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The Vanishing Effect of Finance on Growth

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Abstract

This paper investigates the causes of the “vanishing effect of finance” detected in recent studies. The results highlight that the negative effect of the financial system on growth is mainly driven by advanced economies, whereas finance is still beneficial for income increases in developing countries. The reason is that finance and growth are associated via a nonlinear relationship, which is due to a fundamental change in the transmission mechanism of finance across different levels of economic and financial development. In early stages of development, finance fosters entrepreneurship, education, and investment in physical capital. As the economies develop, this positive influence vanishes. The negative effect of finance is stronger in countries with sophisticated public education systems, low levels of income inequality, as well as low fertility rates, and in times with low factor productivity growth.

Keywords: Economic Growth, Financial Sector, Panel Data

JEL no.: F40, O16, O47

1. Introduction

In the aftermath of the 2007 Financial Crisis, the traditional view that the financial sector benefits real economic activity came under increasing scrutiny. The subprime meltdown in the United States and the global crisis that followed encouraged a new discussion about the role of financial markets in economy and society. Demands for stricter regulations were expressed that aim to provide incentives for financial agents to drastically change their economic behavior. These developments were in sharp contrast to a number of hitherto accepted doctrines in economic theory.

Since the beginning of the 1970s, during which two seminal contributions—[Goldsmith \(1969\)](#) and [McKinnon \(1973\)](#)—influenced the economic profession, economists have agreed that finance benefits income increases via facilitation of efficient allocation of capital. Efficiency gains mainly stem from evaluation of entrepreneurs, thereby leading savings into the most promising investment projects and reducing market frictions caused by information asymmetries and transaction costs. These ideas were later formalized in the framework of endogenous growth models (see, e.g., [King and Levine, 1993a](#), [Rajan and Zingales, 1998](#),

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Levine et al., 2000, Beck et al., 2000, and Aghion et al., 2005). The implications of these models were supported by a number of empirical studies conducted previous to the Financial Crisis, where the positive contribution of finance to growth seemed to appear as a clear empirical pattern (see, e.g., King and Levine, 1993b, Levine and Zervos, 1998, Levine, 1998, Levine et al., 2000 and Beck et al., 2000).¹

When re-examining the traditional ideas after the Financial Crisis, Rousseau and Wachtel (2011) found that the influence of finance has considerably weakened over time. Utilizing data from the time period up to 2004, their results highlight a positive impact of finance during the period from 1960-1989, which vanishes during the post-1990 period and eventually becomes (slightly) negative. Likewise, de la Torre et al. (2011) emphasize that the impact of financial development on GDP is subject to decreasing marginal returns, resulting in the disappearance of growth-enhancing effects during the development process of financial systems. The threshold beyond which finance no longer stimulates growth has been examined by Arcand et al. (2015), who find that the “vanishing effect” of finance sets in once credit to private sector reaches 100 percent of GDP.

These new results clearly herald the arrival of a paradigm shift concerning the question of how to assess the latest expansions of financial markets in many advanced economies. However, thus far little is known about the causes of the change in the growth-effect of finance. This paper provides an explanation for the reversal of the influence of finance based on the transmission channels through which the financial sector exerts its effect of growth. Very similarly to the recent studies of Rousseau and Wachtel (2011) and Arcand et al. (2015), this paper finds a negative effect of finance on growth in the whole sample of 162 countries analyzed between 1960 and 2010. However, a more in-depth analysis of the data reveals a nonlinear relationship between finance and growth, indicating that the variables are linked by a parabolic function. While countries with less developed financial markets benefit from an increase in the size of the financial sector, there is virtually no effect on growth if the initial size is already large. In extreme cases, further expansions of financial markets even turn out to be impediments to growth.

As poorer economies tend to have significantly less developed financial sectors, the evolution of the impact of finance can be retraced by splitting the sample into different development levels and time periods. It turns out that the overall negative effect of the financial system remained insignificant before the post-2005 period. Until the early 1990s, the influence of finance was even slightly positive. The data also reveals that finance still exerts positive growth stimuli in low-income countries, whereas the effect of finance vanishes in economies with income levels greater than 7,500 USD and turns negative once a development level of approximately 12,000 USD is exceeded. These findings imply that the overall negative effect of finance detected in the whole sample stems entirely from advanced economies and recent time periods.

¹A detailed overview of the theoretical models and the empirical findings is provided by Beck (2008). Although clearly in the minority, some of the earlier studies tentatively point to possibly negative effects of finance. See Kaminsky et al. (1998), Reinhart and Kaminsky (1999), Demirgüç-Kunt and Detragiache (1998), Demirgüç-Kunt and Detragiache (1999), and Kroszner et al. (2007).

In the context of these results, this paper explores the causes of the divergence occurring in the development process by analyzing the transmission channels of finance. The findings show that in developing countries, an increase in the size of the financial sector fosters education, entrepreneurship, and physical capital accumulation. On the one hand, finance benefits education in poor economies via mitigation of the households' trade-off between the quantity and the education of children, particularly if the public schooling sector is less mature and incomes are unequally distributed. On the other hand, the financial sector fosters investment in physical capital, thereby accelerating conditional convergence and facilitating innovation activity. The development process of the economies brings with it an improvement in the quality of public schooling systems, greater equality of opportunities, and lower fertility rates, yielding a reduction in the importance of finance for educational achievements. Likewise, a particular size of the financial sector enables the support of all growth-boosting investments in physical capital and innovation. As a result, the effect of finance eventually levels-off during the development process and becomes virtually irrelevant once a more advanced income level is achieved. After this point, a further increase in the size of the financial system exerts no additional influence on real economic activity via traditional transmission channels.

In advanced economies with mature financial markets, the pressure to meet the returns required by investors forces financial intermediaries to develop new—and often non-interest-based—business segments. Unlike traditional intermediation activities, these segments do not contribute to any additional income increases as they do not equate to real economic activity via the stimulation of growth determinants. On the contrary, these new business areas may increase the vulnerability of the economy to crisis, yield inflation, and lead to instability, with the result that the overall effect of finance becomes negative. The findings also imply that the negative effect is particularly strong in times when factor productivity grows at low rates, providing little potential for returns via support of innovation activity. Thus, the major decline in productivity growth observable in the advanced economies since the early 2000s—which has become known as “secular stagnation”—has intensified the negative growth effect of the financial sector observable in the post-2005 period.

The paper is organized as follows. Section 2 provides a theoretical framework of finance and growth. While the explicit focus of this paper is on the empirical relation between both concepts, theory provides some helpful insights on how the variables may be linked. Section 3 is concerned with the transfer of the theoretical model into an empirical specification and explains the underlying estimation technique. Section 4 illustrates and discusses the results. Section 5 concludes.

2. Theoretical framework: The financial sector and economic growth

This section introduces a tractable theoretical model of the financial sector and economic growth that consolidates a number of arguments previously expressed by the literature. By identifying several transmission channels through which finance influences growth, the model lays the foundation for the subsequent empirical work.

2.1. The basic model

Considering a continuum of specialized intermediate goods $j \in \mathbb{J}$, the output y_e of firm e can be formulated similar to [Romer \(1987, 1990\)](#) as

$$y_e = \Psi_e(\kappa_e HK)^{1-\alpha} \int_{\mathbb{R}_+} x_{ej}^\alpha dj \quad (1)$$

where Ψ denotes factor productivity, κ_e gives the fraction of human capital HK employed by e and x_{ej}^α is the amount x of the intermediate good j used in the production process of e . As each j features diminishing marginal returns, it follows that $\alpha \in (0, 1)$. The term $\int_{\mathbb{R}_+} x_{ej}^\alpha dj$ reflects the stock of physical capital.² The total amount of human capital employed in the production sector is $K*HK$ where $K = \sum_e \kappa_e$. Equation (1) illustrates the production potential if all intermediate goods have been invented. Yet, in each period, there is only a finite number $|\mathbb{J}|$ available in the production process.

Suppose that $|\mathbb{J}| = N$ gives the range or number of capital goods used and let Γ be the total quantity of these inputs.³ If all firms are equal and $\{\Gamma, N\}$ denotes the list of x_i with constant value $x_i = \Gamma/N$, then Equation (1) becomes

$$y_e = \Psi_e(\kappa_e HK)^{1-\alpha} N^{1-\alpha} \Gamma^\alpha. \quad (2)$$

In this case, output increases with N when holding constant productivity, labor and Γ . Inventions thus boost economic growth as they lead to an increase in the stock of physical capital. Meanwhile, inventions also enhance factor productivity, as a by-product of the invention process is the creation of new knowledge. This knowledge eventually diffuses to competitors, but initially provides an advantage to the inventor. [Aghion and Howitt \(2009\)](#) capture this effect, defining the starting technology of e as

$$\Psi_{t-1} = E^{-1} \sum_{e=1}^E \Psi_{e,t-1}, \quad e = 1, \dots, E.$$

Therefore, each non-innovating e presumably has the average productivity level of all entrepreneurs in $t-1$, that is $\Psi_{e,t} = \Psi_{t-1}$. Innovating firms, however, have access to $\Psi_{e,t} = \gamma_{j^*} \Psi_{t-1}$ where γ_{j^*} represents the importance (“size”) of the particular innovation j^* . It follows that $(\partial\Psi/\partial\gamma) > 0$ and $(\partial y/\partial\gamma) > 0$. Let μ denote the probability of an innovation of e and $\gamma = N^{-1} \sum_{j^*=1}^{N^*} \gamma_{j^*}$, $j^* = 1, \dots, N^*$ be the average size. Then the average productivity across all firms will be

$$\Psi_t = \mu\gamma\Psi_{t-1} + (1 - \mu)\Psi_{t-1}$$

²In general, it is reasonable to use any increasing, strictly concave function $g(x)$ with $g(0) = 0$ to model firm output depending on capital goods utilization. The special case considered here, however, is analogous to the power function of [Dixit and Stiglitz \(1977\)](#) and assumes the form $g(x) = x^\alpha$.

³Note that this denotation deviates from the original [Romer \(1987\)](#) paper. The definition of N used here refers to [Barro and Sala-i-Martin \(2004\)](#).

implying that the average productivity grows at a rate of

$$\frac{\dot{\Psi}}{\Psi} = \frac{\Psi_t - \Psi_{t-1}}{\Psi_{t-1}} = \mu(\gamma - 1).$$

Innovating entrepreneurs benefit the economy through two channels. First, increasing numbers of N have a direct effect on physical capital in Equation (2). If one entrepreneur creates a new j^* , it can be inserted in the production process of all firms. Second, innovations create new knowledge. After some time, this knowledge becomes available to all firms, enhancing factor productivity and thus output in Equation (2).⁴

The innovation j^* makes the innovator a monopolist. Each entrepreneur thus has two incentives to innovate: first, the innovator earns monopolistic profits by selling j^* . As existing capital products can be provided by a range of entrepreneurs, producing j makes e_j a mere price-taker. Second, j^* enhances productivity of e , leading to a more efficient production of all capital goods supplied by e_{j^*} and facilitates future innovations.

Households maximize utility over an infinite horizon and have CRRA preferences

$$U = \int_0^\infty \left(\frac{c^{1-\lambda} - 1}{1-\lambda} \right) \exp\{-\rho t\} dt.$$

Household income is composed of wage w and capital income r on assets a , yielding the common aggregate budget constraint $(da/dt) = wL + ra - c$ and the familiar Euler equation $(\dot{c}/c) = (1 - \lambda)(r - \rho)$.

2.2. The investment decision of the entrepreneur

The decision of an entrepreneur to invest in physical capital or in innovation is determined by the costs and the risk of the project. The capital value earned by creating j^* is

$$V(j^*) = \int_t^{t+\psi} \pi_{j^*}(v) * e^{-st} dt$$

where $\pi(v) \equiv (P_{j^*} - 1)x_{j^*}$ is the cashflow stream at any time $v \in [t, t+\psi]$ and e^{-st} denotes the discount factor where $s \in \mathbb{C}$ approximates the interest rate r with $s = \log(1 + r)$.

Each e decides to carry out a project if the expected capital value exceeds the costs η of the particular investment, that is, the expected rent $\mathbb{E}[V(j^*)] - \eta$ is positive. Basically, any investment in j^* under certainty is profitable if $\eta < V(j^*)$. However, the expected capital value will be achieved with a probability $p_{j^*} \in (0, 1)$, which includes a risk factor in the entrepreneur's calculation. The parameter p_{j^*} is inversely proportional to the inherent risk associated with j^* . This risk is primarily unknown and must be estimated by the entrepreneur. Thus, the investment decision adjusts to

$$V(j^*) > \frac{\eta}{p_{j^*}},$$

emphasizing that a higher risk makes an investment in j^* less likely.

⁴The application of $(d\Psi_e/dt)$, however, depends on the level of human capital available in e . See [Nelson and Phelps \(1966\)](#) and [Benhabib and Spiegel \(2005\)](#).

2.3. The role of financial intermediaries and the equilibrium growth rate

Financial intermediaries can exert a strong influence on the investment decisions of entrepreneurs. Usually, the entrepreneur will not be able to procure financing on his own. In most cases, it is likely, though not certain, that the entrepreneur's initial wealth will not be sufficient for him to cover η himself. Moreover, the model of [King and Levine \(1993b\)](#) indicates that the risk of innovation success is diversifiable, which makes reliance on any amount of internal finance less efficient. In consequence, the entrepreneur will choose to borrow the funds necessary to finance η from the financial sector.

To decide whether the project shall be supported or rejected, the bank can determine the feasibility of the investment by paying a cost of $f = f(\eta)$, $(\partial f/\partial \eta) > 0$, where [Aghion and Howitt \(2009\)](#) suggest a multiplicative function $f = \phi\eta$. In order to break even, the bank must require a repayment of $\phi\eta/p$.⁵ The total cost of the entrepreneur thus adjusts to $\eta(1 + \phi/p)$.

In equilibrium, it must hold that $\eta(1 + \phi/p) = V(j^*)$ under the free-entry condition. Using the production function stated above, it is easy to show that π_{j^*} reaches its maximum at price $P_{j^*} = (1/\alpha) > 1$, yielding⁶

$$\pi = (K * HK)\Psi^{1/(1-\alpha)}\Omega. \quad (3)$$

Applying the free-entry condition, using the maximum price and making use of the condition $\bar{r}(t, v) = [1/(v - t)] \int_t^v r(\xi)d\xi$ gives

$$r(t) = \frac{\pi}{V(j^*)} + \frac{\dot{V}(j^*)}{V(j^*)}$$

which follows by Leibniz's rule for differentiation under the integral sign (see [Barro and Sala-i-Martin, 2004](#)). As η is a constant and p_{j^*} depends on the inherent risk of the project that cannot change over time, it follows that $\dot{V}(j^*) = 0$, simplifying the interest rate to $r = \pi/[\eta(1 + \phi/p)]$.

Inserting π from Equation (3), the interest rate becomes

$$r = \frac{K * HK}{\eta(1 + \phi/p)}\Psi^{1/(1-\alpha)}\Omega.$$

Substituting the interest rate in the Euler equation gives the growth rate of the economy

$$\frac{\dot{y}}{y} = (1/\lambda) \left[\frac{K * HK}{\eta(1 + \phi/p)}\Psi^{1/(1-\alpha)}\Omega - \rho \right]. \quad (4)$$

Equation (4) highlights a number of transmission channels through which the financial sector influences economic growth. First, financial intermediaries enable the pooling of funds

⁵Let Π denote the repayment from a feasible innovation project. The expected profit from screening is $p\Pi - \phi\eta$ and thus $\Pi = \phi\eta/p$, as the payment of Π depends on the probability p , whereas the cost of screening will be $\phi\eta$ with certainty.

⁶One way to derive this condition can be found in [Barro and Sala-i-Martin \(2004\)](#). The parameter $\Omega \equiv \frac{1-\alpha}{\alpha}\alpha^{2/(1-\alpha)}$ is inserted for reasons of lucidity.

from small savers to mobilize sufficient resources to cover η . Second, the financial sector facilitates evaluation of investment projects, conducting ex ante screening to estimate p . Such an evaluation typically requires information about future cashflows and interest rates, as well as firm-specific information that is often difficult to acquire. In the majority of cases, individual savers will neither have the time, nor the means or capacity to accomplish this assessment. As a result, the absence of a well-functioning financial system hinders the flow of capital to the most promising projects, as in this case the inherent risk of projects is likely to be over- or under-estimated. Whereas the former misjudgment yields a decline in investment projects and innovation activity, the latter may result in too many risky investments that are likely to default. In both cases growth will be reduced. Third, once p is assessed, financial intermediaries choose the path of caution. By supporting investments with high p and rejecting projects that are not feasible, bad investments are filtered out. If a project is supported, financial institutions may also provide means to diversify the adherent risk.

Finally, financial intermediaries possess extensive practical knowledge and experience in various fields. Advice from the financial sector may thus lead to an increase in p . The equation also shows that the higher the screening costs ϕ , the lower both the frequency of innovations and the growth rate will be. A larger financial sector may create economies of scale with regard to the assessment of projects, resulting in a decrease in ϕ that benefits growth.

Equation (4) further illuminates the positive growth effect emanating from an increase in factor productivity. As discussed previously, factor productivity grows at rate $(\dot{\Psi}/\Psi) \equiv \mu(\gamma - 1)$, where the size of the innovation γ and the probability of its occurrence μ are crucial in determining productivity gains. An established financial system is more likely to be able to support innovations with large γ . In addition, through the various channels discussed above, the financial sector also contributes to an increase in μ .

While the previous mechanisms emphasize the role of finance in the creation of investment in physical capital as well as innovation projects, Equation (4) highlights a further transmission channel, that of human capital. The model implies that a higher education level yields an increase in economic growth; however, binding household budget constraints may impede investment in education, particularly if there are capital market imperfections (see Galor and Zeira, 1993). Through the provision of the funds necessary for education programs, the financial sector fosters investment in human capital. This growth effect is particularly strong in economies with highly skewed income distributions (see Benhabib and Spiegel, 2000) and in developing countries with less sophisticated financial markets.

In fact, the growth rate illustrated in Equation (4) provides a number of implications in terms of the role of finance in the development process. In poor countries that have not yet approximated the steady state level of per worker capital, the financial system may accelerate conditional convergence by facilitating investment in physical capital. A similar effect has been identified in Aghion et al. (2005). In these countries, the absence of advanced financial markets hinders growth, as many investments fail to receive financing without a functioning banking system. This problem is particularly severe if domestic savings are not sufficient to cover the costs η of investment projects, resulting in the need to receive funds from international financial markets. As poor countries experience higher marginal effects

of investment in physical capital on growth than advanced economies, the effect of finance may be particularly pronounced in developing economies. Diminishing marginal returns of education provide a further argument for why the effect of finance is likely to be stronger in poorer countries.

In contrast to the positive effects discussed so far, the model also reveals channels through which finance may impede growth. First, if high wages paid by financial intermediaries attract an increasing fraction of human capital, K declines and hence causes a reduction in the growth rate. The prospect of efficiency wages may also prevent individuals from investing in tertiary education. A similar effect is extensively discussed in the work of Philippon (2010), Bolton et al. (2011), Philippon and Reshef (2013) and Kneer (2013). Furthermore, if the financial sector steers away from traditional intermediation and screening activities and increasingly focuses on non-interest income (e.g. via trading or mortgage-backed securities), an increase in the size of the financial sector will have no effect on the growth rate illustrated in Equation (4). Quite the contrary, the shifting of business fields may raise inflation and contribute to a higher vulnerability of countries to economic crises. In such an event, unemployment and hysteresis reduces K , directly affecting the growth rate. Finally, growth in advanced economies is based largely on technological progress and innovation activity. In times when below-average technological progress enables little potential for beneficial innovation projects—i.e. μ , p and γ are low—, there are only little growth prospects for advanced economies. In this situation, the negative effects of the financial sector may offset its positive contribution, resulting in the overall effect to turn negative.

To summarize the theoretical implications, finance may benefit growth by accelerating conditional convergence, facilitating education, and fostering investment in physical capital and innovation. However, there is some indication that the positive effects may ebb once incomes and the size of the financial system reach more sophisticated levels.

3. Estimation strategy and the data

3.1. Specification and estimation technique

The next step is to transfer the theoretical framework into a model of the financial sector and economic growth that can be estimated empirically. From Equation (4) it follows that human capital and factor productivity influence economic growth. Similar to Barro (2003, 2013), human capital is proxied by average years of school attainment and the logarithm of life expectancy, denoted by SCHOOLY and log(LIFEEX), respectively. Following Aghion et al. (1999), it is reasonable to assume that learning-by-doing externalities result in a positive influence of past production activities on current firm productivity. This relationship is specified via $\Psi_t = \{\log(y_{t-1})\}^\varrho$ with $\varrho \in [0, 1)$ and y denoting real per capita GDP. In doing so, the empirical model also accounts for (conditional) convergence.

To obtain consistent estimates of the effect of finance, it is crucial to specify the basic system very accurately, as the disregard of covariates most likely results in an omitted variable bias. Omitted variables may also yield an over-estimation of the effect of finance, as the financial sector itself depends on the political and institutional environment of the

economies. For this reason, the specification is enlarged by a set of growth determinants identified by Barro (2003, 2013), which has been proven to explain empirical growth patterns quite accurately in recent investigations. These determinants account for the fundamental differential equation in the standard growth model by introducing the investment share (INVS) and the logarithm of the fertility rate, denoted by $\log(\text{FERT})$.⁷ The growth effect of the government is introduced by government consumption (GOVC) and political rights (POLRIGHT). In addition, the model captures growth-stimuli of foreign trade relations by introducing the degree of openness (OPEN) and changes in the terms of trade (TOTR). Finally, the inflation rate (INFL) approximates economic uncertainty.

Putting together the implementations discussed above, the growth rate of per capita GDP becomes a function

$$\frac{d}{dt}(y) \approx \log(y_t) - \log(y_{t-1}) = F(\log y_{t-1}, HK, F, \mathbf{X}_t) \quad (5)$$

where F is a proxy for the size of the financial sector and \mathbf{X}_t contains the environment and control variables. Due to diminishing returns to reproducible factors, y_{t-1} is assumed to be negatively associated with growth.

More specifically, considering additive linkage of the variables and transforming Equation (5) into a 5-year panel data model yields

$$\log(y_{it}) - \log(y_{it-1}) = \vartheta \log(y_{it-1}) + \alpha HK_{it} + \beta F_{it} + \delta' \mathbf{X}_{it} + (a_i + \xi_t + v_{it}) \quad (6)$$

where $i = 1, \dots, N$ is the country index and $t = 1, \dots, T$ is the time index with t and $t-1$ five years apart. The variable a_i accounts for unobserved heterogeneity, ξ_t is a time effect of period t , and $v_{it} \equiv u_{it} - \xi_t - a_i$ is the idiosyncratic error term of the estimation.

Equation (6) can easily be rewritten as⁸

$$\log(y_{it}) = (\vartheta + 1) \log(y_{it-1}) + \alpha HK_{it} + \beta F_{it} + \delta' \mathbf{X}_{it} + (\xi_t + a_i + v_{it}) \quad (7)$$

implying inconsistent estimates of ϱ and δ when utilizing standard panel data approaches such as fixed effects (FE) or random effects (RE) with small T . A detailed description of this topic can be found in Bond et al. (2001). The RE estimator by construction requires $\text{cov}[a_i, \log(y_{it-1})] = 0$, whereas application of FE would lead to a correlation of the transformed error term and the transformation of $\log(y_{it-1})$, resulting in a dynamic panel bias (see Nickell, 1981). In order to circumvent these problems, the econometric literature has developed more reliable estimators if a lagged dependent variable is to be introduced.

Define $\Delta k \equiv (k_{it} - k_{it-1})$ and $\Delta_2 k \equiv (k_{it-1} - k_{it-2})$. The first-difference GMM estimator proposed by Arellano and Bond (1991) eliminates unobserved heterogeneity by estimating

⁷The model does not directly include physical capital since such data is mostly unreliable due to inaccurate measurements and the need to draw arbitrary assumptions on investment and depreciation. Instead, the interaction of the human capital stock with the initial level of per capita GDP approximates the stock of physical capital.

⁸Note that the estimated parameter gives $\vartheta \equiv \varrho - 1 < 0$ (see Halter et al., 2014).

$$\Delta \log(y) = \vartheta \Delta_2 \log(y) + \alpha \Delta HK + \beta \Delta F + \delta' \Delta \mathbf{X} + \Delta \xi + \Delta v$$

and using sufficiently lagged values of y_{it} , HK_{it} , F_{it} , and \mathbf{X}_{it} as instruments for Δk and $\Delta_2 \log(y)$. These instruments are valid provided that the error term is serially uncorrelated. However, this approach discards much of the information in the data. Even more problematic, many of the variables in Equation (6) are highly persistent. [Blundell and Bond \(1998\)](#) and [Bond et al. \(2001\)](#) emphasize that the standard difference GMM estimator can be poorly behaved if time-series possess a high degree of persistency. The reason is that lagged levels in this case provide only weak instruments for subsequent first-differences, resulting in a large finite sample bias.

System GMM proposed by [Arellano and Bover \(1995\)](#) and [Blundell and Bond \(1998\)](#) provides a tool to overcome this problem under the assumption that $E(\eta_i \Delta y_{i2}) = 0$, which holds if the process is mean stationary. In this case, additional orthogonality restrictions can be exploited, using lagged values of Δk and $\Delta_2 k$ as instruments. Utilization of these moment conditions enables more efficient exploitation of the data and ensures that some of the information in the equation in levels is maintained. System GMM is found to have better finite sample properties if the additional assumptions are satisfied (see, inter alia, [Blundell et al., 2000](#)). To detect possible violations of these assumptions, the Difference-in-Hansen test is reported for each estimation.

Let Ξ'_{it} be $\Xi'_{it} \equiv [\log(y_{it}) \ HK \ F \ \mathbf{X}'_{it}]$, the moment conditions used in the estimation of the first difference GMM method considered in this paper are

$$E\{(v_{it} - v_{it-1})\Xi_{i,t-2}\} = 0 \text{ for } t \geq 3, \quad (8)$$

implying that the set of instruments is restricted to lag 2. [Roodman \(2009b\)](#) illustrates the need to define such a limitation, as otherwise the problem of “instrument proliferation” may lead to severe biases. In the case of System GMM, (8) additionally contains the moment conditions based on the regression equations in levels, which in our case are

$$E\{(v_{it} + \eta_i)(\Xi_{i,t-2} - \Xi_{i,t-2})\} = 0 \text{ for } t \geq 3. \quad (9)$$

In general, the equations can be estimated using one-step or two-step GMM. Whereas one-step GMM estimators use weight matrices independent of estimated parameters, the two-step variant weights the moment conditions by a consistent estimate of their covariance matrix. [Bond et al. \(2001\)](#) shows that the two-step estimation is asymptotically more efficient. Yet it is well known that standard errors of two-step GMM are severely downward biased in small samples. The estimation therefore relies on the [Windmeijer \(2005\)](#) finite sample corrected estimates of the variance, which yield a more accurate inference.

3.2. The data

The primary aim in collecting the data is the establishment of a comprehensive data set that covers as many countries as possible to ensure that the selection is representative. In particular, the set of countries specifically needs to incorporate low and middle income

countries as the theoretical hypotheses suggest that the financial sector affects economies asynchronously during the process of development. Data concerning GDP, GOVC, OPEN and INVS is from [Heston et al. \(2012\)](#), SCHOOLY is from [Barro and Lee \(2010\)](#), TOTR is from [Unctad \(2013\)](#) and LIFEEX as well as FERT are taken from [World Bank \(2013b\)](#). The democracy variable POLRIGHT stems from [Freedom House \(2014\)](#). A later section investigates the transmission channels of finance on growth. This exploration includes entrepreneurial activity, which is measured via the TEA index of the [GEM \(2012\)](#) database. In addition, the analysis uses Gini coefficients of disposable incomes (GINI) compiled by [Solt \(2009, 2015\)](#), public spending on education in percent of GDP (PSE) from [World Bank \(2013b\)](#), as well as total factor productivity growth (TFP) reported by [The Conference Board \(2015\)](#).

To ensure that the results are comparable with the findings of recent studies, the estimation strategy relies on commonly used proxies of the financial system. In addition, the selection of variables aims to best fit the hypotheses of the theoretical model and to maximize availability to construct a large panel of countries. Whereas existing financial datasets theoretically enable exploitation of very different facets of finance, two proxies are particularly suitable to meet the basic requirements. The first concept uses the definition of [Goldsmith \(1969\)](#), measuring the size of the financial sector in relation to the real economic activity as overall liquid liabilities of the financial system divided by GDP, denoted by FDEPTH. This indicator is perhaps the most commonly used proxy of the financial sector in the related literature and is often referred to as the “financial depth”. Liquid liabilities include currency as well as demand and interest-bearing liabilities of banks and other financial intermediaries.⁹

The main growth effects of finance identified in the theoretical model are the support of investments in physical and human capital, and the facilitation of innovations. The second concept captures these effects more explicitly by measuring the ratio of claims on the private sector to GDP. These claims include gross credit from the financial system to individuals, enterprises, and non-financial public entities. There is a strong argument that deposit banks are much more likely to engage in the type of financing activities that stimulate growth rather than other financial intermediaries. Thus, the analysis uses claims of deposit banks in relation to GDP (BCREDIT) rather than a measure including all financial intermediaries. Note, however, that the correlation between these two concepts is high (95 percent).

Data on the financial variables are from [Beck et al. \(2000\)](#), [Beck et al. \(2009\)](#) and [Čihák et al. \(2012\)](#) and can be accessed via [World Bank \(2013a\)](#). Table (1) provides descriptive statistics of the variables used in the analysis, including the number of observations, the extrema, and standard deviations. In general, the dataset contains a total of 189 countries during the time period between 1960 and 2010. Yet unavailability of data leads to a reduction in both the cross-section and the time dimension for some of the variables. Whereas the dependent variables and most of the covariates are available from 1960 onward, data concerning FDEPTH and BCREDIT only goes back to the early 1970s and—in some extreme cases—to the early 1980s, respectively. The problem with data availability is particularly severe with respect to the terms of trade, which are only available from 1980

⁹For a more detailed description see [Beck et al. \(2009\)](#) and [Čihák et al. \(2012\)](#).

Table 1 Descriptive statistics of the variables

Variable	N	Mean	Std. Dev.	Min	Max
\dot{y}	1624	.0218823	.040689	-.302555	.3210244
$\log(\text{GDP}_{pc})$	1626	8.387529	1.30292	5.317263	11.80222
BCREDIT	1249	34.2974	33.38769	.01	205.99
FDEPTH	1209	46.06291	38.44916	.025185	358.8823
INVS	1626	.2064493	.111355	-.0131223	1.684564
SCHOOLY	1584	5.900455	3.063374	.04	13.09
$\log(\text{LIFEEX})$	2027	4.126937	.1997474	3.080882	4.42237
GOVC	1626	.2050443	.1180274	-.0240873	.9337125
INFL	1656	.361469	2.624121	-.0662845	69.62831
OPEN	1822	.7599636	.4862227	.0198891	4.378075
POLRIGHT	1624	4.083528	2.194809	1	8
$\log(\text{FERT})$	2029	1.2833	.5502135	-.1369659	2.21336
TOTR	771	.0700488	.2676975	-.6612992	.9457714
TEA	280	13.16807	8.818189	.9	36.4
GINI	1126	.3890027	.1114037	.1605069	.7643369
PSE	1018	4.468867	2.029314	.6202	26.37015
TFP	605	.6443825	2.560896	-15.0355	16.3813

onward. Unavailability of data with respect to some of the country-years included in the sample underscores the advantage of the empirical specification described in Section 3.1, which is explicitly designed to accommodate unbalanced panels.

3.3. The development of the financial sectors across countries and over time

Whereas Table (1) shows that the proxies of the financial sector differ to some extent in their mean and standard deviation, Figure (1) highlights that FDEPTH and BCREDIT are positively related. However, there are some substantial deviations from the average correlation, as the major part of the observations lies outside the 95 percent confidence interval. This implies that countries with a large amount of overall liquid liabilities do not necessarily have a high degree of claims on private sector and vice versa. Particularly in developing countries such as the Democratic Republic of the Congo, Ghana, Laos, Sierra Leone, and Rwanda, FDEPTH is much larger than BCREDIT. In contrast, BCREDIT considerably exceeds FDEPTH in a number of advanced economies such as Iceland, Ireland, the Netherlands, Norway, Sweden, and the United Kingdom. The data also implies that democracies tend to have more highly developed financial systems (mean of BCREDIT: 44 percent) than non-democracies (20 percent).

Figure (2) pictures kernel density estimates of FDEPTH and BCREDIT. Both distributions are strongly right-skewed (skewness is 2.9 for FDEPTH and 2.0 for BCREDIT), indicating that there are many countries in which the development level of the financial sector is significantly lower than the mean. The kernel estimation also reveals that there are some major outliers in both variables. Particularly in Luxembourg (359.88), Hong Kong (287.83), Japan (209.50), Switzerland (153.55), and the United Kingdom (152.54), FDEPTH substantially exceeds the world average. However, the overwhelming majority of

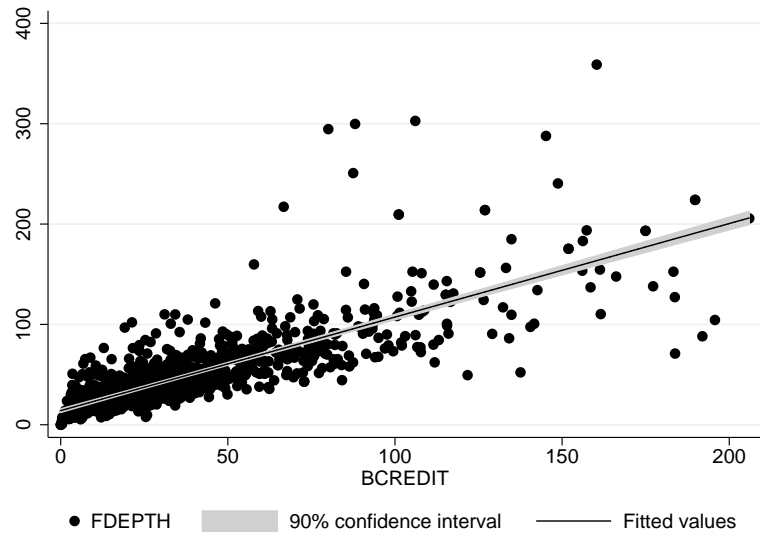


Figure 1 The correlation of FDEPTH and BCREDIT. Whole sample of countries during the 5-year intervals between 1960-1964 and 2005-2010.

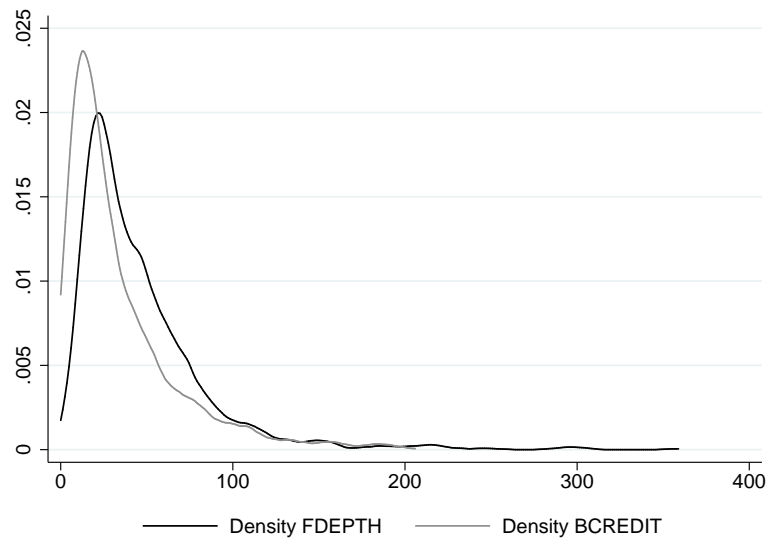


Figure 2 Kernel density estimate of FDEPTH and BCREDIT. Kernel is Epanechnikov. Bandwidth: 5.9111 (FDEPTH) and 5.2993 (BCREDIT).

observations (80 percent of the data) is located in the intervals $FDEPTH \in [14.54, 86.17]$ and $BCREDIT \in [6.10, 77.49]$, implying a much less developed financial system.

Financial systems on average have developed considerably over the past decades. Whereas the mean value of FDEPTH was 42.31 in the early 1980s, we observe a tremendous increase during the 1980s and the 1990s, culminating in a mean of 60.76 in the late 2000s. Figure (3) shows the kernel density of the data in the 1980-1984 period and in the 2005-2010 period, respectively. This illustration clearly demonstrates that the increase in the mean of FDEPTH is mainly due to a sharp rise in a minority of countries, whereas there is only a slight increase in the mode of the distribution. In fact, the asynchronous development of the financial sector has resulted in a substantial increase in the standard deviation of FDEPTH between the early 1980s (26.83) and the late 2000s (49.48).¹⁰

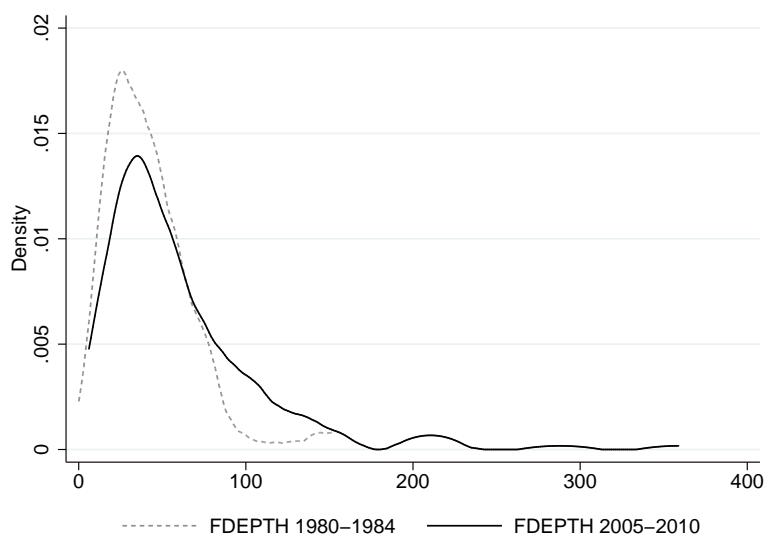


Figure 3 The evolution of the financial system over time. Kernel density estimate of FDEPTH in the 1980-1985 period and the 2005-2010 period. Kernel is Epanechnikov.

Figures (A1) and (A2) in the appendix list the countries with the highest absolute increase in FDEPTH and BCREDIT between the 5-year periods 1980-1984 and 2005-2010. This list is composed entirely of high-income countries. With regard to FDEPTH, the strongest increase is observable in Cyprus (143.05), the United Kingdom (116.69), and Barbados (94.25). The United Kingdom is also among the countries with the highest increase in BCREDIT (148.21), exceeded only by Iceland (163.29), Denmark (160.05), Cyprus (149.73), and Ireland (150.90). In contrast, the sample also includes a number of countries with a decline in FDEPTH and BCREDIT between the early 1980s and the late 2000s, listed in Figures (A3) and (A4) in the appendix. This list almost entirely consists of developing economies from the Arab Peninsula, Africa, the Caribbean, and Central America.

¹⁰Note that the same asynchronous development can be observed with respect to BCREDIT, where the standard deviation rose from 24.42 to 45.77.

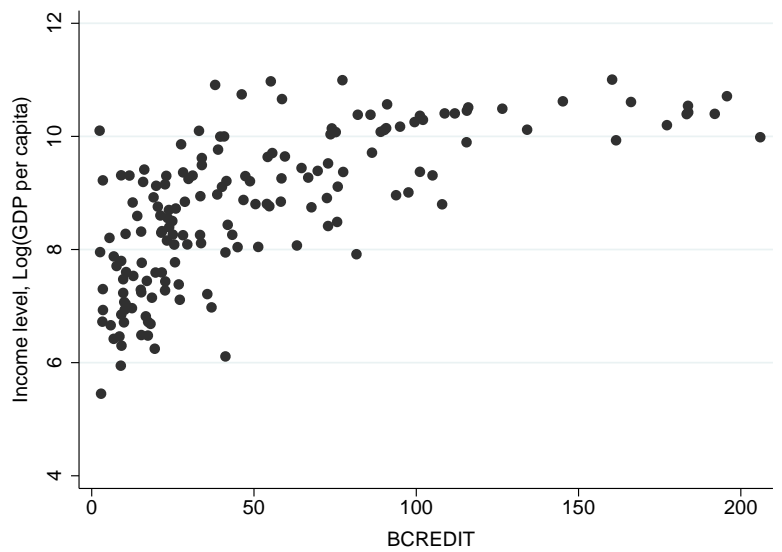


Figure 4 The relationship between per capita incomes and the development level of the financial sector, period 2005-2010.

Figure (4) illustrates the relationship between the income level and the size of the financial sector. The figure shows that on average richer economies have more advanced financial markets (correlation: 67.5 percent). However, whereas above-average values of BCREDIT can without exception be observed only in high-income countries, the figure implies a huge variation in the income level of countries with less developed financial sectors. The bottom quartile of the distribution of BCREDIT in 2005 features countries with a ratio of domestic credit to GDP less than 17.31 percent. This group contains both less developed countries—e.g. the Republic of the Congo, Mozambique, and Niger—and middle-income economies, such as Argentina and Mexico.

Figure (5) presents a kernel estimate of the joint distribution of BCREDIT and the investment share in the periods 1965-1969 and 2005-2009. This illustration gives a first implication on the correlation of finance and its main transmission channel to growth identified by the theoretical model. In the late 1960s, the bivariate distribution of financial development and investment was clearly bimodal, dividing countries with a relatively low size of the financial sector and low investment shares on the one hand, and economies with more sophisticated financial markets and higher investment shares on the other hand. In the late 2000s, however, such a distinction is no longer visible. Instead, the variation of financial development across countries rose considerably. This evidence may serve as a first indication that the transmission mechanism of the financial sector on growth has changed over time.

Summarizing the data, it can be observed that the development level of the financial sector is strongly heterogeneous across countries. Over the past decades, this gap has widened even further, which is reflected in an increasing sophistication of financial markets in advanced economies, and little progress in developing economies.

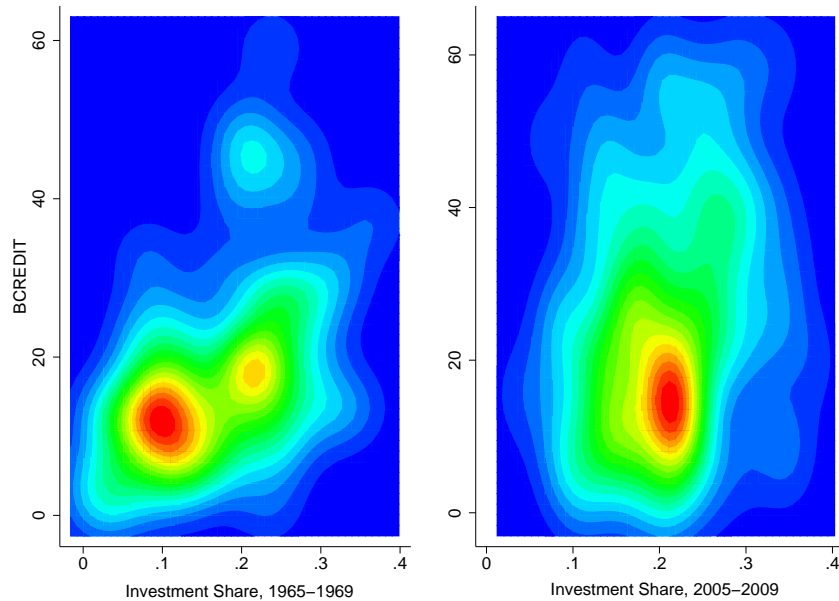


Figure 5 The joint distribution of BCREDIT and the investments share in the periods 1965-1969 and 2005-2009. Kernel estimation, kernel is Gaussian.

4. Empirical results

4.1. Baseline results

Table (2) presents the results of the whole sample estimation using BCREDIT (Panel A) and FDEPTH (Panel B) as proxies of the financial sector. Column (1) of Panel A explores the impact of BCREDIT in a reduced model to capture the full effect of finance, leaving all possible transmission channels open. Accounting only for the initial income level, finance is negatively related to economic growth. This effect turns out to be remarkably significant. Column (2) enlarges the specification by incorporating the investment share and school attainment, two transmission channels of finance on growth identified by the theoretical model. Both the accumulation of physical capital and better education are positively associated to growth. The marginal impact of BCREDIT shrinks when holding constant INVS and SCHOOLY, but retains its negative sign.

The third specification, reported in Column (3), includes life expectancy, government consumption, the inflation rate, openness, and the political rights index. The results suggest that better health contributes to income increases. Likewise, openness and democratic structures in the form of greater political rights are positively related to growth. In contrast, a higher inflation rate is an impediment to growth, reflecting the negative effect of an enhanced degree of instability. The results also point to a slightly positive effect of government consumption, which becomes insignificant in the subsequent estimations. Accounting for the growth effects of the additional variables in Column (3), the influence of BCREDIT is still significantly negative, indicating that its effect extends beyond the transmission channels

Table 2 Baseline regressions of the effect of finance on growth, full sample 1960-2013, dependent variable is real per capita GDP growth.

	(1)	(2)	(3)	(4)	(5)
Panel A: Claims on the private Sector in relation to GDP (BCREDIT)					
Log(GDP _{pc})	0.0203*** (0.00616)	-0.00612 (0.00549)	-0.0113*** (0.00419)	-0.0100*** (0.00350)	-0.0177*** (0.00351)
BCREDIT	-0.000420*** (0.000142)	-0.000235*** (0.0000740)	-0.000172*** (0.0000648)	-0.000141*** (0.0000540)	-0.000148** (0.0000601)
INVS		0.123*** (0.0306)	0.0379 (0.0306)	0.0394 (0.0299)	0.0498 (0.0327)
SCHOOLY		0.00826*** (0.00279)	-0.000266 (0.00141)	-0.00415** (0.00169)	0.00307 (0.00254)
Log(LIFEEX)			0.108*** (0.0152)	0.0640*** (0.0163)	0.0748*** (0.0225)
GOVC			0.0431* (0.0243)	0.0279 (0.0225)	0.0138 (0.0319)
INFL			-0.00128*** (0.000470)	-0.00100* (0.000580)	0.000160 (0.000816)
OPEN			0.0163** (0.00667)	0.0129* (0.00675)	0.0109* (0.00575)
POLRIGHT			0.00279* (0.00163)	0.000134 (0.00143)	-0.00252 (0.00207)
Log(FERT)				-0.0379*** (0.00820)	-0.0183 (0.0115)
TOTR					-0.00442 (0.00871)
Panel B: Overall liquid liabilities in relation to GDP (FDEPTH)					
FDEPTH	-0.000137 (0.000136)	-0.0000197 (0.0000874)	-0.0000812 (0.0000879)	-0.0000649 (0.0000537)	-0.0000817 (0.0000976)
Observations	1071	922	830	830	370
Countries	162	132	130	130	130
Hansen p-val	0.00529	0.0177	0.243	0.275	0.351
Diff-Hansen	0.053	0.083	0.855	0.720	0.154
AR(1) p-val	6.16e-08	0.000000208	0.00000123	0.000000790	0.0193
AR(2) p-val	0.200	0.757	0.985	0.932	0.525
Instruments	48	64	112	127	76

Notes: Table reports two-step system GMM estimations with Windmeijer-corrected standard errors in parentheses. Test statistics refer to Panel A. All regressions include period fixed effects. Hansen p-val gives the J-test for overidentifying restrictions. Diff-Hansen reports the p -value of the C statistic of the difference in the p -values of the restricted and the unrestricted model. The unrestricted model neglects the [Arellano and Bover \(1995\)](#) conditions. AR(1) p-val and AR(2) p-val reports the p -values of the AR(n) test. Instruments gives the number of instruments used in the regression. The instrument matrix is restricted to lag 2. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

incorporated in this specification.

For this reason, Column (4) enlarges the model by incorporating the fertility rate. In line with the credit market imperfections channel pioneered by [Galor and Zeira \(1993\)](#), the theoretical model of Section 2 implies that the growth effects of finance and fertility are strongly interwoven. The reason is that the budget constraint of households is more binding in the presence of capital market imperfections. Indeed, a descriptive analysis reveals a strong correlation of -59 percent between the variables. The results of Column (4) imply that fertility is negatively associated to growth, as predicted by the standard growth model. In addition, the marginal effect of finance remains negative and significant, but declines further when accounting for fertility. This highlights that families in countries with less developed financial markets tend to resolve the trade-off between the quantity and the education of the children in favor of having more offspring. The shrinking effect of finance compared to Column (3) may be a hint that better credit availability can help to mitigate this effect.

The final column introduces the terms of trade. Whereas the effect of finance remains unaltered when holding constant TOTR, its inclusion comes at a high cost. Given the limited data availability with respect to the terms of trade, the number of observations is reduced from 830 to 370. In light of the limited contribution of TOTR to growth and the loss of observations when incorporating the variable, the subsequent tables neglect the results of model (5).

Panel B of Table (2) investigates the impact of FDEPTH as a proxy for the financial sector, conducting model specifications identical to those in Panel A. There are no major changes in the effect of the covariates in either their sign or their magnitude, which is why the table only reports the effect of FDEPTH. As identified in Panel A, the effect of finance on growth is essentially negative, irrespective of the model structure used for specification. However, in case of FDEPTH, this effect is not significant at the 10 percent level.

The test statistics reported in Table (2) are concerned with the validity of the estimations. The table reports the statistics for Panel A; however, there are no relevant differences to the test outcomes of Panel B. A crucial requirement in the model is the absence of second-order serial correlation in the residuals, which is clearly the case judging from the AR(2) p-values that (strongly) exceed 0.1 in each of the estimations. A second requirement is validity of the instruments. Whereas the p-values of the Hansen tests regarding models (3)–(5) suggest that the null of joint validity of all instruments cannot be rejected, the J-test rejects the null when considering the reduced model specifications. This, however, most likely points to an omitted variable problem rather than to invalidity of the instruments, as the J-test can also be viewed as a test of structural specification ([Roodman, 2009a](#)). As the model specifications deliberately omit some of the covariates in order to capture the full impact of finance on growth and to achieve a sound understanding regarding the transmission channels through which finance affects income increases, a rejection of the reduced specifications is not surprising. Finally, the results of the Difference-in-Hansen tests emphasize validity of the additional orthogonality restrictions used for system GMM, suggesting efficiency gains in comparison with first-difference GMM.

To summarize the baseline results, there is no indication of any positive effect of finance

on economic growth. On the contrary, the influence of the financial sector is either negligible (Panel B) or even negative (Panel A).

4.2. Sensitivity analysis of the baseline findings

To test the robustness of the previous findings, this section reports the results of three modifications of the baseline regressions. The first adjustment is based on first-difference GMM as illustrated in Section 3.1, while the second concept utilizes a collapsed instrument matrix to limit the number of instruments used in the baseline system GMM estimations. The latter may be beneficial, as large sets of instruments provide the potential to overfit the instrumented variables, simply by virtue of their large number. As a result, the estimation fails to expunge the endogenous components and biases coefficient estimates toward those from noninstrumenting estimators (see Roodman, 2009b). By combining instruments, the collapsing method creates one instrument for each variable and lag distance rather than one for each time period, variable, and lag distance. While the standard approach in Table (2) restricts the instrument matrix to lag 2, collapsing the instrument matrix provides an alternative tool to account for instrument proliferation. Finally, the third robustness check uses a one-step GMM variant of the baseline model.

Table (3) reports two specifications for each of the adjustments. The first specification refers to the reduced models depicted in Column (1) of Table (2), while the second estimation is identical to the comprehensive model shown in Column (3) of the baseline table. In sum, the sensitivity tests strongly support the previous findings, suggesting a negative impact of finance on growth that is visible in each of the regressions. Regarding the first-difference GMM results, it is crucial to emphasize that this technique yields a reduction in the number of observations from 1,071 to 906, as the approach requires having at least three consecutive observations for each of the regressors. This requirement results in an asynchronous loss of observations across different development levels, as data availability is more restricted in low-income countries. Indeed, the results of first-difference GMM point to an even stronger negative effect of finance than the baseline regressions. This suggests that the negative influence of finance on growth may be more prevalent in rich economies.

4.3. Nonlinear effects of finance

The results of the baseline regressions are astonishing, indicating that finance does not contribute to an increase in incomes at all. The theoretical model provides some explanations for why finance may exert such a negative effect; nonetheless, it is hardly imaginable that these channels entirely exceed the positive effects of financial intermediation, especially the provision of capital and risk-screening. One explanation may be that there is a nonlinear relationship between finance and growth, as argued by Arcand et al. (2015) and Law and Singh (2014). When considering the theoretical model, it is reasonable to assume that an increase in finance enhances growth if the development level of the financial system is low, but becomes negative in countries with advanced financial sectors.

Table (4) is concerned with the investigation of a nonlinear effect of finance by incorporating BCREDIT SQUARE—the square of BCREDIT—in the model specification of Table (2). As there are virtually no changes in the signs and magnitudes of the parameter estimates

Table 3 Sensitivity analysis of the baseline results, full sample 1960-2013, dependent variable is real per capita GDP growth.

	First-Difference GMM (Arellano-Bond)		System GMM (Collapsed)		System GMM (One-step)	
	(1)	(2)	(3)	(4)	(5)	(6)
Log(GDP _{pc})	-0.0493* (0.0286)	-0.0532 (0.0385)	0.0247** (0.0117)	-0.0295 (0.0250)	0.0209*** (0.00665)	-0.00862** (0.00436)
BCREDIT	-0.000968** (0.000388)	-0.000634** (0.000247)	-0.000589*** (0.000201)	-0.000127 (0.000179)	-0.000424*** (0.000142)	-0.000223*** (0.0000578)
INVS		0.00993 (0.0813)		-0.00476 (0.0933)		0.0368 (0.0318)
SCHOOLY		-0.000688 (0.00795)		0.00487 (0.00381)		-0.000863 (0.00166)
Log(LIFEEX)		-0.0457 (0.0994)		0.107 (0.0806)		0.0965*** (0.0226)
GOVC		0.0197 (0.0522)		0.0126 (0.0476)		0.0184 (0.0252)
INFL		-0.00108 (0.000911)		-0.0112** (0.00549)		-0.00146*** (0.000499)
OPEN		0.103** (0.0455)		-0.0139 (0.0353)		0.0168*** (0.00649)
POLRIGHT		0.00257 (0.00743)		0.0107 (0.00986)		0.00384** (0.00180)
Observations	906	698	1071	830	1071	830
Countries	157	127	162	130	162	130
Hansen p-val	0.106	0.0154	0.00743	0.267	0.0147	0.0647
Diff-Hansen			0.010	0.113	0.093	0.520
AR(1) p-val	0.0000186	0.000600	0.000000109	0.155	6.44e-08	0.00000142
AR(2) p-val	0.753	0.281	0.213	0.729	0.219	0.941
Instruments	23	49	15	26	39	97

Notes: Table reports first-difference and system GMM estimations with robust standard errors in parentheses. The model specification is identical to Column (1) and (3) of Table (2). Columns (1) and (2) use first-difference GMM neglecting the [Arellano and Bover \(1995\)](#) orthogonality conditions. The estimations reported in Columns (3) and (4) use collapsed instrument matrices with two step GMM and Windmeijer-corrected standard errors. Column (5) and (6) report a one-step variant of the baseline regression. All regressions include period fixed effects. Hansen p-val gives the J-test for overidentifying restrictions. Diff-Hansen reports the p -value of the C statistic of the difference in the p -values of the restricted and the unrestricted model. The unrestricted model neglects the [Arellano and Bover \(1995\)](#) conditions. AR(1) p-val and AR(2) p-val report the p -values of the AR(n) test. Instruments gives the number of instruments used in the regression. The instrument matrix is restricted to lag 2. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4 Nonlinear effects of finance, full sample 1960-2013, dependent variable is real per capita GDP growth

	(1)	(2)	(3)	(4)
Log(GDP _{pc})	0.00803 (0.00759)	-0.00637 (0.00635)	-0.0112** (0.00439)	-0.0105*** (0.00356)
BCREDIT	0.000822** (0.000337)	0.000544* (0.000328)	0.000344 (0.000236)	0.000242 (0.000215)
BCREDIT SQUARED	-0.00000715*** (0.00000218)	-0.00000462** (0.00000210)	-0.00000303** (0.00000131)	-0.00000223* (0.00000117)
Observations	1071	922	830	830
Countries	162	132	130	130
Hansen p-val	0.0204	0.0181	0.300	0.328
Diff-in-Hansen	0.036	0.083	0.792	0.742
AR(1) p-val	8.57e-08	0.000000192	0.00000103	0.000000607
AR(2) p-val	0.210	0.667	0.896	0.998
SLM p-val	0.00738	0.0489	0.0726	0.13
Instruments	48	64	112	127

Notes: Table reports two-step system GMM estimations with Windmeijer-corrected standard errors in parentheses. All regressions include period fixed effects. Hansen p-val gives the J-test for overidentifying restrictions. Diff-Hansen reports the p -value of the C statistic of the difference in the p -values of the restricted and the unrestricted model. The unrestricted model neglects the [Arellano and Bover \(1995\)](#) conditions. AR(1) p-val and AR(2) p-val report the p -values of the AR(n) test. SLM p-val gives the p-value of the Sasabuchi-Lind-Mehlum test for an inverse U-shaped relationship. Instruments gives the number of instruments used in the regression. The instrument matrix is restricted to lag 2. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

of the covariates, the table only reports the effects of finance and convergence. The results indicate that finance and growth stand in a parabolic relationship following an inverted U curve. The quadratic component of the model is significantly negative in each of the specifications. The linear term, in contrast, is positive in all models, but is significant only in the reduced specifications. The reason is that the comprehensive specifications reported in Columns (3)–(4) control for the transmission channels identified in the theoretical model. The significant decline in the marginal effect of the linear term after the introduction of education and investment in physical capital is an indicator that these variables serve as the transmission channels of a positive effect of finance in earlier stages of financial development.

To test for the presence of an inverted-U relationship between finance and growth, Table (4) also reports the p-values of the Sasabuchi-Lind-Mehlum test developed by [Lind and Mehlum \(2010\)](#). With exception of Column (4), the test suggests an inverse U-shaped relationship in each model. The 90 percent Fieller interval of the reduced model of Column (1) implies that the extreme value of the function lies in the interval [30.83; 78.22]. Figure (6) depicts the evolution of the effect of finance across different development levels of the financial sector. The black line refers to the reduced model of column (1), whereas the gray line illustrates the impact of finance according to the comprehensive model of column

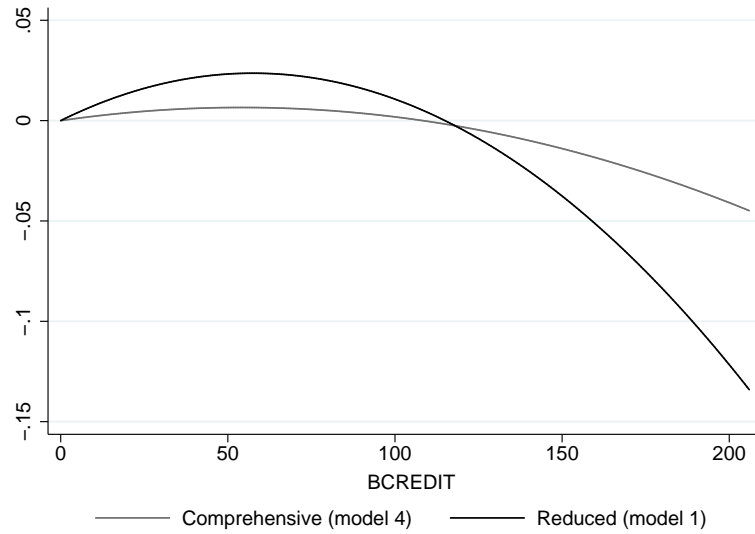


Figure 6 The nonlinear effect of finance on economic growth. The functions refer to the point estimates of model 1 and model 4 of Table (4).

(4). In both models, finance benefits growth if the development level of the financial sector is low. However, the marginal effect is much smaller in the comprehensive model. The reason is that the reduced model captures the full growth effect of finance, neglecting all possible transmission channels. When controlling for these channels in the comprehensive model, the marginal effect of BCREDIT declines. The parameter estimates suggest a peak of the parabola at BCREDIT= 57.48 (reduced model) and BCREDIT= 54.17 (comprehensive model), while the combined 90 percent Fieller interval of both models implies that the effect of finance decreases at the very latest at BCREDIT= 77.18.

Summarizing the results in this section, the findings imply that finance influences growth via a parabolic function, i.e. the influence of the financial sector is positive for low development levels of finance and eventually becomes negative as the financial system evolves. As a result, the overall negative effect detected in the baseline table stems from the descending branch of the parabola. Demirgüç-Kunt and Huizinga (2010) illustrate that banks have gradually steered away from their traditional intermediation activities during the last decades. In the 1990s and the 2000s, non-interest incomes of banks in countries with advanced financial markets experienced a substantial increase, particularly via trading of mortgage-backed securities. Whereas a higher fraction of finance in relation to GDP provides the potential to fund a larger number of investment projects, there may be a point at which the remaining investment projects are less profitable than the development of new business fields. This particularly holds if the financial sector grows at a higher rate than the number of promising investment opportunities. However, the shift in banking activities observable over the past decades has led to higher inflation rates and an increasing vulnerability of banks to economic crises without triggering any growth stimuli (see, for instance, Demirgüç-Kunt and Huizinga, 2010).

Table 5 The effect of finance over time, dependent variable is real per capita GDP growth.

	1960-2010	1960-2005	1960-2000	1960-1995
Log(GDP _{pc})	-0.0100*** (0.00350)	-0.0106** (0.00423)	-0.00607 (0.00582)	-0.00577 (0.00644)
BCREDIT	-0.000141*** (0.0000540)	-0.0000777 (0.0000845)	-0.0000123 (0.000102)	0.0000576 (0.000183)
Observations	830	702	575	453
Countries	130	128	124	109
Hansen p-val	0.275	0.287	0.247	0.0604
Diff-Hansen	0.720	0.540	0.539	0.211
AR(1) p-val	0.000000790	0.000000506	0.000000108	0.00000134
AR(2) p-val	0.932	0.840	0.584	0.762
Instruments	127	110	93	76

Notes: Table reports two-step system GMM estimations with Windmeijer-corrected standard errors in parentheses. The underlying model is the comprehensive specification of Table (2) (model 4). All regressions include period fixed effects. Hansen p-val gives the J-test for overidentifying restrictions. Diff-Hansen reports the p -value of the C statistic of the difference in the p -values of the restricted and the unrestricted model. The unrestricted model neglects the [Arellano and Bover \(1995\)](#) conditions. AR(1) p-val and AR(2) p-val report the p -values of the AR(n) test. Instruments gives the number of instruments used in the regression. The instrument matrix is restricted to lag 2. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$

4.4. The evolution of the impact of finance over time

This section puts together two key findings concerning the effect of finance that have been identified so far. First, there has been a substantial increase in the mean value of finance in the sample. In the early 1960s, the mean of BCREDIT was 20.38 and increased to an average of almost 50 percent in the period 2005-2010. The descriptive analysis in Section 3.2 revealed that this development was mainly due to a major increase in the financial sector in some of the advanced economies. Second, the nonlinear relationship between finance and growth indicates that the influence of finance levels off at some point in the development process of the financial system and may eventually even become negative. Combining these results, it can be expected that finance triggers income increases in earlier periods of the sample, but contributes negatively to growth in later periods.

Table (5) investigates whether there is such a change in the effect of finance over time. As in the previous section, the table only reports the effect of finance and convergence, since the effects of the covariates remain largely unaltered by the reduction in the time dimension. The columns in the table are labeled in accordance with the time period covered in the estimation. The first column illustrates the outcome of the whole sample estimation as reported in Table (2). The subsequent columns successively reduce the time dimension by one period. When investigating the 1960-2005 period, the impact of BCREDIT is still negative, but the marginal effect halves in comparison to the baseline outcome. The impact declines further when considering the period between 1960 and 2000, and even becomes

Table 6 The effect of finance for different development levels, dependent variable is real per capita GDP growth.

	(1)	(2)	(3)	(4)
Log(GDP _{pc})	0.0198*** (0.00641)	-0.000178 (0.00814)	-0.00939* (0.00483)	-0.00906** (0.00451)
BCREDIT	0.00495*** (0.00120)	0.00250* (0.00137)	0.000615 (0.000815)	0.000225 (0.000816)
BCREDIT×GDP	-0.000525*** (0.000120)	-0.000270** (0.000137)	-0.0000781 (0.0000809)	-0.0000371 (0.0000816) (0.00836)
Observations	1071	922	830	830
Countries	162	132	130	130
Hansen p-val	0.0276	0.0150	0.263	0.309
AR(1) p-val	3.72e-08	0.000000105	0.000000982	0.000000785
AR(2) p-val	0.164	0.582	0.949	0.982
Instruments	48	64	112	127

Notes: Table reports two-step system GMM estimations with Windmeijer-corrected standard errors in parentheses. All regressions include period fixed effects. Specification of the models refers to the baseline estimates of Table (2). Hansen p-val gives the J-test for overidentifying restrictions. Diff-Hansen reports the p -value of the C statistic of the difference in the p -values of the restricted and the unrestricted model. The unrestricted model neglects the [Arellano and Bover \(1995\)](#) conditions. AR(1) p-val and AR(2) p-val report the p -values of the AR(n) test. Instruments gives the number of instruments used in the regression. The instrument matrix is restricted to lag 2. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

positive when reducing the covered time span to the 1960-1995 period. In this period, the mean value of BCREDIT is lower than the lower bound of the 90 percent Fieller interval reported in Section 4.3, whereas it lies inside the Fieller interval in each of the remaining models reported in the table.

The results of Table (5) underline the inverse-U relationship of finance and growth. Before 1995, the average development level of the financial sector had not yet reached the critical point from which finance and growth cease to be correlated. However, the further increase in the size of the financial system in the late 1990s triggered negative growth effects that were initially neutralized by the diminishing positive effects of finance. In the post-2005 period, the negative effects of the increasing size of the financial sector prevail and the overall effect turns negative. As many of the earlier studies do not contain data from the post-2005 period, Table (5) may also provide an explanation for why many of the earlier investigations find ambiguous—or even positive—effects of finance on growth.

4.5. Different development levels

The reduction in the time-dimension in the sample reveals a change in the sign regarding the influence of the financial sector on growth over time. However, even if the effect of finance was still positive in the 1960-1995 period, its contribution to growth was far from

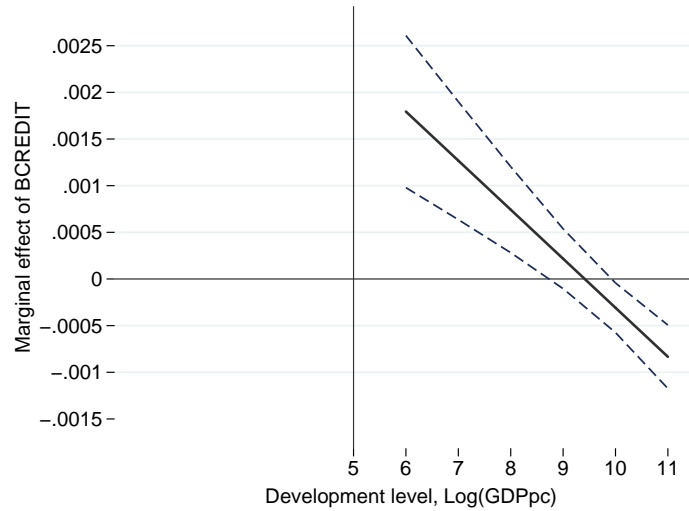


Figure 7 The effect of finance on growth for different levels of development. Values are calculated using the results of the growth regression of Table (6). The black line plots the marginal effect of BCREDIT at various levels of development. Surrounding dashed lines represent the 90% confidence intervals.

significance. In addition, one striking fact gathered from the descriptive analysis in Section 3.2 is that financial systems in the world developed asynchronously over the last decades, where huge increases in the size of finance observed in advanced economies stand in marked contrast to the slight progress made in developing economies.

Table (6) investigates whether there are differences in the effect of finance across different development levels. For this purpose, the table introduces an interaction term between the size of the financial sector and the development level, denoted by $BCREDIT \times GDP$. The specifications of the models refer to the baseline estimates of Table (2). The first column again illustrates the effect of finance in the reduced model, leaving all possible transmission channels open. The positive sign of BCREDIT indicates that finance is beneficial for growth if the development level is low. In contrast, the interaction term is negatively related to growth, implying that the effect of finance turns negative once a critical development level is exceeded. When accounting for several of the identified transmission mechanisms of finance in the more comprehensive model specifications depicted in Columns (2)–(4), the positive effect of finance becomes less significant.

Figure (7) illustrates the effect of finance for different levels of development based on the results of Table (6). The 90 percent confidence interval reaches the null at incomes of approximately 7,500 USD, whereas the marginal effect becomes zero at incomes of roughly 12,000 USD. If incomes exceed a critical threshold of approximately 20,000 USD, the effect of finance on growth becomes significantly negative.

4.6. Transmission channels of finance

This section is concerned with a more in-depth analysis of the transmission channels of finance and the role played by the development level in this process. The theoretical model as well as the empirical investigations in the previous sections imply that finance exerts its influence on growth by facilitating R&D, investment, and education. Table (7) is concerned with the effect of finance on these transmission variables in the whole sample of countries. This investigation uses INVS to assess the influence of finance on investment in physical capital, and SCHOOLY to explore the contribution of the financial sector to the education level of the countries. In addition, the analysis investigates the effect of finance on entrepreneurship as a third transmission variable to evaluate the hypotheses of the theoretical model more directly. Entrepreneurship may also serve as a proxy for R&D activity. To measure the extent of entrepreneurship in a country, the *Total Entrepreneurial Activity* (TEA) index of GEM (2012) is used.¹¹ However, data for this variable is only available from 1999 onward, resulting in a considerable reduction in the time dimension. While it may also be advantageous to assess the effect of this variable in the baseline estimations, the strong limitation in data availability rules out the application of system GMM.

The analysis is built on three specifications for each of the transmission variables, analyzing the effect of finance in reduced as well as in comprehensive specifications. The estimation technique uses Within-Group (WG) regressions with cluster robust standard errors. As the models do not include lagged dependent variables, WG can safely be applied without the fear of a potential dynamic panel bias. Meanwhile, system GMM is not an option in this case, particularly with regard to the limited time dimension covered by TEA.¹²

The first transmission channel in Table (7) concerns investment in physical capital. The results imply that on average richer economies have lower investment shares, which is in accordance with the standard growth model. In addition, fertility and inflation are negatively related to investment in physical capital, as savings are lower in presence of larger households and less secure economic conditions. Health—measured by life expectancy at birth—is positively associated with the investment share. Holding constant these variables, the results do not imply any significant effect of finance on investment, neither in the reduced model specifications, nor when incorporating a number of covariates that distinguish the countries.

The second transmission channel illustrates the effect of the financial sector on entrepreneurship. Note that the number of observations is reduced from a maximum of 1,071 when considering investment to a total of 188 with respect to TEA. Thus, the results only reflect the short-term effect of finance during the past 15 years, whereas the estimations of

¹¹Note that recent empirical research on the effect of entrepreneurship on growth concludes that the self-employment rate cannot be considered an appropriate measure of entrepreneurship, as poorer countries tend to have a substantially higher fraction of self-employed than developed economies. This, however, reflects poor labor market conditions rather than a higher extent of innovation activity. This “corner-shop effect” disqualifies utilization of self-employment rates when exploring the transmission channels of finance.

¹²Note, however, that outcomes obtained by system GMM estimations based on the same specifications as the models reported in Table (7) and the same assumptions as in Table (2) yield results strongly comparable to the findings illustrated in this section with regard to INVS and SCHOOLY.

Table 7 Transmission channels of finance, whole sample, dependent variables are investment, entrepreneurship, and schooling

	Investment			Entrepreneurship			Schooling		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Log(GDP _{pc})	-0.0113 (0.0145)	-0.00733 (0.0181)	-0.00685 (0.0179)	-0.202 (1.020)	1.581 (2.546)	2.912 (3.091)	2.243*** (0.283)	2.245*** (0.286)	0.607** (0.266)
BCREDIT	0.000148 (0.000179)	0.000115 (0.000175)	0.000150 (0.000181)	-0.00571 (0.0134)	-0.0136 (0.0134)	-0.0162 (0.0149)	0.00925** (0.00355)	0.00922** (0.00359)	0.00565** (0.00233)
SCHOOLY		0.000759 (0.00336)	-0.00939** (0.00453)		-0.471 (0.605)	-0.529 (0.618)			
Log(LIFEEX)			0.132** (0.0586)			-2.277 (6.203)			3.943*** (1.018)
INFL			-0.00259*** (0.000269)			-0.819 (0.658)			0.00500 (0.00461)
Log(FERT)			-0.0435* (0.0255)			1.054 (2.740)			-3.121*** (0.299)
GOVC			-0.113 (0.0750)			6.391* (3.228)			-1.352* (0.733)
OPEN			-0.00983 (0.0214)			-1.012 (0.944)			0.165 (0.268)
INVS								0.255 (1.130)	-1.619** (0.682)
Observations	1071	922	904	188	155	155	922	922	904
Countries	162	132	132	65	52	52	132	132	132
R-squared	0.00264	0.00164	0.0663	0.00311	0.0177	0.0391	0.424	0.424	0.723

Notes: The table reports Within-Group (WG) estimations for the transmission channels of finance on growth. Cluster robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

the remaining transmission variables cover a substantially larger time dimension. The parameter estimates suggest that the financial sector on average is negatively associated with entrepreneurship, but this effect is far from being significant.

Finally, the last group of transmission regressions is concerned with the impact of finance on schooling. In each of the specifications, it can be observed that more highly developed financial markets significantly enhance the average education level of the countries. This implies that underdeveloped financial institutions impede accumulation of human capital. In addition, higher incomes and better health foster education. Moreover, the trade-off between the quantity and the education of children is clearly visible, as fertility is significantly and negatively related to schooling.

The results thus far illustrate the effect of finance on the potential transmission channels in the whole sample of countries, yielding contradictory results with respect to the hypotheses drawn in the previous sections. However, the strong deviation in the influence of the financial system on economic development discovered in Section 4.5 gives reasons to suspect that the impact of finance on the transmission variables is contingent upon the stage of development. Therefore, Table (8) investigates changes in the effect of the transmission mechanisms across

Table 8 Transmission channels of finance across different development levels, dependent variables are investment, entrepreneurship, and schooling

(1) Low-income countries (less than 4,125 USD)

	Investment			Entrepreneurship			Schooling		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
BCREDIT	0.00161* (0.000824)	0.00218** (0.000884)	0.00136* (0.000814)	0.0579* (0.0321)	0.0553* (0.0331)	0.0491 (0.0385)	0.0489*** (0.0139)	0.0498*** (0.0155)	-0.00183 (0.00852)
Observations	487	398	389	68	68	68	398	398	389
Countries	94	73	72	25	25	25	73	73	72
R-squared	0.0701	0.122	0.209	0.0834	0.0866	0.150	0.309	0.310	0.776

(2) Middle-income countries (Between 4,125 USD and 12,736 USD)

	Investment			Entrepreneurship			Schooling		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
BCREDIT	0.0011*** (0.000369)	0.0017*** (0.000330)	0.0014*** (0.000328)	0.0406** (0.0199)	0.0447*** (0.0155)	0.0173 (0.0136)	0.0127 (0.00928)	0.0116 (0.0106)	-0.00082 (0.0078)
Observations	622	523	509	105	105	103	523	523	509
Countries	122	99	99	41	41	41	99	99	99
R-squared	0.0549	0.149	0.220	0.0518	0.0656	0.125	0.437	0.437	0.752

(3) High-income countries (OECD members)

	Investment			Entrepreneurship			Schooling		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
BCREDIT	0.000105 (0.000132)	0.000114 (0.000131)	0.000127 (0.000147)	0.00118 (0.0150)	0.00872 (0.0161)	0.0255 (0.0216)	0.00141 (0.00322)	0.00163 (0.00322)	0.000635 (0.00362)
Observations	274	274	268	66	66	66	274	274	268
Countries	34	34	34	22	22	22	34	34	34
R-squared	0.0639	0.0756	0.153	0.0505	0.0630	0.186	0.667	0.672	0.758

Notes: The table reports Within-Group (WG) estimations for the transmission channels of finance on growth. Cluster robust standard errors in parentheses. Country classification refers to the World Bank. Labeling of the columns refers to the specification of the models in Table (7). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

different development levels by reporting the results of Table (7) separately for low-, middle-, and high-income countries. The classification of countries refers to the categories of the World Bank, i.e. low-income countries are defined as having annual incomes less than 4,125 USD, while middle-income economies are those with incomes greater than 4,125 USD and less than 12,736 USD. Deviating from the World Bank classification, the group of high-income countries consists of the 34 OECD members.¹³

Table (8) focuses on the parameter estimates of BCREDIT, as there are only minor changes in the effects of the control variables. The labeling of the columns refers to the specifications used in the whole sample estimations of Table (7). This analysis highlights a dramatic change in the effect of finance. In low and middle income countries, a larger financial system significantly contributes to investment in physical capital, thereby accelerating conditional convergence. However, in the group of OECD countries, the effect of BCREDIT is insignificant. A quite similar influence can be observed with respect to entrepreneurship. In low- and middle-income economies, the financial sector significantly boosts entrepreneurship; however, once a critical income level is reached, this effect vanishes and becomes insignificant.

The sample split further highlights that the positive effect of finance on education detected in the whole sample estimations entirely stems from low-income economies. In fact, whereas the financial sector and schooling tend to remain positively correlated in richer economies, the marginal impact declines in developed countries. These findings emphasize that in general, better credit availability softens the budget constraints of the household, thereby enabling families to invest in the education of the children. However, the development process of the economies is accompanied by improvements in the public schooling system as well as higher average household incomes. Both effects mitigate the trade-off between the quantity and the education of children, enabling higher education levels irrespective of the development level of the financial sector.

In sum, the results demonstrate quite clearly that the impact of the financial sector via its transmission channels depends on the development level of the economies. In low- and middle-income countries, an increase in the size of the financial system triggers positive effects on investment, entrepreneurship, and schooling. However, once a critical development level is exceeded, the influence of finance on the transmission variables vanishes, which is why a further increase in BCREDIT is not accompanied by any positive growth effect. As the positive impact of the financial sector on the transmission variables diminishes, the negative effects of the financial sector may eventually prevail, which is why the overall effect becomes negative.

In addition to these results, the effect of finance may be subject to another conditionality that is related to the income level. Section 4.3 demonstrates that finance and growth are

¹³The reason is that the usual classification—countries with per capita incomes larger than 12,736 USD—is misleading for the purpose of this analysis. Among the high-income economies via classification of the World Bank, there are a large number of countries where we would still expect positive effects on education by the financial sector, such as Equatorial Guinea, Barbados, Kuwait, Oman, Qatar, and Saudi Arabia. Restricting the group of developed economies to the OECD members instead ensures that the analysis relies on economies which are highly advanced in terms of both incomes and human development.

Table 9 Transmission channels of finance across different levels of financial development, dependent variables are investment, entrepreneurship, and schooling

(1) Low development level of the financial sector (less than 57.48)

	Investment			Entrepreneurship			Schooling		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
BCREDIT	0.00118*** (0.000410)	0.00147*** (0.000438)	0.00120*** (0.000432)	0.00909 (0.0226)	0.00762 (0.0271)	0.0120 (0.0272)	0.0418*** (0.0102)	0.0420*** (0.0107)	0.0101 (0.00715)
Observations	865	734	719	127	127	126	734	734	719
Countries	152	125	125	49	49	49	125	125	125
R-squared	0.0201	0.0477	0.0923	0.00774	0.00803	0.0478	0.339	0.339	0.719

(2) High development level of the financial sector (higher than 57.48)

	Investment			Entrepreneurship			Schooling		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
BCREDIT	0.000185 (0.000287)	0.000378 (0.000295)	0.000392 (0.000280)	-0.00145 (0.0210)	0.00122 (0.0220)	-0.0368 (0.0268)	0.00301 (0.00277)	0.00350 (0.00296)	0.00142 (0.00266)
Observations	206	188	185	61	61	60	188	188	185
Countries	58	52	51	25	25	25	52	52	51
R-squared	0.0613	0.122	0.279	0.0273	0.0338	0.260	0.628	0.632	0.748

Notes: The table reports Within-Group (WG) estimations for the transmission channels of finance on growth. Cluster robust standard errors in parentheses. Labeling of the columns refers to the specification of the models in Table (7). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

connected via a nonlinear relationship, i.e. the effect of finance is positive if its size is low, but eventually becomes negative once financial markets are mature. The estimations imply that the point from which the marginal effect of finance declines is reached at a level of approximately 57.48. This shift must have its roots in a change in the transmission process of finance on growth. Table (9) explores this effect. The analysis uses the same specification as in Tables (7) and (8), but splits the sample into two groups according to the size of the financial sector. The first group consists of countries where the ratio of claims of deposit banks in relation to GDP is lower than 57.48. The findings of Section 4.3 imply that economies in this stage of financial development are positively affected by an increase in finance. The results of Table (9) illustrate why: If the development level of the financial market is low, an increase in its size is beneficial to investment in physical capital and education. There is also a slight evidence for a positive relationship between finance and entrepreneurship, which is, however, not significant.

The second part of Table (9) illustrates the influence of BCREDIT on the transmission variables in the group of countries with advanced financial markets. This analysis reveals a dramatic change in the picture. If the financial system is sophisticated, a further increase in its size is no longer accompanied by positive effects on any of the transmission variables. Apparently, the development of the financial sector is completely disconnected from the

development of the transmission variables once a critical level of BCREDIT is reached.

What is the underlying reason for the divergence in the effect of finance, dependent upon the level of economic and financial development? Table (10) investigates the roots of this change by exploring the conditional effect of finance on growth in dependence on public spending on education (PSE), inequality of disposable incomes (GINI), total factor productivity growth (TFP), and the fertility rate (FERT). Each of the models reported in the table enlarges the baseline specification reported in Column (1) of Table (2) by introducing an interaction term between BCREDIT and the respective moderator variable M , denoted by $\text{BCREDIT} \times M$. Figure (8) illustrates the effects graphically. The results highlight that the influence of finance on growth is *positive* if public education systems are less mature. However, once public education reaches a more sophisticated level, the effect of finance turns negative. As an increase in living standards typically brings with it better provision of public education, this outcome explains much of the deviation in the effect of finance on schooling reported in Tables (8) and (9). Closely related to this issue is the effect of finance on the fertility rate. Whereas finance is an impediment to growth in economies with low fertility rates, it has a positive effect on growth in countries with high population growth rates. The reason is that a more sophisticated financial sector helps to soften the budget constraint of the household in these countries, thereby attenuating the trade-off between the quantity and the education of the children.

A similar effect can be observed with respect to inequality of disposable incomes. If income inequality is low, the financial sector exerts a negative effect on growth. However, in countries with an unequal distribution of incomes, credit to the private sector helps to cover the direct costs of schooling and the indirect costs of forgone income. These findings strongly support the models of Galor and Zeira (1993) and Benhabib and Spiegel (2000). In addition, the conditional relationship between finance and growth, dependent on the inequality level, may provide an explanation for the deviating effect of finance on investment in physical capital and innovation. In light of decreasing marginal returns of individual investment opportunities and credit market imperfections, potential entrepreneurs with insufficient wealth may not be able to realize their investment projects in the absence of a functioning financial sector, whereas the wealthy overinvest. In this situation, a more sophisticated financial sector ensures the flow of capital to the most promising investment opportunities. Whereas there are little differences in market inequality across development levels, asynchronous redistribution policies result in much lower Gini indices of net incomes in rich economies (30.86) compared to developing countries (46.03).

Finally, the results of Table (10) imply that finance is particularly detrimental to growth in times when TFP growth is low, but may positively influence income increases if factor productivity grows at high rates.¹⁴ These outcomes support a crucial hypothesis drawn from the theoretical model: If the potential for promising innovation projects is high, the financial sector boosts growth via ex-ante screening of the projects, the provision of funds and knowledge, and by reducing the inherent risk of the innovation. However, in times

¹⁴Note, however, that the AR(1) p-value suggests serial correlation in the TFP model, which is due to the reduced time dimension for which TFP data is available.

Table 10 The changing effect of finance, full sample 1960-2013, dependent variable is real per capita GDP growth

	PSE	GINI	TFP	FERT
BCREDIT	0.000666* (0.000392)	-0.00156*** (0.000406)	-0.000266** (0.000134)	-0.000712** (0.000292)
PSE	0.000194 (0.00255)			
BCREDIT×PSE	-0.000148** (0.0000653)			
GINI		-0.291*** (0.0713)		
BCREDIT×GINI		0.00421*** (0.00110)		
TFP			0.00884*** (0.00170)	
BCREDIT×TFP			0.0000629* (0.0000370)	
FERT				-0.0156*** (0.00350)
BCREDIT×FERT				0.000239** (0.0000984)
Observations	751	795	401	1067
Countries	158	146	115	162
Hansen p-val	0.0159	0.0501	0.113	0.0359
Diff-Hansen	0.025	0.346	0.502	0.600
AR(1) p-val	0.00000417	0.0000279	0.990	0.000000130
AR(2) p-val	0.581	0.983	0.547	0.320
Instruments	57	80	29	64

Notes: Table reports two-step system GMM estimations with Windmeijer-corrected standard errors in parentheses. All regressions include period fixed effects. Hansen p-val gives the J-test for overidentifying restrictions. Diff-Hansen reports the p -value of the C statistic of the difference in the p -values of the restricted and the unrestricted model. The unrestricted model neglects the [Arellano and Bover \(1995\)](#) conditions. AR(1) p-val and AR(2) p-val reports the p -values of the AR(n) test. Instruments gives the number of instruments used in the regression. The instrument matrix is restricted to lag 2. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

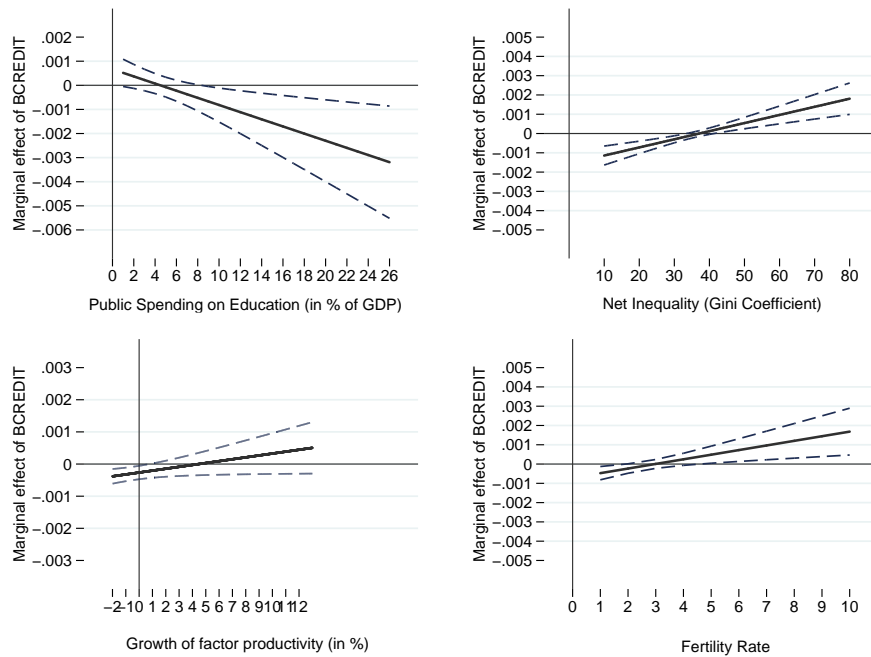


Figure 8 The effect of finance on growth for different levels of public spending on education, net inequality, total factor productivity growth, and fertility. Values are calculated using the results of the growth regression of Table (10). The black line plots the marginal effect of BCREDIT at various levels of the moderator variable. Surrounding dashed lines represent the 90% confidence intervals.

when below-average technological progress restricts the potential for beneficial innovation projects, financial intermediaries increasingly engage in non-lending activities, which do not contribute to income increases but may enhance the vulnerability of economies to crises. In the context of these results, the major decline in productivity growth observable in most advanced economies since the turn of the millennium (see [Gordon, 2015](#) and [Berthold and Gründler, 2015](#)) may to a large extent explain the negative effect of the financial sector on growth in the post-2005 period.

5. Concluding remarks

Evidence from a broad panel of countries highlights that the former positive influence of the financial sector on economic growth has disappeared since the early 1990s. This “vanishing effect of finance” is mainly driven by advanced economies, whereas finance is still beneficial for income increases in developing countries. The reason is that finance and growth are associated via a nonlinear relationship, which is due to a fundamental change in the transmission mechanism of finance across different levels of economic and financial development.

At early stages of development, an increase in the size of the financial sector facilitates

investment in physical capital and entrepreneurship, which accelerates conditional convergence. Furthermore, the financial sector also contributes to investment in education, as it helps to soften the budget constraints of the household. As the economies develop, financial markets become more advanced and the positive effects of finance dissipate. On the one hand, a particular size of the financial market enables funding of all growth-boosting investment and innovation projects, which is why a further expansion ceases to benefit growth. On the other hand, increasing household incomes, more expansive social security systems, and better public school education enable human capital accumulation independent of the financial sector once its size has reached a sophisticated level.

Per capita incomes in many countries have experienced a tremendous increase during the past decades. Economies that benefited from an increasing financial sector at the beginning of the 1990s may today fail to respond to further expansions. This may explain why earlier studies based on the pre-2000 period tend to find a positive impact of finance on economic growth.¹⁵

While the goal of this paper is concerned with an explanation of the vanishing effect of finance, there are in fact several possible reasons why the effect of finance may eventually turn negative. The prospect of efficiency wages payed by banks and other financial intermediaries inhibits tertiary education and prevents human capital from being productive in the real economy. This argument goes back to [Tobin \(1984\)](#) and has recently found support in a number of empirical and theoretical investigations (see, e.g., [Philippon and Reshef, 2013](#) and [Kneer, 2013](#)). A further argument emphasizes that financial firms tend to steer away from traditional intermediation and screening activities once a critical level of financial development is reached.¹⁶ As the number of profitable investment opportunities is finite, banks are increasingly confronted with pressure to develop new business areas in order to guarantee the expected returns of investors. These areas, however, hardly yield any growth effects. In contrast, by increasingly focusing on non-interest income, financial intermediaries contribute to a higher vulnerability of countries to economic crises (see [de la Torre et al., 2011](#) and [Rajan, 2005](#)). The incentive to establish these non-interest business segments is particularly strong in times when fundamentally new ideas are scarce and monetary policy is expansive. This is currently the case in many advanced economies, where a decline in productivity growth is accompanied by low key interest rates, this being a reaction to the latest economic crises (see [Gordon, 2015](#) and [Berthold and Gründler, 2015](#)).

The results of this paper provide striking implications for economic policy. In most developing countries, an increase in the financial system may be beneficial to growth. Future research in this field may concentrate on the policy instruments by which the growth-enhancing effects of finance can be achieved most efficiently. A major prerequisite may be the establishment of individual and economic liberty, political stability, and also property laws, as many developing economies still fail to acquire foreign capital and direct investments

¹⁵See, for instance, [King and Levine \(1993a,b\)](#), [Beck et al. \(2000\)](#), and [Levine et al. \(2000\)](#).

¹⁶A similar argument that deals with productive and unproductive lending activity is provided by [Thorsten et al. \(2012\)](#), who emphasize that it is essential to distinguish between credit that is used for productive investments and loans that are spent on household consumption.

of financial intermediaries. In contrast, the financial sector of many advanced economies has developed beyond the critical size necessary to support the investments that benefit growth. In light of the instability that can be created by a financial system that is large in relation to the real economy, it is doubtful whether future increases in the size of the financial system are sustainable from a macroeconomic point of view.

Appendix

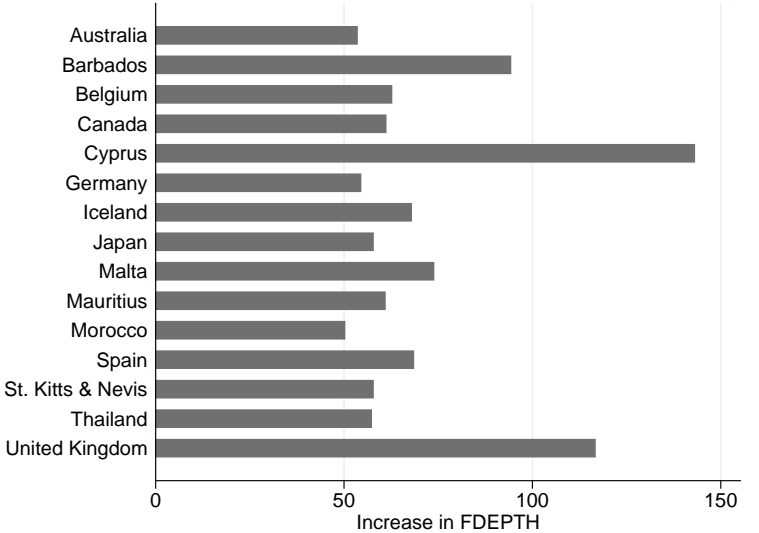


Figure A1 Top 15 countries with the strongest increase in FDEPTH between the 1980-1984 period and the 2005-2010 period.

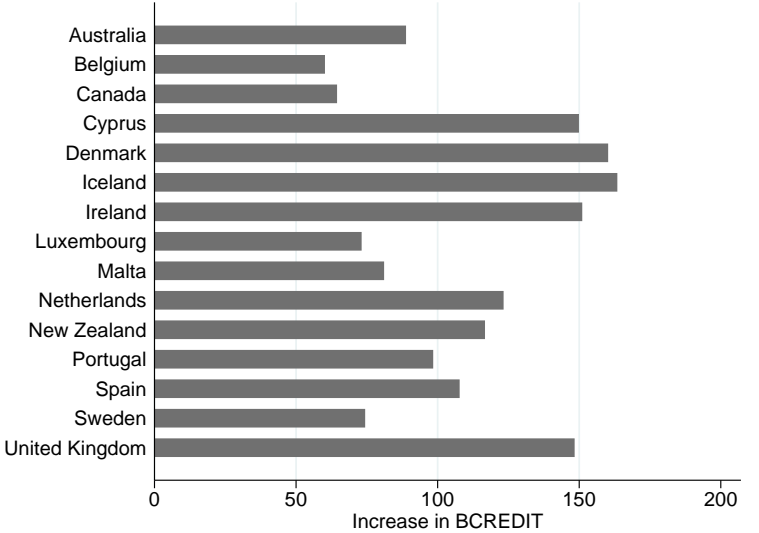


Figure A2 Top 15 countries with the strongest increase in BCREDIT between the 1980-1984 period and the 2005-2010 period.

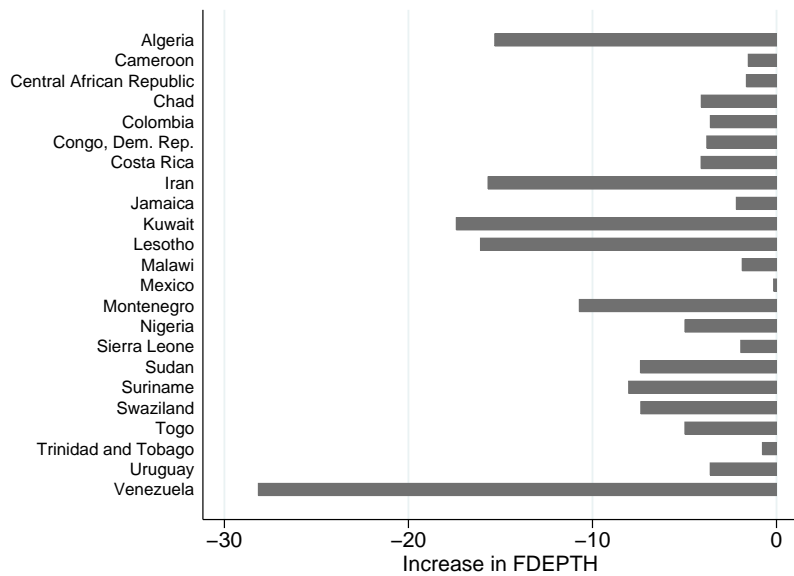


Figure A3 Countries with a decline in FDEPTH between the 1980-1984 period and the 2005-2010 period.

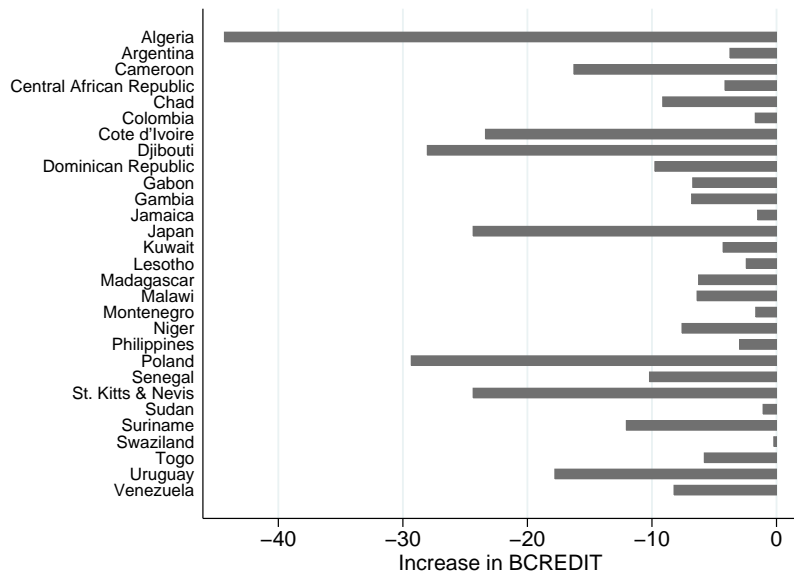


Figure A4 Countries with a decline in BCREDIT between the 1980-1984 period and the 2005-2010 period.

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