Financial development, real sector, and economic growth

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Abstract

This paper evaluates the interdependence between financial development and real sector output and the effect on economic growth. Using panel data for 101 developed and developing countries over the period 1970 to 2010, we show that the effect of financial development on economic growth depends on the growth of private credit relative to the real output growth. The findings also suggest that the effect of financial development on growth becomes negative, if there is rapid growth in private credit not accompanied by growth in real output. Our findings provide empirical evidence that supports the theories that postulate the existence of an optimal level of financial development given by the characteristics of an economy.

Keywords: Financial Development, Real sector output, Economic Growth
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1. Introduction

Financial development is an important determinant of economic growth. However, due to the broad definition and interdependence with other spheres of economic development, the effect of financial development on economic growth is unclear. Empirical studies periodically re-evaluate the relationship between financial development and economic growth as new theories, datasets, and empirical tools become available. This paper analyzes how the relationship between financial development and economic growth is affected by the development of the real sector of the economy. Based on panel data for developed and developing countries, we show that for smooth economic development, balanced growth of the real and financial sectors is required. Our results are consistent with existing theoretical studies that suggest there is a trade-off between financial and real sector expansion.

The channels through which financial development contributes to economic growth have been discussed extensively in the literature. Related theories can be characterized by optimistic and skeptical approaches. According to the former approach, better financial systems mobilize savings and facilitate efficient allocation of resources (King & Levine, 1993; Greenwood, Sanchez, & Wang, 2010), reduce agency costs and enhance innovation activities (Aghion, Howitt, & Mayer-Foulkes, 2005), and contribute to high-return investments through risk-sharing (Greenwood & Jovanovic, 1990; Bencivenga & Smith, 1991; Saint-Paul, 1992). According to the latter approach, financial development may lead to high systemic risk (Allen & Carletti, 2006; Wagner, 2007; Gai, Kapadia, Millard, & Perez, 2008; Gennaioli, Shleifer, & Vishny, 2012), suboptimal low savings (Jappelli & Pagano, 1994), suboptimal high allocation of labor to the financial sector (Philippon, 2010; Bolton, Santos, & Scheinkman, 2011), overheated economic capacity (Zeira, 1999), or the exertion of inefficiently high cost on the economy (Santomero & Seater, 2000).

These theoretical findings suggest that the causal effects of financial development should be considered jointly with the state of development in other sectors that govern economic growth. For example, if financial deepening increases systemic risk because excess financing is allocated to risky investments, technological progress in the productive sector could extend the economy's production capacity and release the demand for funds from more efficient firms. This would stabilize the economy, reduce the probability of systemic crises, and thus increase the average economic growth rates. Otherwise, if high rent resulting from the financial sector's disproportionately fast development attracts too many skilled labor resources, then exogenous growth in other sectors' technologies could restore the optimal allocation of labor. As shown, for example, in Murphy, Shleifer, & Vishny (1991), optimal allocation of labor across sectors is crucial to sustain economic growth rates. Similarly, if financial innovations reduce savings (due to, for example, dampening interest rates), technological progress in the real sector has the opposite effect (increases the demand for funds with a consequent rise in interest rates). Savings, in turn, define the accumulation of capital in the economy, subsequent levels of output, and economic growth rates. Thus, balanced growth of financial sector technologies and real sector technologies might be necessary for financial development to have an unambiguously positive effect on economic growth.

In this paper, we investigate whether the effect of financial development on economic growth depends on the relative speed of the development of the financial and real sectors in a sample of developed and developing countries. Financial development is proxied by the amount of private credit by banks and other financial institutions as a share of the gross domestic product (GDP). This variable has been used extensively in the literature and is considered a good measure compared to available alternatives (Beck, Demirgüç-

Kunt, & Levine 2007). The variable reflects the state of technology in the financial sector: the amount of financial funds the system transfers within a period of time. For robustness, we also use private credit by banks as a share of the GDP and liquidity as a share of the GDP. These proxies for financial development are also measures of financial sector outputs. Accordingly, we proxy development of the real sector by industrial output growth. Numerous studies have discussed the relationship between financial development and industrial output at the micro level. These studies have shown that the effect of financial development on a particular industry depends on the characteristics of that industry, such as its level of financial dependence (see, for example, Rajan & Zingales, 1998; Larrain, 2006; Raddatz, 2006; Manganelli & Popov, 2013; Huang, Fang, & Miller, 2014). Our paper considers the relationship between development of the financial and real sectors of the economy at the macro level. We consider a cross-section of 101 countries with the data averaged over the the period 1970–2010 to characterize the long-run relationship between the variables of interest and panel data to characterize the relationship between the variables of interest over a shorter time horizon. For the cross-section estimates, we also consider the research and development (R&D) expenditure share of the GDP as a proxy for development of the real sector. This variable is a common proxy for technological progress in a country and is an alternative measure of real sector development.

To control for the simultaneity between financial development and economic growth, we use the first-difference generalized method of moments (FD-GMM) estimator developed by Arellano & Bond (1991), and we use lags of the endogenous variables as instruments in the panel of five-year non-overlapping periods. For the cross-section analysis, we use legal origin indicators as instruments for financial development.

The empirical literature characterizing the role of financial development in economic growth, similar to theoretical studies, follows two history-determined general approaches: optimistic (more popular during the 1990s and 2000s) and skeptical (more popular after 2000).

The first approach seeks to rationalize financial innovations and financial development as necessary components of economic prosperity and sustainable economic growth. This approach developed during the decade of the rapid expansion of financial services and the financial liberalization of the global economy. Representatives of the first approach include King & Levine (1993), Rajan & Zingales (1998), and Levine, Loayza, & Beck (2000).

The second approach describing the role of financial development in economic growth flourished after the financial crises of 1997–1998 and 2007–2008. This approach identifies possible dangers of financial liberalization. In particular, the after-great-crises studies cast doubt on the conclusions of the optimistic approach's representatives.

Deidda & Fattouh (2002) re-estimate King & Levine's (1993) findings by applying the threshold regression model and find support for the nonlinear effect of financial development on economic growth. Manganelli & Popov (2013) show that the effect of financial development on economic growth is nonlinear in the Rajan & Zingales (1998) dataset: The effect weakens for very large financial markets. Cecchetti & Kharroubi (2012) also find that financial development has an inverted U-shape effect. Ben Gamra (2009) shows that partial financial liberalization has a stronger positive effect on economic growth than full liberalization in a sample of East Asian economies. Owen & Temesvary (2014) find that the impact of different types of bank lending on economic growth depends on the level of development of the country's banking sector.

Kaminsky & Reinhart (1999) suggest a possible negative channel of financial devel-

opment effect on economic growth through triggering financial instability. Loayza & Ranciere (2006) find evidence for the coexistence of a positive relationship between financial intermediation and output in the long run and a negative short-run relationship due to financial instability. Rousseau & Wachtel (2011) argue that the positive effect of financial deepening weakens over time regardless of a country's level of development. Beck, Degryse, & Kneer (2014) reconsider findings of the paper by Levine, Loayza, & Beck (2000). The authors suggest that a larger financial sector increases growth and reduces volatility over the long run, while stimulating growth at the cost of higher volatility over short-term horizons. Arcand, Berkes, & Panizza (2012) find similar results using several estimation techniques and controlling for the endogeneity of financial development.

Calderón & Liu (2003) suggest that financial deepening contributes more to growth in developing countries than in industrial countries. A similar result is found by Masten, Coricelli, Masten (2008) who analyze a sample of European countries and show that less developed countries gain more from financial development. Rioja & Valev (2004) find financial development has a strong and positive effect on economic growth only for countries with intermediate levels of development. Ang (2011) proposes empirical evidence suggesting that financial liberalization can slow technological progress due to the reallocation of talent from the innovative sector to the financial sector. This paper contributes to the empirical literature on the non-trivial relationship between financial development and economic growth, by considering the co-determination of financial development and real sector development.

The rest of the paper is organized as follows. In section 2, we outline the conceptual framework underlying our hypothesis for empirical investigation. In section 3, we describe the data. Empirical strategy is explained in section 4. In section 5, we discuss the results. In section 6, we conclude the paper.

2. Conceptual framework

According to economic growth theory (pioneered by Solow, 1956; Romer, 1986; Lucas, 1988), the main determinants of economic growth per capita are the initial levels of the GDP, human capital, and physical capital accumulation. Economic growth per capita should be negatively related to the initial level of GDP because economies tend to converge to their steady states with the speed diminishing in the amount of capital accumulated (this is known as the convergence effect) and positively related to the level of human capital in the country because higher human capital implies more innovative ideas and, potentially, faster economic growth. In addition, many other economic, political, institutional, and geographic factors have been included in empirical growth models (see Durlauf, Johnson, & Temple, 2005 for an extensive survey).

The literature studying the effect of financial development on economic growth considers a particular set of control variables related to government policy and the economic stability of the country: fiscal policy indicators, measures of openness to international trade, and price stability measures (see, for example, Levine, Loayza, & Beck, 2000), along with measures of financial development. Recently, Arcand, Berkes, & Panizza (2012) included a quadratic term of financial development in the growth regression and found a non-linear relationship between financial development and economic growth. Theoretical justifications of the non-monotone effect of finance on growth can be generalized in two statements:

(1) *Financial development can decrease economic growth through increased economic*

fragility. Accumulated systemic risk is a consequence of financial innovations and financial liberalization, both of which are captured by financial development (see, for example, Allen & Gale, 2004; Allen & Carletti, 2006; Wagner, 2007; Gennaioli, Shleifer, & Vishny, 2012). Higher systemic risk implies more frequent and/or more severe crises, which in turn negatively affect economic growth rates in the short and medium term.

(2) *Financial development can decrease economic growth through resource misallocation.* A fast-growing financial sector generates high rents and attracts resources that ideally should be used in other sectors (see, for example, Santomero & Seater, 2000; Philippon, 2010; Bolton, Santos, & Scheinkman, 2011). Suboptimal allocation of the resources implies that feasible growth rates may not be achieved, in the short and long term. For example, if the financial sector attracts too many skilled workers, who contribute to its growth and development (what is called "cream-skimming"), the other sectors could stagnate in the absence of sufficient human resources, with growth and development lagging. The latter can have a negative effect on the total output and output growth of the economy.

We argue that both statements should include the following remark: *"Financial development can decrease economic growth if it is not accompanied by development in the real sector of the economy."* Along the balanced growth path, by definition, all sectors of the economy should grow at constant rates. In particular, the real and financial sectors should grow at commensurate rates. Whenever either sector grows disproportionately, the growth of the total output of the economy will be affected. In order to prevent the build-up of financial instability, the sectors that use financial services (such as the real sector) should grow sufficiently fast to maintain the demand for financial funds. Sustained or increasing competition for financial funds implies that the fraction of inefficient and riskier projects that get funded is low or decreasing over time (higher demand for funds increases their relative price and makes less efficient projects unprofitable). Similarly, in order to avoid misallocation of inputs due to a fast-growing financial industry, the productive sector of the economy should grow fast enough to be able to compete for these inputs, e.g., by offering competitive remuneration.

Thus, we consider the hypothesis that the effect of financial development on economic growth depends on the growth of financial services relative to the growth of the real sector of the economy. To test this hypothesis, we include in the empirical growth model considered in the financial development literature an interaction term between the measure of financial development and the difference between the growth of the financial and real sectors of the economy. Along with the measure of financial development included as a regressor, the interaction term provides a potential channel through which financial development may have a non-linear effect on growth: The effect of financial development on economic growth might be weakened or could be even negative if there is unbalanced growth in the financial and real sectors. In the following sections, we describe the empirical methodology in detail.

3. Data

In this section, we describe the data we used in our estimation of the relationship among financial development, real sector development, and economic growth.

For the empirical analysis, we use panel data for 101 countries from 1970 to 2010. All the data is from the World Development Indicators (WDIs) published by the World

Bank, except the human capital index obtained from the Penn World Table 8.0 (Feenstra, Inklaar, & Timmer, 2013).

We use the following indicators as measures of financial development:

(i) *Private credit to GDP.* This variable is calculated as the value of credit issued by deposit money banks and other financial institutions to the private sector. It is the main proxy for financial development used in the literature (see, for example, Levine, Loayza, & Beck, 2000 and Aghion, Howitt, & Mayer-Foulkes, 2005).

(ii) *Private credit by banks to GDP.* This variable is calculated as the value of credit issued by deposit money banks to the private sector. This measure does not include credit issued to the private sector by non-deposit money banks. It is a narrower measure of financial development (Beck, Demirgüç-Kunt, and Levine, 2009), which we use for robustness.

(iii) *Liquid liabilities to GDP.* This variable is equal currency plus demand and interest-bearing liabilities of banks and non-bank financial intermediaries divided by the GDP. It is the broadest measure of financial development used in the literature (Beck, Demirgüç-Kunt, & Levine, 2009); we use it for robustness.

The development of the real sector of the economy is proxied using the following variables:

(i) *Growth of the industrial value added.* This variable comprises value added in mining, manufacturing, construction, electricity, water, and gas. Value added is the net output of a sector after all outputs are added up and intermediate outputs are subtracted. We use this variable to proxy the speed of the real sector development.

(ii) *Research and development expenditures (R&D) to GDP.* Research and development expenditure is a common proxy for technological progress, which in turn is associated with productivity growth in the economy and can be considered an alternative measure of real sector development assuming that R&D affects the real sector differently from the financial sector. This variable is used only for the cross-section (long-run) estimation, since research and development is available only from 1996 and only for some countries.

Following the empirical literature on economic growth, we use the following set of control variables: the initial real GDP per capita; government spending as a share of the GDP; the human capital index, based on years of schooling and returns to education (Feenstra, Inklaar, & Timmer, 2013); openness to trade measured as the sum of exports and imports as a share of the GDP; and the inflation measured as the growth rate of the consumer price index. The initial GDP is used to control for the convergence effect. Human capital facilitates the generation of new products or ideas that underlie technological progress; thus, countries with a larger initial stock of human capital should grow faster. Government expenditure measures fiscal stability and distortions in the economy, e.g., government consumption could decrease savings and growth through distorting effects of taxation. Inflation captures macroeconomic stability; it reflects the effectiveness of the monetary policy and can affect growth through its influence on investment and savings decisions by households and firms.

Descriptive statistics for the variables used in the analysis are presented in Table 1. The value for the initial GDP per capita is calculated as the logarithm of the average

real GDP per capita from the period 1970–1973. The growth variables are the average annual growth rates across the period 1975–2010 in percentage. Since sample includes countries with different levels of development, the data vary significantly. We present the values for the 25%, 50%, and 75% percentiles to facilitate comparison across the countries and interpretation of the results presented in the following sections. Among the control variables, the variable that has the largest variation across countries is the inflation rate. The average value of 39.87% is significantly larger than the median (7.84%) and reflects the fact that many countries in the sample experienced hyperinflation episodes during the period under consideration.[1] Government spending is relatively homogeneous across countries. The average difference between the growth of the financial and real sectors is around 2% when financial development is measured by total private credit or by private credit by banks to GDP (rows (12) and (13) of Table 1, respectively). This average value is significantly higher than the median, which is close to zero (-0.2336 and 0.0306, respectively), implying that the distribution of the differences is skewed to the right. That is, for most of the countries, the financial sector seems to grow significantly faster that the real sector of the economy. For the other measure of financial development, liquid liabilities to GDP, the differences in the growth rates between the financial and real sectors (rows (14) of Table 1) is negative at the median; when R&D is used as a proxy for real sector development, the median difference in the growth rates is 1.9615 with the mean value 0.7933.

Figure 1 shows the plot of the economic growth rates for the considered sample of developed and developing economies versus the measure of financial development, both variables averaged over the sample period (1970–2010). The relationship is nonlinear, positive for low and intermediate levels of financial development, and negative for high levels of financial development.[2] We argue that this nonlinear relationship may be driven by the influence of the real sector of the economy.

In order to obtain circumstantial evidence for the interdependence between financial development, real sector development, and economic growth, we consider episodes of severe crises studied by Reinhart & Rogoff (2008). These authors analyze the similarities of the most severe financial crises, among which they define the "big"crises in Norway (1987), Sweden (1991), and Japan (1992).

[1]To avoid our results being entirely driven by the hyperinflation episodes, we use the hyperbolic sine transformation: $log(inflation + \sqrt{inflation^2 + 1})$. This transformation allows us to consider the logarithm of negative variables and zeros. The countries that experienced inflation rates higher than 100 over the period 1970 to 2010 are Angola, Argentina, Bulgaria, Belarus, Bolivia, Brazil, Croatia, Indonesia, Iraq, Israel, Peru, Poland, Romania, Sudan, Suriname, Uganda, Congo, Zambia, and Zimbabwe. The results are qualitatively the same when we include inflation in levels and when we use the $log(inflation+1)$ transformation.

[2]The coefficients for the level and the square of the financial development measure using 135 countries are 0.026 with a std. error of 0.084 and -0.0093 with a std. error of 0.0050, respectively. The relationship is preserved when other measures of financial development, such as bank credit to the GDP and liquid liabilities to the GDP, are used instead of private credit to the GDP.

Table 1: Summary statistics

Variables/Statistics	Mean	St.d.	Pct. 25	Pct. 50	Pct. 75
(1) Real GDP growth per capita	1.6419	1.9872	.5829	1.6898	2.3867
(2) Log initial GDP	7.4997	1.5610	6.2890	7.3499	8.9008
(3) Trade openness	84.3192	44.9667	55.5997	77.5307	105.1037
(4) Inflation	39.8721	123.5321	4.4753	7.8425	18.2399
(5) Human capital	2.2971	0.5634	1.8584	2.3259	2.7488
(6) Government expenditure	17.2128	6.8484	12.4315	16.6247	19.7484
(7) Private credit to GDP	39.9822	39.321	14.1054	28.3624	54.5547
(8) Private credit by banks to GDP	37.4212	37.0781	14.0036	26.7461	50.3957
(9) Liquid liabilities to GDP	48.5273	37.1293	25.1097	38.0708	62.2186
(10) Real output growth	4.0081	3.3931	1.9222	3.4389	5.6103
(11) R&D expenditure to GDP	.7509	.8603	.1928	.4344	1.0064
(12) Diff. between growth of (7) & (10)	1.7593	13.562	-2.5945	-.2336	3.5065
(13) Diff. between growth of (8) & (10)	2.0169	13.7151	-2.5851	.0306	3.5065
(14) Diff. between growth of (9) & (10)	.6790	16.2024	-3.0125	-1.1728	1.8319
(15) Diff. between growth of (7) & (11)	.7933	28.7646	-3.3234	1.9615	6.1433

Initial GDP per capita is the average real GDP per capita in the period 1970–1973. The growth variables are average annual growth rates across the period 1975–2010 as a percentage.

In Figure 2, we plot the growth rates of private credit to the GDP and industrial output to the GDP together with the GDP growth rates around the years of the big financial crises for these economies as well as for the recent 2007–2008 crisis in the United States.

The amount of private credit increases significantly 1–2 years before each severe crisis, while the industrial output growth of the economy slows before the financial crisis. Considering the two factors together, the difference between financial development and real output development seems to increase before the financial crises. This pattern suggests that financial development not accompanied by growth in the real sector of the economy could be a source of economic instability and contribute to a decrease in growth rates. In our empirical specifications, which we discuss in the following section, we do not model the crisis episodes explicitly; these episodes are implicitly captured by the slowdown in economic growth during the crisis periods.

4. Empirical strategy

Numerous theoretical models show that financial development can decrease economic growth through several channels. Our main hypothesis is that financial development will not decrease economic growth if the growth in the financial sector is accompanied by growth in the productive sector of the economy. We test this hypothesis by adding an interaction term between financial development and the difference in the growth rates of financial development and real output to the standard growth model considered in the empirical literature of financial development (e.g., Levine, Loayza, & Beck, 2000; Arcand, Berkes, & Panizza, 2012). Specifically, we consider the following growth model:

$$ln(y_{i,t}) - ln(y_{i,t-1}) = \alpha ln(y_{i,t-1}) + \beta_1 FD_{i,t} + \beta_2 FD_{i,t}(g_{FDi,t} - g_{RSi,t}) + \delta' X_{i,t} + \eta_i + \mu_t + \varepsilon_{i,t}, \quad (1)$$

where $ln(y_{i,t})$ is the natural logarithm of the real GDP per capita of country i in period t, $ln(y_{i,t-1})$ denotes the natural logarithm of GDP per capita of country i in period $t-1$,

Figure 1: Financial development as a determinant of economic growth. Financial development is measured as the ratio of total private credit to GDP. Economic growth is the real GDP growth. Data source: WDIs.

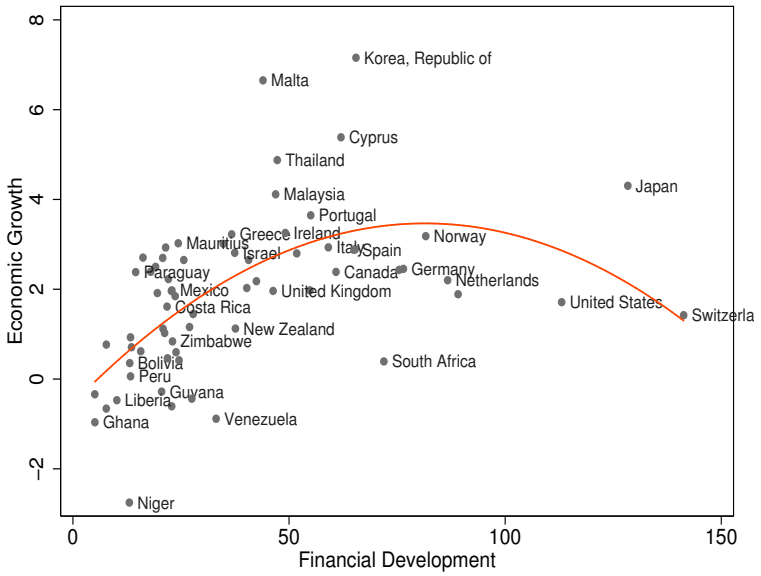
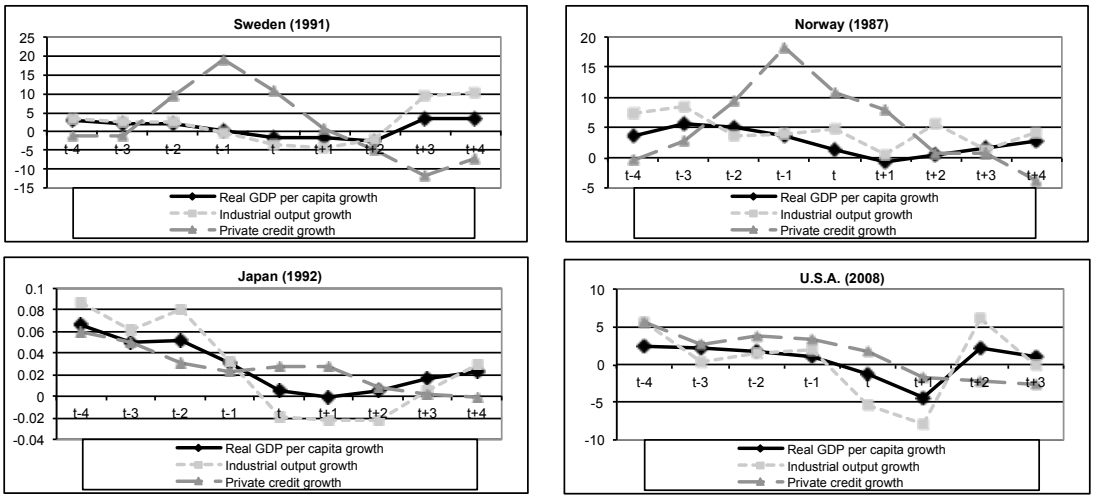


Figure 2: Financial development, real output growth, and real GDP growth before and after the "big" crises. Data source: WDIs.



Period t corresponds to the big financial crisis years: 1991 in Sweden, 1987 in Norway, 1992 in Japan, and 2008 in the United States.

$FD_{i,t}$ is a measure of financial development, $(g_{Fi,t} - g_{RSi,t})$ is the difference between the growth of the financial development measure and the growth of the real sector development measure, and $X_{i,t}$ represents the set of standard control variables: human capital, trade openness, government expenditure, and inflation. η_i is the country-specific fixed effect, μ_t are time dummies, and $\varepsilon_{i,t}$ is the stochastic error term.

We eliminate the country-specific effect using first differences. The individual country fixed effects account for institutional and cultural differences across countries. However, by construction the error term in the first difference equation is correlated with the lagged dependent variable (dynamic panel bias). Moreover, there may be potential feedback from growth to explanatory variables and time-varying unobservable factors. We use the first difference generalized method of moments estimator (FD-GMM) to deal with these

endogeneity threats (Arellano & Bond, 1991). Under the assumptions that the error term, ε, is not serially correlated, and the explanatory variables, X, are weakly exogenous (uncorrelated with future realizations of the error term), the FD-GMM estimator uses the lags of all the explanatory variables as instruments.[3] The moment conditions of the FD-GMM are:

$$E[ln(y_{i,t-s})\,(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \quad for \quad s \geq 2, t \geq 3,$$
$$E[X_{i,t-s}\,(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \quad for \quad s \geq 2, t \geq 3,$$

We use these moment conditions and apply a GMM procedure to generate consistent and efficient parameter estimates using the Windmeijer (2005) standard errors correction.[4] We provide the necessary checks of this estimator's consistency. In particular, we use Sargan and Hansen's tests of over-identifying restrictions to test the exogeneity of the instruments, and we check the validity of the assumption that there is no serial correlation between error terms.

This specification assumes homogeneity of the parameters across countries. The effect of financial development on economic growth is likely to be time and state dependent. For robustness, we also consider a sample that excludes low-income economies in Table 6 and show that the results are qualitatively the same.

5. Results

We first present the results of the long-run effect of financial development on economic growth, and we test whether this effect depends on the balanced growth between credit to GDP and industrial output using a cross-section analysis. Then, we discuss the optimal level of financial development in the panel setting.

5.1. Cross-section regressions

To evaluate whether the effect of financial development on economic growth depends on the difference between the growth rates of credit and real output, we consider a cross-sectional analysis using data averaged over the period 1975–2010; therefore, there is one observation per country. The basic regression is equation (1) without time subindices.

In column 1 of Table 2, we use ordinary least squares (OLS) to estimate the long-run relationship between financial development and growth. The main variable of interest is the interaction between financial development and the difference between private credit to the GDP growth and industrial output to the GDP growth. The negative sign of the interaction term suggests that one of the potential factors determining the inverted U-shape relationship between financial development and economic growth documented in Arcand, Berkes, & Panizza (2012) is an acceleration of the credit growth that is not accompanied by growth in the real sector. In particular, financial development decreases growth when the steady state (long-run) private credit growth exceeds the steady state industrial output growth by 12.96%. However, the effect of financial development on growth is unambiguously positive if credit and real output grow at the same rate (i.e., if the difference in their growth rates is zero).

[3] We do not use the System GMM since in our case the lags of the explanatory variables are relevant instruments. The System GMM estimator imposes the additional assumption that deviations from long-run means must not be correlated with the fixed effects. This assumption is not likely to hold since not all the countries are likely to be in the steady state.

[4] We use the Stata module xtabond2, developed by Roodman (2009).

In column 2 of Table 2, we control for the simultaneity between financial development and growth through an instrumental variable (IV) strategy, exploiting exogenous variations of financial development using legal origin indicators as instrumental variables.[5] Our instruments have been intensively used in the literature to capture the exogenous effect of financial development on growth, e.g., Aghion, Howitt, & Mayer-Foulkes (2005); Levine, Loayza, & Beck (2000).[6] As La Porta, Lopez-de-Silanes, Shleifer, & Vishny (1998) showed, the legal origins across countries explain differences in covering secured creditors and differences in the efficiency of contract enforcement across countries. Our estimating method is the two-stage least squares. In the context of the cross-sectional growth regressions, our instrumental variable strategy relies on the assumption that legal origin may affect real per capita GDP growth only through financial development. We use the Hansen J overidentification test of all instruments to check their validity. The results from the IV estimation, presented in column 2, are qualitatively similar to those obtained when financial development is treated as exogenous (column 1). However, the threshold value after which financial development decreases economic growth is lower when we account for the endogeneity of financial development. In particular, when private credit grows 10.56% faster than real output, the effect of financial development on economic growth becomes negative. This threshold was reached over the period 1975–2010 in the following countries: Albania, Angola, Armenia, Bhutan, Lao PDR, Latvia, Moldova, Syrian Arab Republic, and Ukraine.

We find a negative relationship between the initial level of GDP per capita and economic growth, consistent with the conditional convergence hypothesis. Human capital has a statistically significant positive coefficient while the rest of the control factors have the expected sign, but they are not statistically significant. The nonlinear relationship between financial development and growth is robust to the exclusion of the insignificant control factors.

For robustness, Table 3 presents results using R&D expenditure instead of real output growth as a proxy for real sector development. R&D expenditure is likely to result in innovation and technological change, which is an important determinant of long-run productivity growth in all the sectors of the economy. The results from the IV estimation reported in column 2 shows that an increase in private credit from the 25th percentile of the distribution of private credit to GDP, 14.10 (e.g., the average private credit level in Belarus over the period 1975–2010), to the 75th percentile of private credit to GDP, 54.55 (e.g., the average private credit level in Belgium over the period 1975–2010), is predicted to increase economic growth by 2.03%, if the growth in credit is accompanied by growth in R&D expenditure. The negative sign of the interaction term between financial development and the difference in the growth of credit and R&D expenditure implies that the effect of financial development on growth is decreased if credit grows faster than R&D expenditure. We find that there is a threshold value after which financial development harms growth, that is, when the growth in private credit exceeds the growth in R&D expenditure by 11.20%. The countries that reached this threshold over the period 1975

[5]Following Aghion, Howitt, & Mayer-Foulkes (2005), we place countries into five major legal families, English, French, German, Socialist, or Scandinavian. The reference category in our specification is socialist legal origin.

[6]See Levine, Loayza, & Beck (2000) for more details on the legal origin variables and their relationship with financial development.

Table 2: Financial development, real sector development, and economic growth. Long-run cross-section regression using averages over the period 1975–2010

Dep. variable: Real GDP growth	(1) OLS	(2) IV
Trade openness	0.3205	0.2536
	(0.2850)	(0.2934)
Inflation	0.0309	0.2317
	(0.2521)	(0.2872)
Government expenditure	-0.2947	-0.2441
	(0.4941)	(0.5536)
Initial human capital	0.3660***	0.3075*
	(0.1372)	(0.1620)
Initial GDP per capita	-0.4491***	-0.3430*
	(0.1297)	(0.2006)
Private credit to GDP	0.0311***	0.0264**
	(0.0056)	(0.0130)
Private credit (Diff. in credit & ind. growth)	-0.0024***	-0.0025**
	(0.0008)	(0.0010)
Constant	1.9184	1.1553
	(1.8778)	(1.7993)
Extreme point	12.96%	10.56%
Hansen J-test (p-value)	–	.1527
P-value of credit and interaction	.0000	.0056
Observations	96	84
R-squared	0.4214	0.4189

All the variables are in logs, except human capital and private credit to GDP. Initial GDP per capita is the average real GDP per capita from the period 1970–1973, initial human capital is the average human capital index from the period 1970–1973. Extreme point corresponds to the threshold value after which financial development has a negative effect on economic growth. The Hansen test evaluates the validity of the over-identifying restrictions. The p-value corresponds to a joint test of the coefficient of financial development and the interaction term. Robust standard errors in parentheses. *** Significant at the 1% level, ** significant at the 5% level,* significant at the 10% level.

to 2010 include Algeria, Armenia, Belarus, The Gambia, Georgia, Indonesia, Kuwait, Latvia, Montenegro, Mozambique, Romania, St. Lucia, and Ukraine.[7]

The findings of the cross-sectional analysis suggest that financial development may harm economic growth under certain circumstances. Developed financial systems reduce agency costs, transaction costs, mobilize savings, and facilitate the efficient allocation of resources, thus increasing economic growth. Nevertheless, financial services compete with the rest of the sectors for inputs, specially for skilled workers. Therefore, expansion of the financial sectors unaccompanied by growth or technological advances in the productive sectors of the economy may divert resources from the rest of the economy to financial services, leading to lower economic growth rates.

In the next section, we estimate the nonlinear relationship between financial development and growth in the panel data controlling for the potential endogeneity of all the determinants of economic growth.

[7]We do not use R&D expenditure as the main proxy for real sector development for two reasons: First, R&D expenditure is likely to result in technological change that affects the development of all sectors of the economy, not only the real sector; and second, R&D expenditure is available only since 1996 and for only some countries.

Table 3: Financial development, real sector development, and economic growth: using R&D as a proxy for real sector development. Long-run cross-section regression using averages over period 1997–2010

Dep. variable: Real GDP growth	(1) OLS	(2) IV
Trade openness	0.3437	0.7557
	(0.3159)	(0.4992)
Inflation	-0.2926	0.7547
	(0.3968)	(0.8028)
Government expenditure	-0.3468	-0.3418
	(0.5687)	(0.8962)
Initial human capital	0.4353**	0.4469
	(0.1766)	(0.2871)
Initial GDP per capita	-0.6941***	-0.8300**
	(0.2205)	(0.3459)
Private credit to GDP	0.0249***	0.0504**
	(0.0082)	(0.0250)
Private credit (Diff. in credit & R&D growth)	-0.0002***	-0.0045*
	(0.0001)	(0.0025)
Constant	4.8767*	0.2086
	(2.5087)	(5.0617)
Extreme point	124.50%	11.20%
Hansen J-test (p-value)	–	.5968
P-value of credit and interaction	.0004	.0064
Observations	64	56
R-squared	0.4716	–

All the variables are in logs, except human capital and private credit to GDP. Diff. credit & R&D growth is the difference between the growth rates of private credit and R&D expenditure (both as % of GDP). Initial GDP per capita is the average real GDP per capita from the period 1970–1973, and initial human capital is the average human capital index from the period 1970–1973. Column 2 presents the results instrumenting financial development and the interaction term between credit and R&D growth using country legal origin dummies. The Hansen test evaluates the validity of the over-identifying restrictions. The p-value corresponds to a joint test of the coefficient of financial development and the interaction term. Robust standard errors in parentheses. *** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

5.2. Panel estimation

To examine the relationship among financial development, real output development, and economic growth across time, we create a panel of five-year non-overlapping periods: 1971–1975, 1976–1980, 1981–1985, 1986–1990, 1991–1995, 1996–2000, 2001–2005, and 2006–2010. These are used in empirical growth models to smooth out the cyclical patterns of the data. We do not consider business cycle models, since our aim is not to forecast expansions and recessions but to test whether the growth of private credit impairs economic growth when it is not accompanied by growth in the productive sector of the economy. Following Fatás & Mihov (2013), we use the real GDP per capita and human capital index as the initial conditions for each non-overlapping period. Both variables are calculated as the average of the initial year of each non-overlapping period and the two preceding ones. For example, for the period 1976–1980, education and the initial GDP are obtained as the average from the 1974–1976 period. All variables are averaged across each period, except the initial real GDP per capita and initial human capital.

Table 4 reports empirical results from model (1), where we regress economic growth on initial GDP per capita, human capital, trade openness, government expenditure, inflation, private credit to GDP, and the interaction between private credit to GDP and the

Table 4: Financial development, real output development, and economic growth. Non-overlapping five-year periods: 1976–1980, 1981–1985, 1986–1990, 1991–1995, 1996–2000, 2001–2005, 2006–2010. Ordinary least squares (OLS) and first difference generalized methods of moments (FD-GMM) estimates.

Dep. variable: Real GDP growth	(1) OLS	(2) FD-GMM	(3) FD-GMM	(4) FD-GMM
Private credit to GDP	0.0251*	0.2886***	0.0720**	0.0934**
	(0.0131)	(0.1115)	(0.0312)	(0.0377)
Private credit to GDP squared		-0.0389***		
		(0.0131)		
Private credit (Credit and Ind. growth diff.)	-0.0146***		-0.0145**	-0.0285***
	(0.0044)		(0.0066)	(0.0065)
Initial GDP per capita	-0.0167*	-0.0675	-0.1486**	-0.1631**
	(0.0090)	(0.1060)	(0.0647)	(0.0720)
Trade openness	0.0228**	0.0675	0.0510	
	(0.0115)	(0.0876)	(0.0632)	
Initial human capital	0.0698***	-0.0252	0.0175	
	(0.0233)	(0.1795)	(0.1282)	
Inflation	-0.0025	-0.0311**	-0.0235***	-0.0182*
	(0.0084)	(0.0133)	(0.0074)	(0.0096)
Government expenditure	-0.0538**	-0.0948	-0.1827***	-0.2371***
	(0.0228)	(0.1232)	(0.0632)	(0.0776)
Observations	413	413	413	413
Countries FE	NO	YES	YES	YES
Year FE	YES	YES	YES	YES
Number of countries/instruments	101	101/77	101/102	101/72
AR(2)-test (p-value)	–	.011	.032	.050
AR(3)-test (p-value)	–	.268	.352	.384
Extreme point	1.72%	3.71%	4.97%	3.28%
P-value of credit and interaction	.0038	–	.0469	.0001
Hansen test (p-value)	–	.135	.436	.352

All the variables are in logs, except human capital. The results reported in columns 2–4 are obtained using the first difference GMM estimator. AR(2)-test and AR(3)-test is the Arellano-Bond test for serial correlation of order 2 and 3, respectively. We use as instruments lags from $t-3$ to $t-5$ of each explanatory variable. The extreme point is the value of the difference between private credit growth and real output growth after which financial development has a negative effect on economic growth. The p-value of credit and interaction corresponds to a joint significant test of the coefficient of financial development and the interaction term between financial and real sector growth differences. Robust standard errors in parentheses. The standard error correction proposed by Windmeijer (2005) is implemented. *** Significant at the 1% level, ** significant at the 5% level,* significant at the 10% level.

difference in the growth rates of credit to GDP and real output. We include time dummies to remove time-related shocks to economic growth from the errors.[8]

Column 1 provides results using a pooled OLS estimator. Consistent with previous studies, we find education and trade have a positive effect on economic growth and inflation and government expenditure have a negative effect on economic growth. Financial development is positively correlated with growth. However, the coefficient in the interaction term of private credit to GDP and the difference in the growth rates of private credit to GDP and industrial output is significantly negative at the 1% level. Thus, the growth of credit lessens the effect of financial development on economic growth when it is not accompanied by development in the real sector of the economy.

[8]The AR(2) and AR(3) tests and the cluster robust standard errors assume no correlation across countries in the error term. Time dummies make this assumption more plausible.

The results presented in column 1 do not capture the potential endogeneity of the explanatory variables. Some of our regressors are a function of economic growth. Real output is part of GDP output; countries with higher economic growth are more likely to attract foreign investment and consequently have a higher capacity to issue private credit. In addition, potential time-varying omitted factors may lead to spurious results. To account for these endogeneity threats, in columns 2, 3, and 4 we use the FD-GMM estimator and lagged level of all explanatory variables as instruments. Since we use the first difference transformation to eliminate the country fixed effects, we lose the first period of our sample, 1971–1975. In column 2, following Arcand, Berkes, & Panizza (2012), we analyze the non-monotonic relationship between financial development and economic growth by adding the square of private credit to GDP. The results are consistent with their findings. We obtain a non-linear relationship between financial development and economic growth; too much finance might lead to a decrease in economic growth. In particular, the effect of financial development on growth becomes negative when credit to the private sector reaches 40.83% of GDP.[9] Our main contribution is to explain this potential non-linearity between financial development and economic growth by considering the interdependence between the financial sector and the real sector. Our main hypothesis is that the effect of financial development on economic growth depends on the growth or technological advance of the real sector. To test this hypothesis, we introduce in our specification the interaction term between private credit to GDP and the difference in private credit growth and real output growth. In column 3, the positive coefficient on private credit to GDP and the negative coefficient on the interaction term between private credit to GDP and the difference in the growth rates of credit and real output confirm our hypothesis. When private credit and real output grow at the same pace (i.e., the difference in their growth rates is zero), an increase in credit growth from the 25th percentile of the distribution of private credit to GDP, 14.10%, to the median of private credit to GDP, 28.36%, is predicted to increase economic growth by 7.28%.[10] This effect is economically important and statistically significant. Nevertheless, when private credit growth exceeds real output growth by 1.76% (the average difference between the growth rates of private credit and real output), an increase in credit growth from the 25th percentile of the distribution of private credit to GDP to the median of private credit to GDP leads to an increase in economic growth of 4.70%.[11]

In column 4, we exclude from the specification the determinants of growth that are insignificant: trade openness and human capital. The conclusions are qualitatively the same, but the interaction term is now statistically significant at the 1% level. In this specification, an increase in credit growth from the 25th percentile of the distribution of private credit to GDP to the median of private credit to GDP leads to an increase in economic growth of 9.44%, if private credit and real output grow at the same rate. The predicted increase in growth evaluated at the average difference between credit growth and real output growth (1.76%) is 4.37%. Note that when private credit growth exceeds the growth in real output by 3.28%, the effect of financial development on growth becomes

[9] To get this number, recall that the regressors are in logs and note that exp(3.71)=40.83.

[10] The 7.28% predicted increase in growth is obtained by first calculating the percentage point increase from 14.10 to 28.36, which is 101.07%, and then multiplying this percentage point increase by the coefficient of private credit, 0.0720.

[11] The 4.70% predicted increase in growth is obtained by first calculating the percentage point increase from 14.10 to 28.36, which is 101.07%, and then multiplying this percentage point increase by 0.0720-0.0145(1.7593), where 1.7593 is the average difference between credit growth and real output growth.

negative.

These findings suggest that one of the main channels through which financial development may harm economic growth is unbalanced growth between private credit and real output. This may occur, for example, when the expansion of credit (due to financial innovations or deregulations) is not followed by the expansion of the demand for funds by the productive sector of the economy, thus increasing the likelihood of funding risky investments and leading to lower economic growth rates and bank runs or financial crises.[12]

The specification tests in the last rows indicate that the conditions required for the FD-GMM estimator to deliver consistent estimates are present: The Hansen test indicates no correlation between instruments and residuals, and the test for autocorrelation of order three confirms the absence of third-order correlation. The test of second-order correlation suggests that we can reject the null hypothesis of no serial correlation at the 5% significance level. This serial correlation of order two prevents us from considering the second lagged level of the regressors as instruments, since they are correlated with the error term. Instead, we use lags of the regressors from $t-5$ to $t-3$ as instruments for the differenced regressors at period t. We follow the rule of thumb and consider less instruments than number of countries, since too many instruments can overfit the endogenous variables and fail to expunge their endogenous components (Roodman, 2009).

Next, we examine whether our results are robust to the definition of our main variables of interest, financial development. In column 1 of Table 5, we present the results for estimating the economic growth equation (1) using private credit issued by deposit money banks as the main proxy for financial development. This is a more restricted measure of financial development since it does not include credits to the private sector by non-deposit money banks. The extreme point after which financial development has a negative effect on growth is lower in this specification; economic growth is decreased when private credit growth exceeds industrial output growth by 2.84%. In column 2 of Table 5, we use as a measure of financial development liquid liabilities of the financial system. Liquid liabilities is a traditional proxy for financial development, and unlike credit, liquidity is an indicator of size (Levine, Loayza, & Beck, 2000).

The results confirm that the effect of financial development on growth depends on the growth rates of the financial system relative to the real sector of the economy.

Finally, Table 6 accounts for the possibility that our results are sensitive to the countries' level of economic development. In this specification, we exclude low-income economies from the sample, so the new panel includes 61 countries. The positive coefficient on private credit to GDP and the negative coefficient on the interaction between private credit and the growth difference between credit and real output demonstrate that our results are not driven by the low-income economies.

[12] Another theoretical justification of the result is the "cream-skimming" theory, which we described in section 2.

Table 5: Financial development, real output development, and economic growth using other proxy variables. Non-overlapping five-year periods: 1971–1975, 1976–1980, 1981–1985, 1986–1990, 1991–1995, 1996–2000, 2001–2005, 2006–2010. First difference generalized methods of moments (FD-GMM) estimates.

Dep. variable: Real GDP growth	(1)	(2)
Bank credit to GDP	0.0610*	
	(0.0340)	
Bank credit (Bank and Ind. growth diff.)	-0.0215**	
	(0.0087)	
Liquidity		0.1268*
		(0.0724)
Liquidity (Liquidity and Ind. growth diff.)		-0.0135***
		(0.0038)
Initial GDP per capita	-0.1325**	-0.2646**
	(0.0600)	(0.1225)
Openness	0.0906*	0.0104
	(0.0544)	(0.0601)
Human capital	-0.0366	-0.0723
	(0.1448)	(0.1274)
Inflation	-0.0248***	-0.0215**
	(0.0078)	(0.0095)
Government expenditure	-0.2023***	-0.0890
	(0.0613)	(0.0694)
Observations	407	286
Countries FE	YES	YES
Year FE	YES	YES
Number of countries/instruments	101/109	102/94
AR(2)-test (p-value)	.046	.318
AR(3)-test (p-value)	.351	.827
Extreme point	2.84%	9.39%
P-value of credit and interaction	.0462	.0004
Hansen test (p-value)	.578	.492

In column 1, we include bank credit to GDP as a proxy for financial development and the interaction between bank credit to GDP and the difference between bank credit growth and industrial output growth to account for the potential non-linear effect between financial development and economic growth. Column 2 presents results using liquid liabilities as share of the GDP as a proxy for financial development and the interaction between liquid liabilities and the difference between liquid liabilities growth and real output growth. AR(2)-test and AR(3) are the Arellano-Bond test for serial correlation of order two and three, respectively. We use as instruments lags from $t-3$ to $t-5$ of each explanatory variable and the year dummies. The extreme point is the threshold value after which financial development has a negative effect on economic growth. The p-value of credit and interaction corresponds to a joint significant test of the coefficient of financial development and the interaction term between financial development and growth differences. Robust standard errors in parentheses. The standard error correction proposed by Windmeijer (2005) is implemented.*** Significant at 1% level, ** significant at the 5% level, * significant at the 10% level.

Overall, the results suggest that the effect of financial development on growth is decreased by unbalanced growth between financial development and real output. We also find a threshold value after which financial development has a negative effect on economic growth when it is not accompanied by growth in the real sector of the economy. In particular, the threshold value is between 1.72% and 4.97%, which suggests that a high level of divergence between the financial and real sectors is necessary for the financial development to have a negative effect on economic growth.

Table 6: Financial development, real sector development, and economic growth using high and middle-income economies. FD-GMM estimates. Non-overlapping five-year periods: 1971–1975, 1976–1980, 1981–1985, 1986–1990, 1991–1995, 1996–2000, 2001–2005, 2006–2010.

Dep. variable: Real GDP growth	(1)
Private credit to GDP	0.1226**
	(0.0611)
Private credit (Credit and Ind. growth diff.)	-0.0302***
	(0.0114)
Initial GDP per capita	-0.0661
	(0.2163)
Openness	-0.0198
	(0.0901)
Human capital	0.3806
	(0.2377)
Inflation	-0.0191
	(0.0200)
Government expenditure	-0.1595
	(0.1303)
Observations	256
Year FE	YES
AR(2)-test (p-value)	.016
AR(3)-test (p-value)	.711
Number of countries/instruments	61/48
Extreme point	4.06%
P-value of credit and interaction	.0098
Hansen test (p-value)	.425

Low-income economies are excluded in this specification, resulting in 61 countries. We use as instruments the lags from $t-3$ to $t-8$ of each explanatory variable; the matrix with instruments is collapsed. AR(2)-test and AR(3)-test are the p-value of the Arellano-Bond test for serial correlation of order two and three, respectively. The standard error correction proposed by Windmeijer (2005) is implemented. *** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

6. Concluding Remarks

In this paper, we discussed the effect of financial development on economic growth controlling for the relative speed of the development of the financial and real sectors. Our findings suggest that the positive effect of finance on growth is maximum under balanced growth of financial and real sectors. Acceleration of financial development that is not accompanied by growth in the real sector reduces positive effect of financial development on growth; this effect might become negative if financial development grows substantially faster than real output.

These results hold in cross-section and panel estimations and are robust to different measures of financial development.

Our results are consistent with existing theoretical studies, suggesting that an interdependency exists between financial sector and real sector technology, which in turn determines the effect of the financial sector growth on the GDP growth. These findings could serve as additional guidance for macro-prudential policy regulations.

The outcomes of this paper suggest several promising directions for future research. First, it would be interesting to test the nexus between the financial and real sector technologies and economic growth for individual countries. In addition, the effect of financial liberalization, following sudden changes in the political regime, would be interesting to study. Finally, conditional on the availability of appropriate forecasting techniques (see

Rivas & Pérez-Quirós, 2012), technological progress in different sectors could be used as a predictor of recessions.

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