (1988) rejects the role of finance in economic growth as 'over-stressed'. In addition to the lack of consensus in theory, the empirical literature is far from reaching a consensus despite the extensive evidence produced. In this paper we interpret the empirical evidence on the finance-growth nexus using meta-analysis in order to detect whether publication bias exists, to understand the factors underlying the range of the estimated values, and most importantly, to consider whether this relationship constitutes a genuine effect.

Schumpeter (1912) when explaining how a well-developed financial system promotes economic growth emphasised the banking system's role in facilitating private investment. The Schumpeterian reasoning was further reinforced by the work of Gurley and Shaw (1955, 1960, 1967) and Goldsmith (1969), who pursued some of the first attempts to empirically investigate the finance-growth nexus. Despite the recognition of financial intermediation's crucial role in economic activity, policymakers had not been proactive in promoting financial development prior to the 1970s; a wide array of financial controls and restrictions characterized the Bretton-Woods system from its inception. In the early 1970s McKinnon (1973) and Shaw (1973) developed theoretical arguments challenging the policies leading to financial repression. According to their view, financial liberalisation would remove financial repression and would bring about financial development, which in turn would spur economic growth. In addition, liberalizing financial markets would allow emerging economies to access international capital markets, allowing consumption smoothing, risk sharing, and producing a virtuous circle between financial development and efficient capital allocation. Recently, however, Broner and Ventura (2010) argue that this view about financial liberalisation, which overtime became the conventional wisdom, has been proved wrong. Moreover, the procyclicality of the financial system emerges as one of the main contributing factors to the recent financial crisis (see, for example, Financial Stability Board, 2009).

The development of endogenous growth theory during the 1980s and the 1990s led to the construction of several models that incorporated financial institutions and described the mechanisms through which financial intermediaries could affect growth.[1] Two channels were thereby identified as to how well-functioning financial systems would affect savings and allocation decisions. According to the capital accumulation channel the fundamental function of financial intermediation is to mobilize savings, which in turn, are channelled to the entrepreneurs who need funds in order to invest. The total factor productivity channel captures various aspects of financial intermediaries' role in mitigating the negative effects of informational asymmetries and minimising transactional costs by allocating resources, facilitating transactions, and exercising corporate control.

Since the early 1990s a burgeoning number of studies have emerged, which attempt to gauge empirically the effect of finance on growth. This literature covers a huge variety of countries, industries, and time periods. The evidence produced seems to uphold the view that financial intermediation matters for growth. This consensus, however, is subject to "ample

[1] See for instance, Greenwood and Jovanovic (1990), Bencivenga and Smith (1991), King and Levine (1993b) and Blackburn and Hung (1998).

qualifications and countervailing views" (Levine, 2005, p. 866). The lack of an indisputable validation of the finance and growth nexus partly reflects the weaknesses and/or the variety of the approaches followed. Indeed, it is quite complicated to synthesise this wealth of evidence produced by such diverse and competent methodologies. Research has explored many different empirical avenues including cross-country data, panel data, time-series analyses, disaggregated microeconomic data, case studies, and so on. Analyses exist focusing on the international, country, industry, and firm level. Moreover, while a menu of indicators for measuring financial development has been proposed, there is not a generally acceptable metric. For example, Levine (2005) questions the accuracy with which these measures can map the corresponding theoretical concepts of financial development. Furthermore, the empirical results may also depend on the dependent variable, which can be GDP and its growth, investment, or productivity.

In this paper we provide an interpretation of the existing evidence by pursuing a meta-analysis. We cover a large number of the most representative empirical studies and estimations that are published as journal articles or working papers. Our aim is to identity the existence of publication bias in the finance-growth literature, that is, the possibility that researchers and journal editors have a predisposition in favour of a particular theoretical and/or quantitative result. We then examine the potential sources of heterogeneity, that is, the disparity of estimated coefficients of the hypothesised relationship. Finally, we consider whether a genuine effect exists, that is, whether an authentic empirical result underlies the literature on financial development and economic growth.

The rest of the paper is organized as follows. Section 2 discusses some of issues that emerge in the empirical literature on finance and growth, which motivate the meta-analysis. Section 3 describes the data selection process. Section 4 analyses the meta-data set and introduces the concepts of heterogeneity, publication bias, and genuine effects. Section 5 concentrates on the meta-regression analysis and Section 6 concludes.

2. Literature Issues

The financial development indicators proposed by King and Levine (1993a) proved to be rather influential for the subsequent research. In particular, King and Levine (1993a) construct four measures of financial development for 80 countries and perform cross-country regressions over the period 1960-1989. These measures of financial development include the ratio of liquid liabilities to GDP, the ratio of deposit money bank domestic assets to deposit money bank domestic assets plus central bank domestic assets, the claims on the nonfinancial private sector over total domestic credit and the claims on the nonfinancial private sector over GDP. The findings reveal that such indices have a positive and statistically significant effect of the financial variables on real per capita GDP growth, on the growth of physical capital accumulation, and on total factor productivity (TFP) growth.

An extend literature has been developed using the above indicators and analyses the banking aspect of financial system. Another strand in the literature shifts focus on the role played by stock markets. For example, Atje and Jovanovic (1993) employing cross-section data for 94 countries over the period 1960-1985, find a positive effect of stock market development on both the level and growth of GDP. Other studies provide additional evidence for the positive role of both banking sector and stock markets on growth (e.g., Demirguc-Kunt and Maksimovic, 1998; Levine and Zervos, 1998). Finally, other studies provide evidence against the Schumpeterian view (e.g., Ram, 1999)).

A large part of the literature, including the studies mentioned above, has been criticised on the basis that it does not account for potential endogeneity, and therefore the results provided may be distorted. In response, methods based on instrumental variables have been used in order to provide unbiased and consistent estimations. For instance, King and Levine (1993b) confirm their previous findings (King and Levine, 1993a) using three-stage least squares. Harris (1997), however, performing a two-stage least squares procedure for a data set covering 39 countries finds that the beneficial effects of stock market activity are limited only to developed economies. Working within a GMM framework, Levine (1998, 1999) and McCaig and Stengos (2005), find that growth is positively associated with financial development proxies. Levine (1998, 1999) draws attention to the determinants of financial development. His analysis suggests that a sound legal and regulatory system is of paramount importance for the efficient function of the financial systems. Bordo and Rousseau (2006) arrive at a similar conclusion.

Deidda and Fattouh (2002) produce evidence of a nonlinear relationship; a significant relation between growth and financial development holds after a specific threshold, which is related to the level of the initial per capita income. In particular, they find that a positive finance-growth link exists in economies with high initial per capita income, whereas in countries with low initial per capita income there seems to be no statistical significance**.** Ketteni *et al*. (2007), on the other hand, provide evidence of a linear impact of financial development on growth. Nevertheless, this linearity holds only when the nonlinearities between growth and initial income/human capital are taken into account.

While various approaches have been developed in the literature in order to overcome endogeneity problems, some researchers stress the fact that cross-sectional analysis cannot incorporate the specific characteristics of each individual economy. Other analysts point out the distinction between correlation and causality to suggest that finding a positive statistically significant coefficient of a financial development variable does not mean that causality necessarily comes from finance to growth. Thus, a more thorough analysis should exploit the time series dimension. Among the first studies that empirically address the issue of causality are these of Demetriades and Hussein (1996) and Arestis and Demetriades (1997). Their results show cointegration between growth rates and several indices of financial development for a number of counties causality appears to run in both directions.

Luintel and Khan (1999), Shan *et al*. (2001), and Calderon and Liu (2003) find bi-directional causality and little support for the hypothesis that finance leads growth while Ang and McKibbin (2007), focusing on the case of Malaysia, find that growth leads financial development. On the contrary, Neusser and Kugler (1998), Rousseau and Wachtel (1998), and Choe and Moosa (1999) provide evidence that financial development leads growth.

The time-series based empirical research also investigates the importance of the banking sector relative to stock markets. Arestis *et al*. (2001) report findings, which show that the contribution of the banking sector in promoting economic activity is much more influential than that of stock markets; excessive reliance on stock market development can cause uncertainty and instability to the financial system. Levine's (2002) results corroborate the view that both banking development proxies and stock markets indices help explain growth. Thangavelu and Ang (2004), however, considering Australian data, find that growth Granger causes banking development but stock market indicators Granfer cause growth. Similarly, Caporale *et al*. (2005) suggest that stock markets induce growth through the capital accumulation channel.

In addition to the purely cross-sectional and time-series analyses, there exist studies that employ panel techniques. Odedokun (1996), Beck *et al*. (2000), Benhabib and Spiegel (2000) and Henry (2000) find that several measures of financial development are positively correlated with real per capita GDP, TFP and the investment rate. Levine *et al*. (2000) also provide evidence pointing to the positive interaction between financial development and growth. Using both cross-sectional and panel estimation techniques they find that differences in legal systems and accounting standards can account for differences in the level of financial development. In this way, they identify specific aspects of the legal system that can have beneficial effects on the financial system and, thus, facilitate growth. Luintel *et al*. (2008) provide a set of qualifications for the use of panel data analysis. The issue of cross-country parameter heterogeneity is addressed by explicitly testing for the probability of cross-country data. It is thereby suggested that careful testing should be undertaken before panel estimation is attempted.

Evidence from panel-cointegration methods show that a long-run equilibrium relation exists between financial development and growth with causality running from both directions (e.g., Christopoulos and Tsionas, 2004; Apergis *et al*., 2007).

A number of studies show that the relationship between financial development and growth depends on many qualifications. Beck and Levine (2004) and Ndikumana (2005) examine whether bank-based or market-based systems are more efficient in promoting economic activity, concluding that both types of financial intermediation play a significant role. Moreover, Rousseau and Wachtel's (2000) show that the increasing influence of stock markets on economic activity holds for both developed and developing economies. Rousseau and Wachtel (2002) consider the role of inflation and find that there is an upper threshold above which financial development ceases to have a positive effect on growth. Aghion *et al*. (2009) stress the importance of the level of financial development in understanding the relationship between growth and exchange rate volatility. Rousseau and Sylla (2001) emphasise the suggest implications of financial development not only for growth but also for capital-marker integration.

Thus, two broad types of research questions emerge in the finance and growth nexus literature. The first type of inquiry is concerned with whether there is a correlation between financial development and growth and the direction of causality. Given that such correlation exists, the subsequent question is which aspects/proxies of the financial system are in a better position to promote growth. The second question is the issue of causality. To our knowledge, the present study is the first quantitative meta-analysis attempt to study the finance and growth relationship, as explained above.

3. Data Description and Data Selection Process

Our initial selection of studies was performed through a comprehensive search in the EconLit and Google Scholar. Given the extent of the relevant literature we performed several search attempts in order to refine the sample. Moreover, in many papers the relationship between growth and financial development is considered a side-issue, with the main focus being on another topic.[2] We also used the survey of Ang (2008) as a secondary source. This resulted to 85 empirical papers.

The variety of quantitative methods used to address the finance-growth nexus is also impressive and one has to select coefficients that are, or can become, comparable across studies. Thus, we focus on the estimates of the effect of financial development on growth according the baseline specification:

$$g = a + \beta F + \gamma X + \varepsilon \tag{1}$$

where g is the growth rate, F is the financial development proxy and X is a vector of control variables. We exclude studies that do not make any reference to the exact values of estimated coefficients' standard errors or their *t*-

[2] We analyse extensively this aspect in section 5.

statistics and they merely report the statistically significance using either *p*-values or asterisks.

Moreover, while we consider estimates based on time-series analyses we do not include the studies that examine the Granger causality between the two variables. Such studies typically report only *p*-values and *F*-tests, which cannot be utilised in meta-analysis. Instead, as we explain in the next section, the two measures that provide usable information for our analysis are the observed effects and their corresponding standard error. Furthermore, we do not include unpublished papers. Stanley and Doucouliagos (2012) suggest that including working papers is not likely to affect the meta-analyses results of well-established literatures . All in all, our data base consists of 549 observations coming from 31 published papers,[3] which are shown in Table 1 along with the number of estimates from each study.

< Please insert Table 1 here>

4. Analyzing Data Characteristics

The analysis of heterogeneity typically constitutes the primary step of the data base examination in meta-analysis and aims to identify the extent to which the estimated effects, that is the estimated coefficients β in equation (1), differ from each other. These coefficients, however, are not directly comparable to each other due to the large number of proxy variables in equation (1). Thus, any inference based on these estimates would be erroneous. For this reason, we convert the estimated coefficients across the literature to partial correlations. Being unitless measures, partial correlations enable us to compare the relation of financial variables with growth across the literature considered. Following Doucouliagos *et al*. (2012) and Stanley and

[3] All these papers are published in referred journals with the exception of one paper, which is a book chapter and had previously appeared as NBER working paper.

Doucouliagos (2012) we compute the partial correlations, *r*, from the *t*-statistics as:

$$r = \frac{t}{\sqrt{t^2 + df}} \quad (2)$$

where *r* is the partial correlation of the observed effect *β* (equation 1), while *t* and *df* are the corresponding *t*-statistics and the degrees of freedom, respectively.

Parts of the empirical literature in economics can be characterized by distortions of the magnitude the estimated effects when the majority of studies report estimates towards a specific value. In other words, the possibility of publication bias or selection bias emerges. Failing to account for such bias may lead to overestimating the presence of a genuine effect and most meta-analytic applications in economics detect the presence of publication bias.

In order to detect any possible bias in our meta-data, we start with a scatter plot in Figure 1, which shows the relation of the partial correlation of estimated effects (horizontal axis) with a measurement of their precision (vertical axis). The inverse of the standard error (INSE) is the most common measure of precision. The absence of such a bias implies that the estimated effects are distributed symmetrically around the genuine effect or around zero when no genuine effect exists. Studies with small (large) sample should result to less (more) precise estimates, that is, larger (smaller) standard errors. Consequently, less precise estimates, which are at the bottom of the graph, ought to spread out more than precise ones, which are at the top of the graph. Thus, in the absence of bias the scatter plot should resemble a symmetric funnel.

<Please insert Figure 1 here>

Figure 1 shows the funnel plot of the partial correlations. Clearly, positive values are over-reported, which is a strong indication of bias. Furthermore, the average of partial correlation is 0.180 and proves to be statistically significant at 1%. This can be considered the result of small economic significance.

The funnel plot, however, provides only indications and not definitive evidence. The asymmetric distribution of the partial correlations may be attributed to other factors. Before examining several possible factors, we have to go beyond the diagrammatic representations of bias using a more formal analysis.

The most typical way for modelling the possibility of publication bias is to perform the 'Funnel Asymmetry Test' (FAT) developed by Egger *et al.* (1997). The FAT test is based on the regression:

$$c_i = \beta_0 + \beta_1 SE_i + \eta_i \qquad (3)$$

where c_i stands for the estimated coefficients of the financial development variable on growth and SE_i for their corresponding standard errors. When there is no bias in the literature under consideration, the estimated effects are not related to the corresponding standard errors. Moreover, the effects should be randomly distributed around β_0, which can be regarded as an approximation of the genuine effect. For this reason, testing the significance of β_0 is traditionally named as Precision-Effect test (PET). The larger the sample is, the smaller the standards errors become, and thus, $\beta_1 SE_i$ tends to zero. On the contrary, when publication bias exists, the effects are related to their standard errors. According to Doucouliagos (2005) "...smaller studies will search for larger effects in order to compensate for their larger standard errors, which can be carried out, for example, by modifying specifications, samples and even estimations technique" (p. 375).

As noted in the previous section, the estimated effects collected from the growth-finance literature are not directly comparable. This fact invalidates the inference based on FAT. One can easily modify equation (3), however, using partial correlation and their standard errors instead of the directly observable estimated effects:

$$r_i = \beta_0 + \beta_1 SEr_i + u_i \tag{4}$$

where r_i is the partial correlation of the estimated effect c_i, SEr_i is the corresponding standard error of r_i and u_i is the error term. Both equation (3) and (4) suffers from heteroskedasticity. To prevent our analysis from erroneous inference the common practice is to divide either of the two equations with the corresponding standard errors. Thus, the regression equation now becomes:

$$r_i^* = \beta_1 + \beta_0 \frac{1}{SEr_i} + v_i \tag{5}$$

where r_i^* is the partial correlation divided by its standard error. This slight modification does not change the inference; namely, if there is publication bias, the new constant β_1 will be statistically significant, while the slope β_0 is an indication of the existence of a genuine effect beyond this bias.

Estimating equation (5) using OLS, however, may prove to be erroneous. Collecting all the estimations from each paper results to a large number of observations (549 in our case). This is likely to induce bias of the OLS results due to possible correlation among estimates within one study. To account for this kind of dependence we, firstly, report cluster-robust standard errors and secondly, we estimate the unbalanced panel version of (5). More precisely, the model is now modified as follows:

$$r_{ij}^{*} = \beta_1 + \beta_0 \frac{1}{SEr_i} + \zeta_j + \varepsilon_{ij} \tag{6}$$

where i and j subscripts denote estimate and study, respectively, while the estimate-level error term, ε_{ij}, is also normally distributed. The term ζ_j denotes the study-level effect that captures the differences between studies. Here, two alternative assumptions can be made; ζ_j can be considered as either fixed or random following a normal distribution. Under the first scenario the study effects are related with the additional regressors (here, $1/SEr_i$), while under the second one, ζ_j are assumed to be independent. In the present study, we follow the suggestion of Stanley and Doucouliagos (2012) and we estimate the panel model (6) assuming fixed study effects. As a robustness check, we also re-estimate the same model computing the cluster-robust standard errors.

The estimation results are shown in Table 2. Column 1 reports the OLS estimates along with their cluster-robust *p*-values in parentheses. The results suggest that a publication bias is present; the intercept β_1 is statistically significant at 5%. The OLS results also show that a genuine empirical effect exists as the slope coefficient β_0 is statistically significant at 10%. This means that there is a statistically significant partial correlation between growth and financial development.

< Please insert Table 2 here>

The above result is corroborated when we estimate the fixed effect panel version of (6) - see column 2. However, under this specification estimation assumption the intercept is found to be insignificant implying that there is no bias. Column 3, reports the results from the same estimation method when we use the cluster-robust standard errors. These results, which are considered the most robust in taking into account the dependence among our meta-observations, suggest that there is no evidence of publication bias or genuine effect. Both the intercept and the slope coefficient are insignificant. The findings at this stage of analysis, however, are not definitive since previous research shows that in cases where there is unexplained heterogeneity the results from FAT and PET may be misleading.[4] This can easily be tested through the error variance, σ_{ε}^{2}, of (5) and (6). More precisely we test the hypothesis that $\sigma_{\varepsilon}^{2} \leq 2$ and we report the *p*-values of this test in the last row of Table 2. In all cases, the hypothesis that $\sigma_{\varepsilon}^{2} \leq 2$ is strongly rejected implying the existence of unexplained heterogeneity. The next section explores more thoroughly the role of several potential factors that may affect both publication bias and the existence of a genuine effect.

5. Meta-Regression Analysis

The aim of meta-regression analysis is to reveal the specific factors that affect the reported results. More precisely, some factors may contribute to publication bias, while others may affect the genuine effect. Since one cannot know these factors a priori we have to search for all the potential determinants. To do so we specify a model as:

$$r_{ij}^{*} = \beta_1 + \sum_{k=1}^{K} \gamma_k L_{ijk} + \beta_0 \frac{1}{SEr_{ij}} + \sum_{k=1}^{K} \frac{\delta_k Z_{ijk}}{SEr_{ij}} + \zeta_j + e_{ij}, \qquad (7)$$

where the *i* and *j* subscripts denote estimate and study, respectively. In fact, this equation is an extension of equation (6) which allows to include the so-

[4] See Stanley (2008).

called moderator variables, L_k and Z_k. The of L_k variables captures factors causing researchers to report a specific outcome, while the Z_k variables captures factors that influence the magnitude of the published estimated coefficients. In other words, the Z moderator variables are used in order to explain the observed heterogeneity.

Clearly the choice of moderator variables depends on the specific topic under examination. In the present study we construct eight general categories of variables that are related to some fundamental characteristics. The first category is related to the econometric methodology. Throughout the extensive growth-financial development literature a variety of empirical methods has been employed. The properties of GMM (e.g., ability to address endogeneity issues) render it the most popular econometric method employed in the modern literature on finance and growth. Thus, we create a dummy variable that takes the value of 1 when the coefficient has been estimated through a variant of this method, such as simple GMM and dynamic panel GMM and the value of 0 in all other cases.[5] The two-stage least squares method shares many common features with the GMM method (e.g., it presupposes an instrumental-variable list) and we include it in the GMM-category. If this moderator variable is found to be statistically significant, the estimation method can be safely regarded as one reason for the coefficients' variability.

The second category is related to the country sets used. The majority of the collected studies use an extended country-level set, which includes developed, developing and less-developed counties. On the other hand, a minority of studies uses specific country groups, e.g. high income OECD, Latin American, or African countries. To capture this feature, we consider a dummy that takes the value of 1 when the extended data set is utilised, and 0 in all other cases.

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[5] In these remaining cases, all the methods are based on least squares (LS), such as OLS and Generalized LS.

The measurement of economic growth constitutes another differentiating feature. The most common variable is the per capita growth of real GDP. Thus, we put the value of 1 when the study uses this growth variable. Other studies use as dependent variable the growth of capital stock, the volume of investment as percentage of GDP, or total factor productivity. We consider the coefficients from these alternative measures as one category, to which we assigned the value of 0.

Next, we look into whether the exact measurement of the financial development plays a significant role in the determination of the results. The literature has employed a variety of variables to proxy financial development. In order to handle all these different measures we use dummies to distinguish between the following groupings: The first group, which we treat as a base, includes the coefficients whose corresponding variables refer to liquid liabilities, the second group is related to the definitions of banking variables and the third group consists of coefficients whose variable is market-based proxies of financial development.

The literature we examine consists of studies that provide evidence from cross-sectional data, time series data, and panel data. Given this distribution, it is interesting to look into whether the type of data used produces different results. Treating the studies that use cross-sectional data as the base category, we create two dummies. The first dummy takes the value of 1 when the coefficient has been estimated from a panel data set and the value of 0 when time series or cross sectional data are used. The second dummy takes the value of 1 when time series data are employed, while takes the value of 0 when panel and cross sectional data are used.

The set of control variables, reflected in vector X of equation (1), can be an important factor affecting the regression results. Since equation (1) is actually a growth regression that has been extensively used in growth literature, the additional regressors are more or less the same across studies.

The number of potential regressors, however, is relatively high rendering impossible the construction of one moderator variable for each single regressor. In fact, the large number of regressors in the finance-growth studies complicates the reporting of the results. To circumvent this problem typically researchers use three conditional sets of control variables. The first set contains an intercept, the initial per capita GDP and the initial school average age. The second set of regressors contains the first one plus the size of government, the inflation rate, the net exports, the black market premium, and a general index of trade, exchange rates and price distortions. The third conditional set contains the second one plus some other specific variables such as measures of political stability.[6] So, we construct three dummies that take the value of 1 for each corresponding conditional set and we use as base variable the dummy that takes the value of 1 for studies that use regressors that cannot be incorporated into the above three conditional sets.

The main focus of the analysis may differ across papers and this constitutes another potential source of heterogeneity. In other words, some studies focus directly on the relationship between financial development and growth while other studies treat this relationship as a baseline model in order to analyse another closely related issue. In this process, however, estimates on the finance-growth nexus are being produced. An effective approach for identifying the implications of this factor is to examine the exact title of each paper. Thus, we construct a dummy that takes 1 when the title of one study reveals a clear focus on growth-finance relation and 0 when the research interest is a closely related topic.

Finally, we examine whether the issue of endogeneity between the financial proxies with growth is examined. Failing to take into account the possibility of endogeneity allows for a bias that may lead to erroneous inference. For this reason, we include a dummy that takes the value of 1 when

[6] For details, see Levine *et al*. (2000).

the corresponding estimates come from a study that takes this type of endogeneity into account. Table 3 summarises all the moderator variables we use.

< Please insert Table 3 here>

We examine whether the above moderator variables, appearing as *L*-variables and *Z*-variables respectively in equation (7), affect the publication bias and the genuine effect. To estimate this equation we first report the OLS results along with the cluster-robust *p*-values and then we estimate the same equation by assuming panel fixed study effects. Finally, we repeat the same procedure computing cluster-robust *p*-values. In each estimation we follow the general-to-specific approach and we drop the variables that are found to be statistically insignificant one step at a time. The final results are shown in Table 4.

< Please insert Table 4 here>

The OLS results in column 1 of Table 4 suggest that the factors possibly affecting the presence of bias are the country set, the conditional variables, and the explicit focus on the growth-finance nexus. Specifically, studies that use the full set seem to report coefficients that imply higher partial correlations. Similarly, studies that use the first and the second set of conditional variables tend to produce higher partial correlations between growth and financial development. On the other hand, studies that focus directly on the growth-finance relations tend to report small coefficients implying smaller correlations. The question that emerges, however, is whether these factors produce a statistically significant bias. In a multiple meta-regression context, the appropriate analysis requires a joint *F*-test (and not merely a mere test of the significance of the intercept) in order to examine whether all these variables are statistically different from zero. Our results ($F_{(4,30)}$ =26.6, p<0.001) suggest the publication bias exists indeed in the finance-growth relationship. As far as the factors of a genuine effect are concerned, the outcomes in the low panel of column 1 show that the usage of bank-based measures and the employment of time-series data tend to produce smaller correlations. Also, studies that use the third conditional set, and focus directly on the examined literature report higher coefficients, and thus, produce higher correlations. These factors, however, tend to produce a genuine effect as the results of the joint significance *F*-test supports ($F_{(4,30)}$=8.32, p<0.001) suggest.

Estimate equation (7) using panel fixed effects, produces results that are almost identical to the above (column 2 of Table 4). The growth-finance literature is characterised by publication bias ($F_{(7,504)}$=33.20, p<0.001) but a genuine effect ($F_{(8,504)}$=25.94, p<0.001) clearly exists. The use of panel fixed effects allows observing some more factors captured by the *L* and *Z*-variables, which we portray in comparison with the results found by the most robust approach shown in the third column. Beginning with the publication bias, we observe that the econometric technique, the type of data, and the issue of endogeneity play a significant role ($F_{(5,30)}$=2382.67, p<0.001). This result is almost identical with that of the previous panel estimation (column 2). Moreover, the growth-finance literature seems to report on average a genuine effect ($F_{(5,30)}$=15.07, p<0.001). The variables that explain this genuine heterogeneity are the bank-based proxies of financial development, the type of data, and the treatment of endogeneity.

As previously mentioned the above estimates are based on 31 studies. Furthermore, all the above estimations support the existence of genuine heterogeneity. To test the robustness of the above outcomes we drop some studies that seem to affect this heterogeneity. First, we drop two studies that examine specific countries and, thus, they use time series data. We also drop one more study that focuses on regions. Finally, we drop one study that performs firm-level analysis.[7]

The new results are shown in Table 5 are very similar with those of Table 4. We emphasise only the most robust result; i.e. the panel fixed effect with cluster-robust *p*-values in column 3. As with the previous estimates, where all the 31 studies are used, the factors that explain the presence of publication bias ($F_{(5,27)}$=1997.29, p<0.001) are the econometric method, the type of data and the treatment of endogeneity. In contrast to the previous analysis, however, the choice of dependent variable seems to play a role as the coefficient of the moderator variable 'growth' is statistically significant.

< Please insert Table 5 here>

Finally, our findings concerning the presence of genuine heterogeneity are sufficiently robust. The variables behind the genuine effect ($F_{(5,27)}$=146.31, p<0.001) are the bank-based measures of financial development, the type of data, and the treatment of endogeneity. Once again, the coefficient of the growth variable is negative and statistically significant. This indicates that studies using the traditional measure of GDP growth produce lower correlations than the studies using some other alternative measure.

6. Conclusion

We conduct a meta-analysis of the existing empirical evidence on the effects of financial development on growth and investigate a number of issues

[7] We suggest that these studies may influence the heterogeneity since they are different in the manner described above. The first three dropped papers do not base their analysis on a country set but use either specific-country or regional data. In a similar vein, the last dropped study uses firm-level data. The rest firm-level studies examine the growth-finance relation in a different framework that does not allow any comparisons even in our meta-analytic framework. All the other differences in the remaining studies are captured by the meta-regression analysis.

pertaining to this voluminous literature. Our meta-regression analysis shows that the type of data employed, and the different variables used to measure growth and financial development in the literature can constitute sources of heterogeneity. The treatment of endogeneity seems to also to play a role in explaining the different values of partial correlations. In particular; the usage of bank-based proxies of financial development seems to result in lower correlations than the usage of either liquid liabilities or market-based variables. In a similar vein, panel data, which are frequently used from the late 1990s onwards, also produce small correlations. Interestingly enough, if a study takes into account the endogeneity problem, the resulting estimates, and thus the partial correlations, tend to be higher. This implies that endogeneity produces a downward bias to the estimations.

Overall, the meta-regression analysis produces evidence suggesting that the literature is not free from publication bias favouring the finance-growth nexus. This is consistent with the funnel-graphical analysis. Nevertheless, all specifications suggest the existence of a robust genuine effect resulting from the statistically significant partial correlations.

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Table 1
Papers included in the Meta-Analysis

Study	Number of Estimates
1. Aghion et al. (2009)	29
2. Ahlin and Pang (2008)	35
3. Allen and Ndikumana (2000)	20
4. Andersen and Tarp (2003)	9
5. Andres et al. (2004)	48
6. Bandyopadhyay (2006)	24
7. Benhabib and Spiegel (2000)	22
8. Bittencourt (2012)	12
9. Bolbol et al. (2005)	32
10. Bordo and Rousseau (2006)	6
11. Bordo and Rousseau (2012)	10
12. Cetorelli and Gambera (2001)	16
13. DeGregorio and Guidotti (1995)	17
14. Deidda and Fattouh (2002)	9
15. Edison et al. (2002)	5
16. Hassan et al. (2011)	27
17. Ketteni et al. (2007)	3
18. King and Levine (1993)	16
19. Levine (1998)	19
20. Levine (1999)	24
21. Levine (2002)	16
22. Levine and Zervos (1998)	42
23. Levine et al. (2000)	9
24. Ram (1999)	12
25. Rousseau and Sylla (2001)	12
26. Rousseau and Wachtel (2000)	3
27. Rousseau and Wachtel (2002)	9
28. Rousseau and Wachtel (2011)	24
29. Rousseau and Yilmazkuday (2009)	24
30. Velverde et al. (2007)	8
31. Yilmazkuday (2011)	8

Table 2
Funnel Asymmetry Test

	(1) ***OLS-CR***[a]	*(2)* ***FE***[b]	*(3)* ***FE-CR***[c]
Intercept- β_1	1.089 (0.047)	0.304 (0. 411)	0.304 (0.773)
1/SEr- β_0	0.073 (0.067)	0.137 (0.000)	0.137 (0.117)
j	31	31	31
n	549	549	549
Testing $\sigma_{\varepsilon}^{2} \leq 2$	*p*-value 0.000	*p*-value 0.000	*p*-value 0.000

a: OLS-Cluster-robust standard errors.
b: Fixed Effects-robust standard errors.
c: Fixed Effects-cluster-robust standard errors.
p-values are reported in parenthesis.
j is the number of studies
n is the number of observations.

Table 3
List of Moderator Variables

Study Characteristics	*Moderator Variables*
Econometric Method	GMM
	Other methods
Country Set	Full Set
	Sub-sets
Growth Variable	GDP Growth
	Other Types
Financial Development Variable	Bank-based measures
	Market-based measures
	Liquid Liabilities#
Data Type	Panel
	Time Series
	Cross-sectional#
Additional Regressors	Conditional Set 1
	Conditional Set 2
	Conditional Set 3
	Other set#
Focus	Direct
	Indirect
Endogeneity	Yes
	No

Note: # indicates the case where variables are used as the base.

Table 4
Meta-Regression Analysis

	(1) *OLS-CR*[a]	*(2)* *FE*[b]	*(3)* *FE-CR*[c]
Publication Bias- L variables			
Intercept-β_1	-	-8.936 (0.000)	-8.223 (0.001)
GMM	-	7.894 (0.000)	7.708 (0.000)
Country	1.698 (0.000)	-	-
Growth	-	-0.521 (0.029)	-
Finance-Bank	-	-	-
Finance-Market	-	-	-
Panel	-	9.273 (0.000)	9.051 (0.000)
Time-Series	-	8.822 (0.001)	8.979 (0.002)
Cont.Regr.1	2.182 (0.000)	1.368 (0.021)	-
Cont.Regr.2	1.412 (0.001)	-	-
Cont.Regr.3	-	-	-
Focus	-1.173 (0.012)	-	-
Endogeneity	-	-9.719 (0.000)	-10.115 (0.000)
Genuine Effect- Z variables			
1/SEr	-	1.477 (0.000)	1.151 (0.000)
GMM/SEr	-	-	-
Country/SEr	-	-	-
Growth/SEr	-	-	-
Finance-Bank/SEr	-0.047 (0.085)	-0.034 (0.008)	-0.034 (0.030)
Finance-Market/SEr	-	-	-
Panel/SEr	-	-1.204 (0.000)	-1.165 (0.000)
Time-Series/SEr	-0.123 (0.052)	-1.970 (0.000)	-1.864 (0.001)
Cont.Regr.1/SEr	-	-0.267 (0.000)	-
Cont.Regr.2/SEr	-	-0.146 (0.001)	-
Cont.Regr.3/SEr	0.154 (0.010)	-	-
Focus/SEr	0.104 (0.001)	-0.150 (0.014)	-
Endogeneity/SEr	-	0.152 (0.001)	0.202 (0.003)
n	549	549	549
j	31	31	31

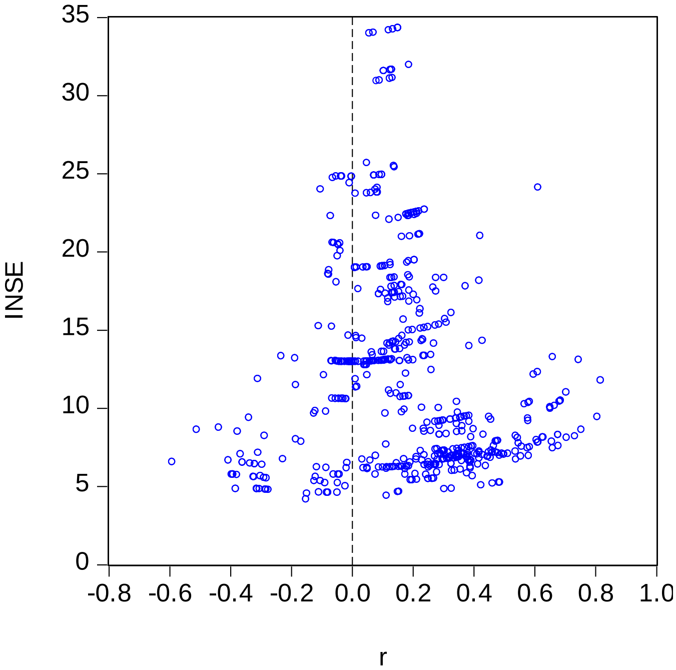
a: OLS-Cluster-robust standard errors.
b: Fixed Effects-robust standard errors.
c: Fixed Effects-cluster-robust standard errors.
p-values are reported in parenthesis.
j is the number of studies
n is the number of observations.

Table 5
Meta-Regression Analysis-Robustness Test

	(1) *OLS-CR*[a]	*(2)* *FE*[b]	*(3)* *FE-CR*[c]
Publication Bias- L variables			
Intercept-β_1	-5.649 (0.024)	-10.874 (0.000)	-10.568 (0.000)
GMM	-	7.974 (0.000)	7.728 (0.000)
Country	2.055 (0.000)	-	-
Growth	-	0.963 (0.100)	1.047 (0.001)
Finance-Bank	1.660 (0.014)	-	-
Finance-Market	-	-	-
Panel	-	11.206 (0.000)	11.044 (0.000)
Cont.Regr.1	5.624 (0.022)	-	-
Cont.Regr.2	5.686 (0.031)	-1.004 (0.073)	-
Cont.Regr.3	2.810 (0.047)	-	-
Focus		-	-
Endogeneity	-	-9.703 (0.000)	-10.128 (0.000)
Genuine Effect- Z variables			
1/SEr	0.400 (0.004)	1.926 (0.000)	1.507 (0.000)
GMM/SEr	-	-	-
Country/SEr	-	-	-
Growth/SEr	-	-0.153 (0.010)	-0.152 (0.000)
Finance-Bank/SEr	-0.193 (0.003)	-0.042 (0.006)	-0.040 (0.072)
Finance-Market/SEr	-	-	-
Panel/SEr	-	-1.410 (0.000)	-1.375 (0.000)
Cont.Regr.1/SEr	-0.243 (0.064)	-0.339 (0.008)	-
Cont.Regr.2/SEr	-0.306 (0.033)	-0.249 (0.039)	-
Cont.Regr.3/SEr	-	-0.240 (0.080)	-
Focus/SEr	-	-0.150 (0.015)	-
Endogeneity/SEr	-	0.147 (0.001)	0.207 (0.004)
n	485	485	485
j	28	28	28

a: OLS-Cluster-robust standard errors.
b: Fixed Effects-robust standard errors.
c: Fixed Effects-cluster-robust standard errors.
p-values are reported in parenthesis.
j is the number of studies
n is the number of observations.

Figure 1



APPENDIX

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