Financial development, real sector output, and economic growth

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Abstract

This paper evaluates the interdependence between financial development and real sector output and its effect on economic growth. Using a panel data of 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 a rapid growth in private credit not accompanied by a growth in real output. Our findings provide empirical evidence in support of the theories postulating the existence of the optimal level of financial development given by the characteristics of an economy.

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1. Introduction

Financial development is an important determinant of economic growth. However, due to its broad definition and interdependence with other spheres of economic development, its effect on economic growth is unclear. Empirical studies periodically re-evaluate the relationship between financial development and economics 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 from developed and developing countries, we show that for smooth economic development, balanced growth of both the real and financial sectors is required. Our results are consistent with existing theoretical studies suggesting that there is a trade-off between the financial and real sectors expansion.

The channels through which financial development contributes to economic growth have been extensively discussed 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 the efficient allocation of resources (King and Levine, 1993; Greenwood, Sanchez and Wang, 2010), reduce agency costs and enhance innovation activities (Aghion, Howitt, and Mayer-Foulkes, 2005), contribute to high-return investments through risk-sharing (Greenwood and Jovanovic, 1990; Bencivenga and Smith, 1991; Saint-Paul, 1992). According to the latter approach, financial development may lead to high systemic risk (Allen and Carletti, 2006; Wagner, 2007; Gai et al., 2008; Gennaioli, Shleifer and Vishny, 2012), suboptimally low savings (Jappelli and Pagano 1994), suboptimally high allocation of labor to the financial sector (Philippon, 2010; Bolton, Santos, and Scheinkman, 2011), overheating economic capacity (Zeira, 1999), or the exertion of inefficiently high cost on the economy (Santomero and 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 governing 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, exogenous growth in other sectors' technologies could restore the optimal allocation of labor. As shown, for example, in Murphy, Shleifer, and Vishny (1991), the 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 (increase the demand for funds with a consequent rise in the interest rates). Savings, in turn, define the accumulation of capital in the economy, subsequent levels of output, and economic growth rates. Thus, a 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 financial and real sector development 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 share of the gross domestic product (GDP). This variable has been extensively used in the literature and is considered a good measure in comparison to available alternatives (Beck, Demirgüç-Kunt, and Levine 2007). Indeed, it reflects the state of technology in the financial sector: the amount of financial funds the system is able to transfer within a period of time. For robustness, we also use private credit by banks as share of GDP and liquidity as share of GDP. These proxies of financial development are also

measures of output of the financial sector. Accordingly, we proxy the real sector development by the industrial output growth. A number of studies have discussed the interrelationship 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 and Zingales, 1998; Larrain, 2006; Raddatz, 2006; Manganelli and Popov, 2013; and Huang, Fang, and Miller, 2014). Our paper considers the interrelationship between development of the financial and real sectors of the economy at the macro-level. We consider both 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 a panel data to characterize the relationship between the variables of interest over a shorter time-horizon. For the cross-section estimates, we also consider research and development expenditure share of GDP as a proxy for the real sector development. This variable is a common proxy for technological progress in the country and can be considered as an alternative measure of real sector development (assuming that it affects real sector differently from the financial sector).

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 and Bond (1991) and we use lags of the endogenous variables as instruments in a panel of five-year non-overlapping period. 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 for economic prosperity and sustainable economic growth. It developed during the decade of financial services' rapid expansion and the world economy's financial liberalization. The representatives of the first approach include King and Levine (1993), Rajan and Zingales (1998), and Levine, Loayza, and Beck (2000).

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

Deidda and Fattouh (2002) re-estimate findings by King and Levine (1993) by applying the threshold regression model and find support for the nonlinear effect of financial development on economic growth. Manganelli and Popov (2013) show that the effect of financial development on economic growth is nonlinear in Rajan and Zingales (1998) dataset: it weakens for very large financial markets. Cecchetti and Kharroubi (2012) also find an inverted U-shaped effect of financial development. 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 and Temesvary (2014) find that the impact of different types of bank lending on economic growth depends on the level of country's banking sector development.

Kaminsky and Reinhart (1999) suggest a possible negative channel of financial development effect on economic growth through triggering financial instability. Loayza and Ranciere (2006) find evidence of 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 and Wachtel (2011) argue that the positive effect of financial deepening is weakening over time, regardless of a country's level of development. Beck, Degryse, and Kneer (2013) reconsider findings of the paper by Levine, Loayza, and Beck (2000). The authors suggest that a larger financial sector increases growth and reduces volatility over the long run, while it stimulates growth at the cost of higher volatility over short-term horizons. Arcand, Berkes,

and Panizza (2012) find similar results using a number of estimation techniques and controlling for the endogeneity of financial development.

Calderón and Liu (2003) suggest that financial deepening contributes more to growth in developing countries than in industrial countries. 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 and Valev (2004) find a strong and positive effect of financial development 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. Section 2 outlines the conceptual framework underlying our hypothesis for empirical investigation. Section 3 describes the data. Empirical strategy is explained in section 4. Section 5 discusses the results. Section 6 concludes the paper.

2. Conceptual Framework

According to economic growth theory (pioneered by Solow, 1956; Romer, 1986; and Lucas, 1988), the main determinants of economic growth per capita are initial level of GDP, human capital, and physical capital accumulation. Economic growth per capita should be negatively related to the initial level of GDP because the economies tend to converge to their steady states with the speed diminishing in the amount of capital accumulated (this is known as 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. Besides, a number of other economic, political, institutional, and geographical factors have been included in empirical growth models (see Durlauf, Johnson, and 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 economic stability of the country: the fiscal policy indicators, the measures of openness to international trade, and the price stability measures (see, for example, Levine, Loayza, and Beck, 2000), along with the measures of financial development. Recently, Arcand, Berkes, and Panizza (2012) have analyzed potential non-linear effect of financial development on economic growth by including a quadratic term of financial development to the growth regression. 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.* The accumulation of systemic risk is one of the consequences of financial innovations and financial liberalization, both of which are captured by financial development (see, for example, Allen and Gale, 2004; Allen and Carletti, 2006; Wagner, 2007; Gennaioli, Shleifer, and Vishny, 2012). Higher systemic risk implies more frequent and/or more severe crises, which in turn negatively affect the economic growth rates in the short and medium term.

(2) *Financial development can decrease economic growth through resource misallocation.* The fast growing financial sector generates high rents and attracts resources that ideally should be employed in other sectors (see, for example, Santomero and Seater, 2000; Philippon, 2010; Bolton, Santos, and Scheinkman, 2011). Suboptimal allocation of the resources implies that the feasible growth rates may not be achieved, both in the short and in the long term. For example, if the financial sector attracts too many skilled workers, which

contribute to its growth and development (what is called "cream-skimming"), the other sectors could stagnate in the absence of sufficient human resources, with their growth and development lagged behind. The latter can have negative effect on the total output and output growth in the economy.

We argue that both of these 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."* Indeed, along the balanced growth path, by definition, all sectors of the economy should grow at constant rates. In particular, the real and financial sector should grow at commensurate rates. Whenever either sector grows disproportionately, the growth of total output of the economy will be affected. In order to prevent 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 remunerations.

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 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 weaken or could be even negative if there is an unbalanced growth in the financial and real sectors. The following sections describe the empirical methodology in detail.

3. Data

This section describes the data used in our estimation of the interrelationship between financial development, real sector development, and economic growth.

For the empirical analysis, we use a panel data on 101 countries from 1970 to 2010. All the data is from the World Development Indicators (WDI) published by the World Bank, except of the human capital index obtained from the Penn World Table 8.0 (Feenstra, Inklaar and Timmer, 2013).

As measures of financial development, we use the following indicators:

(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, and Beck, 2000 and Aghion, Howitt, and 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 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 GDP. It is the broadest measure of financial development used in the literature (Beck, Demirgüç-Kunt, and 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 adding up all outputs and subtracting intermediate inputs. 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 as an alternative measure of real sector development assuming that it affects real sector differently from the financial sector. This variable is only used for the cross-section (long-run) estimation, since it is only available 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 GDP; human capital index, based on years of schooling and returns to education (Feenstra, Inklaar and Timmer, 2013); openness to trade measured as a sum of exports and imports as a share of GDP; and the inflation measured as the growth rate of 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, hence countries with greater 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 from 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 period 1970-1973. The growth variables are the average annual growth rates across the period 1975-2010 in percentage. Given that the considered sample includes countries with different levels of development, the data are characterized by significant variation. We present the values for 25%, 50%, and 75% quantiles 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. To avoid our results from being entirely driven by the hyperinflation episodes, we use the hyperbolic sine transformation: $log(inflation + \sqrt{inflation^2 + 1})$.[1] On the other hand, the government spending is relatively homogeneous across countries. The average difference between the growth of the financial and real sector is around 2% when the financial development is measured by the total private credit or by the 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, 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 of the growth rates between the financial and real sectors

[1]This transformation allows to consider 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 or when we use the $log(inflation + 1)$ transformation.

(rows (14) of Table 1) is negative at the median; when the R&D is used as a proxy for real sector development, the median difference of the growth rates is 1.9615 with the mean value 0.7933.

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 from period 1970-1973. The growth variables are average annual growth rates across the period 1975-2010 in percentage.

Figure 1 shows a 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 looks 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 some circumstantial evidence on the interdependence between financial development, real sector development and economic growth, we consider episodes of severe crises studied by Reinhart and 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).

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 crisis of 2007-2008 in the United States.

[2]The coefficients for the level and the square of 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 or liquid liabilities to the GDP, are used instead of private credit to the GDP.

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: WDI.

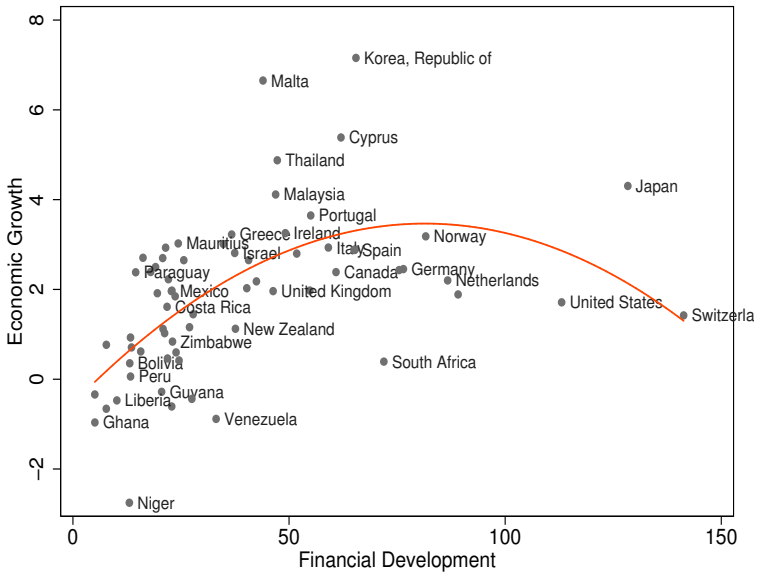
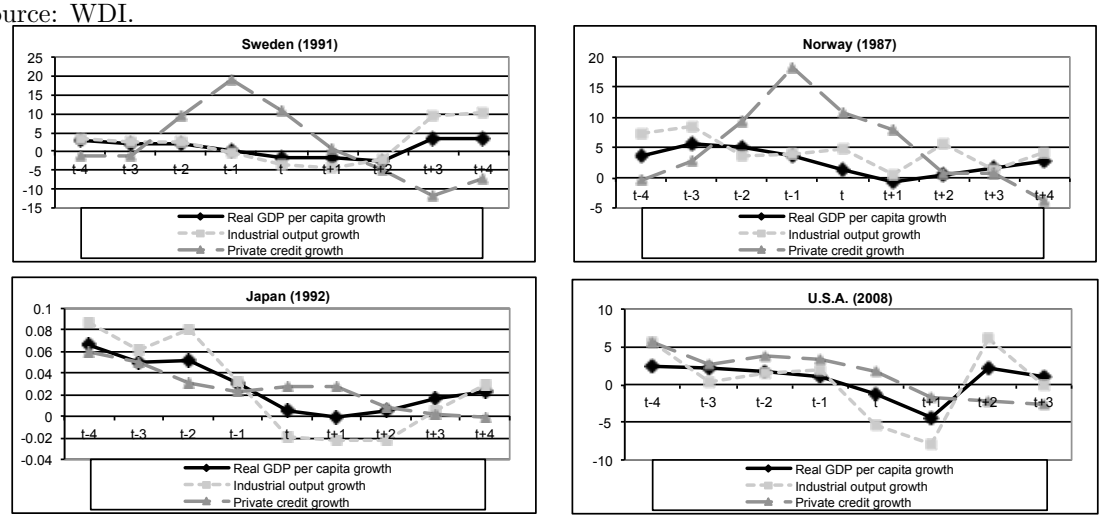


Figure 2: Financial development, real output growth and real GDP growth before and after the "Big" crises. Data source: WDI.



Period t corresponds to the big financial crisis year: 1991 in Sweden, 1987 in Norway, 1992 in Japan and 2008 in U.S.A.

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

4. Empirical strategy

As discussed above, 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 the 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, and Beck, 2000; Dabos and Williams, 2009; Arcand, Berkes, and 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 $t-1$, $FD_{i,t}$ 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 and 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 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 the above moment conditions and employ 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.

The above 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 excluding low income economies in Table 6 and show that the results are qualitatively the same.

[3] We do not use the System GMM as in our case the lags of the explanatory variables are relevant instruments. 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 as not all the countries are likely to be in the steady state.

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

5. Results

We first present the results of the long-run effect of financial development on economic growth and we test if 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 a 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 of 1975–2010; therefore, there is one observation per country. The basic regression is equation (**??**) without time subindices.

In column 1 of Table 2, we use 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-shaped relationship between financial development and economic growth documented in Arcand, Berkes and Panizza (2012) is an acceleration of the credit growth that is not accompanied by a 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%. On the other hand, the effect of financial development on growth is unambiguously positive if both, credit and real output, are growing at the same rate (i.e. if the difference in their growth rates is zero).

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, and Mayer-Foulkes (2005), Dabos and Williams (2009) and Levine, Loayza and Beck (2000).[6] As La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998) showed the legal origin across countries explain differences in covering secured creditors and differences in the efficiency of contract enforcement across countries. Our method of estimation 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 reduces 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 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 control factors have the expected sign but they

[5]Following Aghion, Howitt, and 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 and Beck (2000) for more details on the legal origin variables and its relationship with financial development.

are not statistically significant. The nonlinear relationship between financial development and growth is robust to the exclusion of the insignificant control factors.

Table 2: Financial Development, real sector development, and economic growth. Long run cross-section regression using averages over 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 period 1970-1973, initial human capital is the average human capital index from 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 parenthesis. *** Significant at 1% level, ** Significant at 5%,* Significant at 10%.

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 a 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 reduced 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 have reached this threshold over the period 1975 to 2010 include: Algeria, Armenia, Belarus, The Gambia, Georgia, Indonesia, Kuwait, Latvia, Montenegro, Mozambique, Romania, St. Lucia, and Ukraine.[7]

[7]We do not use R&D expenditure as the main proxy of real sector development for two reasons: first, R&D expenditure is likely to result on technological change that affect the development of all the sectors of the economy, not only the real sector; and second, R&D expenditure is only available from 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 period 1970-1973, initial human capital is the average human capital index from 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 parenthesis. *** Significant at 1% level, ** Significant at 5%,* Significant at 10%.

The findings of the cross-sectional analysis suggest that financial development may harms economic growth under certain circumstances. Developed financial systems reduce agency costs, transactions costs, mobilize savings and facilitate the efficient allocation of resources, thereby raising economic growth. Nevertheless, financial services compete with the rest of the sectors for inputs, specially for skilled workers. Therefore, expansions of the financial sectors unaccompanied by a growth or technological advance 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 a panel data controlling for the potential endogeneity of all the determinants of economic growth.

5.2. Panel Estimation

To examine the relationship between 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, as our aim is not to forecast expansions and recessions, but rather 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 and Mihov (2013), we use the real GDP per capita and human capital index as 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 1974–1976. All variables are averaged across each period, except the initial real GDP per capita and initial human capital.

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) estimations.

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 of 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. 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 parenthesis. The standard error correction proposed by Windmeijer (2005) is implemented. *** Significant at 1% level, ** Significant at 5%,* Significant at 10%.

Table **??** reports empirical results from model (**??**), 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 difference of 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 a positive effect of education and trade on economic growth and a negative effect of inflation and government expenditure on economic growth. Financial development is positively correlated with growth. However, the coefficient on the interaction term of private credit to

[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.

GDP and the difference of the growth rates of private credit to GDP and industrial output is significantly negative at the 1 percent 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.

The results presented in column 1 are not capturing the potential endogeneity of the explanatory variables. Some of our regressors are 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. There are also potential time varying omitted factors that may lead to spurious results. In order to account for these endogeneity threats, we use in columns 2, 3 and 4, the FD-GMM estimator and lagged level of all the 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 and 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 reduction of 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 the 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 by 4.70%.[11]

In column 4, we exclude from the specification the determinants of growth which 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 lead to an increase in economic growth by 9.44%, if private credit and real output grow at the same rate. On the other hand, 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 negative.

[9]To get this, 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 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 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).

These findings suggest that one of the main channels through which financial development may harm economic growth is an 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 suggest 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, as 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 **??**, we present the results of estimating the economic growth equation (**??**) using private credit issued by deposit money banks as the main proxy of 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 reduced when private credit growth exceeds industrial output growth by 2.84%. In column 2 of Table **??**, we use as a measure of financial development liquid liabilities of the financial system. Liquid liabilities is a traditional proxy of financial development and unlike credit, liquidity is an indicator of size (Levine, Loayza, and 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.

[12] Another theoretical justification of the result is the "cream-skimming" theory, as we have 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) estimations.

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 of 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 GDP as a proxy of 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) 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 and the year dummies. 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 parenthesis. The standard error correction proposed by Windmeijer (2005) is implemented.*** Significant at 1% level, **Significant at 5% level, * Significant at 10% level.

Finally, Table **??** accounts for the possibility that our results are sensitive to the level of economic development of the countries. In this specification, we exclude from the sample the low-income economies, so the new panel includes 61 different 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 demonstrates that our results are not driven by the low-income economies.

Overall, the results suggest that the effect of financial development on growth is reduced by an unbalanced growth between financial development and real output. We also find the existence of a threshold value after which financial development has a negative effect on economic growth when it is not accompanied by the 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

Table 6: Financial development, real sector development, and economic growth using high and middle-income economies. FD-GMM estimation. 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 lags from $t-3$ to $t-8$ of each explanatory variables; 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 1% level, **Significant at 5% level, * Significant at 10% level.

divergence between the financial and real sector is necessary for the financial development to have a negative effect on economic growth.

6. Concluding Remarks

In this paper we discussed the effect of financial development on economic growth controlling for the relative speed of financial and real sectors development. Our findings suggest that the positive effect of finance on growth is maximum under balanced growth of financial and real sectors. An acceleration of financial development that is not accompanied by growth in the real sector reduces the effect of financial development on growth, an a

These results hold both 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 inter-dependency 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. Also, 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 Gadea and Pérez-Quirós, 2012), technological progress in different sectors could be used as a predictor of recessions.

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