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Financial Development and Economic Growth: A Meta-Analysis

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Abstract

We analyze 1334 estimates from 67 studies that examine the effect of financial development on economic growth. Taken together, the studies imply a positive and statistically significant effect, but individual estimates vary a lot. We find that both research design and heterogeneity in the underlying effect play a role in explaining the differences in results. Studies that do not address endogeneity tend to overstate the effect of finance on growth. While the effect seems to be weaker in poor countries, the effect decreases worldwide after the 1980s. Our results suggest that stock markets support faster economic growth than other financial intermediaries. We find no evidence of publication bias in the literature.

JEL-Classification: C83, G10, O40

Keywords: finance, development, growth, meta-analysis

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1 Introduction

Does the development of the financial sector support economic growth? On the one hand, we observe that financial markets in developed countries display substantial complexity, and some researchers suggest a causal effect from financial development on growth (for example, Levine et al. 2000 and Rajan & Zingales 1998). On the other hand, the complexity of financial markets may contribute to financial crises that occur regularly around the world and often cause a long-lasting decrease in growth rates (Kindleberger 1978).

In this paper, we quantitatively review the empirical literature on the finance-growth nexus. We focus on two fundamental questions. First, does financial development foster economic growth? Second, are some types of financial structures more conducive to growth than others? This is important in the light of the recent discussion showing conflicting findings about the importance of different financial structures on growth (see Demirguc-Kunt and Levine, 1996, Levine, 2002, 2003, Beck and Levine, 2004, Luintel et al., 2008, and Demirguc-Kunt et al., 2013, among others).

To examine these issues, we use modern meta-analysis techniques. Although originally developed for use in medicine, meta-analysis is increasingly used in economic research (see, for example, Stanley & Jarrell 1998, Card & Krueger 1995, Stanley 2001, Disdier & Head 2008, Doucouliagos & Stanley 2009, and Daniskova & Fidrmuc 2012). To our knowledge, however, a comprehensive meta-analysis of the relation between finance and growth has not yet been conducted, and we aim to bridge this gap. The closest paper to ours is that of Bumann et al. (2013), who use meta-analysis to document in the related literature a positive but relatively weak effect on financial liberalization and growth.

Our results suggest that the literature identifies an authentic positive link between financial development and economic growth. We argue that the estimates of the effect reported in the literature are not driven by the so-called publication selection bias, i.e., the preference of researchers, referees, or editors for positive and significant estimates. The results also indicate that the differences in the reported estimates arise not only from the research design (for example, from addressing or ignoring endogeneity) but also from real heterogeneity in the effect. To be specific, we find that the effect of financial development on growth varies across regions and time periods. The effect weakens somewhat after the 1980s and is generally stronger in wealthier countries, a finding consistent with Rousseau & Wachtel (2011). Our results also suggest that financial structure is important for the pace of economic growth, as suggested, for example, by Demirguc-Kunt & Levine (1996). We further find that stock market-oriented systems tend to be more conducive to growth than bank-oriented systems, which is in line with the theoretical model of Fecht et al. (2008) or empirical evidence by Luintel et al. (2008).

The remainder of this paper is structured as follows. In Section 2, we discuss how researchers measure financial development. In Section 3, we describe how we collect the data from the literature, and we provide summary statistics of the data set. In Section 4, we test for the presence of publication selection. In Section 5, we examine the heterogeneity in the reported estimates. Section 6 concludes the paper, and the Appendix provides a list of studies included in the meta-analysis.

2 Measuring Financial Development

Our ambition in this section is not to provide an exhaustive survey on the methodology used in the literature to estimate the link between financial development and growth; in this respect, we refer the readers to thorough reviews by Levine (2005) and Ang (2008). Rather, we focus on the key aspect of this empirical literature: the measurement of financial development.

The Financial Development Report 2011, published by the World Economic Forum, defines financial development as "*the factors, policies, and institutions that lead to effective financial intermediation and markets, as well as deep and broad access to capital and financial services*" (WEF 2011, p. 13). In a similar vein, Levine (1999, p. 11) puts forward that an ideal measure of financial development would capture "*the ability of the financial system to research firms and identify profitable ventures, exert corporate control, manage risk, mobilize savings, and ease transactions.*" These definitions assign a major role to the effectiveness of financial intermediaries and stock markets. Empirical studies must operationalize these definitions, however, which may present the greatest challenge for the literature (Edwards 1996). For example, high credit growth does not necessarily imply smooth financial intermediation, as the use of the typical indicators, such as the credit-to-GDP ratio, implicitly assumes. In contrast, faster credit growth can indicate an unbalanced allocation of financial resources and signal an upcoming financial crisis.[1]

The most commonly used indicators of financial development can be broadly defined as financial depth, bank ratio, and financial activity. Financial depth, measured as the ratio of liquid liabilities of the financial system to the gross domestic product GDP, reflects the size of the financial sector. Researchers employ various measures of financial sector depth, which are typically connected to a money supply: some authors use the ratio of M2 to the GDP (for example, Giedeman & Compton 2009 and Anwar & Cooray 2012), while others rely on M3 (Dawson 2008, Hassan et al. 2011b, and Huang & Lin 2009). The use of the broader aggregate, M3, is driven by the concern

[1] See Arcand et al. (2012), Cecchetti & Kharroubi (2012), and Beck et al. (2013) for evidence that fast-growing financial markets may have adverse effects on economic growth.

that the ratio of M2 to the GDP does not appropriately capture the development of the financial system in countries where money is principally used as the store of value (Yu et al. 2012). To eliminate the pure transaction aspect of narrow monetary aggregates, some authors prefer the ratio of the difference between M3 and M1 to the GDP (for example, Yilmazkuday 2011 and Rousseau & Wachtel 2002). Financial depth, however, is a purely quantitative measure and does not reflect the quality of financial services. In addition, financial depth may include deposits in banks by other financial intermediaries, which raises the problem of double counting (Levine 1997).

The second proxy used to measure financial development is bank ratio, first applied by King & Levine (1993). Bank ratio is defined as the ratio of bank credit to the sum of bank credit and domestic assets of the central bank. Bank ratio stresses the importance of commercial banks compared with central banks in allocating excess resources in the economy. Nevertheless, Levine (1997) notes that there are weaknesses associated with the implementation of this measure, as financial institutions other than banks also provide financial functions. Moreover, bank ratio does not capture to whom the financial system is allocating credit, nor does it reflect how well commercial banks perform in mobilizing savings, allocating resources, and exercising corporate control.

The third proxy used in the literature is financial activity. Researchers employ several measures of financial activity, such as the ratio of private domestic credit provided by deposit money banks to the GDP (for example, Beck & Levine 2004, and Cole et al. 2008); the ratio of private domestic credit provided by deposit money banks and other financial institutions to the GDP (employed by Andersen & Tarp 2003 and De Gregorio & Guidotti 1995); and the ratio of credit allocated to private enterprises to total domestic credit (employed by King & Levine 1993 and Rousseau & Wachtel 2011). These measures offer a better indication of the size and quality of services provided by the financial system because they focus on credit issued to the private sector. However, neither private credit nor financial depth can adequately assess the effectiveness of financial intermediaries in smoothing market frictions and channeling funds to the most productive use (Levine et al. 2000).

The empirical research in this area originally focused on banks. Later, researchers started to examine the effect of stock markets as well (Atje & Jovanovic 1993), and as a consequence, proxies for stock market development have become increasingly used. The most commonly employed measures of stock market development are the market capitalization ratio (Chakraborty 2010, Shen & Lee 2006, and Yu et al. 2012), stock market activity (Manning 2003, Tang 2006, and Shen et al. 2011), and turnover ratio (Beck & Levine 2004, Yay & Oktayer 2009, and Liu & Hsu 2006). Stock market capitalization refers to the overall size of the stock market and is defined as the total value of listed shares relative to the GDP. The other two measures are associated more with liquidity. Stock market activity equals the total value of traded shares relative to the GDP, while the turnover ratio is defined as the total value of traded shares relative to the total value of listed shares.

Alternative measures of financial development include, for example, the aggregate measure of overall stock market development (Naceur & Ghazouani 2007), which considers market size, market liquidity, and integration with world capital markets; the share of resources that the society devotes to its financial system (Graff 2003); the ratio of deposit money bank assets to the GDP (Bangake & Eggoh 2011); and financial allocation efficiency, which is defined as the ratio of bank credit to bank deposits.

The preceding paragraphs suggest that the literature offers little consensus concerning the most appropriate measure of financial development. For this reason, most researchers use several definitions of financial development to corroborate the robustness of their findings. Different indicators are also suited for different countries depending on whether the country features a financial system oriented on banks or on the stock market.

3 The Data Set of the Effects of Finance on Growth

As a first step in our meta-analysis, we collect data from the literature. In doing so, we focus on studies that estimate a growth model augmented for financial development:

$$G_{it} = \alpha + \beta F_{it} + \gamma X_{it} + \delta_t + \eta_i + \epsilon_{it}, \quad (1)$$

where i and t denote country and time subscripts; G represents a measure of economic development; F represents a measure of financial development; X is a vector of control variables accounting for other factors considered important in the growth process (for example, the initial income, human capital, international trade, or macroeconomic and political stability); δ_t captures a common time-specific effect; η_i denotes an unobserved country-specific effect; and ε is an error term. Note that (1) describes a general panel data setting, which can collapse to cross-sectional or time-series models. The cross-sectional and time-series studies are analyzed in the following sections, too.

We consider the empirical studies mentioned in the recent literature review of Ang (2008). Moreover, we search in the Scopus database and identify 451 papers for the keywords “financial development” and “economic growth”. We read the abstracts of the papers and retained any studies that demonstrated a chance of containing empirical estimates regarding the effect of finance on growth. Overall, this approach leads to 274 potential studies. We terminate the literature search on April 10, 2012.

We read the 274 potential studies to see whether they include a variant of the growth model as shown in equation (1). We only collect published studies because we consider publication status to be a simple indicator of study quality. Rusnak et al. (2013), for example, found that there is little difference in the extent of publication bias between published and unpublished studies, and we thus correct for the potential bias in any case. Furthermore, we only include studies reporting a measure of precision of the effect of finance on growth (that is, standard errors, t-statistics, or p-values) because precision is required for modern meta-analysis methods. Finally, to increase comparability of the estimated effects, we only include studies where the dependent variable is the growth rate of the total GDP or the GDP per capita.

The resulting data set contains 67 studies, which are listed in the Appendix; the data set is available in the online appendix at http://meta-analysis.cz/finance_growth. Because most studies report multiple estimates obtained from different specifications (for example, using a different definition of financial development), it is difficult to select a representative estimate for each study. For this reason, we collect all estimates, which provides us with 1334 unique observations. It seems to be best practice in recent meta-analyses to collect all estimates from the relevant studies (for instance, Disdier & Head 2008, Doucouliagos & Stanley 2009, and Daniskova & Fidrmuc 2012). We also codify variables reflecting study characteristics that may influence the reported estimates of the effect of finance on growth, and these variables are described in Section 5.

We are interested in coefficient β from equation (1), the regression coefficient reported in a growth model for financial development. Nevertheless, as different studies use different units of measurement, the estimates are not directly comparable. To summarize and compare the results from various studies, we need standardized effect sizes. We use partial correlation coefficients (PCCs), as they are commonly used in economic meta-analyses (Doucouliagos 2005, Doucouliagos & Ulubasoglu 2006, Doucouliagos & Ulubasoglu 2008; Efendic et al. 2011). The PCCs can be derived from the t-statistics of the reported regression estimate and residual degrees of freedom:

$$PCC_{ij} = \frac{t_{ij}}{\sqrt{t_{ij}^2 + df_{ij}}} \tag{2}$$

where PCC_{ij} denotes the partial correlation coefficient from the i^{th} regression estimate of the j^{th} study; t is the associated t-statistics; and df is the corresponding number of degrees of freedom. The sign of the partial correlation coefficient remains the same as the sign of the coefficient β, which is related to financial development in equation (1).

For each partial correlation coefficient, the corresponding standard error must be computed to employ modern meta-analysis techniques. The standard error can be derived employing the following formula:

$$SEpcc_{ij} = \frac{PCC_{ij}}{t_{ij}} \tag{3}$$

where $SEpcc_{ij}$ represents the standard error of the partial correlation coefficient PCC_{ij} and t_{ij} is, again, the t-statistics from the i^{th} regression of the j^{th} study.

Because the PCCs are not normally distributed, we use Fisher z-transformation of partial correlation coefficients to obtain a normal distribution of effect sizes:

$$Zpcc_{ij} = 0.5 \ln\left(\frac{1 + PCC_{ij}}{1 - PCC_{ij}}\right) \tag{4}$$

This transformation enables us to construct normal confidence intervals in the estimations. These z-transformed effect sizes are used for computations and then transformed back to PCCs for reporting.

Of the 1334 estimates of the effect of finance on growth in our sample, 638 are positive and statistically significant at the 5% level, 446 are positive but insignificant, 128 are negative and significant, and 122 are negative but insignificant. These numbers indicate substantial heterogeneity in the reported effects. Table 1 presents summary statistics for the partial correlation coefficients as well as their arithmetic and inverse-variance-weighted averages.

Table 1 Partial Correlation Coefficients for the Relation between Finance and Growth

Observations	
Number of studies	67
Number of estimates	1334
Median PCC	0.14
Averages	
Simple average PCC	0.15 (0.095, 0.20)
Fixed effect average PCC	0.09 (0.088, 0.095)
Random effects average PCC	0.14 (0.129, 0.150)

Notes: Figures in brackets denote 95% confidence intervals.

The arithmetic mean yields a partial correlation coefficient of 0.15 with a 95% confidence interval [0.1, 0.2]. The simple average of partial correlation coefficients, however, suffers from several shortcomings. First, it does not consider the estimate's precision, as each partial correlation coefficient is ascribed the same weight regardless of the sample size from which it is derived. Second, the simple average does not consider possible publication selection, which can bias the average effect. More appropriate summary statistics that account for the estimate's precision can be computed using the fixed-effects or random-effects model, described in detail by Card (2011) and Borenstein et al. (2009).

The fixed-effects model assumes that all reported estimates are drawn from the same population. To calculate the fixed-effects estimate, we weight each estimate by the inverse of its variance**.** The model yields a partial correlation coefficient of 0.09 with a 95% confidence interval [0.088, 0.095], which is only slightly less than the simple mean. This result indicates that when we give more weight to larger studies, the average effect decreases, which can be a sign of selection bias. Thus, studies with small sample sizes must find a larger effect to offset high standard errors and achieve statistical significance. We explore this issue extensively in the next section.

All of our results reported thus far rest on the assumption that all studies measure a common effect, which does not have to be realistic because the studies use different data sets and examine different countries. In this case, random effects may provide better summary statistics. The random-effects model, in addition to considering the precision of estimates, accounts for between-study heterogeneity. The method yields a partial correlation of 0.14 with a 95% confidence interval [0.129, 0.15]. Nevertheless, the random effects model assumes that the differences among underlying effects are random and thus, in essence, unobservable. We proceed to model explicitly the heterogeneity among effect sizes using meta-regression analysis in the following sections.

4 Publication Bias

Publication bias, sometimes referred to as the file-drawer problem, arises when researchers, referees, or editors have a preference for publishing results that either support a particular theory or are statistically significant. In a survey of meta-analyses, Doucouliagos & Stanley (2013) examine the extent of publication bias in economics and find that the problem is widespread. For example, Stanley (2005) shows that the bias exaggerates the reported price elasticities of water demand four-fold. Havranek et al. (2012) find that after correcting for publication bias, the underlying price elasticity of gasoline demand is approximately half of the average published estimate. The economic growth literature is no exception. For example, Doucouliagos (2005) finds bias in the literature regarding the relationship between economic freedom and economic growth, and Doucouliagos & Paldam (2008) identify the bias in the research on aid effectiveness and growth.

Publication bias is particularly strong in fields that show little disagreement concerning the correct sign of the parameter. As a consequence, estimates supporting the prevailing theoretical view are more likely to be published, whereas insignificant results or results showing an effect inconsistent with the theory tend to be underrepresented in the literature. Nevertheless, not all research areas in economics are plagued by publication bias, as several meta-analyses demonstrate (for example, Doucouliagos & Laroche 2003, Doucouliagos & Ulubasoglu 2008, and Efendic et al. 2011).

The commonly used tests of publication bias rest on the idea that studies with smaller samples tend to have large standard errors; accordingly, the authors of such studies need large estimates of the effect to achieve the desired significance level. Thus, authors with small samples may resort to a specification search, re-estimating the model with different estimation techniques, data sets, or control variables until the estimates become significant. In contrast, studies that use more observations can report smaller effects, as standard errors are lower with more observations and statistical significance is then easier to achieve.

A typical graphical method used to examine possible publication bias is the so-called funnel plot (Stanley & Doucouliagos 2010). On the horizontal axis, the funnel plot displays the standardized effect size derived from each study (in our case, partial correlation coefficients); on the vertical axis, it shows the precision of the estimates. More precise estimates will be close to the true underlying effect, while imprecise estimates will be more dispersed at the bottom of the figure. Therefore, in the absence of publication selection, the figure should resemble a symmetrical inverted funnel.[2] The funnel plot for the literature on finance and growth is depicted in Figure 1.

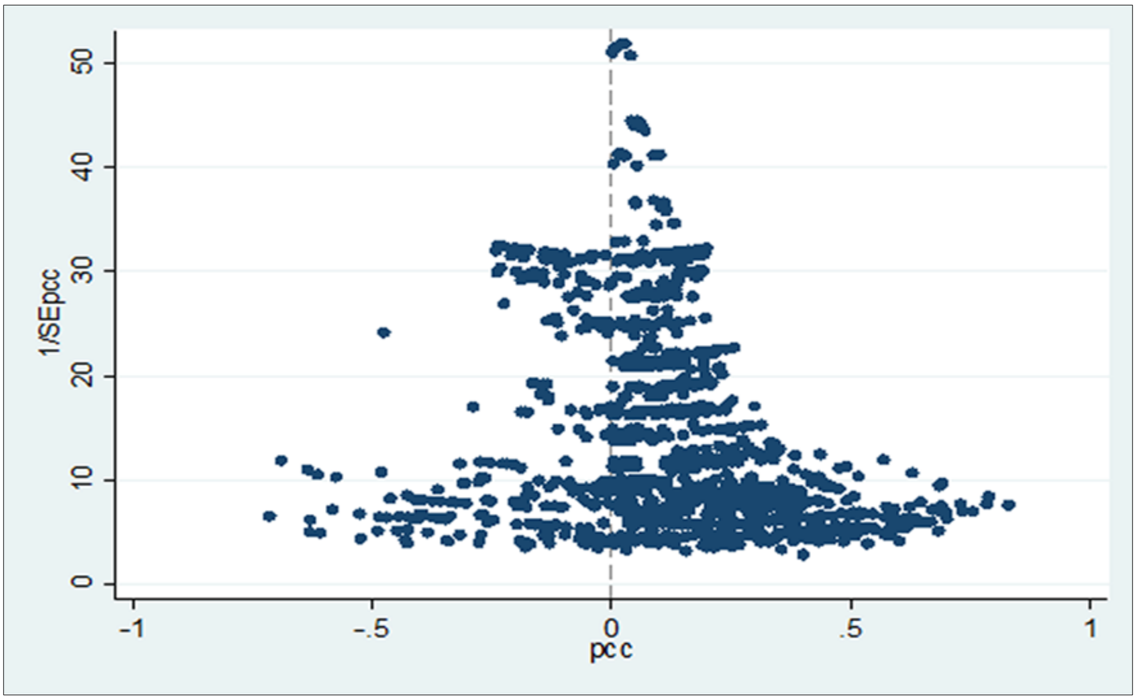

Figure 1 A Funnel Plot of the Effect of Finance on Growth

Though the cloud of observations in Figure 1 resembles an inverted funnel, a closer visual inspection suggests an imbalance in the reported effects, as the right-hand side of the funnel appears to be heavier. This finding suggests that positive estimates may be preferably selected for publication. However, visual methods are subjective, and therefore, in the remainder of the section, we focus on formal methods of detection of and correction for publication bias. We follow, among others, Stanley & Doucouliagos (2010), who regress the estimated effect size on its standard error:

[2] The tip of the funnel does not have to be zero in general; it denotes the most precise estimates. The funnel can be symmetrical even if the true effect was positive (see, for instance, Krassoi Peach and Stanley, 2009).

$$PCC_{ij} = \beta_0 + \beta_1 SEpcc_{ij} + \mu_{ij}\ ;\ j = 1, \ldots, N; i = 1, \ldots, S, \qquad (8)$$

where N is the total number of studies, i is an index for a regression estimate in a j^{th} study, and each j^{th} study can include S regression estimates. The coefficient β_1 measures the magnitude of publication bias, and β_0 denotes the true effect.

Nevertheless, because the explanatory variable in (8) is the estimated standard deviation of the response variable, the equation is heteroskedastic. This issue is, in practice, addressed by applying weighted least squares such that the equation is divided by the estimated standard error of the effect size (Stanley 2008):

$$\frac{PCC_{ij}}{SEpcc_{ij}} = t_{ij} = \beta_0 \left(\frac{1}{SEpcc_{ij}}\right) + \beta_1 + \mu_{ij} \left(\frac{1}{SEpcc_{ij}}\right) = \beta_1 + \beta_0 \left(\frac{1}{SEpcc_{ij}}\right) + \nu_{ij}, \qquad (9)$$

where $SEpcc_{ij}$ is the standard error of the partial correlation coefficient PCC_{ij}. After transforming equation (8), the response variable in equation (9) is now the t-statistics of the estimated coefficient β from equation (1). The equation can be interpreted as the funnel asymmetry test (it follows from rotating the axes of the funnel plot and dividing the new vertical axis by the estimated standard error) and, therefore, a test for the presence of publication bias.

Because we use multiple estimates per study, we should control for the potential dependence of estimates within a study by employing the mixed-effects multilevel model (Doucouliagos & Stanley 2009; Havranek & Irsova 2011):

$$t_{ij} = \beta_1 + \beta_0 \left(\frac{1}{SEpkk_{ij}}\right) + \alpha_j + \epsilon_{ij}, \quad \alpha_j | SEpkk_{ij} \sim N(0, \psi), \quad v_{ij} | SE_{ij}, \alpha_j \sim N(0, \theta). \qquad (10)$$

The overall error term (ν_{ij}) from (9) now breaks down into two components: study-level random effects (α_j) and estimate-level disturbances (ϵ_{ij}). This specification is similar to employing the random-effects model in a standard panel data analysis, except that the restricted maximum likelihood is used in the estimation to account for the excessive lack of balance in the data (some studies report many more estimates than other studies). The mixed-effects technique gives each study approximately the same weight if between-study heterogeneity is large (Rabe-Hesketh & Skrondal, 2008, p. 75).

If the null hypothesis of β_1= 0 is rejected, we obtain formal evidence for funnel asymmetry, and the sign of the estimate of β_1 indicates the direction of the bias. A positive constant, β_1, would suggest publication selection for large positive effects. A negative and statistically significant estimate of β_1 would, conversely, indicate that negative estimates are preferably selected for publication. Stanley (2008) uses Monte Carlo simulations to show that the funnel-asymmetry test is an effective tool for identifying publication bias.

A rejection of the null hypothesis β_0= 0 would imply the existence of a genuine effect of finance on growth beyond publication bias. The test is known as precision-effect test. Stanley (2008) examines the properties of the test in simulations and concludes that it is a powerful method for testing the presence of genuine effect and that it is effective even in small samples and regardless of the extent of publication selection.

Table 2 Test of the True Effect and Publication Bias

1/SEpcc (Effect)	0.199***(0.018)
Constant (bias)	–0.353 (0.422)
Within-study correlation	0.46
Observations	1334
Studies	67

Notes: Response variable is the t-statistics of the estimated coefficient on financial development. Estimated using the mixed effects multilevel model. Standard errors in parentheses; *** denotes significance at the 1% level.

Table 2 reports the results of the meta-regression analysis. The constant term is insignificant, indicating no sign of publication selection. Thus, the slight asymmetry of the funnel plot that we suspected is not confirmed by formal methods. The statistically significant estimate of β_0, however, indicates that the literature identifies, on average, an authentic link between financial development and economic growth. According to the guidelines of Doucouliagos (2011), the partial correlation coefficient of 0.2 represents a moderate effect of financial development on economic growth. The guidelines are based on a survey of 41 meta-analyses in economics and the distribution of reported partial correlations in these studies. The partial correlation coefficient is considered "small" if the absolute value is between 0.07 and 0.17 and "large" if the absolute value is greater than 0.33. If the partial correlation coefficient lies between 0.17 and 0.33, which is the case here, Doucouliagos (2011) considers the effect to be "medium."

Using the likelihood ratio test, we reject the null hypothesis of no between-study heterogeneity at the 1% level, which is why we report the mixed-effects multilevel model instead of ordinary least squares (OLS). Nevertheless, the specification we use assumes that all heterogeneity in the results is caused only by publication bias and sampling error, an assumption that is not realistic.

5 Multivariate Meta-Regression

In many studies that examine the finance-growth nexus, researchers emphasize that the estimated effect depends on estimation characteristics, proxy measures for financial development, data span, and countries included in the estimation (see Beck & Levine 2004, Ang 2008, and Yu et al. 2012, among others). To determine whether the results systematically vary across different contexts in which researchers estimate the effect, we employ multivariate meta-regression analyses. The differences in the reported results may stem either from heterogeneity in research design or from real economic heterogeneity across countries and over time. We follow Havranek & Irsova (2011) and estimate the following equation:

$$t_{ij} = \beta_1 + \beta_0 \left(\frac{1}{SEpcc_{ij}} \right) + \sum_{k=1}^{K} \frac{\gamma_k Z_{ijk}}{SEpcc_{ij}} + \alpha_j + \epsilon_{ij}, k = 1, \dots, K, \qquad (13)$$

where Z stands for the set of moderator variables that are assumed to affect the reported estimates, each weighted by $1/SEpcc_{ij}$ to correct for heteroskedasticity, and K denotes the total number of moderator variables. Table 3 presents the moderator variables that we codified. We divide them into two broad categories: variables related to differences in research design and variables related to real economic differences in the underlying effect of finance on growth.

Table 3 Description of Moderator Variables

Variable	Description	Mean	Std. dev.
t-statistics	The t-statistics of the estimated coefficient on financial development; the response variable	1.77	3.49
1/SEpkk	Precision of the partial correlation coefficient	14.68	9.91
Data characteristics			
No. of countries	The number of countries included in the estimation	43.13	30.19
No. of time units	The number of time units included in the estimation	11.06	18.69
Sample size	The logarithm of the total number of observations used	4.96	1.27
Length	The number of years in time unit T	4.96	1.27
Log	= 1 if logarithmic transformation is applied	0.58	0.49
Panel	= 1 if panel data are used	0.62	0.48
Cross-section	= 1 if cross-sectional data are used	0.24	0.43
Time series	= 1 if time series data are used	0.13	0.33
Homogeneous	= 1 if homogeneous sample of countries is considered	0.34	0.47

Table 3 (continued)

Variable	Description	Mean	Std. dev.
Nature of the dependent variable			
Real GDP per capita	= 1 if dep. var. in primary regression is growth rate of real GDP per capita	0.72	0.45
GDP per capita	= 1 if dep. var. in primary regression is growth rate of GDP per capita	0.08	0.27
GDP	= 1 if dep. var. in primary regression is growth rate of GDP	0.14	0.35
Real GDP	= 1 if dep. var. in primary regression is growth rate of real GDP	0.06	0.24
Proxy measures for financial development			
Depth	= 1 if financial depth is used as an indicator of FD	0.33	0.47
Activity1	= 1 if private domestic credit provided by deposit money banks to GDP is used as an indicator of FD	0.14	0.35
Activity2	= 1 if private credit is used as an indicator of FD	0.10	0.30
Bank	= 1 if bank ratio is used as an indicator of FD	0.06	0.24
Private/dom. credit	= 1 if private credit/domestic credit is used as an indicator of FD	0.03	0.17
Market capitalization	= 1 if stock market capitalization is used as an indicator of FD	0.06	0.23
Market activity	= 1 if stock market activity is used as an indicator of FD	0.07	0.25
Turnover ratio	= 1 if turnover ratio is used as an indicator of FD	0.09	0.29
Other	= 1 if other indicator of FD is used as an indicator for FD	0.12	0.32
Non-linear	= 1 if the coefficient is derived from non-linear specification of financial development	0.22	0.42
Changes	= 1 if financial development is measured in changes, rather than levels	0.06	0.23
Joint	= 1 if more than one financial development indicator is included in the regression	0.50	0.50
Estimation characteristics			
OLS	= 1 if ordinary least squares estimator is used for estimation	0.42	0.49
IV	= 1 if instrumental variables estimator is used for estimation	0.17	0.37
FE	= 1 if fixed effects estimator is used for estimation	0.08	0.27
RE	= 1 if random effects estimator is used for estimation	0.02	0.13
GMM	= 1 if GMM estimator is used for estimation	0.30	0.46
Endogeneity	= 1 if the estimation method addresses endogeneity	0.77	1.04
Conditioning variables characteristics			
Regressors	The total number of explanatory variables included in the regression (excluding the constant term)	7.97	3.77
Macro. stability	= 1 if the primary study controls for macroeconomic stability in the conditioning data set	0.71	0.45
Pol. stability	= 1 if the primary study controls for political stability	0.13	0.34
Trade	= 1 if the primary study controls for the effects of trade	0.53	0.50
Initial income	= 1 if the primary study controls for the level of initial income	0.71	0.45
Human capital	= 1 if the primary study controls for the level of human capital	0.67	0.47

Table 3 (continued)

Variable	Description	Mean	Std. dev.
Conditioning variables characteristics			
Investment	= 1 if the primary study controls for the amount of investments	0.30	0.46
Fin. Crisis	= 1 if a dummy variable for some indicators of financial fragility is included in the estimation	0.03	0.17
Time dummy	= 1 if time dummies are included in the estimation	0.15	0.35
Publication characteristics			
Impact	The recursive RePEc impact factor of the outlet as of July 2012	0.33	0.42
Publication year	The year of publication (mean is subtracted)	0.00	1.05
Real factors: differences between time periods			
1960s	= 1 if data from the 1960s are used	0.35	0.48
1970s	= 1 if data from the 1970s are used	0.78	0.42
1980s	= 1 if data from the 1980s are used	0.94	0.24
1990s	= 1 if data from the 1990s are used	0.79	0.41
2000s	= 1 if data from the twenty-first century are used	0.50	0.50
Real factors: differences between regions			
East Asia & Pacific	= 1 if countries from East Asia and Pacific are included in the sample	0.75	0.43
South Asia	= 1 if countries from South Asia are included in the sample	0.70	0.46
Asia	= 1 if Asian countries are included in the sample	0.70	0.46
Europe	= 1 if European countries are included in the sample	0.70	0.46
Latin America	= 1 if Latin American & Caribbean countries are included in the sample	0.75	0.43
MENA	= 1 if Middle East & North African countries are included in the sample	0.72	0.45
Sub-Saharan Africa	= 1 if sub-Saharan African countries are included in the sample	0.71	0.45
Rest of the world	= 1 if rest of the world (mainly high income OECD countries) is included in the sample	0.66	0.47

Note: FD stands for financial development.

The variables reflecting differences in research design can be divided into four broad categories: differences in specification, data characteristics, estimation characteristics, and publication characteristics. Various measures that approximate the degree of financial development have been used in the empirical literature. To account for the different measures, we construct several dummy variables based on the discussion in Section 2. Moreover, we introduce dummy variables to capture the definition of the dependent variable in equation (1). Researchers typically use the GDP growth or per capita GDP growth rate measured in either real or nominal terms.

We construct moderator variables that capture the differences in regressions included in the reported growth regressions. Our motivation for including these variables is that model uncertainty has been emphasized as a crucial aspect in estimating growth regressions (Levine & Renelt 1992). We include variables that reflect the number of regressors in primary studies and dummy variables, such as *Macroeconomic stability*, *Political stability*, and *Financial crisis*, that correspond to the inclusion of important control variables.

In addition, we control for data characteristics such as the number of countries included in the regressions, data frequency, and sample size. Time series models usually use annual data, and studies with panel data commonly employ values averaged over five-year periods, whereas cross-country regressions often use values averaged over several decades. Beck & Levine (2004) find that using annual data rather than data averaged over five-year periods results in a breakdown of the relationship between financial development and economic growth. Some authors emphasize the importance of using low-frequency data to reduce the effect of business cycles and crises, and thus, they focus entirely on the long-run effects of growth (see Beck & Levine 2004 or Levine 1999, among others). The dummy variable *Homogeneous* is used to assess whether mixing too heterogeneous countries may lead to systematically different estimates.[3] For example, Ram (1999) points to the structural heterogeneity across the countries pooled together by King & Levine (1993).

As some estimation techniques used in the literature do not address the simultaneity bias in the finance-growth nexus, we control for different econometric methods employed in primary studies. In cross-sectional studies, some authors use the initial values of financial development and other explanatory variables in the regression to address the simultaneity bias (e.g., King & Levine 1993; Deidda & Fattouh 2002; Rousseau & Wachtel 2011). Other studies use the country's legal origin as an instrumental variable for the financial development (e.g., Levine 1999 and Levine et al. 2000). In addition, panel data techniques may also be more successful in dealing with the omitted variable bias.

[3] We consider that the primary studies used a homogeneous sample of countries if regional cross-country sample is used, if countries are similar in terms of per capita income or if the focus of primary study is a single country.

We include journal impact factors to capture the differences in quality not covered by the variables reflecting methodology. We use the recursive RePEc impact factor of the outlet where each study was published. While there are many ways to measure impact factors, we select the one from RePEc because it reflects the quality of citations and covers almost all economic journals. We also include the variable *Year of publication,* for two reasons. First, we hypothesize that the perception of the importance of financial development in economic growth may have changed over time. If this is the case, the results that are in accordance with the prevailing view may be more likely to be published. Second, the published pattern in the literature may also have changed because recent studies could benefit from the application of new econometric techniques, which considers simultaneity or omitted variable biases as well as unobserved country characteristics.

Financial development may have different growth effects in different regions and in different times. For example, Patrick (1966) and, more recently, Deidda & Fattouh (2002) suggest that the role of financial development in economic growth changes over the stages of economic development. Several studies find that the growth effect of financial sector development varies across countries (for instance, De Gregorio & Guidotti 1995; Odedokun 1996; Ram 1999; Rousseau & Wachtel 2011; Manning 2003 or Yu et al. 2012). To address the possibility that the finance-growth nexus may be heterogeneous across different geographic regions, we include regional dummies. To investigate the effect of finance on growth across different time periods, we construct dummy variables reflecting the following decades: *1960s*, *1970s*, *1990s* and *2000s*, with the *1980s* as the base. We select the *1980s* as the base period to test the hypothesis of Rousseau & Wachtel (2011), who argue that the effect of financial development on economic growth has declined since the 1980s.

Table 4 presents the results of the multivariate meta-regression. The results suggest that heterogeneity in the estimated effects arises not only because of the differences in research design but also because of real factors, such as differences between regions and time periods. The results of the meta-regression analysis with all potentially relevant moderator variables are listed in the third column of Table 4. The final specification in the rightmost column of Table 4 is obtained by sequentially omitting the least significant moderator variables. We follow the general to specific modeling approach as it represents a common practice in meta-regression analysis for obtaining a parsimonious model that contains only the most important variables (see, for example, Doucouliagos & Stanley 2009). Based on the likelihood ratio test, we reject the null hypothesis of no between-study heterogeneity at the 1% level, which supports the use of the mixed effects multi-level model rather than OLS. As a robustness check, however, we also estimate our regression model using OLS with standard errors clustered at the study level. The findings confirm our baseline results, even though the estimated standard errors are, for some variables, a bit larger. The OLS results are available upon request.

Table 4 Explaining the Differences in the Estimates of the Finance-Growth Nexus

Moderator variables			All variables	Specific
Differences due to research design	**Differences in dep. var.**	GDP per capita	0.041(0.064)	
		GDP	0.314***(0.071)	0.242***(0.062)
		Real GDP	0.208***(0.072)	0.157**(0.064)
	Data characteristics	No. of countries	–0.002***(0.000)	–0.002***(0.000)
		No. of time units	0.000(0.000)	
		Sample size	–0.237***(0.024)	–0.237***(0.022)
		Length	0.012***(0.002)	0.012***(0.002)
		Log	–0.101**(0.043)	–0.069*(0.037)
		Cross-section	0.065**(0.032)	0.070**(0.031)
		Time series	0.449***(0.158)	0.408***(0.151)
		Homogeneous	–0.037(0.024)	
	Measures of FD	Activity1	–0.029***(0.011)	–0.031***(0.010)
		Activity2	0.037**(0.015)	0.037**(0.015)
		Bank	0.001(0.015)	
		Private/dom. credit	–0.053**(0.024)	–0.051**(0.024)
		Market capitalization	0.128***(0.016)	0.128***(0.016)
		Market activity	0.151***(0.014)	0.148***(0.013)
		Turnover ratio	0.087***(0.015)	0.087***(0.015)
		Other	0.077***(0.013)	0.077***(0.013)
		Non-linear	–0.006(0.010)	
		Changes	0.084(0.066)	
		Joint	–0.044**(0.017)	–0.048***(0.016)

Table 4 (continued)

Moderator variables			All variables	Specific
Differences due to research design	Estimation characteristics	OLS	0.069* (0.038)	0.028*** (0.010)
		IV	0.002(0.030)	
		FE	0.040(0.037)	
		RE	0.050(0.040)	
		Endogeneity	0.032(0.039)	
	Conditioning variables	Regressors	–0.008** (0.003)	–0.006** (0.003)
		Macro stability	0.029(0.022)	
		Pol. stability	0.036(0.045)	
		Trade	0.013(0.020)	
		Initial income	0.188*** (0.054)	0.184*** (0.049)
		Human capital	0.081** (0.036)	0.092*** (0.035)
		Investment	–0.242*** (0.052)	–0.225*** (0.047)
		Fin. Crisis	0.232*** (0.067)	0.262*** (0.061)
		Time dummy	0.046(0.035)	
	Publication characteristics	Journal impact factor	0.109** (0.044)	0.079* (0.042)
		Publication year	0.029*** (0.006)	0.022*** (0.005)
Differences due to real factors	Differences between time periods	1960s	–0.185*** (0.035)	–0.144*** (0.030)
		1970s	0.153*** (0.039)	0.120*** (0.036)
		1990s	–0.077* (0.046)	–0.118*** (0.034)
		2000s	–0.069(0.043)	
	Differences between regions	South Asia	–0.013(0.041)	
		Asia	0.003(0.032)	
		Europe	0.132*** (0.033)	0.131*** (0.020)
		Latin America	0.104*** (0.031)	0.108*** (0.027)
		MENA	0.034(0.027)	0.047* (0.025)
		Sub-Saharan Africa	–0.091** (0.037)	–0.082*** (0.027)
		Rest of the world	–0.032(0.032)	
		1/SEpkk	1.804*** (0.151)	1.805*** (0.133)
		Constant (Bias)	–8.032*** (0.629)	–7.754*** (0.587)
		Observations	1334	1334
		Studies	67	67
		Within-study correlattion	0,66	0,62

Notes: Dependent variable: t-statistics of the estimated coefficient related to financial development. Estimated by mixed effects multilevel model. Standard errors in parentheses; ***, **, * denote significance at the 1%, 5%, and 10% level, respectively. FD stands for financial development.

We identify several variables that significantly influence the reported effect of financial development on economic growth, and we find that the effect varies across regions. Therefore, researchers who combine different regions should be careful when interpreting their results. For example, the effects seem to be greater in Latin America and Europe, but smaller in sub-Saharan Africa. This finding suggests that the growth effects depend on the level of economic development, which is stressed by Rioja and Valev (2004), Ram (1999), Rousseau & Wachtel (2011), Manning (2003), and Yu et al. (2012), among others. In contrast, the results are not in accordance with De Gregorio & Guidotti (1995), who find that the impact of financial development on growth is negative for a panel of Latin American countries. Our results on sub-Saharan Africa, conversely, give support to the previous research of Levine et al. (2000). It also seems that the growth effect of financial development has declined in the 1990s compared to the 1980s, which is consistent with Rousseau & Wachtel (2011).

Our results suggest that the number of countries, as well as the sample size included in the analysis, matters for the reported results. Cross-sectional studies and time-series studies report, on average, larger effects than studies using panel data. The variable *Length,* which stands for the number of years in the data set, is found to be positive and significant, which corresponds to the findings of Calderon and Liu (2003). Studies that average observations across longer periods generally report larger effects. Studies using the log of the dependent variable report, on average, smaller finance-growth effects than do other studies.

Specifications that use measures of stock market development, such as market capitalization, market activity, or turnover ratio, typically yield greater growth effects compared to financial depth, which we use as the base category. Therefore, our results suggest that the growth effects of stock markets are greater compared to the effects caused by other financial intermediaries. In addition, we also estimate a regression model, for which we put different measures of financial development and create only two dummy variables, the one for the studies examining the stock market development and the other one for the studies examining the banking sector development. Our robustness check (the results are available upon request) show the positive coefficient of 0.06 for stock market studies and negative coefficient of –0.09 for banking sector studies, both statistically significant at the 1% level. The issue of the importance of financial structure has received a considerable attention in primary studies. Demirguc-Kunt and Levine (1996), Levine (2002, 2003), and Beck and Levine (2004) show that it is the provision of financial services rather than the financial structure that affect economic growth. On the other hand, Arestis et al. (2010) and Ergungor (2008) argue that the financial structure matters.

Luintel et al. (2008) and Arestis et al. (2010) find that financial structure is irrelevant for growth only if the cross-country heterogeneity is ignored. Once the panel econometric framework explicitly accounts for heterogeneity, financial structure gains importance. Ergungor (2008) shows that the effect of financial structure on economic growth depends on the level of inflexibility of judicial environments. If inflexibility is high, bank-based systems are more conducive to growth. Otherwise, stock markets are more supportive for growth. The results of Peia and Rozsbach (2013) also suggest that the banks and stock markets influence economic growth differently.

Demirguc-Kunt et al. (2011) show that the effect of banks and stock markets on economic growth depends on the stage of economic development. The effect of bank development on economic growth decreases with economic development. On the other hand, the pattern for stock markets is opposite and the effect increases as the country develops. Therefore, the results suggest that there exists a certain optimal financial structure. In addition, Demirguc-Kunt et al. (2013) find that the deviation from this optimal financial structure is costly in terms of economic growth. This is in line with the prediction of the theoretical model by Fecht et al. (2008), who show that stock markets may have greater effects on economic growth than banks.

Our results suggest that it is important to control for endogeneity when estimating the effect of finance on growth. Studies using OLS find, on average, larger effects than studies that account for endogeneity in some way – for example, using instrumental variables, panel data methods, or other more advanced techniques. Both moderator variables related to publication characteristics, namely, *Journal impact factor* and *Publication year*, are significant and positive. This finding suggests that studies published in journals with a higher impact factor report, on average, larger effects and that more recent studies report, on average, larger effects than earlier studies.

The reported estimates of the finance-growth relationship are sensitive to the set of conditioning variables included in growth regressions, a finding that corroborates the findings of Levine and Renelt (1992). If primary studies account for the level of the initial income, include a variable related to human capital, or control for financial fragility, they likely yield larger effects. On the other hand, specifications that control for the amount of investment in the economy tend to report lower effects. This result may be because the level of investment in the economy is a function of financial development.

6 Conclusions

We perform a meta-regression analysis of studies that investigate the effect of financial development on economic growth. We observe substantial heterogeneity in the reported estimates and find that approximately 50% of them report a positive and statistically significant effect. Nevertheless, using meta-analysis methods, we show that the literature as a whole documents a moderate, but statistically significant, positive link between financial development and economic growth. In addition, we subject the literature to several tests for publication bias and find little evidence that researchers, referees, or editors demonstrate a preference for certain types of results.

After examining 67 studies that provide 1334 estimates of the effect of finance on growth, we find that the heterogeneity in the reported effects is driven by both real factors and differences in research design. The finance-growth nexus varies across regions, which challenges the assumption of a common parameter used for heterogeneous countries in growth regressions. For example, we find that the growth effect of financial development is strong in European and Latin American countries but weak in sub-Saharan Africa. Our results also suggest that the beneficial effect of financial development decreased in the 1990s, but seems to have rebounded in the last decade to the level of the 1980s.

We find that how researchers measure financial development does play an important role. Measures based on stock markets are associated with greater growth effects than measures based on banks. As a consequence, our results give support to the hypothesis that financial structure is important for the pace of economic development as the contribution of stock markets in the growth process tends to be higher relative to that of other financial intermediaries.

With respect to the differences in research design, our meta-regression analysis provides evidence that the reported estimates of the finance-growth relationship depend on the set of control variables included in the growth regressions. Studies that control for the level of initial income, human capital, and financial fragility tend to report larger effects, which suggests that regression model uncertainty and omitted variable bias are important factors driving the estimated effect of financial development on growth.

In addition, our results show that addressing endogeneity is important for correct estimation and that studies that ignore endogeneity issues tend to exaggerate its effect. The data frequency used in the estimation also influences the reported estimates. We find that studies that use averages of observations across longer periods (thus, reducing the impact of the business cycle or short-term financial volatility on the estimates) and that use longer data samples tend to report greater effects of finance on growth.

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