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 account for 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. Among the most significant factors behind this heterogeneity is the choice of financial-variable proxies, the kind of data used as well as whether the relevant studies take into account the issue of endogeneity. Our results suggest that the empirical literature on the finance-growth nexus is not free from publication bias. Also, a genuine positive 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 along the lines of 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 examine 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.

The Schumpeterian reasoning was further reinforced by the work of Gurley and Shaw (1955, 1960, 1967) and Goldsmith (1969), who were part of the first attempts to empirically investigate the finance-growth nexus. 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 over time 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

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

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 minimises 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 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 whether publication bias exists 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 from the hypothesised relationships. Finally, we consider whether a genuine effect exists; that is, the size and the sign of a potentially authentic empirical result.

The rest of the paper is organized as follows. Section 2 discusses some of the 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 summarises and concludes.

2. Literature Issues

The financial development indicators proposed by King and Levine (1993a) proved to be rather influential for 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 on real per capita GDP growth, on the growth of physical capital accumulation, and on total factor productivity (TFP) growth.

An extended literature has been developed using the above indicators and analyses, in an attempt to study the banking aspect of financial systems. Another strand of the literature shifts focus to the role played by stock markets. For example, Atje and Jovanovic (1993) 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 the banking sector and stock markets on growth (e.g., Demirguc-Kunt and Maksimovic, 1998; Levine and Zervos, 1998); but evidence also exists that challenges 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 importance of a sound legal and regulatory system 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 of the relevant relationship**.** 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. 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. Luintel *et al.* (2008) provide a set of qualifications for the use of panel data analysis. 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 (see, however, Arestis et al., 2001, for a different view). Moreover, Rousseau and Wachtel's (2000) find 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 importance of financial development not only for growth but also for the integration of capital markets.

Thus, the validity of finance and growth nexus is subject to a number of qualifications pertaining to the empirical methodology and data used, the treatment of endogeneity, measurement issues, and so on. These issues constitute a potential source of heterogeneity. Limited meta-analytic work exists so far, however, on the finance-growth nexus. To our knowledge the only published meta-analysis directly addressing the finance-growth nexus is by Valickova *et al.* (2014). Bumann *et al.* (2013) focus on the closely related, but different, topic of the financial liberalisation-growth nexus. Clearly, however, such an important issue as the effects of financial development on growth warrants more evidence in order to obtain a thorough and robust meta-analytic characterization.

3. Data Description and Data Selection Process

The data selection process follows the MAER-NET guidelines (see Stanley *et al.* 2013). We made our initial selection of studies through a comprehensive search in the EconLit and Google Scholar using combinations of keywords, such as 'economic growth', 'economic development', 'financial development', 'empirical', 'estimation'. 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 results in 118 empirical papers. The search finished in September 2013.

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 to the baseline specification:

$$g = a + \beta F + \gamma X + \varepsilon \qquad (1)$$

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

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

of the estimated coefficients' standard errors or their *t*-statistics and they merely report the statistically significant variables using merely asterisks.

Moreover, while we consider estimates based on time-series analyses we do not include the studies that use time series data in order to examine the Granger causality between growth and financial development. Such studies typically report *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. In this way, we cannot use any piece of information from studies examining the issue of causality.

Furthermore, we do not include unpublished papers. Stanley and Doucouliagos (2012) suggest that including working papers is not likely to affect the meta-analysis results of well-established literatures. All in all, our data base consists of 1151 observations coming from 69 published papers[3], which are shown in the Appendix along with the number of estimates from each study.

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 different proxies of financial development that have been used. 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 Doucouliagos (2012) we compute the partial correlations, r, from the *t*-statistics as:

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

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.

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

Parts of the empirical literature in economics can be characterized by distortions of the magnitude of 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.

To detect any possible bias in our meta-data, we start with a scatter plot in Figure 1, which shows the relation between the partial correlation of estimated effects (horizontal axis) and 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. Positive values are slightly over-reported, which may indicate a bias. Furthermore, the simple average partial correlation is 0.15 and proves to be statistically significant at 1%. This can be considered as the result of small to moderate 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) which 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 for 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 estimation techniques" (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 the relevant 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 associated with the estimated effect c_i, SEr_i is the corresponding standard error of r_i and u_i is the error term. Both equations (3) and (4) suffer from heteroskedasticity. To prevent our analysis from erroneous inference, we follow the common practice and divide either of the two equations by 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.[4]

[4] The OLS estimation of (5) is equivalent to estimating (4) using weighted least squares (WLS). Since we base our analysis on equation (5) and its variants and due to the fact that we have already divided with standard errors, we prefer to write OLS instead of WLS.

Estimating equation (5) using OLS, however, may prove to be erroneous. Collecting all the estimations from each paper results to a total of 1151 observations. This is likely to induce bias to the OLS results due to possible correlation among estimates within one study. To account for this kind of dependence we estimate the unbalanced panel version of (5) using Fixed Effects (FE) and reporting cluster-robust standard errors. More precisely, the model is now modified as follows:

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

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 to 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.

We provide the estimation results in Table 1. The first column shows the results from OLS using clustered standard errors so as to take into account dependence. The outcome suggests the existence of publication bias of 10%. Additionally, there is no evidence for the existence of a genuine effect. When we employ fixed effects the results remain the same. As a robustness check we estimate equation (6) using random effects. In this case, the evidence of publication bias is stronger as the intercept is statistically significant at 1%. Contrary to the previous results, the zero effect is not true; the slope coefficient is found also statistically significant at 1%. As a further test, we estimate equation (5) using only the average values of each study and the results, reported in the last column, show that there is a non-zero effect of financial development on growth. On the other hand, the evidence of publication bias is not confirmed.

< Please insert Table 1 here>

Up to this point the findings are not definitive. Previous research shows that in cases where there is unexplained heterogeneity the results from FAT and PET may be misleading.[5] This can easily be tested through the error variance, σ_{ε}^{2}. 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 1. In all cases, the null hypothesis is strongly rejected implying the existence of unexplained heterogeneity. The next section explores more thoroughly the role of several potential factors that may affect 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 and genuine effects. Our modelling strategy is in accordance to the MAER-NET's guidelines. To search for all potential determinants we specify a model as:

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

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-called moderator variables, Z_k. These variables capture 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. We tried to account for all the potential factors that may affect heterogeneity and at the same time to be parsimonious in order to deal with the distortional effects of multicollinearity.

The choice of moderator variables depends on the specific topic under examination and in the present study we construct six general categories of variables that are related to some fundamental features. The first category is related to data characteristics. The first variable of the category is the kind of data used. Distinguishing among cross-sectional, time series and panel data, we treat the studies that use cross-sectional data as the base category and we create two dummies. The first dummy takes the value of 1 when coefficients have 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.

Furthermore, another aspect of data characteristics is the number of countries examined by each study. In the growth-finance literature, there are large differences in

[5] See Stanley (2008).

this respect since some studies focus only on one country while others use an extended set of economies. Another related issue is whether the examined sets are homogeneous or not. So, we construct a dummy taking the value of 0 when the examined set of countries can be considered as homogeneous and 1 when it is heterogeneous. Homogeneous set is considered a group of counties whose per capita GDP is similar. Also, in studies that focus on single economies we also put 1 to this dummy variable.

The second category deals with the exact measurement of the financial development. The literature has employed a variety of variables to proxy financial development. The simplest proxy of financial development would be to use the ratio of liquid liabilities to GDP. A more appropriate and popular variable, however, is the ratio of domestic credit to GDP, which provides information about the financing of economic activity by the banking sector. Furthermore, some studies use market-oriented measures, which are not related to banking. The most popular market-oriented measure is that of stock market capitalisation. In order to handle all these different measures we use three dummies to distinguish between different proxies. Using liquid liabilities as the treatment variable, the first dummy corresponds to studies that use bank-based measures of financial development. The second dummy corresponds to studies that use market-based proxies. Lastly, we use a third dummy for the studies that use complex indexes that cannot be characterised either as bank or as market-based measures. In this way, we can consider whether the use of a specific kind of financial variable plays a significant role to the reported results.

The measurement of economic growth constitutes another differentiating feature. The most common variable is the per capita growth of real GDP. Other studies use as dependent variable the growth of capital stock or total factor productivity.[6] Our moderator variable 'growth' takes the value of 0 when the study uses GDP growth rates and 1 when other measures are used.

Throughout the extensive growth-financial development literature a variety of empirical methods has been employed. The properties of GMM and especially the ability to address the endogeneity problem render it the most popular econometric method employed in the modern literature on finance and growth. We capture this feature by introducing a dummy that takes the value of 1 for estimates that come from a method

[6] Some authors use these measures as alternative proxies for economic growth. We include these variables in order to keep up with the literature. For more details see Beck *et al.* (2000).

that takes into account the endogeneity (such as GMM and 2SLS) and 0 for the remaining cases (OLS, GLS).[7]

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 ('conditional set 1'). The second set of regressors contains the first one plus the size of government, the inflation rate, net exports, the black market premium, and a general index of trade, exchange rates and price distortions ('conditional set 2'). The third conditional set contains the second one plus some other specific variables such as measures of political stability ('conditional set 3').[8]A small amount of studies uses only time dummies as additional regressors ('conditional set 0'). Finally, a number of authors use alternative sets of regressors ('other set'). So, using as base the 'conditional set 0' we construct four dummies: the first dummy takes the value of 1 for the 'conditional set 1' and 0 otherwise. The second and the third dummies are constructed in a similar way for the 'conditional set 2' and '3', respectively. The fourth dummy corresponds to all the other studies that use different conditional sets. In addition to those moderator variables, we also include the number of conditional variables added to equation (1).

The last category is related to publication characteristics. Here, we use two variables. The first is the impact factor of the journal where each study has been published. More precisely, we use the recursive RePEc impact factor. Another interesting publication feature is the main focus of each study. Some authors 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

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[7] We also experimented with additional dummies that could potentially capture the use of different econometric methods but the results suffered from high multicollinearity. As a consequence, the best compromising solution that emerged was to use the endogeneity dummy; considering endogeneity we are actually able to take into account differences in the econometric methods across the literature.

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

title of each paper. Thus, we construct a dummy that takes 1 when the title of the relevant study reveals a clear focus on the growth-finance relation and 0 when the research interest is a closely related topic. Table 2 summarises all the moderator variables we use and presents their corresponding means and standard deviations.

< Please insert Table 2 here>

Table 3 shows the meta-regressions. Following the general to specific approach we focus on the parsimonious estimation after sequentially deleting variables that are not statistically significant at the 5% level of significance.

According to our results, data characteristics seem to explain the observed heterogeneity. Specifically, using either panel data or time series tends to produce lower partial correlation than using cross-sectional data. This is the most robust result since it is true for the three different estimations. The issue of endogeneity seems to play a role, at least in the OLS results. Taking into account the issue of endogeneity tends to produce slightly higher coefficients. The same is true when a researcher uses the 'conditional set 1'. Furthermore, the coefficient of the 'number of countries' variable contains a different sign in OLS and FE estimations. In both cases, however, its magnitude is very low, which suggests that it is not economically meaningful. Interestingly, the proxy of financial development seems to be an important factor of heterogeneity. Market-based variables produce higher partial correlation than liquid liabilities.

In all three estimations the genuine effect is significant. We come to this conclusion testing whether all coefficients in the parsimonious models are jointly zero through a F-test. The p-values of F-tests reported in the last row of Table 3 suggest the existence of a statistically significant genuine effect. Using the variables' sample means of Z-variables, the average estimated partial correlation is positive and equal to 0.16 when the parsimonious OLS estimation is used. The corresponding number that results from the estimated FE model is 0.18. Both values are very close to the value of 0.2 found by Valickova *et al.* (2014).[9] According to Doucouliagos (2011) such a magnitude can be regarded as moderate. Lastly, the intercept in all three cases remain statistically significant

[9] The estimated value that emerges from using the RE model is slightly higher at 0.23. The RE model, however, is not our preferred model and we present the relevant results only for the sake of robustness. For more details about the differences between the FE and RE models see Stanley and Doucouliagos (2012).

indicating that the growth-finance literature is not free from publication bias.[10] This outcome actually confirms the initial impression from the funnel plot.

< Please insert Table 3 here>

6. Summary and Conclusions

We conduct a meta-analysis of the existing empirical evidence on the effects of financial development on growth and investigate a number of issues pertaining to this voluminous literature following the guidelines provided by MAER-NET (Stanley *et al.*, 2013). Our meta-regression analysis shows that the type of data employed, and the different variables used to measure financial development in the literature can constitute sources of heterogeneity. Specifically, the usage of market-based proxies of financial development seems to result in lower correlations than the usage of either liquid liabilities or market-based variables. On the other hand, the estimated coefficients of bank-based measures and complex indexes are found statistically insignificant in all specifications. This is robust evidence that using different proxies of financial development gives rise to the observed heterogeneity. Additionally, panel data, which are frequently used from the late 1990s onwards, produce smaller correlations. The same seems to hold for time series data. Furthermore, taking endogeneity into account, and using a specific set of regressors, seems to explain part of the heterogeneity. Overall, the meta-regression analysis produces evidence suggesting that the empirical literature on the finance-growth nexus is not free from publication bias. Beside this bias, however, the results suggest the existence of a statistically significant and economically meaningful positive genuine effect from financial development to economic growth.

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[10] Interestingly, the values of FE and RE estimates are negative. This puzzling finding is corroborated by the findings of Valickova *et al.* (2014). A possible explanation is that other factors exists affecting publication bias

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Table 1
FAT-PET Results

	(1) OLS[a]	(2) FE[a]	(3) RE	(4)Average[b]
publication bias	1.513*	0.911*	1.265***	0.722
β_1	(0.573)	(0.477)	(0.361)	(0.573)
genuine effect	0.013	0.058	0.073***	0.115***
β_0	(0.047)	(0.036)	(0.020)	(0.037)
j	69	69	69	69
n	1151	1151	1151	69
Testing $\sigma_\varepsilon^2 \leq 2$	*p*-values			
	0.000	0.000	0.000	0.000

Notes
a: cluster-robust standard errors
b: average values
j is the number of studies, *n* is the number of observations ***,**,* report statistical significance at 1%, 5% and 10%, respectively.

The estimated equation for columns (1) and (4) is $r_i^* = \beta_1 + \beta_0 \frac{1}{SEr_i} + v_i$, where for columns (2) and (3) is the panel version $r_{ij}^* = \beta_1 + \beta_0 \frac{1}{SEr_i} + \zeta_j + \varepsilon_{ij}$.

Table 2

Lists of Variables and Descriptive Statistics

Variable Name	Variable Description	Mean	S.D.
Partial Correlation	Partial Correlation (equation 2) of the effect of financial development on growth	0.150	0.220
Data Characteristics			
Cross Sectional (base)	D=1, when cross-sectional data are used	0.352	0.478
Panel	D=1, when panel data are used	0.596	0.491
Time Series	D=1, when time-series data are used	0.052	0.222
Number of Countries	Number of examined countries included in the sample	44.103	29.303
Homogeneous Set	D=1, when the examined countries are considered homogeneous	0.639	0.480
Financial Development Proxies			
Liquid Liabilities (base)	D=1, when liquid liabilities are used as a measure of financial development	0.215	0.411
Bank-based Indexes	D=1, when a variable based on bank credit is used as a measure of financial development	0.495	0.500
Market-based Indexes	D=1, when a market based variable is used as a measure of financial development	0.224	0.417
Complex Indexes	D=1, when a proxy is neither bank nor market-based measure of financial development	0.065	0.247
Growth Measures			
Growth	D=1, when other measures apart from per capita GDP are used as dependent variable	0.070	0.254
Endogeneity-Econometric Method			
Endogeneity	D=1, when the econometric method takes into account the endogeneity	0.557	0.497
Conditional Regressors			
Set 0 (base)	D=1, when the Set 0 of additional regressors is used	0.033	0.179
Set 1	D=1, when the Set 1 of additional regressors is used	0.111	0.315
Set 2	D=1, when the Set 2 of additional regressors is used	0.325	0.469
Set 3	D=1, when the Set 3 of additional regressors is used	0.122	0.327
Other Set	D=1, when the Set of additional regressors cannot be considered a subset of 1,2 or 3	0.409	0.492
Number of Additional Regressors	Number of additional Regressors included in the equation	5.759	3.048
Publication Characteristics			
Impact Factor	RePEc Impact Factor	0.438	0.706
Focus	D=1, when the direct focus is on the relation between 'Growth-Financial Development'	0.811	0.391

Notes: D stands for dummy variable.

Table 3

Meta-Regressions

Variable Name	(1) OLS-General	(2) OLS-Parsimonious	(3) FE-General	(4) FE-Parsimonious	(5) RE-General	(6) RE-Parsimonious
constant	0.736	1.260***	-4.504***	-3.552***	-1.839***	-1.164**
	(0.592)	(0.293)	(1.398)	(1.295)	(0.560)	(0.453)
1/SEr	0.079		0.900	0.714***	0.509***	0.408***
	(0.110)		(0.247)	(0.165)	(0.101)	(0.049)
Panel	-0.078	-0.062***	-0.437***	-0.384***	-0.295***	-0.281***
	(0.059)	0.020	(0.064)	(0.064)	(0.035)	(0.031)
Time Series	-0.122	-0.175***	-0.638***	-0.573***	-0.446***	-0.434***
	(0.087)	0.064	(0.230)	(0.200)	(0.133)	(0.130)
Number of Countries	0.000	0.001**	-0.001	-0.001**	0.000	
	(0.000)	0.001	(0.001)	(0.001)	(0.000)	
Homogeneous Set	0.039		-0.070		-0.034	
	(0.053)		(0.077)		(0.029)	
Bank-based Indexes	-0.007		-0.016		-0.010	
	(0.025)		(0.015)		(0.012)	
Market-based Indexes	0.109		0.181***	0.189***	0.176***	0.182***
	(0.081)		(0.052)	(0.056)	(0.013)	(0.010)
Complex Indexes	-0.016		0.020		0.015	
	(0.063)		(0.122)		(0.058)	
Growth	0.067*		0.021		0.026	
	(0.035)		(0.031)		(0.034)	
Endogeneity	0.047	0.066**	0.006		0.009	
	(0.037)	0.026	(0.020)		(0.016)	
Set 1	0.065	0.077***	-0.001		0.120*	0.065***
	(0.054)	0.027	(0.070)		(0.071)	(0.024)
Set 2	0.030		-0.050		0.058	
	(0.056)		(0.078)		(0.069)	
Set 3	0.074		-0.053		0.089	
	(0.098)		(0.099)		(0.077)	
Other Set	-0.067		0.018		0.041	
	(0.051)		(0.039)		(0.067)	
Number of Additional Regressors	-0.004		0.005		0.005	0.006**
	(0.005)		(0.007)		(0.003)	(0.003)
Impact Factor	-0.015		0.078*		0.002	
	(0.016)		(0.041)		(0.021)	
Focus	-0.011		-0.125		-0.055	
	(0.047)		(0.135)		0.039	
Testing Genuine Effect	-	10.68***	-	13.8***	-	410.63***

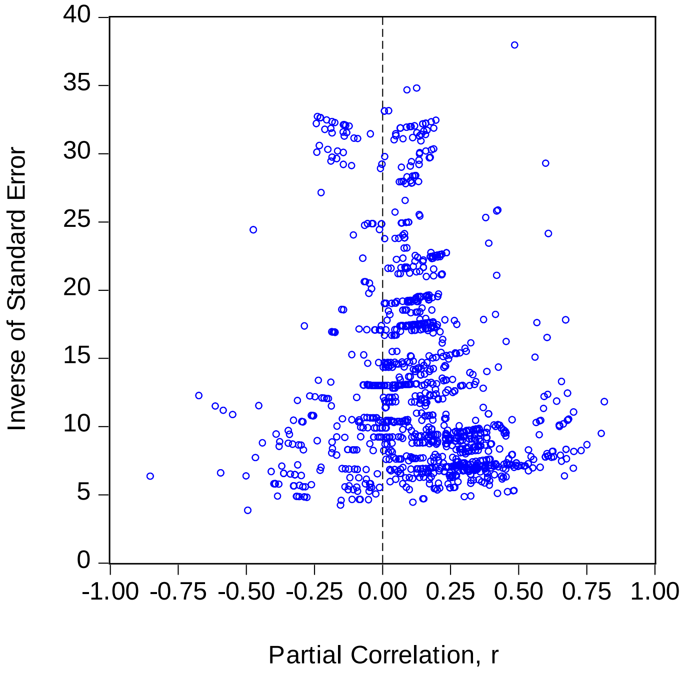
Notes: The dependent variable is the partial correlations. Columns report estimates of equation 7;

$r_{ij}^{*} = \beta_1 + \beta_0 \frac{1}{SEr_{ij}} + \sum_{k=1}^{K} \frac{\delta_k Z_{ijk}}{SEr_{ij}} + \zeta_j + \varepsilon_{ij}$. Standard errors are included in parentheses.

***,**, and * report statistical significance at 1%, 5% and 10%, respectively.

Figure 1

Funnel Plot



Appendix

Papers included in the Meta-Analysis

Study	Number of Estimates
1. Aghion et al. (2009)	23
2. Ahlin and Pang (2008)	30
3. Allen and Ndikumana (2000)	14
4. Al-Malkawi and Abdullah (2011)	6
5. Andersen and Tarp (2003)	9
6. Andres et al. (2004)	48
7. Anwar and Cooray (2012)	15
8. Bandyopadhyay (2006)	20
9. Beck and Levine (2004)	40
10. Beck et al. (2000)	12
11. Benhabib and Spiegel (2000)	12
12. Bittencourt (2012)	12
13. Bolbol et al. (2005)	32
14. Bordo and Rousseau (2006)	6
15. Bordo and Rousseau (2012)	10
16. Compton and Giedeman (2011)	80
17. Dawson (2003)	2
18. Dawson (2008)	2
19. DeGregorio and Guidotti (1995)	17
20. Deidda and Fattouh (2002)	9
21. Djalilov and Piesse (2011)	4
22. Edison et al. (2002)	5
23. Ergungor (2008)	44
24. Giedeman and Compton (2009)	12

25. Graff (2003)	4
26. Hao (2006)	12
27. Hassan et al. (2011a)	8
28. Hassan et al. (2011b)	27
29. Huang and Lin (2009)	12
30. Huang et al. (2010)	12
31. Hwang et al. (2010)	1
32. Jalilian and Kirkpatrick (2005)	2
33. Ketteni et al. (2007)	3
34. King and Levine (1993a)	12
35. Lartey (2010)	5
36. Lartey and Farka (2011)	4
37. Leitão (2010)	4
38. Lensink (2001)	6
39. Levine (1998)	18
40. Levine (1999)	24
41. Levine (2002)	16
42. Levine and Zervos (1998)	30
43. Levine et al. (2000)	27
44. Liu and Hsu (2006)	20
45. Loyza and Rancière (2006)	4
46. Lu and Yao (2009)	12
47. Manning (2003)	10
48. Masten et al. (2008)	2
49. McCaig and Stengos (2005)	18
50. Minier (2003)	6
51. Naceur and Ghazouani (2007)	28
52. Ram (1999)	12
53. Rioja and Valev (2004)	6
54. Rousseau and Sylla (2001)	12
55. Rousseau and Wachtel (2000)	3
56. Rousseau and Wachtel (2002)	9
57. Rousseau and Wachtel (2011)	51
58. Rousseau and Yilmazkuday (2009)	24
59. Saci et al. (2009)	24
60. Seetanah et al. (2009)	2
61. Shen and Lee (2006)	85
62. Shen et al. (2011)	36
63. Tang (2006)	36
64. Tsangarides (2002)	3
65. Velverde et al. (2007)	8
66. Yao (2010)	8
67. Yay and Oktayer (2009)	28
68. Yilmazkuday (2011)	8
69. Yu et al. (2012)	5