Excess Financial Development and Economic Growth

Lorenzo Ductor, Daryna Grechyna*

February 2013

Abstract

This paper investigates the possible negative influence of financial development on economic growth. We define excess finance as the difference between the financial and real output growth of the economy under which the aggregate output decreases. Based on a panel data of 33 OECD economies, we show that for smooth economic development the equilibrated growth of both the real and the financial sectors is required. Whenever financial development exceeds the development of the productive industries by more then 4.5% (when measured in terms of growth rates of the two sectors output), there is a thread of reaching the productive capacity bound of the economy, with consequent "financial"crisis. The existence of excess financial development may be justified by the theory of informational overshooting.

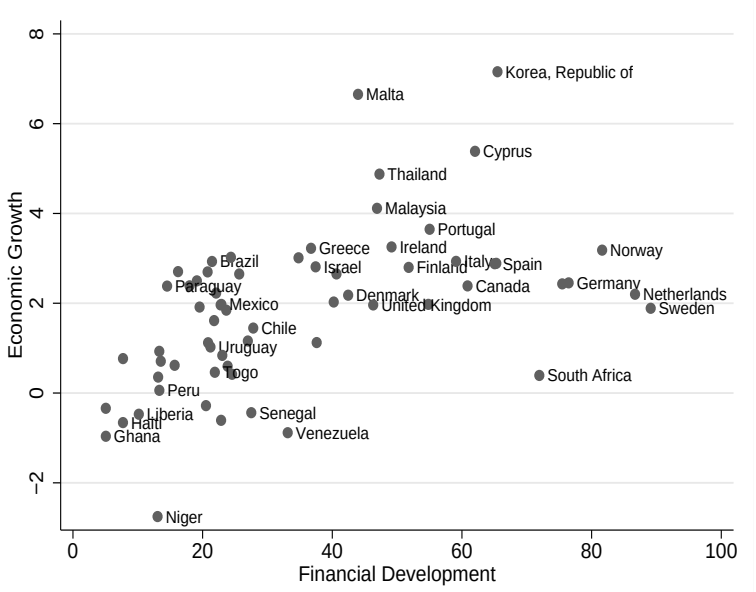
Keywords: excess financial development; economic growth; technological progress.
JEL Classification Numbers: O16; O40; E44.

*Lorenzo Ductor: Department of Economics, Massey University, New Zealand; e-mail: l.Ductor@massey.ac.nz. Daryna Grechyna: Department of Economics, the University of Auckland, New Zealand; e-mail: d.grechyna@auckland.ac.nz.

1 Introduction

Financial intermediaries that are better at ameliorating information asymmetries and facilitating transactions exert a positive influence on economic growth (Levine, Loayza and Beck, 2000). However, recent crises suggest that the excess of private credit or financial development might harm economic growth under certain circumstances. Traditional approach focus on linear relationship between economic growth and financial development, though non-linearities might be important. Figure 1 proposes a plot of the averages of economic growth rates for 63 developed and developing economies versus the averages of financial development, measured by the amount of private credit issued by deposit money banks and other financial institutions to the private sector as a share of GDP, over 1970-2005.

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: WBI and Beck and Demirgüç-Kunt (2009).



The relationship looks nonlinear, positive for low and intermediate levels of financial development, and negative for high levels of financial development.[1] Low levels of financial development characterize mainly low-income countries. The inverted-U relationship is even more profound if we keep the outliers (removed in Figure 1) - countries characterized by very high

[1]Quadratic fit of the coefficients for the level and the square of financial development measure are 0.1589 with std. error 0.0325 and -0.0013 with std. error 0.0003, respectively.

level of financial development and relatively low GDP growth rate - USA, Switzerland and Japan.

In this paper we re-examine the effect of financial development on economic growth. Analyzing the state of industrial and financial progress during the last four decades leads us to the following hypothesis: financial crises may occur because of over-developed financial system. This hypothesis is tested empirically, given the data on economic growth and indicators of financial development of the country. First, we re-estimate the effect of financial development on economic growth using the traditional specifications implemented in the literature and an updated dataset. We find that excess financial development has a negative effect on economic growth for the period 1970-2005. Second, we consider the growth in the industrial sector (consisting of manufacture and energy), and the growth in the financial sector (consisting of financial services), as two forces that jointly determine the economic growth of the country. We suggest that for smooth economic development, balanced technological progress in both the productive and the financial sectors of the economy is necessary. Technological progress in the real sector expands the production capacities of the economy, while growth in the financial sector allows to efficiently use these new capacities. We define excess financial development as a measure of the difference between the output growth of these two sectors that leads to a decline in total output. We concentrate on the real sector of the economy because it is considered to be the main predictor of productivity growth and thus of technological progress of the country (see Kaldor, 1967, and followers). The services sector, regardless its growing weight in total output does not add predictive power to our estimated model.[2]

The results of the paper suggest that there exist a critical level of financial development, after which the effect of financial development on economic growth is negative, both in the short and long run. In particular, in the short-run, when the growth of the financial sector is not accompanied by the real sector growth and the difference between both growth rates is higher than 4.45%, the effect of financial development on economic growth becomes negative. These results are robust to the specification of the excess financial development variable.

Up to now, the empirical literature did not concentrate on the possible negative effect of excess financial development on economic growth. Traditional empirical approach suggested comparison of economic and financial conditions among the countries characterized by different stages of their economic development. The works by Levine, Loayza and Beck (2000), Aghion,

[2]See Appendix B2 for a description of the results.

Howitt and Mayer-Foulkes (2005), Michalopoulos, Laeven and Levine (2009) are examples of studies that concluded that financial development facilitates economic growth and countries convergence. These results seem to be robust to different estimation technics (see for example, Oguzoglu and Stengos, 2008, Dabos and Williams, 2009). Moreover, Aghion, Howitt and Mayer-Foulkes (2005) build a theory and find evidence that the effect of financial development on economic growth vanishes as the country approaches the technological frontier. However, the authors do not consider the possibility of economy's overshooting due to the excess supply of financial funds, which would lead to the negative effect of financial development on economic growth. More related to our work, Arcand, Berkes and Panizza (2011) reevaluate the results of Levine, Loayza and Beck (2000) allowing for nonlinear relation between financial development and growth. They interpret the availability of excess finance in the economy as a result of expectations of bailout.

Theoretical justification of the ideas discussed in the paper may rely on the theory of informational overshooting, as considered by Rob (1991), Zeira (1994), and Zeira (1999). The economy grows, together with its financial system, as long as it does not reach its production capacity limit. Given that this limit is unknown, rational agents continuously learn about it. The expectations are optimistic until, at some point in time, the economy hits the limit. Technological progress in the real sector allows to expand the capacity limit. We suggest, that the occurrence of the financial crises may be prevented as long as the pace of progress in the real sector is higher than the pace of progress in the financial sector. Alternative theoretical justification of the existence of excess finance may rely on negative externalities resulted from over-developed financial system.[3]

The existing literature proposes a number of other justifications of cautious attitude towards fast development of financial sector. The idea of informational overshooting by Zeira (1994) is used by Biais, Rochet and Woolley (2009) to explain financial crises. The authors show how uncertain strength of innovation leads to growing confidence and rents as long as the innovation bound is not reached. If the innovation is fragile, the economy goes into crisis. Barbarino and Jovanovic (2007) provide a microfoundation for market crashes based on informational overshooting. Given uncertain demand, the economy grows together with optimism until demand outstrips the capacity. They provide an explanation of the dot-com crisis of 2000-2001. Similar idea is developed in Wang (2007). Gennaioli, Shleifer and Vishny (2010) demonstrate how the financial services may be excessive when there are certain unlikely risks faced by the investors.

[3]For related research on the topic, see for example, Philippon (2010) and Bruno, Rochet and Woolley (2009).

When the risks are recognized, investors switch from the risky securities, and the markets become fragile because of the excessive volume of the new claims. Finally, Santomero and Seater (2000) derive the optimal size of the financial sector evaluating the trade-off between the costs of maintaining this sector and the benefits of improved efficiency because of monitoring the production process by the financial sector.

We should stress the differences and similarities between this paper and two recent closely related works: the work by Arcand, Berkes and Panizza (2011) and the work by Dabos and Williams (2009). Similar to Dabos and Williams (2009), we re-evaluate the effect of financial development on economic growth using the same dataset as Levine, Loayza and Beck (2000), estimating the model by two-step system GMM, correcting the standard errors as described in Windmeijer (2005) and applying a reduced set of instruments. We find that financial development measure is a significant and positive determinant of economic growth for the period 1961-1995. In addition to that, our paper estimates the effect of financial development on economic growth in an updated dataset. We use a set of variables analogous to those used by Levine, Loayza and Beck (2000), but extended to the period 1970-2005. Once we re-estimate our model on this extended dataset using a two-step system GMM estimation, with corrected standard errors and with a reduced set of instruments, the effect of financial development on economic growth becomes negative. Consistent with previous findings, when we focus on the period before 1990s, the updated dataset reports positive effect of financial development measures on economic growth.

Similar to Arcand, Berkes and Panizza (2011), we analyze the non-monotonic relationship between economic growth and financial development. Our results are consistent with their findings, that is, we obtain a non-linear relationship between financial development and economic growth; too much finance might lead to a reduction of economic growth. However, the rest of the coefficients in such regressions are insignificant, and the validity of the instruments is doubtful as it is shown by the Sargan test statistics.[4] Therefore, we try to test a deeper relationship between finance and growth, based on the relative rates of development of the real and financial sectors of the economy.

The paper is organized as follows. Section 2 presents the estimation of the effect of financial development on economic growth in the specification analogous to the previous literature. In section 3 we investigate empirically the interdependence between financial sector development,

[4]See tables in Appendix B1, or the results reported in Table 3 of Arcand, Berkes and Panizza, 2011.

real sector development, and economic growth. In section 4 we discuss possible theoretical justification of the existence of excess finance. Section 5 concludes the paper.

2 Financial Development and Growth

The aim of this section is to re-evaluate the effect of financial development on economic growth, using the traditional measures of financial development and econometric tools allowing to obtain robust and consistent estimates. We re-estimate the results of Table 5 in Levine, Loayza and Beck (2000) using a reduced set of instruments and implementing the Windmeijer (2005) small-sample correction for the two-step standard errors, without which those standard errors tend to be severely downward biased (Roodman, 2006). We find evidence of not always positive influence of financial development on economic growth. We suggest that the effect of financial development on economic growth might depend on the growth and characteristics of the other sectors.

Our basic hypothesis states, that in order to have positive influence on economic growth, country's financial development must be accompanied by corresponding technological development in other productive sectors of the economy. The next section proposes several tests of this hypothesis.

In the rest of this section we briefly describe the methodology, applied in Levine, Loayza and Beck (2000) and related studies to evaluate the effect of financial development on economic growth. Then, we briefly review the data used in the estimation and present our estimation results.

2.1 Methodology

Similar to Levine, Loayza and Beck (2000), Dabos and Williams (2009) and Arcand, Berkes and Panizza (2011), we use the System Generalized-Method-of-Moments (GMM) estimator developed for dynamic models panel data by Arellano and Bover (1995) and augmented by Blundell and Bond (1998). Following Levine, Loayza and Beck (2000), the regression equation considered is:

$$y_{i,t} - y_{i,t-1} = (\alpha - 1)y_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t}, \tag{1}$$

where y is the logarithm of real per capita GDP, X represents the set of explanatory variables, η is an unobserved country-specific effect, ε is the error term, and the subscripts i and t represent country and time period, respectively. We can rewrite equation (1) as,

$$y_{i,t} = \alpha y_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t}, \tag{2}$$

Then, we eliminate the country-specific effect taking first-differences of equation (2):

$$y_{i,t} - y_{i,t-1} = \alpha(y_{i,t-1} - y_{i,t-2}) + \beta'(X_{i,t} - X_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}). \tag{3}$$

Under this specification the explanatory variables are endogenous because of feedback from growth to its determinants, or because of the common effects of omitted variables on both growth and its explanatory variables or perhaps due to measurement error of some proxy variables. Moreover, in equation (3) by construction the new error term, $\varepsilon_{i,t}-\varepsilon_{i,t-1}$, is correlated with the lagged dependent variable, $y_{i,t-1}-y_{i,t-2}$. 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 GMM dynamic panel estimator uses lags of explanatory variables in levels as instruments to solve the endogeneity problem under the following moment conditions:

$$\begin{aligned} E[y_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \quad for\ s \geq 2, t = 3, ..T, \\ E[X_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \quad for\ s \geq 2, t = 3, ..T. \end{aligned} \tag{4}$$

We apply system GMM estimator that combines the difference estimator defined above with a levels estimator. The inclusion of an equation of the variables in levels allows us to use information of differences among countries that comes purely from the cross-section part of the sample.

The levels equation uses lags of differences of explanatory variables as instruments. These are appropriate instruments under the following additional assumption: although there may be correlation between the levels of the right-hand side variables and the country-specific effect in equation (2), there is no correlation between the differences of these variables and the country-

specific effect:[5]

$$E[y_{i,t+p}\eta_i] = E[y_{i,t+q}\eta_i],\ E[X_{i,t+p}\eta_i] = E[X_{i,t+q}\eta_i] \quad \text{for all} \quad p, q, \tag{5}$$

$$\begin{aligned} E[(y_{i,t-1} - y_{i,t-2})(\eta_i + \varepsilon_{i,t})] = 0, \\ E[(X_{i,t-1} - X_{i,t-2})(\eta_i + \varepsilon_{i,t})] = 0. \end{aligned} \tag{6}$$

A GMM procedure is employed to generate consistent and efficient parameter estimates. We provide the necessary checks of the consistency of this estimator. In particular, we use Sargan and Hansen tests of over-identifying restrictions to test the exogeneity of the instruments; we check the validity of the assumption that there is no serial correlation between error terms; we deal with the small sample standard errors bias by applying the correction suggested by Windmeijer (2005); and we collapse the instruments in blocks, as too many instruments can overfit endogenous variables and fail to expunge their endogenous components (Roodman, 2006).[6]

2.2 Data

We consider two panel data sets: i) the same panel data as used by Levine, Loayza and Beck (2000), which contains information on 74 countries over the period 1961-1995 (we use this data set to test the robustness of their results to Windmeijer standard-errors correction), ii) data for 82 countries over the period 1971-2005. The data is averaged over non-overlapping five-year periods. 5-year averages are used in empirical growth models to smoothen out the cyclical patterns of the data.

Firstly, we use the same dataset as Levine, Loayza and Beck (2000) to replicate their results, correcting for the standard errors bias and for the possible overfitting due to a large number of instruments. This dataset consists of non-overlapping averages over the five years periods from 1961 to 1995 for 74 countries. The dependent variable is economic growth per capita. The set of control variables includes: the level of real GDP per capita in the beginning of each five-year period (Initial GDP), measure of openness of the country (Trade), defined as a sum of real exports and imports as share of real GDP; inflation rate (Inflation), defined as a log difference

[5]The same moment conditions were used by Levine, Loayza and Beck (2000). For theoretical justification, see Arellano and Bover (1995).

[6]We use the Stata module xtabond2, developed by Roodman (2006).

of Consumer Price Index; government expenditures to GDP (Gov. size); the proxy for human capital (Schooling), measured as average years of secondary schooling in the population over 15; and black market premium (Black mkt premium), defined as a ratio of black market exchange rate and official exchange rate minus one. The main variables of interest are the commonly used proxies for financial development:

i) Private credit, defined as the value of credits by financial intermediaries to the private sector divided by GDP;

ii) Bank credit, defined as the credit by deposit money banks to the private sector divided by GDP;

iii) Liquid liabilities of the financial system (currency plus demand and interest-bearing liabilities of banks and non-bank financial intermediaries) divided by GDP.

Secondly, we estimate the same specification as in Levine, Loayza and Beck (2000), but using the new dataset covering the time period 1971-2005. For this purpose, we consider the same measures of financial development defined above by i)-iii), from the dataset constructed by Beck and Demirgüç-Kunt (2009). We use analogous control variables, extracted from the World Bank Development indicators, except for the proxy for human capital (Tertiary), which in this second case is measured as enrollment in tertiary education[7].

The summary statistics and the data sources used in the estimations are reported in Appendix A.

2.3 Estimation Results

Table 1 presents the estimation results based on the dataset used in Levine, Loayza and Beck (2000) for the time period 1961-1995. Column 1 shows the results using private credit as the proxy for financial development. Column 2 presents the results using bank credit as the financial variable and column 3 show the results using liquid liabilities as a proxy for financial development. The Windmeijer (2005) standard errors correction is implemented, we also collapse the instruments. Period-specific dummies are included to account for specific time trends.

The financial development measures have a positive and significant effect on economic growth, whereas the black market premium appear to be negatively associated with GDP growth. The rest of the variables are insignificant.

[7]We were not able to find the human capital proxy used by Levine, Loayza and Beck (2000) for the years after 1995. The results of estimation are robust to this change of variable.

Table 1: Financial Intermediation and Growth: Re-estimation of the System GMM estimates of Levine, Loayza and Beck (2000) for time period 1961-1995

Variables/ System GMM Models:	Private Credit (1)	Bank Credit (2)	Liquid Liabilities (3)
Initial GDP	−.475	−.379	.172
	(1.142)	(1.194)	(1.228)
Government Size	−.421	−.167	.782
	(1.624)	(1.665)	(1.896)
Trade	−.625	−.507	−1.529
	(1.209)	(1.262)	(1.212)
Inflation	1.619	1.131	3.758
	(2.745)	(2.439)	(2.913)
Schooling	−1.515	−1.163	−4.266
	(3.491)	(3.605)	(3.879)
Black Market Premium	−1.474*	−1.509*	−3.039**
	(.811)	(.821)	(1.227)
Private Credit	2.167**		
	(.949)		
Bank Credit		1.833**	
		(.841)	
Liquid Liabilities			4.338**
			(1.358)
Constant	−.733	.357	−13.697
	(8.031)	(8.414)	(11.436)
Year Dummies	YES	YES	YES
Number of Instruments	21	21	21
Number of Countries	74	74	74
Number of observations	439	439	439
AB-test for AR(2) (p-value)	.906	.994	.973
Hansen J-test (p-value)	.569	.340	.709
Sargan test (p-value)	.028	.006	.385

a.

For comparison purpose with Levine, Loayza and Beck (2000) all variables are taken in natural logs with the exception of Inflation, Schooling and the Black market premium, whose transformation is log(variable+1). The instruments employed in the estimation are: the lags of the variables from t-4 to t-2, the first difference of the variables lagged one period, the year dummies and the first difference of the year dummies. ** Significant at 5% level, * Significant at 10% level.

Table 2 presents the estimation results based on the updated dataset for the time period 1971-2005. Under this sample, the effects of financial development on economic growth becomes negative regardless of the financial development measure considered. As expected, human

capital has a positive impact on economic growth. The rest of the variables have the expected signs. Note that we do not include the black market premium in the second estimation, since this measure disappeared in the middle of 1990s. The results are robust to alternative proxies for human capital.

Table 2: Financial Intermediation and Growth: System GMM estimates for the time period 1970-2005

Variables/ System GMM Models:	Private Credit (1)	Bank Credit (2)	Liquid Liabilities (3)
Initial GDP	−.648	−.744	.054
	(1.285)	(1.337)	(1.289)
Government Size	−4.106	−3.687	−6.532*
	(2.837)	(3.043)	(3.363)
Trade	.573	1.582	1.839
	(1.582)	(2.817)	(2.974)
Inflation	−.932	−1.274**	−1.415
	(.905)	(.603)	(.920)
Tertiary Education	3.646*	3.492*	3.819*
	(1.967)	(1.838)	(1.985)
Private Credit	−1.957**		
	(.903)		
Bank Credit		−1.680**	
		(.728)	
Liquid Liabilities			−4.726**
			(1.638)
Constant	16.258	4.611	1.831
	(20.351)	(16.921)	(15.717)
Year Dummies	*YES*	*YES*	*YES*
Number of Instruments	31	31	31
Number of Countries	82	82	82
Number of observations	367	367	367
AB-test for AR(2) (p-value)	.360	.232	.398
Hansen test (p-value)	.228	.303	.185
Sargan test (p-value)	.295	.470	.659

b.

For comparison purpose with Levine, Loayza and Beck (2000) all variables are taken in natural logs with the exception of Inflation and Schooling whose transformation is log(variable+1). The instruments employed in the estimation are: the lags of the variables from t-4 to t-2, the first difference of the variables lagged one period, the year dummies and the first difference of the year dummies. *** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level.

Comparison of tables 1 and 2 suggests that once we consider a more recent period, financial development seems to harm economic growth. Interestingly, the effect of financial development on economic growth reported in Table 2 becomes positive when we restrict the updated dataset to the period before 1995. Among the possible reasons of such a change, we could consider a slowdown of technological progress during the 1990s. If this was a case, further financial development could have a negative influence on economic growth, according to our hypothesis. We propose more discussion on this issue in the next section.

3 Financial Development, Real Sector, and Growth

This section analyses the empirical facts related to the main hypothesis under consideration: is the harmonized development of both the financial sector and the technological possibilities of the country needed for the financial development to have unambiguously positive effect on economic growth?

In attempt to answer this question we re-evaluate the effect of the financial development on economic growth controlling for the technological development of the country. As a proxy of technological development we consider the industrial output growth, the unit labor cost growth, and the labor productivity growth in the industrial sector.

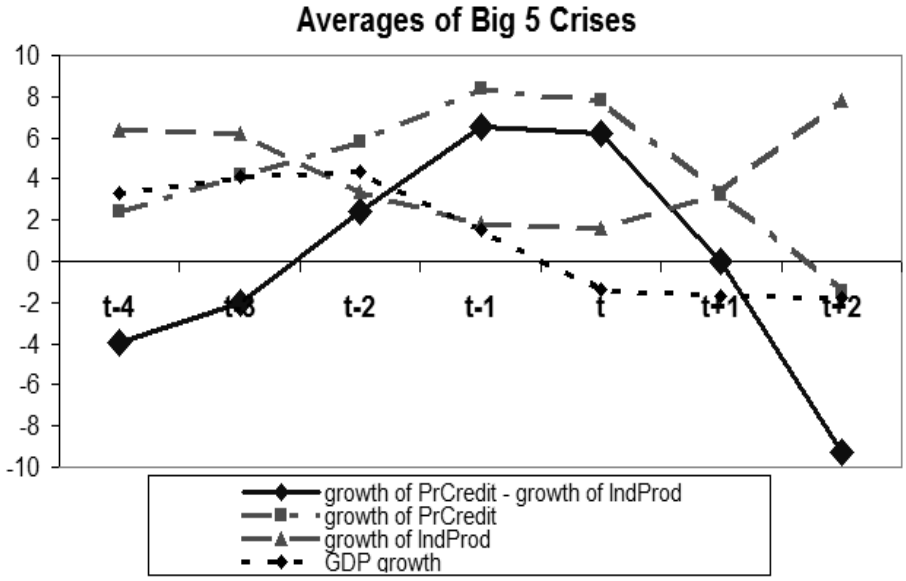
As it has been pointed out by Reinhart and Rogoff (2008) and documented in Kaminsky and Reinhart (1999), "the majority of historical crises are preceded by financial liberalization". Financial liberalization has taken place in the United States before the financial crisis of 2007. "New unregulated, or lightly regulated, financial entities have come to play a much larger role in the financial system, undoubtedly enhancing stability against some kinds of shocks, but possibly increasing vulnerabilities against others. Technological progress has plowed ahead, shaving the cost of transacting in financial markets and broadening the menu of instruments"(Reinhart and Rogoff, 2008). These authors analyze the similarities of the most severe financial crises, among which they define the "big 5"crises episodes in Spain (1977), Norway (1987), Finland (1991), Sweden (1991) and Japan (1992).

First, to obtain some circumstantial evidence, we intend to analyze the relative development of the financial and the real sector preceding the severe crises episodes in the economies studied by Reinhart and Rogoff (2008). In particular, we look at the financial development, defined as a growth rate of the value of credits by financial intermediaries to the private sector divided by GDP four periods before and after the crisis occurred, for the "big 5 crises"economies. We also

look at the growth rate of labor productivity in the real (industrial) sectors of these economies prior and just after the crises episodes.

Figure 2 presents the averages of these measures of financial and technological development, as well as averages of their differences and average economic growth rates for the following "big 5"financial crises: Norway (1987), Finland (1991), Sweden (1991), Japan (1992), and the USA (2007).[8] Period t in the figure represent the year of crisis, and $t-i$, $t+i$ -years before and after the crisis, respectively.[9]

Figure 2: Financial and technological development before and after the "Big 5"crises



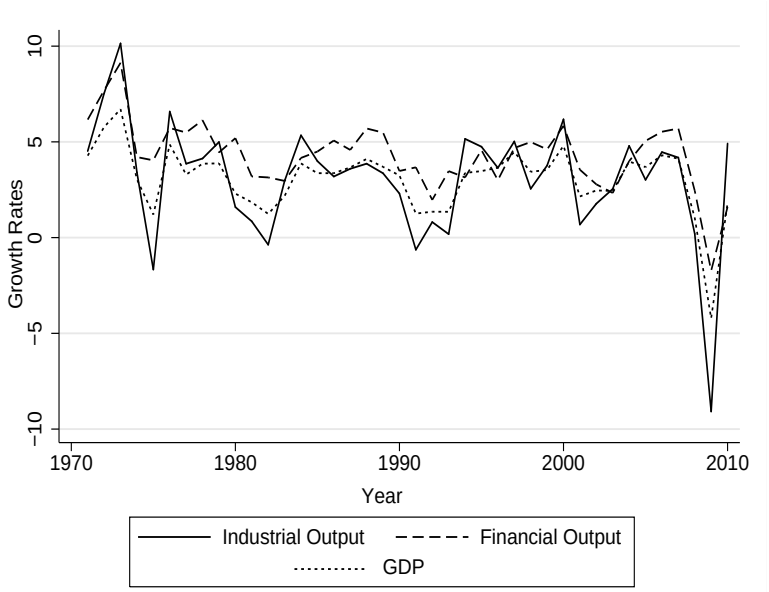
As we can observe from Figure 2, the amount of private credit increases significantly 1-2 years before the severe crisis episode, while the labor productivity of the industrial sector of the economy grows at a significantly lower rate during two years preceding the financial crisis. Considering the two factors together, the difference between financial development and what we call here industrial development seems to augment prior to the financial crises episodes. This demonstrates that the financial development on average was faster than real sector development before the five biggest financial crises defined by Reinhart and Rogoff (2008).

Figure 3 shows the industrial and financial output growth averages across 33 OECD countries - all of them except Estonia - for the time period 1970-2010. We want to test whether non-synchronized financial and industrial growth (captured in the figure by significant differences between the two time-series) leads to lower economic growth.

[8]We do not have data for the Spanish crisis in 1977.

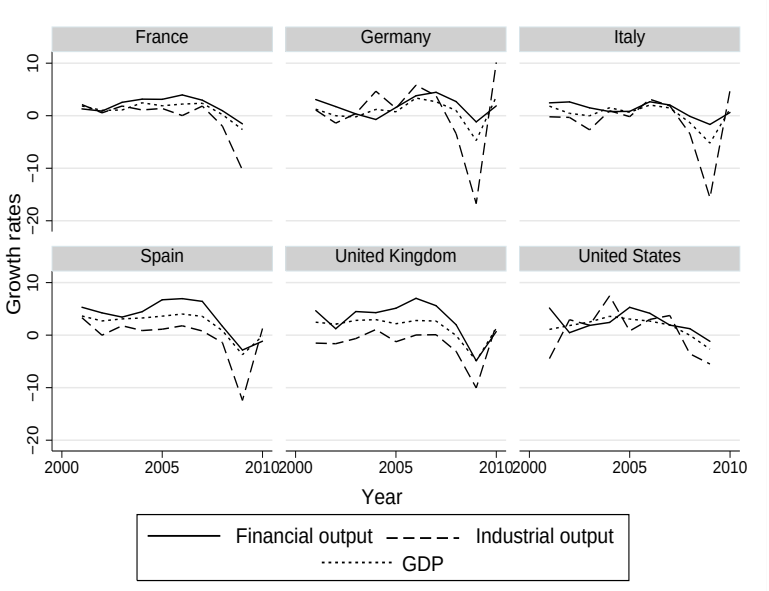
[9]The plots of individual countries' time-series (non-averaged) may be found in appendix C.

Figure 3: Industrial and Financial growth output. Average across countries. Data Source: OECD.



Figures 4 focuses on the period of the last crisis, and plots the data from 2000 to 2010 for the biggest economies in Europe and United States. Note that the gap in growth of output in the financial and industrial sectors is augmented around year 2005 for the US, prior to the financial crisis of 2007.

Figure 4: Growth rates during the last ten years.



Further, we try to explore the effect of relative development of the financial and real sectors on economic growth using the panel data for a set of countries. We try to capture both the short and the long run effects. For the long run estimation we use pooled data across the time period 1970-2005 for 63 developed and developing countries. For the short run estimates, we consider a panel data of 33 OECD economies, averages over five-years non-overlapping periods for the time period 1970-2005. Our main proxy for technological development is the industrial output growth. We also consider as determinants of economic growth the difference of the growth rate in the financial and industrial sectors and a quadratic term of this difference, which takes into account potential non-linearities.

In addition, we include in our analysis the industrial output growth as a control variable, as we want to consider variations of the difference of the growth rates in the two sectors not determined by the industrial sector growth. Industrial growth is one of the main predictors of economic growth (Kaldor, 1967). However, there is still an important variation of economic growth which remains unexplained. We focus on explaining part of this variation through the financial sector.[10]

After describing our data, we estimate the impact of excess financial development on economic growth in the long and short run using cross-section analysis and System GMM, respectively. Then we carry out some robustness check using other proxy variables for excess financial development. The results provide strong evidence in favor of our general hypothesis: excess financial development may harm economic growth.

3.1 Data

In our empirical analysis we use a panel-data on 33 OECD countries - all of them with the exception of Estonia - over the period 1970-2010, taken from the OECD database, World Bank, and Levine, Loayza and Beck (2000).[11] For a cross section estimation we use averaged data for 63 countries over the period 1970-2010. To measure "excess" financial development, we construct four indicators of differences between the financial and industrial sector:

i) Difference between the financial and industrial output growth.

[10]In appendix B2 we present the estimations that include not only the industrial sector growth, but also a sector of services as a proxy for technological progress. Our conclusions do not change.

[11]Unfortunately, we have no data on industrial output growth or industrial productivity for non-OECD countries.

ii) Difference between the private credit divided by GDP and industry output divided by GDP.

iii) Difference between the financial and industrial unit labor cost growth.

iv) Difference between the financial and industrial unit labor productivity growth.

The first two indicators are our main measures of excess financial development. The intuition behind the choice of the explanatory variables lies in our understanding of the sources of economic growth of the country. For steady economic development, according to our hypothesis, the balanced co-development of the financial and real sector is required. Development (technological progress) in the real sector insures growth of economy's productive possibilities, and precludes the economy from going into recessions (caused, for example, by the presence of capacity limits). Financial development is necessary for the economic growth of the country as it allows the growing capacities of the economy to be fully utilized. However, whenever the latter exceeds the former, the productive capacity limits may be reached at some point in time, causing economic downturn.

The difference between the financial output growth and the real output growth are computed using data from the OECD. The financial output is measured as the GDP produced by financial intermediation, real estate, renting and business activities. The real output is obtained as the GDP produced in industry including energy. The difference in the growth of both sectors and its quadratic term partially capture the effect of excess financial development on growth.

The second indicator of excess financial development is obtained as the difference between the value of credits by financial intermediaries to the private sector, divided by GDP (the measure from Levine, Loayza and Beck, 2000) and the real output divided by GDP (Industry share of GDP). The value of credits by financial intermediaries to the private sector is the preferred measure of Levine, Loayza and Beck. This measure is also used by, for example, Aghion, Howitt and Mayer-Foulkes (2005), Oguzoglu and Stengos (2008) and Dabos and Williams (2009). Industrial output divided by GDP is used as a corresponding measure of technological development, because its units of measurement are compatible with the considered financial development indicator.

The third and fourth indicators of financial development are closely related measures of productivity growth in the two sectors. They are taken from OECD dataset and are used for robustness check. We considered both labor productivities per hour worked and per employee. Both of these measures are highly correlated with the industrial output growth and with the unit labor cost in industry. The labor productivity of the financial sector, on the contrary,

does not vary a lot for the time period considered, and it is not strongly correlated with other measures of financial development, such as the amount of private credit or financial output.[12]

We support the claim that financial development contributes to growth, as found in Levine, Loayza and Beck (2000). However, when there is excess financial development, that is, when the difference between financial and industrial development is very high, the effect of finance on growth may become negative. To account for this non-linear relationship, we always include a quadratic term of the excess financial variable in our regressions.

Table 3 shows summary statistics of the main variables used in the estimation equations. Column 1 shows the mean of the variables using the 33 countries and the 40 years of our panel, from 1970 to 2010. Column 2 shows the standard deviation of each variable and column 3 the correlation between each variable and real GDP growth per capita.

Table 3: Summary Statistics of the main variables

Variables/Statistics	Mean	St.d.	Corr.
Real Growth Per capita	2.282	3.116	1.000
Industrial Output Growth	2.999	5.266	.745
Financial Output Growth	4.234	4.445	.409
Diff. between Financial and Industrial Growth	1.235	5.884	-.329
Industrial Labor Cost Growth	6.204	13.126	-.137
Financial Labor Cost Growth	8.705	12.813	.070
Difference in Labor Cost Growth Rates	3.126	6.960	.286
Labor Productivity Growth in Industry	3.760	4.211	.463
Labor Productivity Growth in Finance	.295	4.781	.027
Difference in Labor Productivities	-3.465	6.147	-.300
Private Credit Share of GDP	63.195	35.831	-.077
Industry Share of GDP	25.071	5.287	.123
Difference in Pr. Credit and Industry Shares	39.031	37.556	-.094

c.

The sample consists of 33 countries across 40 years, from 1970 to 2010. Column 3 shows the correlation between each variable and real GDP growth per capita.

Observe the high volatility of all the variables and the negative correlation between the difference variables and real GDP growth per capita.

[12]A detailed description of the data and its sources are presented in Appendix A.

3.2 Estimation Results

First, we examine the relationship between excess financial development and growth using a pure cross-sectional estimator. Next, we use GMM dynamic panel procedures that more comprehensively confront problems induced by country-specific effects and endogeneity.

3.2.1 Impact of excess financial development on long-run economic growth: Cross-sectional analysis

Following Levine, Loayza and Beck (2000), we consider not only OECD countries but also developing countries in the cross section analysis. Here we focus only on the difference between private credit and industry share of GDP as a measure of excess finance, as the other indicators of excess finance are only available for OECD countries.

The pure cross-sectional analysis uses data averaged over 1970-2005, therefore, there is one observation per country. The basic regression takes the form:

$$GROWTH_i = \alpha + \beta_1 DIFF_i + \beta_2 DIFF_i^2 + \beta_3 S_i + \gamma[CONDITIONINGSET]_i + \varepsilon_i,$$

where the dependent variable, $GROWTH_i$ equals real per capita GDP growth, $DIFF_i$ is the difference between private credit and industry share. We include a quadratic term of this variable as the expected relationship between excess financial development and growth is not linear. As we want to focus on excess financial development, we control for the industry share, thus, the DIFF variable is capturing variations in the difference between the two sectors due to variations in the private credit. $CONDITIONINGSET$ represents a vector of conditioning information that controls for other factors associated with economic growth. The conditioning information set includes the constant, the logarithm of initial GDP, a proxy for human capital, government size, inflation and openness to international trade. The control variables are the same as the ones used in the section above. The initial income variable is used to capture the convergence effect and school attainment is used to control for the level of human capital. Government size and inflation captures macroeconomic stability.

To examine whether cross-country variations in the exogenous component of excess financial development explains cross-country variations in the rate of economic growth, the legal origin indicators are used as instrumental variables for the excess financial development, $DIFF_i$ and its square. This cross section analysis estimates the structural long-run equilibrium of the model assuming homogeneity over the 63 countries.

Our method of estimation is the two-steps generalized method of moments (GMM). In our estimation we only use linear moment conditions, which require the instrumental variables - legal origin variables - to be orthogonal to the error term, ε_i. In the context of the cross-sectional growth regressions, the moment conditions mean that legal origin may affect per capita GDP growth only through the excess financial development variable, $DIFF_i$. We test this condition using the Hansen J-statistic. Our instruments have been intensively used in the literature to capture the exogenous effect of financial development on growth.[13] We confirmed through F-test that the instruments are relevant, that is, they are enough correlated with the troublesome variable, $DIFF_i$.

Table 4 presents the results from the cross-section analysis. Column 1 shows the results without controlling for the industrial share, in column 2 we control for the industrial share so that the excess financial variable captures difference in the two sectors due to variations in the amount of private credit.

[13]For example, in Aghion, Howitt and Mayer-Foulkes (2005), and Dabos and Williams (2009). See Levine, Loayza and Beck (2000) for more details on the legal origin variables and its relationship with financial development.

Table 4: Long-Run Effects of Excess Financial Development on Growth

Economic Growth	(1)	(2)
Excess Finance	6.457**	7.294**
	(3.035)	(3.416)
(Excess Finance)^2	−4.008$^{(*)}$	−5.060*
	(2.455)	(3.047)
Log Trade	.367	2.206
	(.236)	(.235)
Tertiary Education	.494*	.268
	(.275)	(.353)
Log Inflation	2.813	2.299
	(2.249)	(2.206)
Log Initial GDP	−1.148***	−1.192***
	(.225)	(.235)
Log Government Size	−.046	.097
	(.335)	(.336)
Industry Share	−	7.252**
		(3.169)
Constant	9.930***	8.181***
	(2.123)	(2.439)
Number of observations	63	63
F-test (p-value)	5.760(.000)	6.370(.000)
Hansen J-test (p-value)	.002(.964)	.020(.887)

d.

Excess financial is defined as the difference between Private credit/GDP and Industry value added/GDP. Industry share is the Industry value added/GDP. *** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level. $^{(*)}$ Significant at 10.3% level.

The results show that excess private credit decreases economic growth in the long-run. In particular, the optimal rate of financial development is achieved when the private credit to GDP is 70% higher than the industry output share of GDP. When we do not include the industrial share, the optimal difference between financial and industrial output is higher (about 80%). However, without controlling for the industry share, the increase in the difference between the financial and industrial share variables may be due to changes in industrial output, without corresponding changes in the financial sector. The rest of control variables have the expected signs, though most of them are not statistically significant.

3.2.2 Impact of excess financial development on short-run economic growth: System GMM

For our panel estimation, we follows the strategy outlined in the previous section. We use the System Generalized-Method-of-Moments (GMM) estimator developed for dynamic models of panel data introduced by Arellano and Bover (1995) and augmented by Blundell and Bond (1998).

Our panel consists of data for 33 OECD countries over the period 1970-2010.[14] We average data over non-overlapping, five-year periods, so there are seven observations per country (1971-75; 1976-80; 1981-85; etc.). The initial GDP and initial level of educational attainment correspond to the first year of each observation interval.

Table 5 presents the results of the System GMM estimator using the difference between the financial and the industrial output growth as a measure of excess financial development.[15] We use the two-step GMM estimation with the standard error correction proposed by Windmeijer (2005). We also "collapse"the instruments to avoid overfit of the endogenous variables due to the use of too many instruments (the rule of thumb is to use a number of instruments smaller or equal to the number of groups). We also include period-specific dummies, which apart from their usual role of capturing deterministic trends in the data, serve as exogenous instruments.

[14]We do not have data on the openness to trade and schooling for the year 2010.

[15]Table 10 in the appendix B2 shows the results using as excess financial development the difference between financial and industrial plus service output growth.

Table 5: System GMM. Excess financial development and growth

Economic Growth	System GMM
Excess Finance	0.211*
	(.115)
(Excess Finance)^2	−0.024**
	(.010)
Industry Growth	0.607***
	(.106)
Log Trade	0.793**
	(.337)
Tertiary Education	1.479
	(1.702)
Log Inflation	−3.387
	(4.890)
Log Initial GDP	−0.354
	(.623)
Log Government Size	−0.766
	(1.506)
Constant	0.035
	(0.056)
Year Dummies	YES
Number of Instruments	23
Number of Countries	33
Number of observations	166
AB-test for AR(2) (p-value)	.456
Hansen test (p-value)	.663
Sargan test (p-value)	.907

e.

Excess financial is defined as the difference between financial output growth and industrial output growth. The instruments employed in the estimation are the variables lagged two periods, the difference of the variables lagged one period, the year dummies and the first difference of the year dummies. The standard error correction proposed by Windmeijer (2005) is implemented.*** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level.

The results show that financial development has a positive effect on growth in the short-run, which is in accordance with the existing literature. However, when the difference between the growth of financial and industrial output is higher than 4.45%, the effect of financial development on growth becomes negative. This is consistent with our hypothesis of excess financial development.

Next, we examine if our results are robust to the specification of our main variable of

interest, excess financial development. Given that financial innovation is not observable, we need to use proxy variables that capture financial innovations which are not an outcome of industrial innovations. In our main analysis, we assume that the difference in output growth rates between the financial and industrial sector captures the excess financial development. However, other factors such as difference in relative prices or unit labor costs, difference in the productivity of labor, or difference between the private credit share and industry share could be capturing excess financial development as well.

Table 6 shows the effect of excess financial development on growth using other proxy variables for excess finance. Column 1 presents the results using the difference between the growth rates of the unit labor cost of the financial and industrial sector as a measure of excess financial development. Column 2 shows the results using the difference between the financial and industrial productivity of labor units as a proxy for excess financial development. Column 3 shows the results using the difference between the private credit share to GDP and industry share to GDP as a measure of excess financial development.

Table 6: System GMM. Excess financial development and growth. Using other proxies for excess financial

Variables/Models:	Labor Cost (1)	Productivity (2)	Credit-Industry Share (3)
Excess Finance	.081	.036	3.727
	(.171)	(.267)	(3.327)
(Excess Finance)^2	$-.031^{(*)}$	$-.014$	-4.306^{*}
	(.019)	(.035)	(2.273)
Industry Labor Cost Growth	.147		
	(.122)		
Industry Productivity Growth		.188	
		(.178)	
Credit-Industry Share			.352
			(17.866)
Log Trade	3.048^{***}	1.331	.007
	(1.098)	(1.761)	(2.125)
Tertiary Education	.497	.702	2.138
	(3.124)	(2.864)	(5.267)
Log Inflation	-16.793	-3.613	-2.683
	(15.143)	(7.389)	(6.597)
Log Initial GDP	-2.210^{**}	$-.851$	$-.122$
	(1.002)	(1.061)	(1.558)
Log Government Size	$-.127$	-2.255	-4.312
	(2.462)	(2.358)	(4.689)
Constant	13.825^{*}	11.259	13.081
	(7.775)	(16.512)	(12.202)
Year Dummies	YES	YES	YES
Number of Instruments	23	23	23
Number of Countries	31	31	25
Number of observations	140	141	143
AB-test for AR(2) (p-value)	.113	.396	.076
Hansen test (p-value)	.314	.308	.551
Sargan test (p-value)	.103	.156	.263

f.

In column 1 excess finance is defined as the difference between the growth rates of the unit labor cost of financial and industrial sectors. Column 2 presents results using as a proxy for financial development the differences between the financial and industrial productivity of labor units. Column 3 shows the results using the difference between the private credit share to GDP and industry share to GDP as a measure of excess financial development. The instruments employed in the estimation are the variables lagged two periods, the difference of the variables lagged one period, the year dummies and the first difference of the year dummies. *** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level,$^{(*)}$ Significant at 12% level.

When we use the difference between the unit labor cost in the two sectors as a proxy for excess financial development, the negative effect of excess finance, given by the square of the difference, is only significant at the 12% of significance level. The effect of financial development on growth becomes negative when the growth of the unit labor cost in the financial sector exceeds the growth of the unit labor cost in the industrial sector by 1.33%. On the other hand, when we use the difference in productivity of labor unit in the two sectors, none of the variables are significant, although they have the correct signs. Finally, when we use the difference between private credit share to GDP and industry share to GDP, we obtain that financial development has a negative impact on growth when the private credit to GDP is 43.3% higher than the industry share to GDP. That is, the private credit share in the economy should not exceed the industrial output share by more than 43.3%, otherwise, the excess of credit might reduce economic growth. Non-significance of the other factors affecting growth may be due to the small number of observations available for the analysis.

4 Discussion

In this section we briefly discuss possible theoretical justification of the existence of excess financial development.

The justification may come from the theory of informational overshooting introduced by Rob (1991) and Zeira (1994), and applied latter by Zeira (1999) to explain credit crushes. According to this theory, the economy has some unknown production capacity limit. The limit may be due to the bounded technology, bounded demand, or scarce resources. Rational agents use all the available information to form expectations about the capacity limit of the economy. As long as the limit has not been reached, the expectations about it become more and more optimistic. Finally, the expectations are so high that the economy overshoots above its capacity limit: the resources invested in production are too large in comparison to the production possibilities. The expectations, investment, and economic activity falls at this point, causing severe economic distress.

We propose to consider technological progress of the country as the source of growth of economy's capacity. Indeed, introduction of new technologies, invention of new goods and materials serves as a substitute for such scarce production factors as, for example, natural resources and labor force. Without technological progress economies would stagnate at the levels of development defined by their resource capacities.

On the other hand, we propose to consider financial development as a factor facilitating economic activities. As technological possibilities of the economy grow, the demand for financial services increases (see, for example, Aghion, Howitt and Mayer-Foulkes (2005) for explanation based on a Schumpeterian model on economic growth). Thus, financial development is a crucial determinant of economic growth. However, when new financial technologies are introduced at a faster rate than new production technologies, the speed with which the economy approaches its capacity increases. Therefore, too fast financial development may finally lead to lower economic growth, by increasing the probability of economic overshooting. Note, that this framework does not imply any market frictions, except of the lack of information.

The idea of market crash based on the informational overshooting has been implemented by several authors, among them Barbarino and Jovanovic (2007) and Bruno, Rochet, and Woolley (2009).

Another justification of the ideas tested in the previous section could rely on the presence of negative externalities from the financial sector operations.

5 Conclusions

We analyze the effect of financial development on economic growth. Our analysis based on three different panels: i) of 33 OECD countries over the period 1970-2010, ii) of 74 countries used by Levine, Loayza and Beck (2000) over the period 1961 - 1995 and iii) of 82 developed an developing countries over the period 1971 - 2005 reveals the following:

First, financial development measured as private credit to GDP have a positive effect on economic growth over the years 1960 to 1995. However, when we use an extended panel for the years 1970 - 2005, the effect of financial development on economic growth turns to negative. A plausible explanation is the slowdown of technological progress during the 1990s. This together with a sharp increase in the private credit to GDP could generate an excess of financial development leading to a negative impact on economic growth.

Second, there is a non-linear relationship between financial development and economic growth. In particular, the effect of financial development on economic growth is maximum when the private credit to GDP is around 122%. This result is consistent with Arcand, Berkes and Panizza (2011).

Third, when the financial development is not accompanied by technological development

(reflected in industrial output growth), financial development might have a negative impact on economic growth, both in the short and long run. In particular, in the short-run, when the difference between growth rates is higher than 4.45% (or when the private credit to GDP exceeds the industrial output to GDP by more than 43%), the effect of financial development on economic growth becomes negative.

Our results should be important for policy makers. When the private credit to GDP exceeds the industrial share by more than 43%, governments should implement policies aimed to reduce the amount of credit as the economy has likely reached its capacity limit. The same happens when the financial output growth exceeds the industrial output growth by more than 4.45%. Otherwise, the excess financial development will slowdown the economic growth and might even lead to severe financial crisis.

In further research we plan to explain the existence of the upper bound on the optimal level of financial development by the limited productive capacities of the economy, or by the negative externalities produced by financial system.

References

[1] Arcand J. L., E. Berkes and U. Panizza, 2011. Too Much Finance? Working Paper.

[2] Arellano, M., and O. Bover, 1995. Another look at the instrumental variable estimation of errorcomponents models. *Journal of Econometrics*, 68 (1): 29–51.

[3] Aghion Ph., P. Howitt and D. Mayer-Foulkes, 2005. The Effect Of Financial Development On Convergence: Theory And Evidence. *Quarterly Journal of Economics*, 120 (1): 173–222.

[4] Barbarino A. and B. Jovanovich, 2007. Shakeouts and Market Crashes. *International Economic Review*, 48 (2): 385–420.

[5] Beck Th. and A. Demirgüç-Kunt, 2009. Financial Institutions and Markets Across Countries and over Time: Data and Analysis. World Bank Policy Research Working Paper No. 4943.

[6] Biais Br., J.-Ch. Rochet and P. Woolley, 2009. Rents, Learning and Risk in the Financial Sector and Other Innovative Industries. Working Paper.

[7] Blundell, R. and S. Bond, 1998. Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87 (1): 115–143.

[8] Dabos M. and T. Williams, 2009. A reevaluation of the Impact of Financial Development on Economic Growth and its sources by regions. Working Paper, Universidad de Belgrano.

[9] Gennaioli N., A. Shleifer and R. W. Vishny, 2010. Neglected Risks, Financial Innovation, and Financial Fragility. NBER Working Paper No. 16068.

[10] Kaldor N., 1967. Strategic Factors in Economic Development, New York, Ithaca.

[11] Levine R., N. Loayza and Th. Beck, 2000. Financial Intermediation and Growth: Causality and Causes. *Journal of Monetary Economics*, 46 (1): 31–77.

[12] Michalopoulos St., L. Laeven and R. Levine, 2009. Financial Innovation and Endogenous Growth, NBER working paper series, Working Paper 15356.

[13] Oguzoglu U. and Th. Stengos, 2008. Can Dynamic Panel Data Explain the Finance-Growth Link? An Empirical Likelihood Approach. Working Paper.

[14] Reinhart, C. M., and K. S. Rogoff. 2008. Is the 2007 US Sub-prime Financial Crisis So Different? An International Historical Comparison. *American Economic Review*, 98 (2), 339–44.

[15] Rob R., 1991. Learning and Capacity Expansion under Demand Uncertainty. *The Review of Economic Studies*, 58 (4), 655-675.

[16] Santomero A. M., and J. J. Seater, 2000. Is there an optimal size for the financial sector? *Journal of Banking and Finance*, 24 (6), 945-965.

[17] Wang Zhu, 2007. Technological innovation and market turbulence: The dot-com experience. *Review of Economic Dynamics*, 10 (1), 78–105.

[18] Windmeijer, F., 2005. A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics*, 126 (1), 25–51.

[19] Zeira J., 1994. Informational Cycles. *The Review of Economic Studies*, 61 (1): 31–44.

[20] Zeira J., 1999. Informational overshooting, booms, and crashes. *Journal of Monetary Economics*, 43 (1): 237–257.

A Description of the Data

A.1 Variables

Private Credit: credit by deposit money banks and other financial institutions to the private sector as a share of GDP, adjusted for inflation. Source: Levine, Loayza Beck (2000), Beck and Demirgüç-Kunt(2009).

Bank Credit: credit by deposit money banks to the private sector as a share of GDP, adjusted for inflation. Source: Levine, Loayza and Beck (2000), Beck and Demirgüç-Kunt(2009).

Liquid liabilities: liquid liabilities as a share of GDP, adjusted for inflation. Source: Levine,Loyayza and Beck (2000), Beck and Demirgüç-Kunt(2009).

Initial GDP: real per capita GDP. Source: World Development Indicators.

Economic growth: real per capita GDP growth rate. Source: World Development Indicators.

Government size: government expenditure as share of GDP. Source: World Development Indicators.

Openness to trade: sum of real exports and imports as share of real GDP. Source: World Development Indicators.

Inflation rate: percentage change of CPI index. Source: World Development Indicators.

Black market premium: ratio of black market exchange rate and official exchange rate minus one. Source: Levine, Loayza and Beck (2000).

Legal origin: dummy variables for British, French, German and Scandinavian legal origin. Source: Levine, Loayza and Beck (2000).

Tertiary Education: enrollment in tertiary education. Source: World Development Indicators.

Schooling: average years of secondary schooling in the population over 15, Source: Levine,Loayza and Beck (2000).

Industry share: industry value added as a share of GDP. Source: OECD dataset, World Bank Development Indicators.

Labour Productivity in Industry (C_E): labour productivity per hour: gross value added in constant prices per hour worked in national currency, annual growth rate. Source: OECD dataset.

Labour Productivity in Finance (J_K): labour productivity per hour: gross value added in constant prices per hour worked in national currency, annual growth rate. Source: OECD dataset.

Industry Labor cost: unit labour cost in Industry (C_E), annual growth rate. Source: OECD dataset.

Finance Labor cost: unit labour cost in Financial and Business services (J_K), annual growth rate. Source: OECD dataset.

A.2 Summary Statistics

Table 7: Summary statistics for dataset of 74 Countries, years 1960-1995

Variables/Statistics	Mean	St.d.	Min	Max
Real Growth Per Capita	1.768	2.939	-10.000	-11.000
Initial GDP	3746.429	4716.518	108	20131
Government Size	14.820	5.959	4	45
Trade	59.981	40.716	9	315
Inflation	.156	.321	-.03	3.5
Schooling	4.327	2.820	.04	12
Black Market Premium	.677	5.424	-.05	110
Private Credit	36.712	32.457	0	206
Bank Credit	28.598	23.971	0	166
Liquid Liabilities	42.450	28.175	5	191

Table 8: Summary statistics for dataset of 82 Countries, years 1970-2005

Variables/Statistics	Mean	St.d.	Min	Max
Real Growth Per Capita	1.878	3.233	-19	20
Initial GDP	6748.813	8701.090	66	47064
Government Size	15.961	6.004	4	47
Trade	70.297	38.539	8	309
Inflation	.295	1.619	.005	13
Tertiary Education	38.081	22.056	1	92
Black Market Premium	.258	.880	-.05	13
Private Credit	48.114	37.249	2	203
Bank Credit	43.144	37.249	7	193
Liquid Liabilities	49.473	35.984	7	399

B More Robustness check

B.1 Re-estimation of the results in Levine, Loayza and Beck (2000)

Table 9 presents the re-estimation of the results in Levine, Loayza and Beck (2000) including a quadratic term of financial development. We can observe the non-linear relationship between financial development and economic growth.

Table 9: Re-estimation of the results in Levine, Loayza and Beck (2009) with quadratic term of financial development

Variables/ System GMM Models:	Private Credit (1)	Bank Credit (2)	Liquid Liabilities (3)
Initial GDP	−.484	−.288	.345
	(1.609)	(2.024)	(1.078)
Government Size	−.301	−.471	.935
	(1.724)	(1.709)	(1.794)
Trade	−.272	−.588	−1.027
	(1.135)	(1.376)	(.953)
Inflation	.356	.335	.511
	(1.211)	(1.248)	(1.135)
Schooling	−.784	−1.276	−3.546
	(3.581)	(4.948)	(2.654)
Black Market Premium	−1.496*	−1.584*	−2.229**
	(.760)	(.799)	(.947)
Private Credit	8.053**		
	(3.176)		
(Private Credit)^2	−3.293***		
	(1.059)		
Bank Credit		11.236**	
		(4.967)	
(Bank Credit)^2		−6.206***	
		(2.961)	
Liquid Liabilities			12.502***
			(4.368)
(Liquid Liabilities)^2			−5.950**
			(2.814)
Constant	4.123	2.144	−3.999
	(11.402)	(13.468)	(8.748)
Year Dummies	*YES*	*YES*	*YES*
Number of Instruments	23	23	23
Number of Countries	74	74	74
Number of observations	441	441	441
AB-test for AR(2) (p-value)	.845	.845	.820
Hansen J-test (p-value)	.437	.364	.548
Sargan test (p-value)	.036	.016	.481

g.

For comparison purpose with Levine, Loayza and Beck (2000) all variables are taken in natural logs with the exception of Inflation, Schooling and the Black market premium, whose transformation is log(variable+1). The instruments employed in the estimation are: the lags of the variables from t-4 to t-2, the first difference of the variables lagged one period, the year dummies and the first difference of the year dummies. ** Significant at 5% level, * Significant at 10% level.

B.2 Another measure of technological progress

Table 10 presents the estimation results when the services sector is added to the measure of technological development of the country. In this case, the excess financial development is defined as the difference between financial and industry plus services output growth - that is, the proxy for technological progress consists of the industry plus service output growth -. Column (1) presents the results controlling for schooling and using data from 1970 to 2005. Column (2) shows the results excluding the proxy for human capital but extending the panel till 2010. We observe that our results (presented in percentage points) are robust to the inclusion of the service sector. Obviously, the industry plus service growth has a higher explanatory power and, thus, there is less uncertainty about output growth in the augmented model.

Table 10: System GMM. Excess financial development and growth, using another proxy for the excess financial development

Variables/ Data sets:	1970-2005 (1)	1970-2010 (2)
Excess Finance	.234*	.332**
	(.127)	(.149)
(Excess Finance)^2	−.026*	−.038**
	(.014)	(.016)
Industry plus Service Growth	1.002***	.877***
	(.203)	(.267)
Log Trade	.193	.687
	(.646)	(.532)
Schooling	−.731	−
	(1.601)	
Log Inflation	−.410	−.379
	(.548)	(.364)
Log Initial GDP	−.572	−.879
	(1.609)	(.671)
Government Size	1.178	1.454
	(.819)	(.738)
Constant	2.294	2.610
	(11.450)	(7.786)
Year Dummies	YES	YES
Number of Instruments	31	29
Number of Countries	32	32
Number of observations	159	201
AB-test for AR(2) (p-value)	.929	0.364
Hansen J-test (p-value)	.550	.530
Sargan test (p-value)	.340	.952

h.

The Excess financial development variable is the difference between financial and industrial plus service output growth. The instruments employed in the estimation are: the lags of the variables from t-3 to t-2, the first difference of the variables lagged one period, the year dummies and the first difference of the year dummies. ** Significant at 5% level, * Significant at 10% level.

C Growth series during the Big 5 financial crises

Figures 5, 6, 7 show the real GDP growth rate, the real private credit to GDP growth rate and the real industry productivity growth rate for Norway, Finland, Sweden, Japan and USA during several preceding and subsequent years to their main financial crises (as defined by

Reinhart and Rogoff, 2008). Note that during the years preceding the financial crisis, private credit to GDP and industrial productivity growth rates are not synchronized, the amount of private credit is growing at faster rate while the growth in industrial productivity slows down. This is consistent with the excess financial development hypothesis.

Figure 5: Economic growth during the "Big 5"financial crises

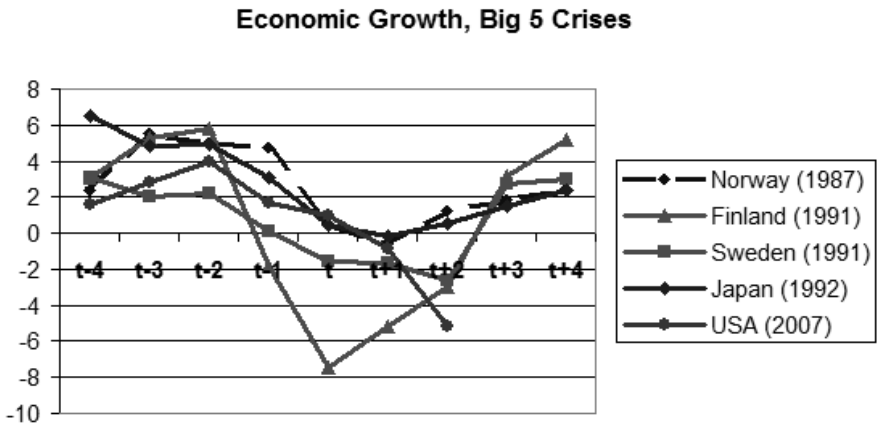


Figure 6: Industrial productivity growth during the "Big 5"financial crises

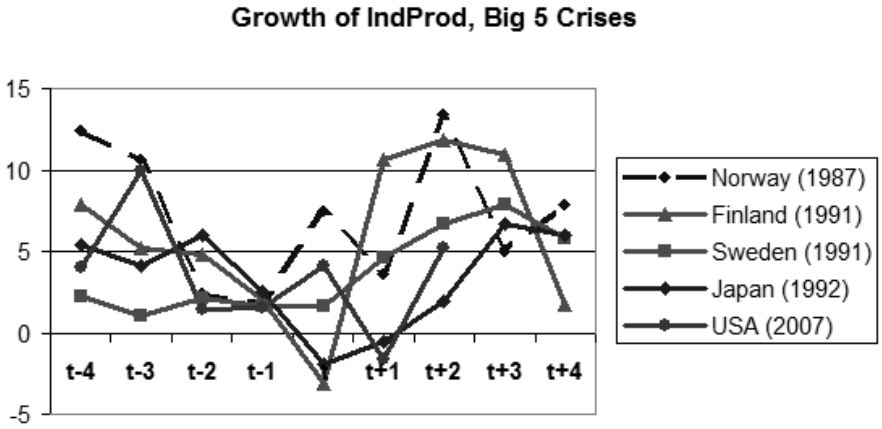


Figure 7: Private credit to GDP growth during the "Big 5"financial crises