Financial development as a shield against growth-abating effects of volatility

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Abstract

The importance of financial development for mitigating the devastating effects of output volatility is conditional on the type of shock hitting the economy. Deeper financial markets lessen the negative impact of output volatility on growth only if inflation rates are high. When price increases are moderate, financial development is neutral for growth because its role resides in reducing the detrimental effects of relative price variability induced by inflation. System GMM dynamic panel data estimates based on a sample of more than 100 countries in the 1970-2004 period support the view that volatility retards growth and financial development acts as a shield against growth-abating effects of volatility only when inflation is high.

Keywords: financial development; inflation; volatility; growth.

1. Introduction

There has been a widely held view that a well-functioning financial system stimulates economic growth. Efficient financial sector pools domestic savings, alleviates informational asymmetries between suppliers and users of funds and permits to diversify risk[1]. It is important to distinguish between financial development and financial integration, the latter being associated, especially in the last few years, with a country's vulnerability to external financial crisis. By contrast, domestic financial development is considered to permit to cope with output fluctuations in a more efficient way.

In this paper I attempt to find evidence and provide theoretical grounds for arguing that the importance of financial development for mitigating the devastating effects of output volatility is conditional on the type of shock hitting the economy. In particular, I show that deeper financial markets lessen the negative impact of output volatility on growth only if inflation rates are high. In other words, I claim that the origin of shocks matters, volatility of relative price putting the role of financial development at the forefront.

[1] For a general overview of the role of financial markets in economic growth, see Levine (2005).

The variability of relative prices has been recognized as the main cost of inflation. Variations in relative prices of final products as well as in the value of collateral are the channel through which inflation affects the role of financial sector since they strengthen uncertainty surrounding all investment projects. I argue that real shocks arising from unpredictable technological advancements unequivocally undermine growth even if the financial markets are perfect. When erratic technological improvements are coupled with high inflation, the reluctance of financial intermediaries to extend credit becomes a serious obstacle to robust growth. I also present an econometric evidence supporting the idea that inflation has threshold effects on the relation between growth, financial development, and volatility.

The paper is structured as follows. In the next section, I review literature about the link between financial development, output volatility and growth. Section 3 is devoted to the presentation of a theoretical argument in favor of empirical evidence presented in section 4. Finally, section 5 concludes.

2. Literature review

Volatility is undesirable not only because it prompts people to seek protection against consumption fluctuations, but also because it slows output growth. From a theoretical perspective, the sign of the growth-volatility relation is ambiguous and depends on whether productivity growth is a by-product of production process or productivity improvements can only be achieved by shifting resources away from production activities. Aghion and Saint-Paul (1998) lucidly summarize two approaches to the problem of the impact of output fluctuations on long-run growth. If growth process is driven by learning-by-doing mechanism or demand externalities, direct production activities and productivity growth are complements. Output expansions will then be an occasion to accumulate knowledge. In the opposite case, where recessions reduce the profitability of direct production activities, thereby lowering the opportunity cost of productivity improving activities, the link between volatility and growth is ambiguous. On the one hand, both activities are substitutes and one should expect economic slowdowns to prompt firms to launch product and process innovations. On the other hand, longer and more frequent recessions arouse expectations of future recessions which destroy the prospects for decent return on innovative activities in the future.

Since theoretical predictions about the sign of the growth-volatility relationship are ambiguous, empirical investigations are of great importance in shedding light on the issue. The pioneering empirical evidence of a strong and negative correlation between output volatility and growth offered by Ramey and Ramey (1995) has been more recently corroborated by numerous studies using cross-section and time-series regression analysis.

Fatas (2002) found in a large sample of 98 countries a negative impact of business-cycle on growth for the 1950-1998 period. A similar conclusion can be drawn from the Martin and Rogers (2000) analysis of the OECD countries over the 1960-1988 period and of the European regions over the 1979-1992 period. Controlling for the likely endogeneity of output volatility, has not prevented Badinger (2009) from identifying the causal negative relation between output volatility and economic growth in a sample encompassing 128 countries in the period 1960 to 2003. Rafferty (2005) adds an important qualifier to the harmful effect of volatility on growth. He stresses the distinction between expected and unexpected volatility, the former having the positive impact on growth but overwhelmed by the negative effect of the latter.

The significance of a negative relation between volatility and growth seems to be robust to the selection of the period under investigation and the number of countries examined. The negative link was also detected by Siegler (2005) in the group of 12 developed countries in the period prior to the Great Depression. At the individual country level, short-run fluctuations seem to have detrimental effect in Australia as reported by Macri and Sinha (2000), whereas evidence for the UK, provided by Speight (1999), and Fountas *et al*. (2004) for Japan is more supportive of macroeconomic models that dichotomize the determination of output growth and variability.

Some researchers assign different weights to economic booms and recessions in their attempt to establish a link between business cycles and growth. Cerra and Saxena (2005) challenged the Schumpeterian view that recessions have a cleansing effect and found, using panel data for a large number of countries over 40-year period, that economic contraction are not followed by offsetting fast recoveries. In a similar vein, Henry and Olekalns (2002) document the growth-dampening effects of recessions in the US despite the fact that growth accelerates as the economy recovers.

An important strand in the literature, to which this paper aims to contribute, has asserted that the strength of the growth-volatility relationship depends on various characteristics of the economy, such as openness and financial development. Using a comprehensive data set Kose *et al*. (2006) document that, while the basic negative association between growth and volatility has been preserved during the 1990s, both trade and financial integration significantly weaken this negative relationship.

To assess the role of financial development in explaining the link between volatility and growth it is promising to refer to a Schumpeterian growth model. Aghion and Banerjee (2005) consider two types of investment, distinct with respect to the time when profits are realized. Investment in physical capital is a short term investment which brings about profits in a near future and capital equipment provides secure collateral for banks. In contrast, uncertain profits from R&D projects arise in a distant future and this type of investment expenditures suffers from liquidity constraints. A negative productivity shock reduces the value of profits and the availability of credit to firms operating in tight credit markets. As a result, the positive impact of macroeconomic fluctuations on growth in the Schumpeterian framework turns to negative when firms face liquidity constraints.

In a sample of OECD countries, Aghion and Banerjee (2005) found that one standard deviation increase in the level of financial development reduces the negative impact of volatility on growth by 75%. Loayza and Hnatkovska (2004) partly corroborate this result by indicating that the negative link between macroeconomic volatility and long-run economic growth is exacerbated in countries that undergo intermediate stages of financial development.

In the next section I question the validity of the abovementioned assumption that physical capital provides secure collateral for banks. The recent economic crisis has taught us that the price if collateral, such as housing, is prone to wide fluctuations which expose banks to risks similar to intrinsic uncertainty accompanying R&D projects. During less turbulent economic times, inflation fuels relative price variability and hence introduces uncertainty about the price of collateral thus increasing the role of experienced financial intermediaries in mitigating the consequences of volatility.

3. A Theoretical argument

In this section I provide a simple theoretical basis for arguing that the role of financial market development in reducing the severity of the growth-depressing effects of volatility is conditional on the rate of inflation. Inflation-induced relative price variability erodes the quality of collateral and prompts financial intermediaries to charge a risk premium, thereby adding to the cost of investment. Uncertainty arising from real technology shocks also discourages investors but its impact is to a lesser extent conditional on the severity of financial constraints.

To begin, I consider a zero-inflation environment where relative prices are constant and the firm faces no uncertainty relating to the relative price of its final product. The firm contemplates investing an amount I which yields a gross return $A(1+\gamma)F(I)$. Parameter A describes the current level of technology and γ measures the scale of technological improvement which is a by-product of investment. Technological progress at the time when investment is undertaken is a stochastic variable with the expected value 0 and the variance σ_γ^2. The production function, $F(I)$, is concave.

Since investment in physical capital brings about a technological advancement, its costs are increasing in the current level of technology. More precisely, I assume that the firm investing an amount I incurs a cost $(A(1+\gamma))^2 I$, i.e. investment costs are a convex function of the level of technology. The interpretation of this cost structure can be twofold. On the one hand, technological progress is a complement to physical capital accumulation. The cost of investment may be a convex function of the state of technology if the productivity of research declines as new ideas are discovered. In other words, it becomes increasingly difficult to invest and thereby to shift the technological frontier when the existing stock of knowledge is high.

On the other hand, a convex relation between the level of technology and investment costs can be rationalized by referring to the concept of adjustment costs. The installment cost may be rising in the complexity of capital equipment the latter being inherently linked to the state of technology. Obviously both explanations are debatable but they give rise to a negative relationship between volatility and growth, supported by empirical research summarized in the previous section.

Given the stochastic nature of technological progress, the firm is maximizing the expected value of profits from investing:

$$\max_I \mathrm{E}[\Pi] = \max_I \mathrm{E}\left[A(1+\gamma)F(I) - (A(1+\gamma))^2 I\right]. \tag{1}$$

Using the fact that $\mathrm{E}\left[A^2\gamma^2 I\right] = A^2 I\sigma_\gamma^2$, the first order condition can be written as:

$$F'(I) = A\left(1+\sigma_\gamma^2\right). \tag{2}$$

It stems from Equation (2) that technology shocks impinge on the level of investment spending. Higher volatility of technological progress raises the expected value of investment costs and induces firms to stop investing when the marginal productivity covers high marginal costs of capital. Since the amplitude of technology shock translates into the magnitude of output volatility, this simple reasoning allows to establish a negative relation between volatility and growth.

Consider now the situation where the firm is liquidity constrained and makes recourse to borrowing from banks when its cash flow falls short of investment costs. Without loss of generality I assume that the firm either borrows the entire amount necessary to cover investment costs or it does not use external finance at all. Then the amount of credit is always equal to $\mathrm{E}\left[(A(1+\gamma))^2 I\right]$. The costs of external finance depend on the degree of development of financial markets.

The financial intermediary has no perfect information about the default probability of investing firms. The firm can collateralize credit with its capital equipment. Because physical capital and the cost of investment are intertwined with the firm's stock of knowledge, once the capital equipment is installed, it becomes a firm-specific input. As a result, the liquidation price of capital stock which secures the credit is equal to the relative price of firm's output. When inflation is low relative price of an individual producer is constant and does not affect the value of collateral[2]. Moderate price changes rule out uncertainty relating to the value of collateral but the probability of default does not vanish. This second type of uncertainty determines the borrowing costs.

Banks are assumed to operate in a competitive market and the interest rate is set at a level that allows them to just break even. Informational imperfections lead banks to assign a subjective probability of contract enforcement, for all borrowers set equal to ρ, when the loan is repaid. With probability $(1-\rho)$ the firm breaches the contract, does not pay off its debt and the bank has the right to seize the collateral. The parameter ρ captures the degree of financial development from a theoretical perspective.

Empirical measures of financial development pertain to the size of the financial market. It can be argued that the stock of domestic credit to the private sector or liquid liabilities reflect the scope for building up long-run customer relationships. Repeated interactions with borrowers and the size of extended loans may be interpreted as a high degree of law enforcement. The size of financial market should therefore be positively connected with the probability of contract enforcement ρ.

Let C denote the amount of credit and ρ the degree of financial development. Then the break even condition for banks can be written as:

$$\rho(1+r)C + (1-\rho)C = C\,. \tag{3}$$

where $0>\rho>1$. The second term reflects the value of collateral which is equal to the value of loan. The stability of relative prices ensures the option to resell the capital equipment which

[2] The relative price has been normalized to 1.

secures the loan at the price of firm's output which mimics the evolution of the general price level.

The resulting gross interest rate is equal to one[3]. The price of external financing does not deviate from the price of internal funds. Hence, investment decisions are not distorted which can be seen from the maximization problem of a borrowing firm:

$$\max_I \mathrm{E}[\Pi] = \max_I \mathrm{E}\left[A(1+\gamma)F(I) - (1+r)\left(A(1+\gamma)\right)^2 I\right]. \tag{4}$$

It is straightforward to observe that Equation (4) reduces to the maximization problem (1) if the gross interest rate was equal to 1.

To conclude, real technology shocks, by provoking uncertainty, induce firms to be more reluctant to undertake investment projects. Financial depth does not dampen this detrimental effect of shocks because volatility reduces the eagerness to invest irrespective of credit availability and cost. The degree of financial development gains in importance when inflation aggravates investment risk.

Credit risk is an unavoidable feature of the banking business. In order to improve credit risk monitoring and measurement the Basel Committee on Banking Supervision (2005) proposed the New BASEL II Accord in 1999. The fundamental objective of the Basel Committee has been to develop a framework that would strengthen the soundness and stability of the international banking system. The framework provides a range of options for determining the capital requirements for credit risk and operational risk. Credit risk mitigation techniques for collateralized transactions outlined in BASEL II norms require to use haircuts to take account of possible future fluctuations in the value of collateral[4]

Inspired by the BASEL II approach to credit risk mitigation I assume that volatility of the relative price of collateral is reflected in the haircuts applied by banks. As was mentioned before, technological progress inherent in investment turns capital into firm-specific input. As a result, the value of capital as a collateral asset is equal to the price of firm's output. In real terms, the value of collateral is given by the relative price of firm's output p, where p is equal to the ratio of the individual price P_i over the general price level P, or $p=P_i/P$.

A notion that inflation is positively linked to variation in relative prices can theoretically be deduced from nominal price rigidity models, where prices are assumed to be adjusted infrequently. These models were met with success when confronted with data. There

[3] It should be stressed that the existence of liquidation costs of collateral would yield different value of the interest rate. This likely aspect of financial market underdevelopment is, however, not explored in this paper since the emphasis is put on the impact of relative price variability on the value of collateral.
[4] See paragraphs 130 and 147 in Basel Committee on Banking Supervision (2005).

is now a widely accepted view that inflation destroys the informational content of prices. I therefore assume that high inflation, by inducing uncertainty, reduces the value of collateral perceived by banks. If a credit is collateralized by the firm-specific capital stock, the bank applies a haircut to this collateral proportional to the rate of inflation π, with a factor of proportionality equal to α. Thus, the value of a collateral which secures credit C is given by $\bar{p}C$ where $\bar{p}$ is the expected value of p. In an inflationary environment the brake even condition for banks takes the following form:

$$\rho(1+r)C + (1-\rho)(1-\alpha\pi)\bar{p}C = C\,, \tag{5}$$

where α is restricted to fall within a range of values for which $\alpha\pi<1$.

The gross interest rate derived from Equation (5) is equal to

$$(1+r) = \frac{1-(1-\rho)(1-\alpha\pi)\bar{p}}{\rho}, \tag{6}$$

and it is an increasing function of inflation and a decreasing function of the degree of financial development[5]. Higher expected real price of firm's output translates into high value of collateral whereas inflation casts doubts on this prospect.

The likely discrepancy between individual price and the general price level developments calls for a careful redefinition of the firm's optimization problem. To underline the necessary adjustment of capital stock to the firm's needs which transforms capital equipment into a specific input, I imposed the restriction that the price of capital serving as collateral is equal to the individual price. In contrast, the price of new machines follows the general price level dynamics. As a result, the condition for the maximization of the expected value of real profits for borrowing firms can be expressed as follows:

$$\max_I \mathrm{E}[\Pi] = \max_I \mathrm{E}\left[pA(1+\gamma)F(I) - (1+r)(A(1+\gamma))^2 I\right]. \tag{7}$$

I assume that technology improvements and the evolution of the relative price of output are not correlated since the latter is driven mainly by inflation. Thus the first order condition is given by:

$$F'(I) = \frac{A(1+\sigma_\gamma^2)(1+r)}{\bar{p}}. \tag{8}$$

Combining the break even condition (6) with the first order condition (9) yields the main result of the paper:

[5] It is important to remember that higher value of f reflects lower degree of financial development.

$$F'(I) = A(1+\sigma_\gamma^2)\frac{1-(1-\rho)(1-\alpha\pi)}{\rho}. \tag{9}$$

Equation (9) elucidates the growth-reducing consequences of volatility. More pronounced technology shocks trigger more cautious behavior of firms which become less inclined to invest. Moreover, the first order condition (9) shows that marginal productivity of investment needs to be higher, i.e. investment needs to be lower when financial development, ρ, is poor and inflation is high. It crucial to observe that that financial development and the variance of technology shocks enter Equation (9) in a multiplicative mode, pointing to the conditionality of the importance of financial markets on output volatility. The comparison of Equations (3) and (6) also reveals that efficient financial intermediation does not play a pivotal role in mitigating the effects of volatility but in a high-inflation environment.

Two main theoretical predictions of the paper will be confronted with the data in the next section. I will verify the hypothesis that volatility hurts growth and is less harmful in countries with well developed financial markets. However, my theoretical reasoning leads to the conclusion that the mitigating role of financial development hinges on the incidence of high inflation.

4. Empirical evidence of the relation between volatility, financial development, and inflation

In this section I use dynamic panel data model to verify the theoretical findings that have been posited in the previous section. In studying economic growth, the procedure that consists in writing regression equation as a dynamic panel data model in first differences has important advantages over simple cross-section or other panel estimation methods. First, unobserved time-invariant country specific effects are removed. Second, the use of instrumental variables allows parameters to be estimated consistently in models where some of the explanatory variables are endogenous. One prominent way to take advantage of the virtues of the dynamic panel data model in first differences is to apply first-differenced generalized method of moments (GMM) estimators. I adopt this approach below.

The basic idea behind the 'system' GMM estimator is to estimate a system of equations in both first-differences and levels, where the instruments used in the levels equations are suitably lagged first-differences. Blundell and Bond (1998) showed that the first-differenced GMM estimator might be subject to a large downward finite-sample bias, particularly when the number of time periods available is small, which is a common feature of empirical growth studies. By imposing an additional set of moment restrictions which allow the use of lagged first-differences of the series as instruments for equation in levels, Blundell and Bond obtained a linear GMM estimator better suited for estimating autoregressive models with persistent panel data, which has superior finite sample properties than the GMM Arellano and Bond (1991) estimator.

To be more specific, the empirical model estimated in this section has the following form:

$$\Delta y_{it} = a_t + by_{i,t-1} + cx_{it} + d_i + e_{it}\,, \qquad (10)$$

where the independent variable, y, is the log of real per capita GDP and Δ denotes five-year difference. The explanatory variables set embraces the period-specific effects, a_t, lagged value of the regressand, the vector of control variables, x_{it}, and the unobserved country-specific effects, d_i. The last term in Equation (10) denotes the error term.

The theoretical basis for Equation (10) can be traced back to the Solow growth model. The moment conditions imposed by the System GMM technique require stationary means of both the y_{it} and x_{it} series. This assumption, especially in the case of per capita GDP, seems to be inconsistent with an empirical growth model but the problem is alleviated by the inclusion of time dummies which allow for a common rate of long-run growth. The assumption of a common pace of technological progress and per-capita GDP growth was adopted in the framework put forward by Mankiw *et al.* (1992) and the selection of control variables will be guided by their work.

The set of independent variables, x, encompasses, among others, investment rate, population growth, human capital, and government size[6]. These controls have been extensively used in empirical literature because their statistically significant impact on growth seems to be robust to the selection of countries and periods under investigation, as well as econometric techniques. The inclusion of these determinants of growth enables reliable tests of statistical significance of the remaining independent variables of interest, namely financial development, output volatility, inflation, and their interactions. Being aware of the sensitivity of growth regression results to data definitions and sources, I provide below a detailed information on the construction of variables and sample composition.

I have collected data for more than 100 countries over the 1970-2004 period divided into seven 5-year intervals. The independent variable, i.e. the rate of economic growth,

[6] A measure of openness, calculated as the ratio of exports and imports to GDP, was also used but it was statistically insignificant in all specifications and the estimated coefficients and standard errors of all remaining variables were unaltered. This likely determinant of growth was therefore abandoned from further analysis.

denoted GROWTH, is the difference in the value of the logarithm of GDP per capita expressed in constant US dollars between the last and the first year of a 5-year subperiod. While growth is calculated as a cumulative change, volatility, VOL, is the 5-year standard deviation of the yearly change in the logarithm of real GDP.

Investment rate, population growth, inflation, and government size are defined in a standard way. Investment rate, denoted INV, is equal to the logarithm of gross capital formation in percentages of GDP. Due to several incidences of depopulation in the sample, population growth, POP, is calculated as the logarithm of one plus the actual rate of population growth. In a similar manner, a number of deflationary observations leads to define inflation, INFL, as the logarithm of one plus the rate of change of the GDP deflator. The size of government, GOV, is measured as the logarithm of a ratio of general government final consumption expenditure to GDP.

All variables listed so far have been compiled from data extracted from the World Bank dataset, World Development Indicators, edition 2008. The World Bank is also the source of measures of the degree of financial development. I used the updated version of the Database of Financial Development and Structure, prepared by Beck and Demirgüç-Kunt (2009). The two indicators of financial development employed in this paper are Private Credit, CREDIT, and Liquid Liabilities, LIQUID. The former improves on other measures of financial intermediary advancement because it excludes credit issued by central bank, credit to the public sector, and cross claims of one group of intermediaries on another. To assess the robustness of my results, I use an additional measure of financial development, equal to liquid liabilities of the financial system, which can be interpreted as an indicator of size. Both CREDIT and LIQUID are expressed in percentages of GDP and in logarithms.

The level of human capital is proxied by the log of mean years of schooling of population aged 25 and older, denoted SCHOOL. The data comes from the Lutz *et al.* (2007) dataset produced using demographic multi-state methods for back projecting the educational attainment of population of 120 countries from 2000 to 1970 in 5-year intervals. Based on empirical distributions of educational attainment by age and sex for the year 2000, the method moves backward along cohort lines while explicitly considering the fact that men and women with different education have different levels of mortality. The backward reconstruction method has an advantage of being immune to changes in the definitions of educational categories since the educational attainment states are defined for the base year 2000. Moreover, the use of harmonized by the UN Statistical Office and UNESCO official data from censuses provides consistent international time series suitable for growth regressions.

Having discussed all data issues, I am now in a position to apply the system GMM technique to obtain the results for the benchmark regression with investment rate, population growth, mean years of schooling, and government size as the sole explanatory variables. Then I verify the first hypothesis that volatility hurts growth. The estimated coefficients together with standards errors are presented in Table 1, accompanied by a battery diagnostic tests.

To detect problems with instrument validity, the Sargan test of over-identifying restrictions was applied and the corresponding p-values are reported. Since finite samples may lack adequate information to estimate a variance matrix of the moments and a large number of instrument may bias the results, I report the instrument count. In all regressions the lagged values of all explanatory variables were used as instruments. The number of lags n indicates that lags n and further of variables in levels were used instruments for equation in differences, and lags n–1 of variables in first differences were used as instruments for equation in levels.

The consistency of estimators is conditional on the assumption that the error term in Equation (10) is not serially correlated. Then the first-differenced residuals should display a negative first-order serial correlation but not second-order serial correlation. I report the p-value of the Arellano-Bond test of first- and second-order serial correlation, denoted, respectively, AR1-p and AR2-p.

In all regressions the time dummies were included as independent variables. For sake of space we do not report the value of coefficients and standard errors for year dummies[7].

[7] The complete results with year dummies are available upon request.

Table 1: The baseline regression and the impact of volatility on growth.

Dependent variable: GROWTH

Method of estimation: System GMM

VARIABLES	(1)	(2)
$y_{i,t-1}$	-0.0224*	-0.0182
	(0.0131)	(0.0140)
INV	0.0602	0.0538
	(0.0588)	(0.0587)
POP	-4.620***	-4.898***
	(1.488)	(1.621)
SCHOOL	0.0705**	0.0391
	(0.0338)	(0.0357)
GOV	-0.0771**	-0.0868**
	(0.0356)	(0.0392)
INFL	-0.158***	-0.150***
	(0.0422)	(0.0456)
VOL		-1.710***
		(0.633)
Observations	609	609
Number of countries	119	119
AR2-p	0.918	0.748
AR1-p	1.65e-09	6.72e-06
Number of instruments	79	93
Number of lags	3	3
Sargan-p	0.254	0.972

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

It stems from Column 1 of Table 1 that high population growth, high inflation and sizable government sector are harmful for growth. Educational attainment is the sole factor which significantly boosts growth. Results in Column 1 provide also a relatively weak evidence of a convergence process because the lagged value of per capita GDP enters with a negative sign. The baseline regression results constitute a background against which the importance of output volatility may be assessed.

The newly-introduced variable VOL is significant at the 1 percent level pointing to the fact that volatility is a serious obstacle to growth. Taking account of the degree of volatility renders the lagged value of income and the human capital measure insignificant. The coefficients and standard errors of remaining variables are marginally affected. One can conclude that the evidence is in favor of the first prediction of the simple model presented in the previous section. A negative relationship between volatility and growth, found in other empirical research, is supported in this paper. It should be noted that the Sargan test in Table 1 does not detect any problem with instrument validity and the order of serial correlation of the error term meets the required condition.

Table 2: The role of credit to private sector in economic growth

Dependent variable: GROWTH

Method of estimation: System GMM

VARIABLES	(1)	(2)	(3)	(4)
$y_{i,t-1}$	0.0334	0.0163	-0.00953	-0.0163*
	(0.0282)	(0.0125)	(0.00959)	(0.00969)
INV	0.196***	0.122***	0.107***	0.101**
	(0.0638)	(0.0470)	(0.0393)	(0.0405)
POP	-2.664	-3.013**	-3.790***	-4.189***
	(1.893)	(1.253)	(1.090)	(1.116)
SCHOOL	-0.112*	-0.0842***	-0.00191	0.00849
	(0.0586)	(0.0289)	(0.0245)	(0.0250)
GOV	-0.0919*	-0.132***	-0.0906***	-0.0691**
	(0.0545)	(0.0354)	(0.0351)	(0.0331)
INFL	-0.0232	-0.0256	0.0606	-0.0219
	(0.0731)	(0.0560)	(0.0635)	(0.0413)
VOL	-2.240***	-3.015***	-1.739***	-1.532***
	(0.607)	(0.797)	(0.384)	(0.480)
CREDIT	-0.0389			
	(0.0281)			
CREDIT×VOL		-0.557		
		(0.359)		
CREDIT×VOL×INFL			1.104**	
			(0.511)	
CREDIT×VOL×HINFL				0.411*
				(0.221)
Observations	524	524	524	524
Number of countries	108	108	108	108
AR2-p	0.765	0.832	0.963	0.923
AR1-p	0.0474	0.272	2.41e-08	3.27e-08
Number of instruments	64	68	107	107
Number of lags	4	4	3	3
Sargan-p	0.145	2.71e-05	0.265	0.273

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

A neutrality of financial development as such is the second testable implication of the theoretical reasoning presented in the previous section. In Table 2 the logarithm of the ratio of credit to private sector to GDP is used as a proxy for the depth of financial markets. The use of variable CREDIT reduces the number of observations by 85.

An inspection of all regressions results presented in Table 2 reveals that the introduction of the measure of financial development consistently affects the significance of two variables. First, investment level becomes statistically significant and its coefficient is greater than zero, as expected. Second, inflation looses statistical significance, above all in Column 1 where it is not an element of any interaction term. The evidence in favor of convergence can be at most described as mixed, since the initial level of income is statistically significant only in Column 4. The level of human capital turns out in two regressions to be negatively related to growth. Other variables do not seem to be particularly vulnerable to the inclusion of CREDIT among regressors and we can focus on the role of financial development. Contrary to Levine *et al.* (2000) who used a similar econometric methodology, my results in Column 1 of Table 2 do not confirm the view that more efficient financial intermediation accelerates growth. It should be stressed, however, that my study covers the period 1970-2004 whereas Levine *et al.* assembled a panel dataset for the period 1965-1995. This apparently minor difference in sample time span may be of pivotal importance. The theoretical reasoning presented in the previous section suggests that financial development gains markedly in importance when inflation rates are high. It is well documented that globalization in the 1990 and in the recent years subdued inflation in both developed an developing countries[8]. It is therefore sensible to hypothesize that earlier studies of the relation between financial development and growth have overestimated the importance of the former because they have been conducted before inflation had reached today's low levels.

To gauge directly the interplay between inflation, volatility, financial development and growth, I introduce interaction terms in Columns 2-4 of Table 2. In Column 2, the mere ratio of private credit to GDP is replaced with the product of two variables, namely VOL and CREDIT to test whether financial intermediaries exert their influence on growth by reducing the detrimental effects of volatility. The theoretical argument presented in the previous section speaks against this hypothesis and it seems to be supported by regression results in Column 2. The interaction term CREDIT×VOL is not statistically significant , which implies that financial depth does not cushion disruptive volatility shocks. It could be argued that the p-value of the Sargan test casts some doubts on this conclusion but several additional

[8] See IMF (2006)

regressions were run with different number of lags and all yielded similar results which also suffered from the problem of invalid instruments.

Drawing on the theoretical basis of my empirical research, I expect to establish a positive impact of financial development when inflation amplifies the negative influence of output volatility on growth. In Column 3 of Table 2 an interaction term CREDIT×VOL×INFL is plugged as an independent variable which is equal to a product of three variables: CREDIT, VOL, and INFL. This combined effect of financial depth, volatility, and inflation is statistically significant at the 5 percent level. According to Column 3 in Table 2, financial development is indeed brought to the fore in countries experiencing high inflation. In other words, high inflation is a precondition for beneficial effects of financial depth to be noticeable. It is noteworthy that the validity of instruments cannot be questioned in regression displayed in Column 3.

To further strengthen this important empirical result, I constructed another interaction variable CREDIT×VOL×HINFL where HINFL is a dummy variable which is equal to 0 if inflation is below its median value and 1 if above its median value. Although the coefficient of CREDIT×VOL×HINFL in Column 4 of Table 2 is statistically significant only at 10 percent level, it provides additional evidence in favor of the main hypothesis of this paper. The mean inflation in the sample is equal to about 8 percent. Thus, the results in Column 4 of Table 2 indicate that in countries with inflation contained below this threshold, there is no a causal link between financial development and growth. In contrast, when inflation exceeds 8 percent, financial depth should be appreciated for reducing harmful effects of volatility.

To check the robustness of the results, I employ in Table 3 an alternative measure of financial development, namely the logarithm of the ratio of liquid liabilities of the financial system to GDP. The testing strategy remains unaffected, i.e. I first add the proxy for financial development among explanatory variables and then the three interaction terms analogous to those constructed before. The results are displayed in Table 3, where the coefficients and standard errors of the year dummies were suppressed for the sake of clarity.

Table 3: The role of liquid liabilities of financial sector in economic growth

Dependent variable: GROWTH

Method of estimation: System GMM

VARIABLES	(1)	(2)	(3)	(4)	(5)
$y_{i,t-1}$	0.0225	0.0128	-0.00946	0.0107	-0.0159
	(0.0176)	(0.0143)	(0.00938)	(0.0290)	(0.01000)
INV	0.177***	0.129***	0.113***	0.174	0.0971**
	(0.0469)	(0.0490)	(0.0367)	(0.114)	(0.0416)
POP	-5.161***	-4.218***	-3.372***	1.791	-4.134***
	(1.466)	(1.516)	(1.010)	(5.373)	(1.155)
SCHOOL	-0.141***	-0.104***	-0.00176	-0.0149	0.00612
	(0.0404)	(0.0331)	(0.0231)	(0.0779)	(0.0260)
GOV	-0.137***	-0.135***	-0.0846**	-0.0586	-0.0774**
	(0.0345)	(0.0363)	(0.0332)	(0.0756)	(0.0338)
INFL	0.00807	-0.0135	0.0725	0.591	-0.0106
	(0.0501)	(0.0606)	(0.0661)	(0.390)	(0.0429)
VOL	-2.733***	-2.495***	-1.878***	-0.0335	-1.591***
	(0.422)	(0.762)	(0.346)	(1.350)	(0.484)
LIQUID	-0.0198				
	(0.0246)				
LIQUID×VOL		-0.276			
		(0.475)			
LIQUID×VOL×INFL			1.100*	7.613*	
			(0.604)	(4.203)	
LIQUID×VOL×HINFL					0.533*
					(0.308)
Observations	512	512	512	512	512
Number of countries	106	106	106	106	106
AR2-p	0.878	0.880	0.816	0.235	0.715
AR1-p	0.101	0.285	7.91e-09	0.920	4.21e-07
Number of instruments	68	68	107	37	107
Number of lags	4	4	3	5	3
Sargan-p	4.79e-06	0.000236	0.00487	0.589	0.148

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The reliability of estimates of growth regressions with liquid liabilities as a measure of financial development is impeded by an inadequacy of instruments. Only in Columns 4 and 5 of Table 3 the validity of instruments is supported by the results of the Sargan test. For the remaining regression equations, varying the number of lags does not lead to any improvement in this respect. Hence the results should be interpreted with caution.

Keeping in mind the instruments validity problem, one can deduce that population growth and government size put a break on growth, whereas investment rate is the main growth booster. The results on the importance of financial services and volatility in Table 3 to a large extent corroborate my previous findings. First, output volatility hampers growth. Second, financial development does not seem to enhance growth unless inflation rates are high.

Due to econometric issues discussed above, one should pay attention to Column 5 of Table 3 because it reports the best results in terms of reliability. The variable LIQUID×VOL×HINFL takes the value LIQUID×VOL if inflation is higher than its median equal to about 8 percent and zero otherwise. Although this interaction term is significant only at 10 percent level, it points to the fact that financial development has a nil effect on growth if inflation falls short of 8 percent. Once this threshold is hit, financial depth helps the economy to struggle against the growth-abating effects of volatility.

5. Conclusions

A statement that financial development is conducive to economic growth is dubious and needs a qualifier. In this paper an attempt has been made at highlighting the critical role of inflation in assessing a quest for more developed financial markets. From a theoretical perspective, more experienced financial intermediaries foster growth indirectly, by protecting the economy from the harmful effects of relative price variability generated by inflation. Real technology shocks are another source of volatility which retards growth, irrespective of the degree of financial development.

Empirical research seems to support the view that output volatility is robustly and negatively linked with growth in a large sample of developed and developing countries studied in the 1970-2004 period. Higher degree of financial development turned out to be impotent in face of firm reluctance to invest when output volatility is high. In contrast, high amount of credit extended to private sector or stock of liquid liabilities of financial intermediaries have been found to underpin growth when inflation is high.

A practical implication of this research can be expressed as a policy recommendation. There exists a trade-off between fight against inflation and financial development. Policymakers hard-nosed on inflation may pay less attention to fostering financial development. On the contrary, when inflation accelerates, active efforts should be made to ease the development of financial markets.

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