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# The Financial Sector and Economic Growth in a Panel of Countries

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# The Financial Sector and Economic Growth in a Panel of Countries

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**Abstract**

Does the financial sector contribute to economic growth? While most of the studies carried out before the Financial Crisis tend to answer this question with 'yes', recent empirical work provides evidence that the opposite is true. We study these new findings in detail, applying GMM and 3SLS estimations of simultaneous equation models that cover a comprehensive set of growth determinants proposed by theory and recent empirical work. It turns out that finance in general exerts a positive influence but this influence vanishes in the development process and eventually becomes negative. While finance still boosts growth in developing countries, a growing financial sector hinders the increase of incomes in rich economies.

Keywords: Economic Growth, Financial Sector
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# 1 Introduction

The positive influence of the financial sector on GDP growth has long been a well-known empirical pattern. Ever since the seminal contributions of Goldsmith (1969) and McKinnon (1973), economists agreed that finance facilitates growth as it enables the efficient allocation of capital. The general idea is that financial intermediaries evaluate entrepreneurs and thus lead savings into the most promising investment projects. By these means, the financial system serves to overcome market frictions emanating from information asymmetries and transaction costs. Hence, most theories that deal with the influence of finance build on Schumpeterian growth models as proposed by, inter alia, Aghion and Howitt (1992, 1998, 2009) and Grossman and Helpman (1991).[1] Summarizing the implications of these models, recent theoretical research emphasizes five general influence channels of finance on growth:[2]

1. It eases the exchange of goods and services by providing payment services.
2. It mobilizes and pools savings from a large number of investors.
3. It acquires and processes information about enterprises and possible investment projects.
4. It monitors investments and exerts corporate governance.
5. It diversifies and reduces liquidity risk and intertemporal risk.

Indeed, most empirical studies confirm one or more of these hypotheses, concluding that finance contributes positively to economic growth.[3] The change of thinking came in the aftermath of the Financial Crisis of 2007. The subprime meltdown in the United States and the following global Financial Crisis encouraged a new discussion about the role of financial markets in today's economy and society. Demands for new regulations and changes in the behavior of the players in financial markets were sprouting from the ground, raising questions about the true value added by banks and other financial intermediaries. Does the financial system contribute to income and wealth increases? Or does a high level of financial development primarily foster the vulnerability of economies to Financial Crises and initiate contagion effects? After numerous empirical studies using both cross-section and panel data sets for the post-1960s period, Rousseau and Wachtel (2011) were among the first to find a negative influence of the financial sector on economic development. While the positive impact of finance appears when analyzing the period from 1960-1989, it vanishes during the post-1990 period and eventually becomes negative. Similarly, Arcand et al. (2012) report a critical threshold of the size of the financial sector

[1] See King and Levine (1993a, 1993b), Rajan and Zingales (1998), Levine et al. (2000), Beck et al. (2000), Morales (2003), Aghion et al. (2005), Howitt and Mayer-Foulkes (2005) and Michalopoulos et al. (2009).

[2] See Beck (2008) for a more detailed description of these arguments.

[3] See, inter alia, King and Levine (1993a, 1993b), Demirgüç-Kunt and Levine (1996), Levine and Zervos (1998), La Porta et al. (1997, 1998), Levine (1998, 1999), Levine et al. (2000) and Beck et al. (2000).

at about 80-100 percent of GDP above which finance tends to have a negative effect on growth. De la Torre et al. (2011) emphasize that the impact of financial development on real GDP exhibits decreasing returns. Consequently, the influence of finance should necessarily level-off at some point in time.

The aim of this paper is to investigate the recent findings in more detail and to shed light on how the influence of finance evolved. We demonstrate why the financial sector has exerted positive effects in the past and show that these effects have vanished at the current edge. For this purpose, we use data from 188 countries between 1960 and 2010 in simultaneous equation models applying 3SLS and White robust GMM estimations. The systems incorporates a wide range of growth determinants proposed by neoclassical and endogenous growth theory and recent empirical findings to ensure consistency of the estimates. The empirical specification refers to Barro (2003, 2008, 2013) and has been well-proven in a range of empirical studies. To the best of our knowledge, this is the first attempt to incorporate the financial system in a comprehensive empirical model using the latest available data for a wide range of countries. Using these new data is indispensable, as the ambiguous effects of the financial system have only emerged during the last two decades. Our results confirm the hypothesis of Rousseau and Wachtel (2011) that the positive influence of finance has vanished since the beginning of the 1990s. As finance may still exert some positive stimuli in developing economies where the financial system is less developed, the positive impact on GDP growth of advanced economies has disappeared completely. In fact, when estimating the effect with data up to 2010, the influence is significantly negative. To test the robustness of our results, we carry out an extensive sensitivity analysis using different proxies of the financial system as well as various specifications of the basic model. The results turn out to be remarkably stable.

The rest of this paper is organized as follows. In section 2 we construct an endogenous growth model illustrating how financial development basically may act as a driver for economic growth. While the main focus of this paper is not on the creation of a theoretical model, theory offers some crucial hypotheses that enrich the empirical investigations, providing various approaches that can be tested with data. Section 3 contains a brief survey of recent empirical studies. To concentrate on the basic relationship between finance and growth, we omit the extensive literature on the advantages and disadvantages of a bank-based financial sector versus a market-based financial sector. Section 4 is concerned with the description of the empirical model, the underlying data, and the estimation strategy. In section 5 we present our basic results. Section 6 provides a sensitivity analysis of the outcomes and discusses the main findings. We conclude in section 7.

## 2 Theoretical Framework: The Financial Sector and Economic Growth

One fundamental hypothesis of the endogenous growth theory is that innovations are the key driver of long-run economic growth. Innovation-based models can be divided into two parallel branches: The first branch is the model of Romer (1986, 1987, 1990) in which horizontal innovations—i.e. entirely new capital goods—trigger economic growth. The other branch, mainly developed by Aghion and Howitt (1992, 1998, 2009) and Grossman and Helpman (1991), focuses on the Schumpeterian idea of quality-improving innovations that render old products obsolete. The crucial determinant of the innovation process is the cost for developing new or improving capital goods. A developed financial system can help to finance these costs, and by selecting the most promising projects it prevents economic subjects from misinvestments. While these are certainly the most important channels through which finance influences growth, the model illustrated in this section will reveal further influencing parameters.

Considering a continuum of specialized intermediate goods $j \in \mathbb{J}$, the basic idea of Romer (1987, 1990) is to formulate output $y_e$ of firm $e$ as

$$y_e = \Psi_e L_e^{1-\alpha} \int_{\mathbb{R}_+} x_{ej}^{\alpha} dj \tag{1}$$

where $\Psi$ denotes factor productivity, $L_e$ is labor force employed by $e$ and $x_{ej}^{\alpha}$ is the amount $x$ of the intermediate good $j$ used within the production process of $e$. As each $j$ owns 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. In general, it is reasonable to use any increasing, strictly concave function $g(x)$ with $g(0) = 0$ to model the response of firm output in dependence of capital goods utilization. The special case considered here, however, is analogous to the power function of Dixit and Stiglitz (1977) assuming the form $g(x) = x^{\alpha}$. (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, where $\mathbb{J} \subset \mathbb{R}_+$.

Suppose that $|\mathbb{J}| = N$ gives the range or number of capital goods used and let $M$ be the total quantity of such inputs.[4] If all firms are equal and $\{M, N\}$ denotes the list of $x_i$ with constant value $x_i = M/N$, then (1) becomes

$$y_e = \Psi_e L_e^{1-\alpha} N^{1-\alpha} M^{\alpha} \,. \tag{2}$$

In this case, output increases with $N$ when holding constant productivity, labor and $M$. Inventions thus boost economic growth as they lead to an increase in the stock of physical capital. Yet, inventions also enhance factor productivity, as they create new knowledge as a by-product of the invention process. 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

[4] Note that this denotation deviates from the original Romer (1987) paper. The definition of $N$ used here refers to Barro and Sala-i-Martin (2003) and is commonly used in theoretical growth research.

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

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, will have the parameter $\Psi_{e,t} = \gamma_{j*}\Psi_{t-1}$ where $\gamma_{j^*}$ reflects the size of the particular innovation $j^*$. Obviously, it follows that $(\partial\Psi/\partial\gamma) > 0$ and $(\partial y/\partial\gamma) > 0$. Let $\mu$ denote the probability of an innovation of $e$ and $\gamma = \sum_{j*=1}^{N^*} \gamma_{j^*}$, $j^* = 1, ..., N^*$ be the average size. Then the average productivity across all firms will be

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

implying that factor productivity grows at a rate of

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

Innovating entrepreneurs benefit the economy through two channels: first, increasing numbers $N$ have a direct effect on physical capital in (2). If one entrepreneur creates a new $j^*$, it can be inserted in the production process of all firms. Second, the innovation creates new knowledge. After some time, this knowledge is available to all firms, enhancing factor productivity and thus output in (2).[5]

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 $e_{j^*}$. As we will see later, the increase of productivity also facilitates future innovations.

The decision of an entrepreneur to innovate is determined by the costs and the risk of the innovation. The capital value earned by creating $j^*$ is

$$V(j^*)_t = \int_t^{t+\psi} (P_{j^*} - 1)\, x_{j^*} e^{-st} \mathrm{d}t$$

where $\pi(v) \equiv (P_{j^*} - 1)x_{j^*}$ is the cashflow stream in 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 an innovation if the expected capital value exceeds the costs $\eta$ of the particular investment, that is, the expected innovation rent $\mathbb{E}[V(j^*)_t] - \eta$ is positive. Basically, any investment in $j^*$ under certainty is profitable if $\eta < V(j^*)_t$. However, the expected capital value will be achieved with a probability $p < 1$, which includes a risk factor in the entrepreneur's calculation. The parameter $p$ reflects the

[5] The application of $(d\Psi_e/dt)$, however, crucially depends on the level of human capital available in $e$. See Nelson and Phelps (1966), Benhabib and Spiegel (2005) and Berthold and Grũndler (2013).

inherent risk of the innovation primarily unknown to the entrepreneur and should not be confused with $\mu$. However, $\mu$ can also be thought of as a function

$$\mu = f(p)\,. \tag{3}$$

One fundamental hypothesis in the work of Schumpeter (1911, 1939) considers the nature of the entrepreneur as a person who is willing to take risks and thus takes advantage of new opportunities. He invests in new products as existing markets are saturated and thus initiates the innovation process. The probability of an innovation hence depends on a second crucial parameter, the individual risk-averseness $\theta_e$ where $(\partial\mu/\partial\theta_e) < 0$. Less risk-averse entrepreneurs may invest in innovations even if the risk of failure is high. Contrarily, entrepreneurs with high values of $\theta_e$ only invest in relatively safe projects. This constitutes a free rider problem within the growth process, as the innovation activity of adventurous entrepreneurs provides externalities for all firms. Additionally, the income level is determined by the average risk-averseness of the economy $E^{-1}\sum_{e=1}^{E}\theta_e$, so (3) adjusts to

$$\mu = f(p, \theta_e)\,.$$

Berthold and Gründler (2012) provide empirical evidence for this hypothesis.

The entrepreneur will invest in $j^*$ if

$$\mathbb{E}\left[V(j^*)_t\right] = \frac{pV(j^*)_t}{\theta_e} > \eta \tag{4}$$

is true. Note that the individual level of risk-averseness is part of the mental programming that is passed from one generation to another and therefore cannot be influenced. Higher values of risk-averseness reduce the probability of an investment for any given probability of success $p$.

Up to this point, the financial sector has been disregarded. Yet, financial intermediaries can crucially influence (4) and thus take influence on the growth process. Usually, the entrepreneur will not be able to procure the financing on his own. In most cases, it is likely, though not certain, that the entrepreneur's initial wealth will not be sufficient to cover $\eta$ himself. Moreover, the model of King and Levine (1993b) indicates that the risk of innovation success is diversifiable, which makes the reliance on any amount of internal finance less efficient. In consequence, the entrepreneur will choose to borrow the funds necessary to finance $\eta$ from the financial sector.

Given the considerations above, we are able to derive several of the initially stated influence channels of the financial system endogenously. First, the financial sector enables the pooling of funds from small savers to mobilize sufficient resources to cover $\eta$. Second, the investment projects need to be evaluated in order to estimate $V(j^*)$ and $p$. The evaluation requires information about future cashflows and interest rates as well as firm-specific information that is often difficult to access. Identifying promising projects hence induces large fixed costs. For this reason, there is an incentive for specialized institutions to perform this task. Individual savers will neither have the time, nor the means or

capacity to accomplish such an assessment. The emergence of a financial sector therefore significantly reduces information costs. In the absence of a well-functioning financial system, these costs would keep capital to flow to the most promising projects. Third, each investment in a new product is equipped with a certain extent of risk $(1-p) > 0$, since the market success of research efforts is uncertain *ex ante*. A further component of risk is the time period $\psi$ in which the innovator retains his monopolistic position. Identifying this risk and providing means to diversify it is another crucial task of the financial sector. Moreover, small savers would not have the opportunity to evaluate the risk properly. Lastly, productivity enhancements emerge if the investments cover newly specialized intermediate goods that increase $\Psi$ and provide both a more efficient production of the output as well as the basis for further improvements and modifications. Yet, these investments always create a high extent of risk. It is the task of the financial system to fund those projects that are most promising and to reject those whose chances of success are low. The financial sector supports investments with high $p$ and rejects projects that are likely to wipe out capital. Despite the low values of $p$ considering $j^*$, it is likely that financial intermediaries choose investments in $j^*$ rather than in existing $j$, since—given the success of the innovation—the expected rewards of $j^*$ are high due to the monopolistic position of $e_{j^*}$. This may lead to $\mathbb{E}[V(j^*)_t] > \mathbb{E}[V(j)_t]$ for two-dimensional investment decisions between $j^*$ and $j \in \mathbb{J}$. Regardless of the type of investment, the financial intermediary always takes the role of caution. If the investment is too risky or the probability of success is too low, the financial sector will not support the investment project.[6] Thus, bad investments are sieved out. A financial intermediary that has carried out a range of investment projects has furthermore a lot of practical knowledge and experience in various fields. Advice from the financial sector may thus lead to an increase in $p$ or $V(j^*)$ and helps satsifying (4).

As the financial system enables the realization of innovations that lead to long-term increases of per capita incomes, financial intermediaries work as lubricants for the main engine of growth. Yet, it is crucial to identify the condition under which the financial intermediary is willing to finance the investment in $j^*$. King and Levine (1993b) consider the financial intermediary funding the innovation $j^*$ as a venture capital firm that could be part of a larger financial conglomerate. In exchange for the capital appropriation, the venture capital firm attains (most of) the firm's stock. The expected market value of $e_{j^*}$ again is $\mathbb{E}[V(j^*)]$. In order to produce a positive outcome for the investment of the venture capital firm, the costs of identifying $(f)$ and funding $(\eta)$ an innovator must at least equal the expected market value, that is

$$\mathbb{E}[V(j^*)] = f + \eta \tag{5}$$

where $f$ reflects the costs for evaluating the innovation project $j^*$ and the entrepreneur $e_{j^*}$. Stock markets in these considerations do have two central functions: first, they reflect the market value of $e_{j^*}$ and second, they provide a vehicle for diversifying the risk $(1-p)$.

[6] As a matter of fact, this function is not always fulfilled. Generally, however, in the own interest of the debtor, it is reasonable to assume that the financial intermediary is very prudent when it comes to lending.

If the risk is perfectly diversifiable, (5) adjusts to $V(j^*) = f + n$. After the successful market introduction of $j^*$, the venture capital firm sells off the shares on a stock market in order to realize $V(j^*)$. This illustrates the necessity of clearly defined property rights and a well-developed stock market system. Thus, higher evolved stock markets are likely to increase growth, at least up to some size of the stock market.

Putting together the implications of (4) and (5), an innovation will be carried out if

$$\eta \quad < \quad \min\left\{pV(j^*)/\theta_e,\, V(j^*) - f\right\} . \tag{6}$$

This condition satisfies the entrepreneur and will lead to a profit for the venture capital firm that is at least zero.

The general approach illustrated above can easily be transferred to any kind of investment. In developing economies that have not yet approximated the steady state level of capital, the financial system can facilitate the accumulation of physical capital and thus accelerate conditional convergence. Considering underdeveloped economies, the absence of a financial market will certainly hinder growth.

One further branch of the endogenous growth theory, building on Uzawa (1965) and Lucas (1988), emphasizes the importance of human capital. The decision of a household to invest in education can be modeled similarly to (4) as the returns to education resemble monopoly profits in many ways.[7] Like investments in innovations, education programmes bear the risk that the wage premium cannot be achieved, e.g. if the participant in such a program enters the job market during a recession. The investment decision of the financial intermediary is similar to (5) when considering human capital investments. As is often the case, the wealth of individuals may not be sufficiently high enough to cope with the initial education costs themselves. For this reason the financial sector will also play an important role in the accumulation of human capital. Underdeveloped financial systems, market imperfections, and borrowing constraints can inhibit a nation's increase in human and physical capital as well as its innovation activity. As Benhabib and Spiegel (2000) point out, the role of financial intermediaries in factor accumulation is particularly strong in economies with highly skewed income distribution. The share of population that is unable to acquire capital for profitable investments can be expected to be significantly lower in such social environments.

Summarizing our theoretical implications, the financial sector generally has the ability to boost economic growth, since it enables and simplifies investments in both existing and innovative intermediate goods as well as investments in human capital and thus supports factor accumulation and productivity increases. The important services of the financial sector are: the funding of innovation projects; the mobilization and pooling of funds from small savers; the evaluation of the capital value and the risk of the investment and the diversification of the innovation risk. Yet, the crucial question is whether the effects ebb in the development process of economies. This would be the case if the amount of

[7] Let $w_H$ be the real wage of skilled workers with a large stock of human capital and $w_L$ denote real wage of unskilled workers. The premium $(w_H - w_L)$ is very similar to the premium $(P_{j^*} - P_j)$ that can be earned by the innovator that achieves a monopolistic position.

promising investment opportunities does not increase as fast as the size of the financial sector. We will come back to this issue in detail and show that the empirical answer to this question unambiguously is 'yes'.

# 3 Literature Review and Recent Studies

Historically, the overwhelming majority of empirical investigations found a positive influence of financial development on growth. Among the first of these studies were Goldsmith (1969) and McKinnon (1973). Using the financial intermediary assets of a country divided by its GNP as an indicator for financial development, Goldsmith (1969) analyzes 35 countries from 1860 to 1963. Although causality cannot be clarified, Goldsmith (1969) suggests a positive correlation between financial development and growth. McKinnon (1973) studies several historical cases of economic performance and financial development and emphasizes the importance of a vital finance sector. However, modern econometric methods provide tools to evaluate the relationship between finance and growth in a more profound way.[8] Endogenous growth theory, on the other hand, provided a much more sophisticated theoretical framework. Hence, performing empirical investigations on the topic has kept being a valuable field of empirical research. This section focuses on the most important recent studies.[9]

## Simple cross-sectional analyses

The first generation of models estimate the effect of the financial sector in cross-sectional data sets using OLS. Roubini and Sala-i-Martin (1992) analyze the effects of governmental efforts to repress financial development as a way to ease the refinancing of public spending. Building on Barro (1991), they show that such political actions have a significantly negative effect on economic growth. Yet, there may be some concern about the proxy variables applied to measure financial repression. In seminal contributions, King and Levine (1993a, 1993b) extent the approach of Goldsmith (1969) by increasing the sample of countries as well as the set of financial indicators. They also include some covariates such as the investment ratio and the capital stock per capita. Using four basic indicators to measure the size and importance of the financial sector, King and Levine (1993a, 1993b) conclude that the financial system positively influences growth. To reject the hypothesis that finance simply follows economic growth, they use initial levels as well as lagged values of the financial indicators and find a positive correlation with growth in later periods. However, the first generation papers struggle with some methodological issues. The main problem is that the error term is almost certainly correlated with the regressors. As these models only control for few growth determinants, the estimated coefficient is inconsistent. In addition, the models pay little attention to reverse causation and heterogeneity.

[8] See Beck (2008), Levine (2004) and Levine (1997) for according arguments.
[9] An extensive survey is provided by Beck (2008) and Levine (2004).

## Instrumental variable approach in cross-sectional analyses

The second generation of models seeks to overcome the problem of endogeneity by using instrumental variable estimations (IV). One of the most common instruments used in this class of models is the legal origin of a country. La Porta et al. (1997, 1998) introduce the legal origin—either English, French, German or Scandinavian—as an exogenous factor that explains different levels of financial development. Different legal frameworks vary in the weight of investor protection and several other factors determining the development of the financial sector. Utilizing this instrument—partly in combination with differences in national accounting systems—in a sample of 49 countries, Levine (1998, 1999), Levine et al. (2000), and Beck et al. (2000) confirm the results of earlier analyses. One further benefit of the IV estimation is that it indicates evidence on the direction of causality. La Porta et al. (2002) utilize the degree of governmental ownership in the banking sector as a proxy for an advanced finance sector. The basic idea is that state-owned banks are less efficient in allocating the resources properly. Confirming this theory, the results suggest that growth rates are higher when the ratio of state-ownership in the financial sector is low.

Several other instruments have been applied in the second generation models. Guiso et al. (2004), for example, use the historical banking structure in Italy, while McCaig and Stengos (2005) exploit religious composition, years of independence, geographical latitude, settler mortality, and ethnic fractionalization. However, these models offer three weak spots: first, they do not account for endogeneity in the covariates. Second, unobserved country effects emerging from omitted variables may still lead to a correlation of the regressors and the error term. Third, instruments are often only available for a small fraction of countries, particularly when applying historical data. This may lead to a severe selection bias, as these samples mostly do not contain low or middle income countries.

## Instrumental variable approach in dynamic panel analyses

The last generation of empirical models estimate dynamic panel regressions. Levine et al. (2000) and Beck et al. (2000) use panel data of 77 countries from 1960 to 1995. To disentangle growth and cyclical effects, both studies use five-year averages. The results confirm the positive effect discovered in the OLS and IV models. Rousseau and Wachtel (2002) use dynamic panel estimations to examine whether the influence of financial development varies with price levels. They show that the positive effect on growth diminishes with higher rates of inflation. Rioja and Valev (2004a, 2004b) explore the channels through which financial development affects growth in more detail. The conclusion is that poorer countries mainly benefit from financial development through capital accumulation, while the financial sector in richer countries primarily enhances factor productivity. Additionally, they find that the marginal impact of finance increases as the financial sector evolves. Yet, this effect vanishes if a certain stage of economic development has been surpassed. By constructing overlapping five year averages, Bekaert et al. (2005) modify

earlier approaches to increase the number of periods in the panel. They find that a rise in equity market liberalizations as a proxy for financial development leads to an increase in income per capita. Loayza and Rancière (2006) emphasize the disparity between the short-term and the long-term effect of growth. While finance turns out to have a positive effect in the long-term, they conclude that the contribution is negative in the short-term. As the study applies data until the year 2000, the findings may foretell the generally negative effect that can be found in longer samples using most recent data. Aghion et al. (2009) show that highly developed financial sectors can help to smooth the negative effects of real exchange volatility and thus spur economic growth. Similarly, Aghion et al. (2010) offer empirical evidence that well-functioning capital markets mitigate liquidity risks and thereby render long-term investments possible.

## Other approaches and the great rethinking

Several other approaches have been carried out to investigate the nexus of finance and growth, such as time series analyses, case studies, and firm-, industry-, and household-level estimations. While a considerable part of these and the above illustrated studies find a more or less positive influence of finance on growth, the picture dramatically changes in the aftermath of the global financial crisis and the following recession. From that time, the extent of economic literature considering financial development in a more critical way increased significantly. Such skeptical studies were clearly in the minority in earlier times. Exceptions are Kaminsky et al. (1997) and Kaminsky and Reinhart (1999) who argue that the ratio of domestic credit to GDP can predict economic and financial crises. Similar effects have been discovered by Demirgüç-Kunt and Detragiache (1998, 1999). Further empirical evidence for this theory is provided by Gourinchas et al. (2001), Kroszner et al. (2007), and Dell'Ariccia et al. (2008).

Another argument in favour of a more critical assessment of finance is that it is important to distinguish between household and firm loans. Beck et al. (2012) show that enterprise loans are positively correlated with growth while loans given to households do not trigger any growth effects. A rise of the financial sector that is largely based on household loans will thus not lead to an increase in incomes. In addition, Demirgüç-Kunt and Huizinga (2010) illustrate that banks gradually steered away from their traditional intermediation activities. Between 1995 and 2007, banks generated substantial non-interest income, mainly through the trading of mortgage-backed securities. This shift entails an increase in the vulnerability of banks to economic crises without generating any growth stimulus. The reason why banks develop new business fields is that the typical function of financial intermediation becomes less important. The number of investment projects fundable by banks rises as the financial sector evolves. The larger the financial sector in relation to GDP, the higher the fraction of promising projects supported by banks. At some point, the remaining investment opportunities are either much riskier or less profitable than the development of an entirely new business field. Hence, it is hardly surprising that more recent studies such as Arcand et al. (2012) find that the relationship of financial development and growth is positive only to a certain extent. By reaching

a specific thershold, the effect of financial deepening turns negative. In a similar way, Rousseau and Wachtel (2011) point out that the positive influence of finance appears when analyzing the period from 1960-1989, it vanishes during the post-1990 period. de la Torre et al. (2011) argue that the ongoing process of financial development can cause a free rider problem. Due to enhanced market liquidity there are fewer incentives for market participants to perform the important function of market discipline. Financial intermediaries can simply wind off their positions when a crisis is likely to come up.

A very different approach is applied by Philippon (2010) and Bolton et al. (2011). They find that large financial sectors in relation to the real economy might depress economic growth by attracting too many talented people.

# 4 Empirical Specification and Estimation Strategy

## The specification of the simultaneous equation model

We build our empirical framework on Barro (1991, 2000, 2003, 2013) and Berthold and Gründler (2012). In these models. real per capita GDP growth is assumed to be a function

$$\frac{\mathrm{d}y}{\mathrm{d}t} = F\left(y_{t-\tau}, h_{t-\tau}, \Phi_{t-\tau}, \Xi_{t-\tau}\right), \tau \in (0, \infty) \tag{7}$$

where $h_{t-\tau}$ denominates the stock of human capital and $\Xi_{t-\tau}$ contains a number of environment and control variables suggested by the standard growth model and endogenous theories, each lagged by $\tau$ periods. In addition, $\Phi_{t-\tau}$ denotes an array of variables approximating the size of the financial sector. We do 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. Because of diminishing returns to reproducible factors, $y_{t-\tau}$ is assumed to be a negative factor, whereas the effect of human capital is expected to be positive.[10]

We estimate (7) using panel data of 188 economies between 1980 and 2010 in simultaneous equation models (SEMs). Each equation of the SEM contains five-year averages of the variables in (7), so each equation reflects a cross-section estimation at a certain point in time. This approach is determined by the long-term perspective of growth regressions, the need to smooth short-term fluctuations and the availability of data. Estimating the influence of finance on growth using annual panel data would lead to severe biases and entirely contradict the implications of growth theory. Yet, we contrast our results to the outcome of panel data regressions based on annual data in the sensitivity analysis in section 6.

In our basic estimation, we use 3SLS and a White robust GMM estimator with heteroscedasticity consistent covariance matrix. The specification of the SEM dictates the

[10] See Barro (2003) for a detailed discussion on the interaction of human capital and initial GDP and their influence on long-run growth.

choice of these estimators: the instrumental variable matrix of 3SLS assumes the form of JORGENSON and LAFFONT (1974), which means that a variable cannot be exogenous to one equation and at the same time be endogenous to another. Yet, the specifications of each system equation in our empirical model are completely identical, differing only in the time horizon. At the same time, asymptotic efficiency is improved by using 3SLS rather than 2SLS or Limited Information Maximum Likelihood (LIML).[11] One disadvantage of 3SLS is that the method is vulnerable to misspecifications. Misspecification in one of the system equations may result in inconsistent estimations of the whole system coefficients. Again, the structure of our 3SLS model prevents this objection from affecting the output of our estimations. There may be some point using the Full Information Maximum Likelihood (FIML) estimator instead of 3SLS. However, while both methods are asymptotically equivalent under standard conditions, the sampling distribution of FIML tends to have Cauchy-like tails, implying that means and higher order moments are not defined. Nevertheless, we contrast our basic results with the outcome of FIML estimations in the sensitivity analysis.

The covariates in $\Xi_{t-\tau}$ are environment, state, and policy variables that capture preferences for savings and fertility and further measure economic freedom and democracy. Human capital is approximated using average years of schooling (YSCHOOL) and life expectancy at birth (LIFEEX). The fertility rate (FERT) accounts for the negative effect of population growth as postulated by the standard growth model. The investment share (INVS) incorporates the preferences for saving and GOVC denominates government consumption. DEM is a dummy variable that assumes 1 if the country is democratically organized and HOF is a rule of law index covering the extent of economic and political freedom. In order to attend to the specific environments of Sub-Saharan and Latin American countries, we include the dummy variables SUB-SAHARA and LATIN AMERICA. The degree of openness (OPEN) furthermore accounts for international spillovers. We explicitly do not apply country fixed effects (FE) since this would eliminate the cross-country variation that we aim to explain with our model.[12] Indeed, most of the sample variation comes from the cross-section rather than the time dimension. However, we compare our basic results with the outcome of a panel FE estimation in the sensitivity analysis. As commonly used in growth estimations, instruments are mainly lagged exogenous variables. The underlying assumption is that the future cannot influence the past. Furthermore, we use primary school attainment PSCHOOL and a continuous democratization index DEMIN as surplus instruments.

The advantage of the large sample is that it encompasses great variation in the variables that are to be examined, leading to a more accurate assessment of the growth effects than in reduced sample estimations. The drawback is that developing economies often have measurement errors in their national accounts. The large sample overcomes this problem as we believe that the strong signal emanating from the diversity of the economies dominates the noise.

[11] Among all IV estimators that use the sample information embodied in the system, 3SLS is efficient. See Schmidt (1976) for a proof concerning 3SLS versus 2SLS.

[12] See BARRO (2003) for a more detailed discussion of the problems using fixed effects in growth panel regressions.

One further empirical issue is to sort out the directions of causation. Whereas government policies clearly influence the economic performance, the behavior of the government may just as well be a reaction to economic events. Again, we rely on the concept that future events cannot influence the past. By using lagged covariates as instruments, we dictate the direction of causation in the empirical model.

Accounting for the effects that distinguish the countries, we wish to explore whether or not the financial sector contributes to real per capita GDP growth. To ensure that our results are comparable with the findings of recent studies, we rely on commonly used proxies of the financial system. In addition, we choose the variables that best fit the hypotheses of our theoretical model and that are also available for a large sample of countries. Thus, the basic regression system includes two definitions of finance. The first concept relies on Goldsmith (1969) and measures the size of the financial sector related to the size of the economy as overall liquid liabilities of the financial system divided by GDP (FDEPTH). In most of the recent empirical articles, this measure is named 'financial depth'. Liquid liabilities equal currency plus demand and interest-bearing liabilities of banks and other financial intermediaries.[13] The main growth effect of finance is that it supports the allocation of physical and human capital and facilitates innovations. The second concept explicitly captures this effect, measuring the ratio of claims on the private sector to GDP. These claims include gross credit from the financial system to individuals, enterprises, non-financial public entities not included under net domestic credit, and financial institutions not included elsewhere.[14] There is a strong argument, however, that deposit banks comply with the type of financing activities that stimulate growth rather than other financial intermediaries. Thus, we use the claims of deposit banks in relation to GDP (BCREDIT) rather than the measure including all financial intermediaries. Yet, the correlation between BCREDIT and an alternate measure that includes all financial intermediaries is high. Estimating the effect of the alternate measure in the sensitivity analysis would therefore be pointless.[15]

While BCREDIT proxies financial intermediation using actually drawn credits, the potentially available resources may be more essential for factor accumulation. For this reason, we narrow the analysis down using the financial system deposits to GDP as FDPSIZE. This concept includes all demand, time and saving deposits of all financial institutions. Again, BSIZE uses the same approach but only captures deposits held by deposit banks. One further interesting measure considers the ratio BCREDIT/BSIZE that can be considered the utilization rate of the banking sector. Higher values indicate that the potential for financing promising future projects is high. We apply this measure (BPOT), BSIZE, and FDPSIZE in the sensitivity analysis in section 6.

[13] For a more detailed description of this and the other financial indicators used in the present paper see Beck et al. (2009) and Čihák et al. (2012).

[14] There is also a somewhat broader definition of that variable available, that accounts for the provision of the financial sector as a whole. Yet, the correlation of this measure and BCREDIT is 96 percent.

[15] Indeed, the outcome of the estimation is nearly identical.

### The data

The main issue of collecting data for our analysis is to obtain a comprehensive data set covering as many countries as possible. Studies that incorporate only a small fraction of economies almost certainly suffer from selection bias, since it is unlikely that the selection is representative. Moreover, isolating an empirical economic relationship requires a large data set as the noise particularly in macroeconomic data is often substantial. In addition, we explicitly want to incorporate low and middle income countries as our theoretical hypothesis suggest that the financial sector affects the economies asynchronously during the process of development. The control and state variables are from commonly used data bases in empirical growth estimations. Data on GDP, GOVC, OPEN and INVS are from Heston et al. (2012), YSCHOOL is from Barro and Lee (2010), TOTR is from Unctad (2013) and LIFEEX as well as FERT are taken from World Bank (2013a). The democracy variables DEM and DEMIN are from Utip (2012) respectively Vanhanen (2012), the rule of law index HOF is from Freedom House (2011). The dummy variables SUB-SAHARA and LATIN AMERICA are based on the classification of World Bank (2013a).

The variables that proxy financial intermediation are from Beck et al. (2000, 2009) and Čihák et al. (2012) and can be obtained from World Bank (2013b). Table 1 provides descriptive statistics of the variables used in our analysis, including the number of observations, means, maxima, minima, and standard deviations. In general, our data set contains 188 countries over the time period between 1950 and 2010. Yet, both the country sample as well as the time span are restricted in most of the estimations due to the unavailability of data. Most data concerning the financial sector is available from 1960 onwards. Yet, for the majority of countries included in the analysis, the data goes back only to the 1970s or the 1980s respectively. The problem with data availability is exacerbated by the terms of trade (TOTR) that can only be gathered from 1980 onwards. For this reason, we estimate the SEM using 5-year-averages of six periods: 1980-1985, 1985-1990, 1990-1995, 1995-2000, 2000-2005 and 2005-2010.[16] The main regressions thus refer to the period 1980-2010 with instruments covering the post-1975 period.

Table 2 illustrates the correlation matrix of the variables used in the basic system. This matrix provides information on possible problems concerning multi-collinearity and the stability of the system. We will discuss these problems in the sensitivity analysis in section 6.

## 5 The results

Table 3 shows the results of the whole-sample estimation. Column (1) illustrates the basic system including only the control and environmental variables. The comparison of this outcome with the estimations incorporating the financial sector allows to comprehend how the financial proxies affect the system. Columns (2) and (3) illustrate this effect,

[16] In the first period (1980-1985), TOTR will act as its own instrument, as there are no data before 1980. We are convinced that this minor adjustment will not cause any severe biases.

**Table 1**:
Descriptive Statistics of Regression Variables, Average of 2000-2010

| Variable | No. of observations (per period) | Mean | Maximum | Minimum | Standard deviation |
|---|---|---|---|---|---|
| $\Delta y$ | 188 | 3.071 | 17.719 | -5.472 | 2.940 |
| LOG(CGDP) | 180 | 8.637 | 11.126 | 5.611 | 1.284 |
| YSCHOOL | 146 | 7.560 | 12.809 | 1.145 | 2.702 |
| LIFEEX | 182 | 67.324 | 82.012 | 43.611 | 10.361 |
| LOG(FERT) | 182 | .995 | 1.990 | .188 | .503 |
| DEM | 153 | .690 | 1.000 | .000 | .452 |
| OPEN | 188 | 93.756 | 407.251 | 2.000 | 49.792 |
| HOF | 188 | 3.354 | 7.000 | 1.000 | 1.972 |
| GOVC | 188 | 12.636 | 55.046 | 2.890 | 9.009 |
| INVS | 188 | 24.191 | 70.187 | 2.612 | 9.644 |
| TOTR | 183 | 105.786 | 160.376 | 35.169 | 18.495 |
| FDEPTH | 174 | 56.183 | 330.837 | 5.904 | 45.298 |
| BCREDIT | 174 | 44.813 | 181.670 | 1.925 | 41.311 |

including FDEPTH (column 2) and BCREDIT (column 3). In order to study whether different estimation methods lead to different results, we estimate each system with 3SLS and GMM.

The basic system in column (1) supports various theoretical hypotheses proposed by neoclassical and endogenous growth theory. Basically, conditional convergence emerges as a clear pattern in the system. In accordance with the results of, inter alia, Barro (2003), the starting position and the growth rate are negatively correlated when holding constant some variables that distinguish the countries. Poor economies thus will eventually catch up with rich countries and per capita incomes converge. Yet, there is a row of crucial variables that determine this process. Human capital in the form of school attainment influences the growth rate positively. Moreover, the fertility rate has a strongly negative effect on income increases. This supports a further fundamental theorem of the standard growth model, predicting that population growth leads to a decline in per capita welfare. Life expectancy contributes negatively to economic growth. This may be for two reasons: first, the correlation with the income level is particularly strong (.830). Thus, the variable may to some extent also cover the effect of convergence. Second, a higher level of LIFEEX can be expected to have the same effect as an increase in population. If LIFEEX rises, the number of citizens at any point in time ceteris paribus increases, too. This, on the other hand, leads to an increase in the effective depreciation rate which reduces per capita incomes in the neoclassical growth model.

The signs of the state variables DEM and HOF are ambiguous. Both variables do not

**Table 2**:
Correlation Matrix of Regression Variables, 1950-2010

| | LOG(CGDP) | YSCHOOL | LIFEEX | LOG(FERT) | DEM | OPEN | HOF | GOVC | INVS | TOTR | FDEPTH | BCREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOG(CGDP) | 1.000 | .707 | .830 | -.763 | .537 | .286 | -.530 | -.415 | .365 | -.147 | .454 | .512 |
| YSCHOOL | .707 | 1.000 | .746 | -.761 | .582 | .173 | -.499 | -.330 | .248 | -.217 | .372 | .408 |
| LIFEEX | .830 | .746 | 1.000 | -.818 | .559 | .234 | -.523 | -.412 | .358 | -.273 | .523 | .554 |
| LOG(FERT) | -.736 | -.756 | -.818 | 1.000 | -.622 | -.231 | .475 | .327 | -.280 | .220 | -.487 | -.558 |
| DEM | .537 | .582 | .559 | -.622 | 1.000 | .017 | -.733 | -.252 | -.000 | -.201 | .171 | .211 |
| OPEN | .286 | .173 | .234 | -.231 | .017 | 1.000 | -.026 | -.125 | .474 | -.057 | .435 | .377 |
| HOF | -.530 | -.499 | -.523 | .475 | -.733 | -.026 | 1.000 | .215 | -.063 | .178 | -.159 | -.185 |
| GOVC | -.415 | -.330 | -.412 | .327 | -.253 | -.125 | .215 | 1.000 | -.268 | .025 | -.198 | -.236 |
| INVS | .365 | .248 | .358 | -.280 | -.000 | .474 | -.063 | -.268 | 1.000 | -.056 | .439 | .406 |
| TOTR | -.147 | -.219 | -.273 | .220 | -.201 | -.057 | .178 | .025 | -.056 | 1.000 | -.135 | -.086 |
| FDEPTH | .454 | .372 | .523 | -.487 | .172 | .435 | -.159 | -.198 | .439 | -.135 | 1.000 | .841 |
| BCREDIT | .515 | .408 | .554 | .560 | .211 | .377 | -.185 | -.236 | .406 | -.086 | .841 | 1.000 |

**Table 3**:
Basic System Finance and Growth, 1975-2010

| | (1) Basic | (2) FDEPTH | | (3) BCREDIT | |
|---|---|---|---|---|---|
| | 3SLS | 3SLS | GMM | 3SLS | GMM |
| Constant | 18.991*** | 18.061*** | 17.670*** | 15.286*** | 14.514*** |
| | [6.97] | [6.53] | [16.08] | [5.36] | [13.68] |
| LOG(GDP) | -1.153** | -1.388*** | -1.317*** | -1.252*** | -1.160*** |
| | [-5.28] | [-6.31] | [-13.96] | [-5.94] | [-12.65] |
| YSCHOOL | .214** | -.140 | .135*** | .134 | .123*** |
| | [2.32] | [-1.60] | [3.31] | [1.52] | [2.97] |
| LIFEEX | -.072* | -.023 | -.032** | .003 | -.002 |
| | [1.89] | [-.62] | [-2.23] | [.07] | [-.12] |
| LOG(FERT) | -4.24*** | -4.296*** | -3.970*** | -4.11*** | -3.750*** |
| | [-7.17] | [-7.63] | [-13.07] | [-7.39] | [-12.06] |
| DEM | -.571 | -.194 | .050 | -.072 | .094 |
| | [-1.28] | [-.44] | [.25] | [-.17] | [.48] |
| OPEN | .004 | .005* | .005*** | .005 | .005*** |
| | [1.30] | [1.77] | [4.90] | [1.57] | [4.34] |
| HOF | .183 | .113 | .124** | .089 | .087 |
| | [1.58] | [.98] | [2,19] | [.75] | [1.53] |
| GOVC | -.017 | .009 | -.004 | .025 | .009 |
| | [-.53] | [.26] | [-.36] | [.75] | [.78] |
| INVS | .030 | .032* | .034*** | .031* | .031*** |
| | [1.52] | [1.70] | [4.72] | [1.66] | [4.52] |
| TOTR | .003 | .003 | .003* | .004 | .002 |
| | [.71] | [.86] | [1.71] | [.93] | [1.16] |
| LATIN AMERICA | -.253 | -.354 | -.415** | -.596 | -.681*** |
| | [-.63] | [-.87] | [-1.97] | [-1.41] | [-3.17] |
| SUB-SAHARA | -1.054* | -.561 | -.797*** | -.357 | -.523** |
| | [-1.84] | [-1.00] | [-3.29] | [.63] | [-2.26] |
| FDEPTH | | -.818* | -.764** | | |
| | | [-1.72] | [-2.54] | | |
| BCREDIT | | | | -1.735*** | -1.43*** |
| | | | | [-3.20] | [-5.84] |
| *N* | 474 | 435 | 435 | 440 | 440 |
| R squared | .01, .38, | .15, .40, | .16, .40, | .20, .40, | .19, .40, |
| | -.09, .34, | -.05, .34, | -.08, .34, | -.01, .33, | -.05, .34, |
| | .23, .09 | .25, .19 | .24, .21 | .27, .15 | .27, .18 |
| Standard Error | 2.98, 2.33, | 2.43, 2.35, | 2.42, 2.34, | 2.34, 2.32, | 2.36, 2.32, |
| | 2.91, 3.32, | 2.96, 3.41, | 2.99, 3.40, | 2.90, 3.41, | 2.94, 3.39, |
| | 2.98, 3.57 | 2.87, 3.50 | 2.88, 3.48 | 2.83, 3.56 | 2.83, 3.50 |

*Notes*: t-Statistics are shown in parantheses. The dependent variables are growth rates of real per capita GDP for 1980-1985, 1985-1990, 1990-1995, 1995-2000, 2000-2005, 2005-2010. Instruments are mainly lagged exogenous variables. Surplus instruments are described in section 4. *p<.10, **p<.05, ***p<.01.

reveal significant impacts on growth in the whole-sample estimations. Yet, as for most of the insignificant variables in the basic system, the estimations of growth in reduced-sample models, which we will report below, inevitably require the incorporation of rule of law and—at least to some extent—democracy. The ambiguous sign of democracy has been subject to an intense discussion in empirical growth literature, see Barro (1990), Barndt et al. (2005), Acemoglu (2008) and Gundlach and Paldam (2008a, 2008b). INVS assumes a positive sign and turns out to have some influence on growth. As a matter of course, the influence of the investment share vanishes in the process of development, since the accumulation of physical capital becomes more and more irrelevant in economies that approach their steady state level of growth. GOVC and TOTR also prove to have little explanatory power. As for GOVC, this finding can be explained with the ambiguity of the variable. Whenever government consumption follows investive purposes, such as expenditures for education or—to some extent—defense, then GOVC can be expected to raise growth. Non-productive government expenditures on the other hand depress the steady state level of output per effective worker. Countries in Latin America and Sub-Sahara Africa tend to have lower growth rates, as the coefficients of both LATIN AMERICA and SUB-SAHARA assume negative and often significant coefficients.

The main focus of table 3 lies on the influence of the financial sector on GDP growth. Columns (2) and (3) illustrate this influence. Both the overall liquid liabilities of the financial system divided by GDP (FDEPTH) and the provision of credit by the banking sector (BCREDIT) turn out to have a significantly negative effect on the development of incomes. Since both FDEPTH and BCREDIT have the same scale and comparable means and standard deviations, the coefficients can be directly compared. It turns out that the marginal effect of BCREDIT is approximately twice as strong as the effect of FPDEPTH. This confirms our hypothesis that the amount of credit provided by banks is the main transmission channel from finance to growth. Nevertheless, both proxies of the financial sector reveal the negative impact of financial intermediaries. The comparison with the basic system in (1) illustrates that the covariates remain relatively unaffected by the incorporation of the financial sector. The system as a whole proves to be remarkably stable. Yet, the impact of OPEN and INVS becomes significant when accounting for the financial sector. Especially with regard to OPEN, this is a more plausible result, since international spillovers enhance factor productivity and lead to an increase in the number of capital goods $N$. Table 3 furthermore demonstrates that the effect of the financial sector and the marginal impact of the covariates are relatively unaffected by the estimation method. Both 3SLS and GMM yield highly comparable outputs. Note, however, that under some assumptions, GMM coincides with 3SLS.[17] The number of observations is slightly reduced when including the financial sector, since data considering FDEPTH and BSIZE are only available for 100 (in 1980) and 174 (in 2010) economies, respectively. By contrast, efficiency increases when taking the financial sector into account. The standard errors decline from 3.02 to 2.92 (FDEPTH) and 2.89 (BCREDIT) respectively. Hence, the average value of R-squared rises from .16 in the basic system to .22 (FDEPTH) and .23 (BCREDIT), respectively.

[17] See Cameron and Trivedi (2005) and Matyas (2008) for a more detailed discussion on the relationship between GMM and 3SLS.

**Table 4:** Restricted Samples, 1980-2010, 3SLS

| | 1980-2010 | | 1980-2000 | | 1980-1995 | |
|---|---|---|---|---|---|---|
| | rich | poor | rich | poor | rich | poor |
| Constant | 18.441*** | 10.587* | 19.48*** | 31.513*** | 19.77*** | 17.703* |
| | [5.59] | [1.74] | [3.34] | [3.16] | [3.08] | [1.83] |
| LOG(CGDP) | -1.604*** | -1.087 | -2.029*** | -3.028*** | -2.123*** | -4.288*** |
| | [-5.60] | [-1.56] | [-4.76] | [-3.33] | [-4.75] | [-5.03] |
| YSCHOOL | .113 | .321* | -.079 | -.051 | -.212 | -.121 |
| | [1.24] | [1.67] | [-.51] | [-.21] | [-1.20] | [-.49] |
| LIFEEX | .021 | .014 | .105 | .021 | .115 | .309*** |
| | [.50] | [.21] | [1.46] | [.22] | [1.32] | [3.39] |
| LOG(FERT) | -3.484*** | -3.448** | -2.661** | -3.967** | -2.598* | -.391 |
| | [-5.85] | [-2.36] | [-2.38] | [-2.10] | [-1.91] | [-.20] |
| DEM | -.237 | .061 | .509 | -.985 | .657 | -1.439 |
| | [-.50] | [.10] | [.83] | [-1.24] | [.92] | [-1.63] |
| OPEN | .010*** | -.012 | .011** | -.010 | .007 | -.010 |
| | [3.19] | [-1.32] | [2.34] | [-.92] | [1.43] | [-1.01] |
| HOF | -.163 | .191 | -.473** | -.097 | -.469* | -.127 |
| | [-1.22] | [.80] | [-2.12] | [-.35] | [-1.82] | [-.46] |
| GOVC | -.057 | .114** | -.125** | -.100 | -.172*** | -.072 |
| | [-1.359 | [1.98] | [-2.07] | [-1.17] | [-2.65] | [-.91] |
| INVS | .024 | .038 | -.012 | -.051 | -.043 | -.070* |
| | [1.10] | [1.08] | [-.36] | [-1.23] | [-1.68] | [-1.72] |
| TOTR | .004 | .003 | -.001 | -.004 | -.001 | .002 |
| | [.89] | [.45] | [-.18] | [-.58] | [.14] | [.71] |
| LATIN AMER. | -1.044** | -2.49* | -2.550*** | -.400 | -2.129** | .253 |
| | [-2.22] | [-1.88] | [-3.32] | [-.17] | [-2.42] | [.08] |
| SUB-SAHARA | -.200 | -.271 | .504 | -1.16 | 1.451 | -1.305 |
| | [-.289] | [-.28] | [.56] | [-1.01] | [1.48] | [-1.17] |
| BCREDIT | -2.104*** | .367 | -1.64 | 5.144** | 3.491* | 7.401*** |
| | [-3.83] | [.19] | [-1.26] | [2.07] | [1.66] | [2.84] |
| *N* | 288 | 152 | 130 | 80 | 98 | 56 |
| R squared | .17, .48, -.05, .35, .47, .24 | .40, .36, .02, .12, -.37, .10 | -.24, .36, .63, .30 | -.31, .50, .27, .15 | .48, .61, .26 | .79, .30, .14 |
| S.E. | 2.18, 1.94, 2.54, 2.88, 3.05, 3.72 | 2.75, 3.64, 4.79, 6.15, 4.82, 8.73 | 2.75, 2.86, 2.60, 3.59 | 5.54, 4.66, 3.56, 8.47 | 2.58, 2.61, 3.67 | 3.02, 3.45, 8.51 |

*Notes*: Method is 3SLS, t statistics are in parentheses. The independent variable is per capita GDP growth in the periods 1980-1985, 1985-1990, 1990-1995, 1995-2000, 2000-2005, 2005-2010. Instruments are mainly lagged exogenous variables. Surplus instruments are described in the text. *p<.10, **p<.05, ***p<.01.

Our theoretical considerations suggest that the financial system can generally be expected to boost growth. However, we have already raised the question whether this influence is restricted to a certain level of development from which finance does not contribute to additional welfare increases. The overall influence of the financial system on income-gains in the basic system is significantly negative. Yet, this does not mean that the influence of financial intermediaries *in general* is essentially negative. Due to its large size, the sample includes large variations in both the cross-section of countries and the time span. Several countries have developed greatly during the period under consideration. To investigate the influence of the financial system in more detail, we split the sample into rich and poor countries and shorten the relevant time span. This allows us to explore the evolution of the effect of the financial system during the process of development. Table 4 illustrates the results of the system estimation, distinguishing between rich and poor countries. The definition of 'poor' and 'rich' refers to the median value of per capita incomes (3.124 int. USD) in the first observation period.[18] The table provides results for three periods: the whole sample from 1980 to 2010, and two restricted time spans (1980-2000 and 1980-1995, respectively). A further reduction of the sample is not possible due to insufficient numbers of degrees of freedom. Table 4 uses BCREDIT as a proxy of the financial system.[19]

The results of table 4 demonstrate that the influence of finance has evolved remarkably during the last decades. When considering only the period from 1980-1995, financial intermediaries took a significantly positive influence on GDP growth in both poor and rich countries. This influence, however, is particularly stronger in developing economies. The coefficient is about 3.5 in rich countries and 7.4 in developing countries. Taking into account the period from 1980 to 2000, the picture changes: the influence of the financial system in developing economies is still significantly positive, although the coefficient reduces from about 7.4 to 5.1. In the sample of the developed economies, by contrast, the financial system does not significantly influences growth in either direction. Apparently, the financial system on average has reached its critical size between 1995 and 2000 in advanced economies. Up to this size, financial intermediaries fulfill the growth-boosting tasks that we discussed in the theoretical section. A larger size of the financial system, however, cannot contribute to additional welfare increases. Thus, there is reason to consider this critical level as the optimal size of the financial market. Assuming perfect information, all growth-enhancing investments, either in existing, new or improved capital goods, can be realized when the size of the financial sector equals this optimum. A higher degree of financial development will not lead to an increase in the output of the real economy.

Considering the whole sample between 1980 and 2010, the positive influence of the financial sector has vanished completely. There is a weak positive correlation in the sample of poor countries, but the t-statistic of .19 does not indicate any significance. Even more astonishing, the former positive effect in the sample of rich economies reverses. Regarding the whole period 1980-2010, the influence of finance in the developed economies is significantly negative. Splitting the sample into two groups shows that the negative influence

[18] According to the Penn World Tables 7.1 by Heston et al. (2012).
[19] Estimations using FDEPTH instead yield highly comparable outputs.

discovered in the baseline estimation is entirely caused by the developed economies. Yet, this negative correlation can only be detected when incorporating the period to 2010.

# 6 Sensitivity Analysis and Discussion

The sensitivity analysis demonstrates the severeness of the omitted variable problem that occurs when estimating reduced models that do not account for country specific effects. The reduced model in column (1) indicates that the effect of finance on growth is significantly positive when neglecting all covariates. Similarly, column 2 shows that this effect remains when accounting for convergence. Yet, both R squared and the standard errors of the estimation imply that these reduced models lead to a loss in efficiency and would be quite misspecified. Even more importantly, the estimator in such models is certainly inconsistent, since there is a strong correlation between the financial proxy $\Phi$ and the omitted variables, so $COV(\hat{\varepsilon}_{it}, \Phi_{it}) \neq 0$.[20] Columns (3) - (6) investigate whether the effect of the financial system changes when neglecting some crucial variables of the system. The correlation matrix in section 4 implies strong correlations of FPEDTH with YSCHOOL (.37), OPEN (.43), LOG(FERT) (-.49) and—to some extent—DEM (.21) and HOF (-.18). Columns (3) - (6) are concerned with the effect of these variables. In each of the estimations, the coefficient of FDEPTH remains negative, suggesting a remarkable stability in the negative influence of finance. Compared with the basic system, however, there is a loss in efficiency in each of the reduced estimations as standard errors rise and R-squared declines. For this reason, we consider the full-specified model more appropriate to reproduce empirical growth rates. In addition, the covariates used in the basic system reflect crucial theoretical hypotheses indicated by the neoclassical and endogenous growth theory. Their incorporation thus reduces the correlation between the financial proxy and the error term. Column (6) neglects the proxy for openness. The negative effect of finance in this model loses significance. Both OPEN and FDEPTH are strongly correlated with the development level of an economy. Hence, neglecting OPEN causes multi-collinearity. The effect of openness appears in the coefficient of FDEPTH, reducing the marginal impact of finance and leading to its insignificance (p value: .25).

Our basic estimations in table 3 and the estimation of the restricted models in the samples of rich and poor countries in table 4 has been carried out using FDEPTH and BCREDIT as proxies for the financial system. For this reason, one can object that the results are determined by the definition of the financial sector. This objection can easily be refuted, as most of the studies finding a generally positive link between growth and finance are based on proxies similar or identical to FDEPTH. Nevertheless, it is essential to investigate if other definitions of the financial sector lead to different results. Thus, columns (7) and (8) are concerned with alternative specifications of the financial system. Column (7) illustrates the results proxying the financial system by its deposits relative to GDP (FDPSIZE). Column (8), on the other hand, uses the overall assets of deposit money banks in comparison to GDP (BSIZE). Both system regressions confirm the negative effect

[20] See the correlation matrix in table 2.

**Table 5:** Sensitivity analysis I: Reduced models and alternative proxies

| | (1) reduced model | (2) reduced model 2 | (3) w/o DEM and HOF | (4) w/o FERT | (5) w/o YSCHOOL | (6) w/o OPEN | (7) proxy FDPSIZE | (8) proxy BSIZE |
|---|---|---|---|---|---|---|---|---|
| constant | 1.75*** | 3.783*** | 14.983*** | 5.683** | 17.808*** | 17.97*** | 17.834*** | 15.603*** |
| | [6.76] | [3.19] | [5.41] | [2.28] | [6.37] | [6.48] | [6.47] | [5.49] |
| LOG(CGDP) | | -.266* | -1.463*** | -1.381*** | -1.321*** | -1.353*** | -1.384*** | -1.192*** |
| | | [-1.73] | [-6.41] | [-5.54] | [-6.15] | [-6.15] | [-6.19] | [-5.25] |
| YSCHOOL | | | .106 | .383*** | | .165* | .148* | .114 |
| | | | [1.26] | [4.12] | | [1.89] | [1.68] | [1.30] |
| LIFEEX | | | .037 | .072* | -.006 | -.032 | -.029 | -.001 |
| | | | [.93] | [1.80] | [-.17] | [-.84] | [-.78] | [-.02] |
| LOG(FERT) | | | -3.905*** | | -4.595*** | -4.409*** | -4.288*** | -4.286*** |
| | | | [-6.87] | | [-8.60] | [-7.88] | [-7.54] | [-7.65] |
| DEM | | | | .074 | -.182 | -.099 | -.042 | -.082 |
| | | | | [.67] | [-.41] | [-.23] | [-.10] | [-.19] |
| OPEN | | | .006*** | .010*** | .006* | | .005 | .005 |
| | | | [2.17] | [2.74] | [1.91] | | [.16] | [1.53] |
| HOF | | | | .074 | .063 | .166 | .151 | .077 |
| | | | | [.57] | [.55] | [1.46] | [1.27] | [.65] |
| GOVC | | | .009 | .018 | .013 | .014 | .012 | .025 |
| | | | [.27] | [.46] | [.37] | [.41] | [.36] | [.74] |
| INVS | | | .027 | .019 | .027 | .042** | .032* | .031* |
| | | | [1.36] | [.89] | [1.48] | [2.37] | [1.66] | [1.68] |
| TOTR | | | .004 | .002 | .004 | .003 | .004 | .003 |
| | | | [1.12] | [.55] | [.91] | [.84] | [.90] | [.77] |
| LATIN A. | | | -.843** | -1.320*** | -.493 | -.224 | -.182 | -.701 |
| | | | [-2.13] | [-2.95] | [-1.23] | [-.55] | [-.45] | [-1.64] |
| SUB-SAH. | | | -.233 | -1.35** | -.452 | -.395 | -.468 | -.479 |
| | | | [-.42] | [-2.15] | [-.81] | [-.71] | [-.83] | [-.85] |
| FINANCE | .770* | 1.214** | -1.859*** | -1.044** | -.937* | -.541 | -.394 | -1.816*** |
| | [1.89] | [2.44] | [-3.37] | [-1.99] | [-1.95] | [-1.20] | [.90] | [-3.46] |
| *N* | 784 | 774 | 483 | 435 | 435 | 435 | 440 | 440 |
| R squared | -.18, -.05, | -.15, -.06, | .17, .37, | .07, .28, | .14, .36, | .17, .40, | .16, .39, | .21, .41, |
| | -.01, -.02, | -.01, -.05, | .00, .30, | -.29, .25, | -.06, .35, | -.03, .32, | -.05, .33, | .01, .33, |
| | .01, -.32 | -.01, .30 | .31, .15 | .14, .17 | .30, .19 | .22, .17 | .24, .15 | .27, .13 |
| S.E. | 3.71, 3.83, | 3.69, 3.86, | 2.47, 2.39, | 2.53, 2.55, | 2.44, 2.40, | 2.40, 2.33, | 2.41, 2.36, | 2.34, 2.31, |
| | 5.31, 3.49, | 5.42, 3.55, | 3.37, 3.71, | 3.23, 3.57, | 2.93, 3.33, | 2.90, 3.41, | 2.94, 3.41, | 2.87, 3.40, |
| | 2.99, 3.54 | 3.04, 3.53 | 2.64, 3.51 | 3.04, 3.50 | 2.74, 3.46 | 2.89, 3.49 | 2.89, 3.52 | 2.84, 3.55 |

*Notes*: t statistics are in parentheses. The independent variables are per capita GDP growth rates in the periods 1980-1985, 1985-1990, 1990-1995, 1995-2000, 2000-2005, 2005-2010. Instruments are mainly lagged exogenous variables. Surplus instruments are primary school attainment (PSCHOOL) and the democratization index of VANHANEN (2012). *p<.10, **p<.05, ***p<.01.

of the financial system. In case of BSIZE, the impact, again, is highly significant.

The sensitivity analysis demonstrates that our results are quite stable and that the specification of the system is reasonable. But why is the effect of finance positive when neglecting all covariates? In general, this can be traced back to two effects: first, the number of observations in columns (1) and (2) is notably higher. This is because some variables are only available in a reduced coverage of nations, especially data that goes relatively far back in time. Yet, countries whose observations are omitted are almost entirely developing economies. In such nations, finance exerts a positive influence as the growth-boosting effects of financial intermediaries are not yet subsided. Thus, the reduced model supports our general hypothesis that finance has positive growth effects up to a certain point of development. Second and even more importantly, neglecting the covariates used in our system would lead to severe misspecification. The correlation matrix illustrates that finance is correlated with development, education, openness, rule of law, and other economic and social variables. Not accounting for these effects leads to inconsistency in $\hat{\theta}_{\Phi}$ as $plim(\hat{\theta_{\Phi}}) \neq \theta_{\Phi}$. Each model that does consistently estimate $\hat{\theta}_{\Phi}$ shows a negative impact of finance. As the naive model causes biases, it is shown by columns (3) - (6) that neglecting one covariate does not lead to a major change in the model or the results concerning finance. Moreover, the coefficients remain remarkably stable in most cases. In addition, alternative approximations of the financial system do not change the results. All estimated proxies FDEPTH, BCREDIT, FDPSIZE, BSIZE lead to a negative coefficient that is significant in most cases.

Table 6 carries out two further sensitivity tests. Column (1) is concerned with the analysis of the long-term effect. As the time series of the terms of trade variable TOTR goes back no further than 1980, the time span has been limited to the period 1980-2010. In order to investigate the long-term effect of finance, column (1) shows the results of the basic system neglecting TOTR. Thus, the sample period can be expanded to 1970-2010. This expansion does not lead to any major changes in the output. The coefficient of the financial proxy remains negative and significant, at least for BCREDIT. The main growth determinants such as conditional convergence, education, openness, fertility, and investment retain both the original signs and marginal effects. Therefore, the restriction of the time sample in our basic results does not lead to any severe distortions in the output.

Columns (2) and (3) are concerned with the application of different estimation methods. As we already pointed out in section 4, we use 3SLS and GMM estimations since we are strongly convinced that these methods are best for our empirical strategy. In addition, Barro (1991, 2000, 2003, 2013) has tested this approach extensively. Similarly, Green (2008) argues for the utilization of 3SLS and GMM in practical applications rather than other simultaneous equation model estimators such as the full information maximum likelihood (FIML) method. Nevertheless, there may be an argument for a FIML or a GMM Panel estimation using annual data. Column (2) reports the results of the basic simultaneous equation model using the FIML estimator. The results turn out to be highly comparable to the outcome obtained by 3SLS and GMM. The coefficients remain remarkably stable and do not tend to change their signs or relative weights. Most

**Table 6**: Sensitivity analysis II: Long-run effect, financial potential, and alternative estimators

| | (1) Long-run effect, 1970-2010 (w/o TOTR) | | (2) Full information Maximum Likelihood | | (3) Panel Estimation | | (4) Potential BPOT (BCREDIT / BSIZE) | |
|---|---|---|---|---|---|---|---|---|
| | FDEPTH | BCREDIT | FDEPTH | BCREDIT | GMM | FE | 3SLS | GMM |
| Constant | 14.025*** | 12.742*** | 11.080 | 11.612 | 18.710*** | 34.954*** | 18.908*** | 18.526*** |
| | [13.52] | [12.85] | [1.01] | [1.12] | [15.55] | [14.30] | [6.85] | [16.72 |
| LOG(GDP) | -1.303*** | -1.288*** | -1.817*** | -1.849*** | -1.426*** | -5.083*** | -1.455*** | -1.344*** |
| | [-16.98] | [-17.07] | [-2.60] | [-2.84] | [-13.68] | [-20.19] | [-6.57] | [-14.94] |
| YSCHOOL | .094*** | .122*** | .082 | .078 | .097* | .425*** | .188** | .170*** |
| | [3.67] | [4.74] | [.38] | [.36] | [1.72] | [4.75] | [2.12] | [3.92] |
| LIFEEX | .006 | .018* | .126 | .120 | .007 | .093*** | -.030 | -.039** |
| | [.58] | [1.88] | [1.27] | [1.26] | [.35] | [5.40] | [-.80] | [-2.41] |
| LOG(FERT) | -2.84*** | -2.63*** | -2.808 | -3.067 | -4.52*** | -2.485*** | -4.236*** | -4.037*** |
| | [-13.18] | [-12.79] | [-1.17] | [-1.49] | [-16.32] | [-5.02] | [-7.41] | [-12.84] |
| DEM | -.328** | -.281** | -.128 | .014 | -.100 | | -.090 | .085 |
| | [-2.36] | [-2.19] | [-.21] | [.02] | [-.84] | | [-.21] | [.41] |
| OPEN | .009*** | .009*** | .005 | .005 | .006*** | .014*** | .004 | .004*** |
| | [8.64] | [9.14] | [.58] | [.55] | [5.28] | [4.28] | [1.21] | [3.54] |
| HOF | .056 | .033 | -.168 | -.222 | -.032 | -.041 | .173 | .179*** |
| | [1.58] | [.89] | [-.44] | [-.51] | [-.59] | [-90] | [1.48] | [3.36] |
| GOVC | .024*** | .026*** | .039 | .038 | -.015 | -.108*** | .007 | -.002 |
| | [2.70] | [2.81] | [.47] | [.46] | [-.77] | [5.28] | [.22] | [-.23] |
| INVS | .029*** | .038*** | .047 | .050 | .014 | .136*** | .033* | .032*** |
| | [3.90] | [5.26] | [1.13] | [1.09] | [1.39] | [17.78] | [1.72] | [4.19] |
| TOTR | | | .003 | .006 | -.004 | .005*** | .004 | .003* |
| | | | [.33] | [.64] | [-1.41] | [3.53] | [1.05] | [1.86] |
| LATIN A. | -.188 | -.371*** | -.688 | -.352 | -.991*** | | .004 | -.124 |
| | [-1.38] | [-2.72] | [-.51] | [-.28] | [-3.70] | | [.01] | [-.64] |
| SUB-SAH. | -1.076*** | -.953*** | .135 | .326 | -.741*** | | -.451 | -.665*** |
| | [-5.98] | [-5.32] | [-.97] | [.17] | [-3.11] | | [-.78] | [-2.68] |
| FINANCE | -.173 | -.683*** | -1.380 | -1.562 | -.851*** | -1.043** | -122.42 | -111.15*** |
| | [-1.01] | [-3.68] | [-.97] | [-1.08] | [-4.33] | [-2.39] | [-1.27] | [-2.84] |
| N | 733 | 749 | 288 | 294 | 1,540 | 2,339 | 439 | 439 |
| R squared | .13, .27, | .16, .29, | .15, .42, | .18, .35, | .33 | .63 | .18, .40, | .17, .40, |
| | -.02, .26, | .01, .27, | -.40, .35, | -.39, .34, | | | -.09, .32, | -.09, .32, |
| | .27, .22, | .27, .20, | .34, .18 | .33, .07 | | | .20, .16 | .20, .18 |
| | -.05, .01 | -.09, .01 | | | | | | |
| S.E. | 2.63, 2.67, | 2.58, 2.61, | 2.22, 1.68, | 2.21, 1.83, | 2.49 | 1.95 | 2.38, 2.34, | 2.39, 2.34, |
| | 3.03, 3.00, | 3.02, 2.98, | 3.50, 3.28, | 3.48, 3.29, | | | 3.00, 3.43, | 3.01, 3.42, |
| | 2.49, 2.69, | 2.47, 2.92, | 2.72, 3.33 | 2.71, 3.80 | | | 2.97, 3.54 | 2.96, 3.51 |
| | 3.48, 1.69 | 3.47, 1.77 | | | | | | |

*Notes*: t-statistics and z-statistics (FIML) are shown in parantheses. The dependent variables are growth rates of real per capita GDP for 1970-1975, 1975-1980, 1980-1985, 1985-1990, 1990-1995, 1995-2000, 2000-2005, 2005-2010. Instruments are mainly lagged exogenous variables. Surplus instruments are described in section 4. Column (3) and the GMM estimation in column (4) reports White robust standard errors, using heteroscedasticity consistent covariance matrices, *p<.10, **p<.05, ***p<.01.

importantly, the influence of FDEPTH and BCREDIT remains negative. Note, however, that the FIML estimator is asymptotically equivalent to 3SLS.[21] Column (3) illustrates the results of a dynamic panel estimations using annual data. To eliminate cyclical fluctuations, we use 5-year-moving-average rates for real GDP growth per capita. Column (3) covers two different panel approaches: panel GMM and fixed effects (FE). In the GMM case, instruments are the same as in the standard SEM model, but the lag is five years in order to guarantee comparability with the output of the 3SLS and GMM estimations. The GMM model uses a White cross-section weighting matrix and robust standard errors. Due to utilization of annual data, the number of observations in this case is significantly higher than in the SEM models. The FE model neglects all time-invariant variables, which further increases the number of observations. The essential assumption that the country-specific effect is correlated with the independent variables rules out the application of a random effects model. The results of both techniques are strongly comparable to the results using 3SLS and GMM in the SEM models. The marginal impacts as well as the signs of the exogenous variables turn out to be remarkably stable. Moreover, the significance of the variables remains unaffected by the utilization of this approach. The J-Test of Hansen (1982) indicates validity of the surplus instruments (p value =.99), so the moment conditions of the GMM model match the data well. As in all estimations concerning the conditional impact of the financial system, the significantly negative influence persists.

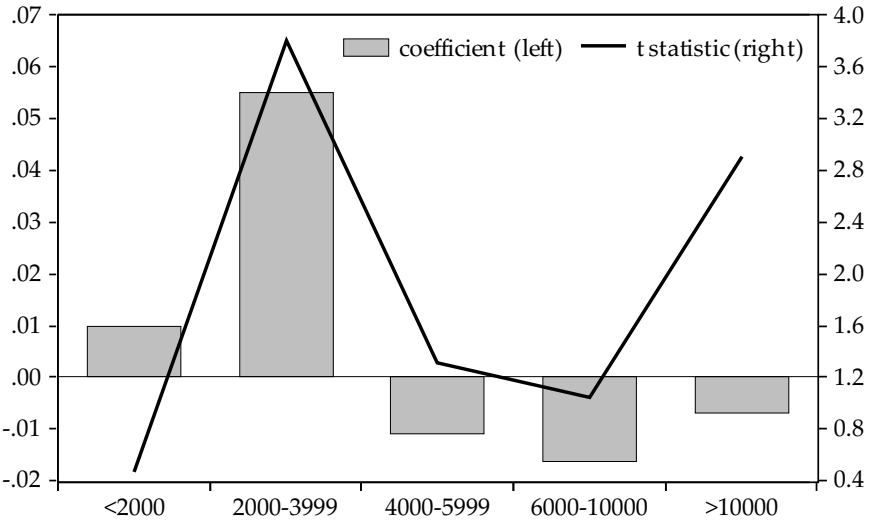
In column (4), we evaluate the potential for financing additional investment projects (BPOT) that equals BCREDIT / BSIZE. The measure gives the quotient of actual drawn credits and bank deposits, and thus can be thought of as the degree of utilization of savings. The higher this ratio, the more savings are currently granted and the lower is the potential for new credits. Hence, high values of BPOT indicate that there is less prospect for financing new growth-boosting investment projects. The estimations suggest that an increase in BPOT leads to a significant decline in growth. The higher the percentage of savings that has already been transformed into loans, the lower the growth rate of the economy. Nations with high values of BPOT include some of the top-25 economies in terms of GDP per capita, such as Iceland (1.23), United Kingdom (1.00), Australia (.99), Ireland (.98), Brunei Darussalam (.97), Luxembourg (.97), Norway (.97), Finland (.95) and the United States (.90). According to table 4, these are countries in which the positive effects of finance have vanished. Therefore, the high value of BPOT does not significantly reduce growth potentials, as the large absolute size of the financial sector already enables the funding of all reasonable investment projects. Yet, there are quite a few developing economies among the countries with high levels of BPOT. The potential for new investments is particularly low in Tajikistan (1.03), Timor-Leste (1.00), Bosnia and Herzegovina (.99), Cambodia (.99), Chile (.98), Ecuador (.98) and Tonga (.94). According to table 4, finance exerts positive effects in these group of countries. High values of BPOT thus significantly decrease growth, as indicated by the estimations of column (4).

We emphasized before that finance in general has a positive effect on growth as it enables the funding of growth-boosting investments. Yet, we repeatedly pointed out that

[21] See Schmidt (1976) for a prove.

this effect vanishes through the development process of economies. The estimation of the Panel GMM model allows us to investigate this process in more detail. If true, the described pattern must be observable in the panel estimation. Figure 1 illustrates the evolution of the coefficient of FDEPTH as shown in column (3) when estimating restricted sample models. Each restriction refers to the level of development of the countries in our sample. Therefore, the first bar in figure 1 reflects the influence of FDEPTH in the sample of all countries with real GDP per capita lower than 2,000 USD. The advantage of this approach is that the sample of the relevant time period remains unaffected. Therefore, countries can move from one sub-sample to another over time. And they actually do: The median of real GDP per capita in 1980 was 3,944.82 USD and 7,934.72 USD in 2010. So the figure captures both the effect of financial development within individual economies over time as well as the effect of finance within the cross-section of countries. In order to obtain an idea of the significance, the black line represents the t-statistic of the particular coefficient.

**Figure 1**: The influence of the financial sector by levels of development




*Notes*: Figure reports the coefficient and t statistics of the estimation illustrated in column (3) of table 6 using FDEPTH as a proxy of financial development. Economic development and refers to real per capita GDP in PPP adjusted international dollars. Each bar represents the coefficient of FDEPTH within the estimation of the particular subsample.

The figure illustrates that the influence of finance is positive in countries with incomes lower than 4,000 USD. Considering the whole period of the Panel GMM estimation, 80 countries fall below this threshold, at least in one year. When considering the countries with incomes between 2,000 - 4,000 USD, the influence of finance is significant. Yet, the picture changes when analyzing more developed countries. In each sample that considers economies with incomes higher than 4,000 USD, the impact of financial intermediaries vanishes. In highly developed economies where average incomes are higher than 10,000 USD, the influence of finance is significantly negative. Only 40 of the 188 nations in the sample have surpassed this threshold at the beginning of the observation period in 1980. Yet, 77 nations have succeeded in exceeding this income level in 2010.

The insignificance of FDEPTH in the long-run model in column (1) fits into our theory very well, since only 32 of the countries in the sample have passed the critical level of development in 1970. Yet, 95 nations have exhibited incomes lower than 4,000 USD. As these countries developed, the positive influence of finance disappeared. Yet, when investigating a large time period, the positive effect of underdeveloped countries superimposes the negative—or indifferent—influence of finance in developed economies.

# 7 Conclusions

Our results indicate that the former positive influence of the financial sector on economic development has vanished since the beginning of the 1990s and even became negative at present time. We showed that our results are strongly robust to the utilization of different estimators, varying specifications of the basic system and different proxies of the financial system. Yet, this result is mainly driven by middle and high income countries. In developing economies, finance still exerts positive effects. The latter is crucial since it indicates that the influence of the financial sector depends on the level of development. Furthermore, it explains why studies building on older data did not find a negative influence. Most of these studies use data up to the early 1990s.[22] However, much development has taken place in the world economy during the last two decades. Between 1990 and 2010, the median annual growth rate of real GDP per capita in the world was 2.2 percent. While the median value of income per capita in 1990 was 4,804 USD, it rose up to 7,350 USD in 2010. Economies that benefited from an increasing financial sector at the beginning of the 1990s may today not respond to further expansions of the financial system at all. In fact, our analysis supports the finding of Rosseau and Wachtel (2011) that the early 1990s were the starting point from which finance and growth ceased to be correlated. There is much reason to believe that a certain size of the financial sector relative to GDP enables the accomplishment of all growth-boosting investments, either in human and physical capital or innovations. If the financial sector exceeds this level and continues to grow, there will be no more positive effect on real economic activity. However, while this clarifies why the impact of finance levels off at a certain point of economic development, it provides no explanation for a negative influence.

So why does this negative correlation appear? The negative impact of finance is mainly driven by high income countries and occurs only when incorporating the post-2000 period. One explanation may be that the Financial Crisis led to a sudden sharp decline in per capita incomes in the year 2009. The average growth rate in 2009 was -1.4 percent, while countries with incomes higher than 10,000 USD suffered a particular cutback of -4.1 percent. A growing financial sector would instantly lead to a negative correlation between both variables. If true, the negative impact of finance would be a one-time effect caused by the Financial Crisis. Yet, this explanation has an essential drawback: in order to smooth cyclical fluctuations, we utilize 5-year averages in our analysis. The 5-year average of high income countries during the 2005-2010 period (2.8 percent) is positive and not

[22] See, for example, King and Levine (1993a, 1993b), Beck et al. (2000), Levine et al. (2000).

significantly lower than during the 2000-2005 (3.1 percent) or the 1995-2000 (3.2 percent) period. Similarly, Arcand et al. (2012) emphasize that banking crises and economic volatility are only part of the story. This poses the need of an explanation independent from the recent Financial Crisis.

One theoretical consideration related to the ideas of Tobin (1984) may be that a large financial systems can lead to misallocations of resources. Such misallocations can occur when all promising investments have already been funded. The pressure to invest surplus liquidity that originated in growth of the financial sector may now force banks to fund projects with disproportionately high risks. This may also encourage banks to steer away from their traditional intermediation activity and to develop new business segments. These new activities do not contribute to economic growth but do enhance instability. Evidence for this explanation is given by Demirgüç-Kunt and Huizinga (2010). Also, the purpose of loans is crucial. Beck et al. (2012) show that enterprise credits are positively correlated with growth while loans given to households do not trigger any growth effects at all. If the enhancement of the financial sector mainly increases household loans, then a negative effect on economic growth can occur if loans default and the financial system loses stability. This point has been made by De la Torre et al. (2011): if financial development possesses decreasing returns, then the marginal costs of maintaining financial stability eventually becomes higher than the marginal returns of financial development. In contrast, Philippon (2010) and Bolton et al. (2011) emphasize the possibility of labor misallocation. If the financial sector is large in relation to the real economic sector, then excessive profits in the financial sector attract too many talented people that would otherwise be productive in the real economy. Thus, productivity in the output sector declines and growth slows down.

Acemoglu et al. (2001) propose a different suggestion, arguing that financial institutes emerge due to the presence of deeper institutional fundamentals. As the authors point out, it is these fundamentals that trigger growth, not the financial sector itself. If true, the positive effects of finance will disappear as the contribution of institutions to economic development abates. Similarly to the argument of De la Torre et al. (2011), this can provoke a negative impact of finance. One drawback of this explanation is that the positive effect of finance remains until the early 1990s, even in high income countries. It is highly unlikely, though, that fundamental institutional changes in developed economies exerted positive growth impulses until the 1990s, as the majority of these alterations occurred several decades earlier.

Further research needs to be carried out to examine which of the presumptions above can explain the negative impact of finance most accurately. Either way, while we do not yet know the underlying reasons, we do know that a further expansion of the financial sector does not contribute to any additional increases in real GDP per capita in developed economies. In the light of the instability that can be implicated by a large financial system 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.

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