FONDATION POUR LES ÉTUDES ET RECHERCHES SUR LE DÉVELOPPEMENT INTERNATIONAL

Working Paper 238 October 2018 Development Policies

Financial Deepening, Terms of Trade Shocks, and Growth Volatility in Low-Income Countries*

Kangni Kpodar | Maëlan Le Goff | Raju Jan Singh

Kangni Kpodar, Senior Economist at the International Monetary Fund (IMF) and Senior Fellow at FERDI. **Email : kkpodar@imf.org**

Maëlan Le Goff, Research Economist at Banque de France. **Email : maelan.legoff@banque-france.fr**

Raju Jan Singh, Program Leader at the World Bank. **Email: rsingh9@worldbank.org**

Abstract

This paper contributes to the literature by looking at the possible importance of the structure of the financial system—whether financial intermediation is performed through banks or markets—for macroeconomic volatility, against the backdrop of increased policy attention on strengthening growth resilience. With low income countries (LICs) being the most vulnerable to large and frequent terms of trade shocks, the paper focuses on a sample of 38 LICs over the period 1978-2012 and finds that banking sector development acts as a shock absorber, dampening the transmission of terms of trade shocks to growth volatility. Expanding the sample to 121 developing countries confirms this result, although this role of shock-absorber fades away as economies grow richer. Stock market development, by contrast, appears neither to be a shock absorber nor a shock amplifier for most economies. These findings are robust across fixed effect, System GMM and local projection estimates.

JEL Classification: F40, G20, O10

Keywords : Banks, stock markets, terms of trade, growth volatility

* The authors are very grateful to Patrick Guillaumont, Sylviane Guillaumont Jeanneney, Ousmane Samba Mamadou, participants at the Banque de France – FERDI Conference (January 2017) and the 6th Bordeaux Workshop in International Economics and Finance (August 2018), for helpful comments and suggestions. This research is part of a Macroeconomic Research in Low-Income Countries project (Project id: 60925) supported by the UK Department for International Development (DFID). The views expressed in this paper are those of the authors and do not necessarily represent the views of the International Monetary Fund (IMF), World Bank, Banque de France, FERDI or DFID. Both authors gratefully acknowledge support from the French National Research Agency under program ANR-10-LABX-14-01.

Contents Page

I. INTRODUCTION

While financial development and its effects on economic growth have attracted considerable attention in the literature, far less work has been done on the relationship between financial deepening and macroeconomic volatility. Is the financial system a shock absorber or a shock amplifier? Is there something like too much finance? The 2008 financial crisis has brought back these questions to the front. Few studies have also examined the possible importance of the structure of the financial system, i.e. whether financial intermediation is performed through banks or markets, for macroeconomic volatility. Theory provides conflicting predictions. Empirically, the results have been equally mixed.

Yet, macroeconomic stability is a prerequisite for durable and sustainable growth. Furthermore, it has been observed that faster growing economies on average do not necessarily grow faster than others in good times but manage to be more resilient and limit the extent of a downturn in bad times. Between 1950 and 2011, most of the relatively faster growth of high-income countries has resulted not from experiencing faster growth but rather from shrinking less, and less often, compared to lower-income countries (World Bank, 2017). Against this backdrop, understanding what contributes to macroeconomic volatility and identifying options to improve global resilience of economies become critical.

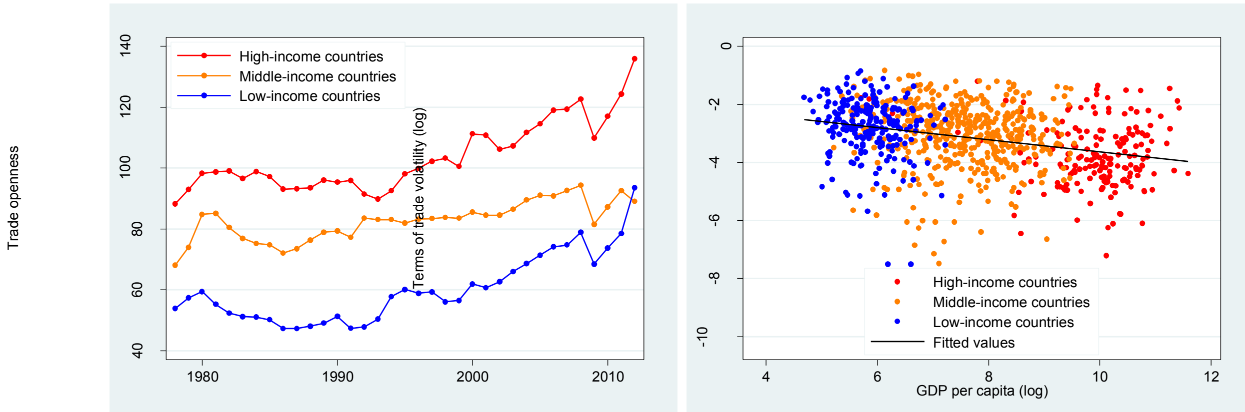
In particular, low-income countries (LICs) have been increasingly integrated to the world economy. As a consequence, they have become more exposed to terms of trade shocks (Figure 1). Yet, their financial sectors remain shallow and their development has stagnated over time (Figure 2). Should we be concerned about this mismatch? Should greater effort be paid in developing financial sectors in LICs to make them more resilient to external shocks and allow them to reap the benefits of greater globalization while containing its downside risks?

This paper aims to contribute to the literature in several ways. First, it looks specifically at LICs, reaching more conclusive results on the potential shock-absorber role of the financial sector, and compares the results with a wider sample. Second, it tries to capture the role of the structure of the financial system by examining to what extent both banking and stock market development play out in the transmission of external shocks.

The results from robust econometric methodologies (fixed effect, System GMM and local projections) with a sample of 38 LICs during 1978-2012 provide support to the hypothesis that banking sector development acts as a shock absorber, dampening the transmission of terms of trade shocks to growth volatility in LICs. Nevertheless, this role fades away as economies grow richer. Stock market development, by contrast, appears neither to be a shock absorber nor a shock amplifier for most cases. Financial deepening achieved through the expansion of banks would thus be associated not only with the usual arguments of better access to finance, but also be more resilient in the face of external shocks, especially at early stages of economic development.

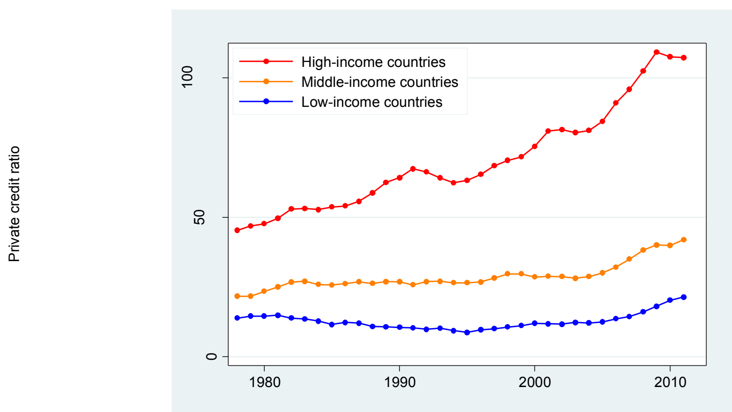
In what follows, Section II reviews the literature; Section III discusses the data and describes the methodology; Section IV presents the results; and Section V concludes with policy implications.

Figure 1. Trade Openness and Terms of Trade Volatility by Income Groups, 1978-2012



Notes. Trade openness is the ratio of the sum of exports and imports to GDP. Terms of trade volatility is the standard deviation of the residual of the log of terms of trade relative to its long-term trend (see table A2 and section 3).
Sources. World Development Indicators and authors' calculations.

Figure 2. Trends in Private Credit Ratio to GDP by Income Groups, 1978-2012



Sources. Financial Development and Structure Dataset (Beck et al., 2000), and authors' calculations.

II. Theoretical Background and Review of the Literature

On the one hand, financial deepening provides opportunities to diversify risks, manage volatility and insure against unexpected events (Stiglitz, 1974; Newberry, 1977; Atkinson and Stiglitz, 1980; Townsend, 1982; and Bardhan et al., 2000). Furthermore, it could be argued that more developed financial systems could make monetary policy more effective in carrying out counter-cyclical policies. These arguments would lead to think that deeper financial markets would absorb external shocks and make an economy more resilient.

On the other hand, financial institutions operate in settings where complete information is often not available. Entrepreneurs seeking financing normally have more information about their projects than their banks do. In this setting, from the viewpoint of a financial institution projects that may have different probabilities of success are indistinguishable. This information asymmetry requires banks to screen applications to grant loans only to the most promising projects (Singh, 1992).

The lender cannot rely simply on increasing the interest rate, however. As Stiglitz and Weiss (1981) demonstrated, increases in the interest rate charged on loans may adversely affect the composition of the pool of borrowers. The expected return to the lender depends on the probability of repayment, so the lender would like to be able to identify borrowers who are more likely to repay. Those who are willing to borrow at high interest rates, however, may be riskier: they are willing to borrow at high interest rates because they perceive their probability of repaying the loan to be low. For a given expected return, an increase in interest rates will induce low-risk projects to drop out first, leaving only the riskier ones in the pool.

Lenders could require collateral, which imposes a cost if the entrepreneur defaults. As the probability of failure is greater for high-risk projects, the same amount of collateral will reduce the expected profit of these projects by more than that of less risky ones. Bester (1985) demonstrated that lenders could design attractive contracts adapted to the various qualities of borrowers, leading to perfect sorting.

In this setting, adverse shocks to the net worth of borrowers would amplify macroeconomic fluctuations (Bernanke and Gertler, 1990; Greenwald and Stiglitz, 1991). According to the "financial accelerator" theory as spelled out in Bernanke and Gertler (1989) and Kiyotaki and Moore (1997), for instance, during booms, borrowers net worth improves, increasing their access to finance, boosting investment and output. On the contrary, during busts, borrowers net worth declines, limiting their access to finance and hampering investment and output.

Alternatively, loan providers could invest in gathering additional information on projects that would lead to a better perception of the probability of success for a given project (Devinney, 1986; Singh, 1994, 1997). In this regard, several authors have argued that banks would be better placed than markets in alleviating these informational problems. For instance, Diamond (1984), Boot and Thakor (1997), Boyd and Prescott (1986), and Ramakrishnan and Thakor (1984) stress the critical role banks play in easing information asymmetries and thereby improving resource allocation.

Furthermore, banks frequently establish close, long-term relations with firms and ease cash-flow constraints on existing firm expansion with positive ramifications on economic growth (Hoshi et al., 1991). By contrast, markets have been argued not to produce the same improvements (Bhide, 1993; Stiglitz, 1985). Stiglitz (1985), for instance, argues that well-developed markets quickly and publicly reveal information, which reduces the incentives for individual investors to acquire information. A bank-based financial system would thus be more resilient than a market-based one.

The importance of a market-based versus bank-based financial system may depend on existing institutions. According to this view, economies will benefit from becoming more market-based only as their institutional framework strengthens (Levine, 2002). Gerschenkron (1962), Boyd and Smith (1998), and Rajan and Zingales (1999) stress that banks can more effectively force firms to honor their contracts than atomistic markets and would thus be especially important in countries at early stages of development and with weak contract enforcement capabilities. As institutions in countries mature, the exchange of information becomes more efficient, reducing the cost of screening borrowers.

Hence, theoretically, given a certain level of economic and institutional development, banks may have an advantage in dealing with information asymmetries compared to markets. If this is true, a bank-based financial system would be better able to handle adverse shocks on its clients' net worth and prevent – or least limit – the extent to which they are cut off from financing. The more a financial structure would be bank-oriented the more it would be able to absorb rather than amplify shocks. This relationship could be, however, non-linear: as the institutions of a country get stronger and its economy richer, the role of banks as shock absorbers could fade away.

The theoretical ambiguity is reflected in the divergence of empirical results. Looking at aggregate data, Easterly et al. (2000), Denizer et al. (2002) and Silva (2002) show that financial depth, especially bank development, reduces output, investment and consumption volatility. Tiryaki (2003) and Beck et al. (2006), by contrast, do not find any robust relation between banking development and growth volatility.

Other empirical analyses provide evidence of a non-linear, U-shaped, relationship between banking sector development and macroeconomic volatility: macroeconomic volatility first diminishes until a certain threshold of banking development is reached and increases thereafter (Easterly et al., 2001; Dabla-Norris and Srivisal, 2013; Kunieda, 2015). Evidence from the recent global financial crises would support this view that while financial depth can help reduce the impact of real sector shocks, it can also propagate financial sector shocks, thus amplifying macroeconomic volatility. This threshold tends to be relatively high, however, observed in advanced economies only.

Empirical studies looking at industry level data have tended to support the stabilization role banks could play. Braun and Larrain (2005), Larrain (2006), and Raddatz (2006) find that banking development reduces industry output volatility, particularly in the case of industrial sectors facing high liquidity needs.

Finally looking at the structure of the financial system, Yeh et al. (2013) provides evidence that the structure of the financial system matters in explaining macroeconomic volatility. Looking at a panel of countries, the authors suggest that more market-based countries enjoy faster economic growth but suffer more from economic fluctuations in the long run than economies where the financial system is more bank-based. At a country level, Wei and Kong (2016) confirms this view, showing that in the case of China bank-based financial depth decreases volatility, while the development of a stock market amplifies it.

III. The Data, Model and Econometric approach

A. Data and sample

For this study, we focus on a sample of 38 LICs over the period 1978-2012. The definition of LICs follows that of the World Bank based on the level of Gross National Income (GNI) per capita. We expand the sample to 121 developing countries in some specifications to assess whether the results are specific to the LICs or also apply more widely to other income groups. The period of study, dictated by data availability, is split in seven subperiods of five years each. Given the small size of the country sample, the panel structure allows to obtain a higher number of observations than in a cross-country setting, while averaging the data over sub-periods helps smooth out noises.

B. Model specification

The basic idea is to examine to what extent financial development, both banking and stock market development, plays out in the transmission of external shocks, controlling for other factors that may affect growth volatility. Given that the theory does not offer a clear-cut answer, the empirical analysis could help uncover the direction and magnitude of the impact. To this effect, this paper adopts a linear model with the following specification, drawing on Kpodar and Imam (2016):

$$Vgrowth_{i,t} = \alpha_0 + \beta Vtot_{i,t} + \varphi Findev_{i,t} + \delta Vtot_{i,t} * Findev_{i,t} + AX_{i,t} + u_i + \varepsilon_{i,t} \qquad (1)$$

where *Vgrowth* represents real GDP growth volatility, *Vtot* is the volatility of terms of trade, *Findev* is the indicator of financial development, *X* is a set of control variables including the level of GDP per capita, trade openness (measured by the sum of exports and imports divided by GDP), financial volatility, inflation volatility, political stability (an index constructed by the World Bank) and the share of agricultural value added in GDP, u is the country-specific effect and ε is the error term.

In measuring financial development, we use indicators of banking development but also stock market development to see if there is a differentiated association with growth volatility. For banking sector development, the private credit ratio and the liquidity ratio are used as indicators, while stock market development is proxied by the market capitalization ratio and the total value traded ratio. Financial volatility is measured by the volatility in the private credit ratio or the liquidity ratio.

The variables of interest are the standalone financial depth variable and its interaction with terms of trade volatility. A negative coefficient on the interaction variable would lend support to the hypothesis that financial development acts as a shock absorber, while a positive sign would indicate that financial depth in fact exacerbates external shocks. A similar interpretation applies to the standalone financial depth variable, but with the difference that this effect is not conditioned to the nature of the shock.

For the other variables, and consistent with previous findings in the literature, we expect terms of trade shocks to be positively correlated to growth volatility, in particular in LICs where economic diversification is scant. Similarly, GDP per capita could be negatively correlated with growth volatility, reflecting high sectoral concentration in high-risk sectors during early stages of development as underscored in Koren and Tenreyro (2007). Trade openness may have an ambiguous effect on output volatility as it provides opportunities for diversification and international risk sharing, but also triggers greater exposure to external shocks. The share of agricultural value added in GDP (a proxy of weather-related shocks), as well as financial volatility, inflation volatility, and a lack of political stability are expected to be positively associated with higher output volatility, in part due to their direct impact on economic activities but also because they are likely to disrupt investment decisions and create economic uncertainties. Table A1 presents the summary statistics of the correlation matrix, with the sign of the correlation coefficients broadly in line with expectations.

How is volatility measured? The traditional approach in the literature has been to use the standard deviation of the growth rate of the given variable during a specific period. However, this approach relies on strong assumptions regarding the functional form of the long-term component. Instead, we use here a more flexible approach, assuming that the long-term component follows an AR (1) process with a trend. The coefficients to determine the long-term trend are country-specific and derived from a regression. The standard deviation of the residual relative to the estimated long-term trend over each sub-period is the measure of the volatility (see Kpodar and Imam (2016) for more details).[2]

To estimate the model, two standard econometric estimators are used: the fixed effect estimator and the System-GMM estimator. The fixed-effect estimator allows to control for time-invariant country-specific factors that may affect growth volatility, thereby reducing the risk of omitted variables. However, endogeneity issues may arise due to omitted variables (not addressed by the inclusion of country-specific effects), measurement errors and reverse causality. For instance, growth instability might lead to lower credit to the private sector when banks are risk-averse and scale back credits in the face of economic uncertainties. Similarly, output volatility could dampen long-term per capita growth, as evidenced in Ramey and Ramey (1995). As an attempt to tackle potential endogeneity issues, we use the System-GMM estimator developed by Blundell and Bond (1998) to instrument the right-hand side variables with the appropriate lags. Blundell and Bond (1998) find that the System-GMM estimator, which uses both the difference panel data and the level specification, improves significantly the consistency and efficiency of the estimates compared to the first-differenced GMM developed by Arellano and Bond (1991).

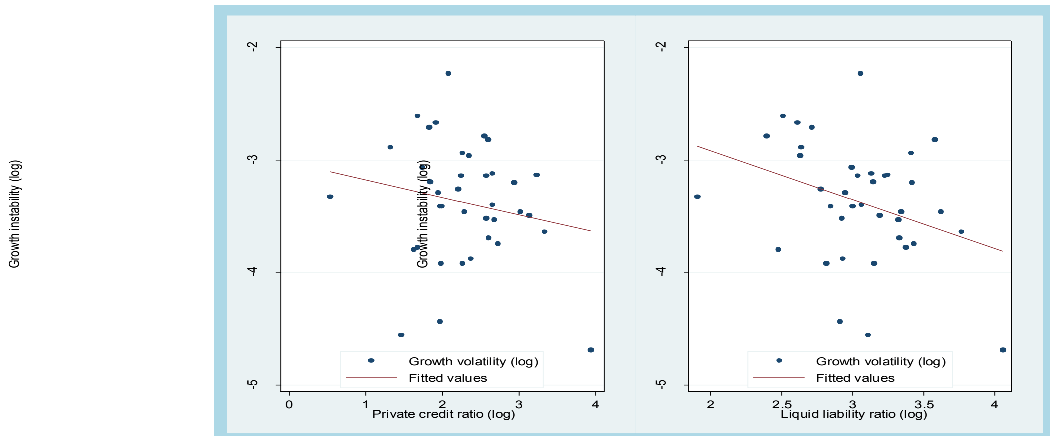
IV. The Results

Before proceeding with the econometric estimations, a quick look at the data provides some interesting insights. Figure 3 shows that, in the sample of LICs considered, those with deeper banking systems tend to experience lower growth volatility, regardless of the measure of financial depth. More importantly, Figure 4 shows that the correlation between terms of trade shocks and growth volatility is weaker in countries in more developed banking sector. These results point in favor of the hypothesis that financial development acts as a shock absorber,

[2] Table A2 presents the definition of the variables and their sources.

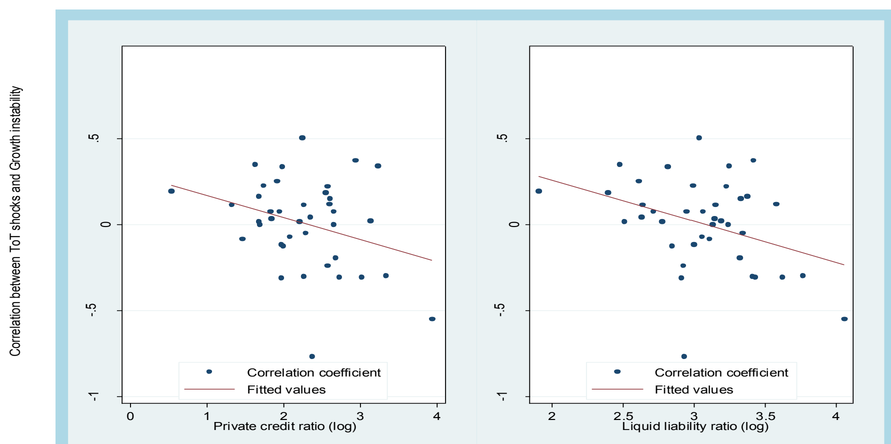
particularly in mitigating the negative effects of real external shocks. However, the picture is less clear cut when considering stock market indicators (Figure 5), probably suggesting that in LICs banks are better at insulating the economy from shocks than stock markets. The absence of a stock market or its limited development in many LICs do not allow, however, to draw definite conclusions.

Figure 3. Banking Sector Development and Growth Volatility in LICs, 1978-2012



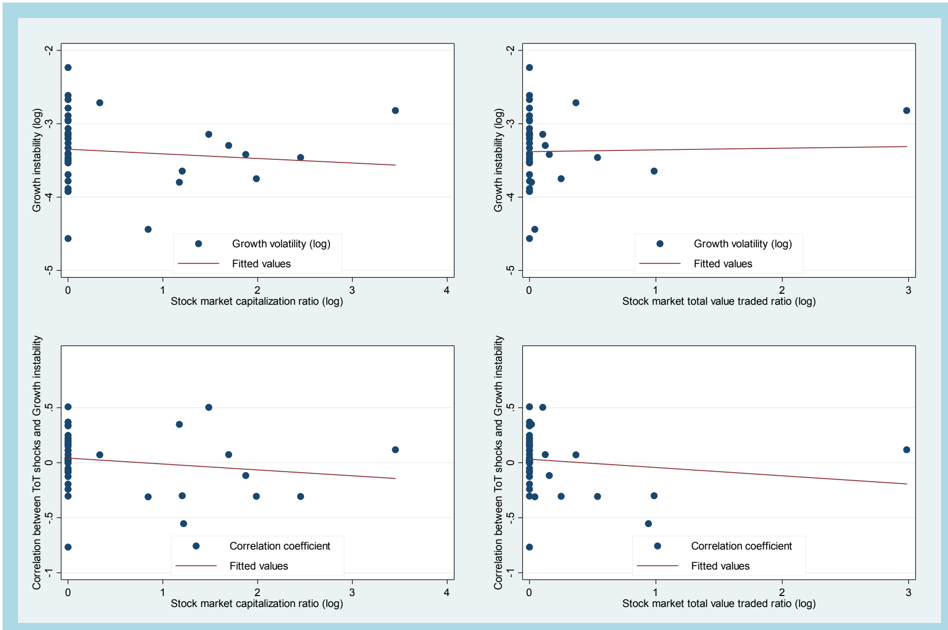
Sources. Financial Development and Structure Dataset (Beck et al., 2000), and authors' calculations.

Figure 4. Banking Sector Development and the Correlation between Growth Volatility and Terms of Trade Shocks in LICs, 1978-2012



Sources. Financial Development and Structure Dataset (Beck et al., 2000), and authors' calculations.

Figure 5. Stock Market Development, Growth Volatility and its Correlation with Terms of Trade Shocks in LICs, 1978-2012



Sources. Financial Development and Structure Dataset (Beck et al., 2000), and authors' calculations.

Table 1 reports the results from the fixed effects estimator. They provide support to the hypothesis that banking sector development acts as a shock absorber in LICs. Banking sector development captured by the private credit ratio is negatively associated with growth volatility consistently across specifications, not only as a standalone variable but also as an interaction with terms of trade volatility. The economic significance is meaningful as moving from the first decile of the distribution of private credit ratio (4.2 percent of GDP) to the first quartile (6 percent of GDP) reduces the elasticity of growth volatility to terms of trade shocks by about 40 percent (from 0.39 to 0.24).[3]

The results also suggest that growth volatility tends to decline as income per capita rises. The coefficient on income per capita is negative and significant in four out of six specifications. As expected, political stability appears to be associated with lower growth volatility, while credit growth volatility seems to be positively related to it. However, we do not find any evidence that higher inflation volatility be related to higher growth volatility, nor that an agriculture driven economy would be subject to larger output volatility.

[3] Estimate obtained using the specification of column 6 in Table 1.

Table 1. Financial Development, Terms of Trade Shocks and Growth Volatility: Fixed-Effect Estimates

Fixed effects	(1)	(2)	(3)	(4)	(5)	(6)
	LICs	LICs	LICs	LICs	LICs	LICs
GDP per capita (log)	-0.423	-0.328	-0.375	-0.520	-0.379	-0.439
	[0.183]**	[0.189]*	[0.202]*	[0.197]**	[0.278]	[0.329]
Trade openness	-0.003	-0.004	-0.003	-0.004	0.001	-0.004
	[0.004]	[0.004]	[0.004]	[0.004]	[0.005]	[0.007]
Terms of trade volatility (log)	0.893	0.838	0.803	0.926	0.740	0.599
	[0.160]***	[0.166]***	[0.132]***	[0.166]***	[0.152]***	[0.173]***
Private credit ratio (log)	-0.896	-0.860	-0.858	-0.918	-0.827	-0.725
	[0.207]***	[0.206]***	[0.195]***	[0.214]***	[0.224]***	[0.236]***
Private credit ratio (log) * Terms	-0.323	-0.311	-0.295	-0.335	-0.269	-0.255
of trade volatility (log)	[0.069]***	[0.068]***	[0.056]***	[0.068]***	[0.058]***	[0.062]***
Credit growth volatility (log)		0.239				0.208
		[0.080]***				[0.147]
Inflation volatility (log)			0.078			0.011
			[0.094]			[0.123]
Political stability					-0.505	-0.645
					[0.205]**	[0.218]***
Agricultural value-added share				-0.349		-0.534
				[0.352]		[0.559]
Constant	1.333	1.145	1.100	3.268	0.081	2.424
	[0.946]	[0.969]	[0.953]	[2.169]	[1.533]	[3.420]
Observations	180	177	171	175	129	118
Number of countries	38	38	38	37	38	37
R-squared	0.16	0.20	0.17	0.17	0.20	0.27

Notes. Robust standard errors in brackets. *,**,***Denote significance at 10%, 5% and 1%, respectively.

Looking at the shock variables, it is worth noting that across specifications the elasticity of growth volatility to terms of trade shocks is the largest, three times the elasticity to credit growth volatility, while the elasticity of inflation volatility is smaller and not significant. This suggest that terms of trade shocks are one of the main sources of growth volatility in LICs, which is not quite surprising considering the narrow export base for many LICs and the high reliance of government budget on commodity revenues.

The results from the one-step system GMM estimator with robust standard errors are presented in Tables 2.[4] They largely confirm the findings from the fixed-effect estimations (column 1 to 5, table 2).[5]

[4] To test the validity of the lagged variables as instruments, we use the standard Hansen test of over-identifying restrictions, where the null hypothesis is that the instrumental variables are not correlated with the residual, and the serial correlation test, where the null hypothesis is that the errors exhibit no second-order serial correlation. The results from both tests support the validity of the instruments.

[5] Political stability is dropped from the regressions because it reduces considerably the sample size due to missing data.

Table 2. Financial Development, Terms of Trade Shocks and Growth Volatility: System-GMM Estimates

System GMM	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	LICs	LICs	LICs	LICs	LICs	LICs+LMICs	Developing countries
GDP per capita (log)	-0.517	-0.413	-0.401	-0.393	-0.442	-0.200	-0.211
	[0.304]*	[0.296]	[0.268]	[0.408]	[0.348]	[0.151]	[0.168]
Trade openness	-0.006	-0.006	-0.008	-0.006	-0.007	-0.009	-0.013
	[0.004]	[0.004]	[0.005]	[0.005]	[0.006]	[0.005]**	[0.004]***
Terms of trade volatility (log)	1.154	0.933	1.409	0.983	0.796	0.773	0.455
	[0.422]***	[0.386]**	[0.487]***	[0.421]**	[0.381]**	[0.342]**	[0.244]*
Private credit ratio (log)	-0.889	-0.698	-1.244	-0.982	-0.776	-0.409	-0.213
	[0.411]**	[0.373]*	[0.531]**	[0.465]**	[0.395]**	[0.395]	[0.279]
Private credit ratio (log) * Terms of trade volatility (log)	-0.331	-0.270	-0.434	-0.327	-0.274	-0.248	-0.169
	[0.151]**	[0.137]**	[0.167]***	[0.166]**	[0.139]**	[0.122]**	[0.083]**
Credit growth volatility (log)		0.203			0.482	-0.116	0.125
		[0.151]			[0.174]***	[0.218]	[0.161]
Inflation volatility (log)			-0.101		-0.102	0.320	0.176
			[0.152]		[0.140]	[0.161]**	[0.111]
Agricultural value-added share				0.168	-0.606	-0.145	-0.513
				[0.740]	[0.495]	[0.275]	[0.251]**
Constant	2.751	1.839	2.698	1.193	4.207	0.800	1.488
	[2.151]	[1.877]	[2.121]	[5.171]	[3.941]	[1.819]	[1.709]
Observations	180	177	171	175	163	373	542
Number of countries	38	38	38	37	37	83	121
Hansen test p-values	0.40	0.45	0.35	0.43	0.49	0.52	0.14
AR(2) test (p-values)	0.51	0.44	0.42	0.55	0.43	0.36	0.69

Notes. Robust standard errors in brackets. *,**,***Denote significance at 10%, 5% and 1%, respectively. AR(2): Arellano and Bond test of second order autocorrelation.

Extending the sample to lower middle-income countries (LMICs, see column 6, table 2) and then to all developing countries (column 7, table 2) leads to two observations: (i) banking sector development dampens the transmission of terms of trade shocks to growth volatility, although it plays a much more important role in reducing output instability in LICs (the elasticity of private credit ratio is not significant for the sample of developing countries in contrast to LICs); and (ii) the elasticity of growth volatility with respect to terms of trade shocks is smaller for the sample of developing countries, underscoring the high vulnerability of LICs to terms of trade shocks.

When using the liquidity ratio as an alternative indicator of banking sector development, the results confirm the previous findings (Table 3) with the difference that the liquidity ratio is significant also in the sample of developing countries, in contrast with the private credit ratio. In fact, while both indicators are often used interchangeably, they capture different, although closely intertwined, dimensions of banking sector development. This result suggests that the ability of banks to provide savings opportunities (which the liquidity ratio measures) matters for growth volatility in both LICs and other developing countries, but the credit channel is much more important for LICs, perhaps reflecting tighter credit constraints.

Table 3. Using the Liquid Liability Ratio to Gauge Financial Development: System-GMM Estimates

System GMM	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	LICs	LICs	LICs	LICs	LICs	LICs+LMICs	Developing countries
GDP per capita (log)	-0.453	0.026	-0.074	-0.455	0.003	0.347	-0.121
	[0.311]	[0.302]	[0.273]	[0.414]	[0.534]	[0.385]	[0.290]
Trade openness	-0.007	-0.006	-0.008	-0.008	-0.004	-0.008	-0.008
	[0.005]	[0.007]	[0.006]	[0.006]	[0.007]	[0.005]*	[0.004]**
Terms of trade volatility (log)	1.711	2.956	2.634	1.884	3.065	2.536	1.296
	[0.639]***	[1.191]**	[0.967]***	[0.752]**	[1.422]**	[0.928]***	[0.547]**
Liquid liability ratio (log)	-1.305	-3.092	-2.815	-1.584	-3.512	-2.275	-0.969
	[0.608]**	[1.349]**	[1.071]***	[0.735]**	[1.341]***	[1.097]**	[0.564]*
Liquid liability ratio * Terms of trade volatility	-0.470	-0.887	-0.772	-0.545	-0.931	-0.761	-0.366
	[0.193]**	[0.380]**	[0.294]***	[0.240]**	[0.452]**	[0.307]**	[0.159]**
Volatility of the liquid liability ratio		0.272			0.177	0.389	0.444
		[0.287]			[0.284]	[0.284]	[0.195]**
Inflation volatility			-0.115		-0.082	0.151	0.155
			[0.174]		[0.160]	[0.183]	[0.129]
Agricultural value-added share				-0.066	-0.034	0.390	-0.781
				[0.616]	[1.031]	[0.707]	[0.577]
Constant	4.052	7.188	6.065	5.010	8.035	2.276	5.106
	[1.960]**	[3.828]*	[3.376]*	[4.360]	[7.658]	[4.049]	[3.954]
Observations	183	167	173	178	161	368	534
Number of countries	38	38	38	37	37	83	120
Hansen test p-values	0.42	0.52	0.27	0.42	0.45	0.60	0.19
AR(2) test (p-values)	0.38	0.34	0.41	0.37	0.43	1.00	0.69

Notes. Robust standard errors in brackets. *,**,***Denote significance at 10%, 5% and 1%, respectively. AR(2): Arellano and Bond test of second order autocorrelation.

Stock markets have emerged in some LICs as early as in the 1980s and have continued to grow over time, although they are still relatively small, and trading is limited to a few large firms. Are these markets associated differently to volatility? The results presented in table 4 suggest that there is no robust evidence that stock markets in LICs act as a shock absorber. The coefficient on the stock market indicator is only significant in one out of four specifications (column 1 to 4, table 3). Surprisingly, the coefficient on the stock market indicator turns positive and significant in the larger sample of developing countries. Further investigation reveals that this result is not robust as it is driven by outliers, representing a mere 2.5 percent of the total number of observations (see Figure A1).[6] Therefore, one can consider that as for LICs stock market development is neither a shock absorber nor a shock amplifier as far as growth volatility and the transmission of terms of trade shocks to the latter are concerned.

[6] In Figure A1, we rank countries by increasing level of GDP per capita and run the specification in Table 4 (column 5 and 6) consecutively by only including for each iteration the sample of countries with GDP per capita below a threshold ranging from the first quartile of the sample distribution to the maximum value of GDP per capita. The idea is to see how the coefficients on stock market development and its interaction term with terms of trade volatility converge to the full sample estimates. It appears that the two coefficients only turn positive and significant toward the end of the sample distribution, driven by outliers accounting for 2.5 percent of the sample. In other words, for 97.5 percent of the sample, the two coefficients are not statistically significantly different from zero at conventional levels.

Table 4. Accounting for Stock Market Development: System-GMM Estimates

System GMM	(1)	(2)	(3)	(4)	(5)	(6)
	LICs	LICs	LICs	LICs	Developing countries	Developing countries
GDP per capita (log)	-0.336	-0.400	-0.282	-0.357	-0.188	-0.179
	[0.353]	[0.340]	[0.355]	[0.324]	[0.202]	[0.182]
Trade openness	-0.006	-0.004	-0.006	-0.004	-0.009	-0.007
	[0.006]	[0.005]	[0.005]	[0.005]	[0.003]***	[0.003]**
Terms of trade volatility (log)	0.703	0.762	0.905	0.825	0.381	0.403
	[0.299]**	[0.327]**	[0.370]**	[0.398]**	[0.254]	[0.243]*
Private credit ratio (log)	-0.621	-0.759	-0.834	-0.875	-0.255	-0.272
	[0.330]*	[0.340]**	[0.431]*	[0.455]*	[0.275]	[0.256]
Private credit ratio * Terms of trade volatility	-0.250	-0.247	-0.293	-0.275	-0.178	-0.173
	[0.107]**	[0.113]**	[0.154]*	[0.160]*	[0.090]**	[0.082]**
Stock market capitalization ratio (log)	-0.238		-0.311		0.265	
	[0.114]**		[0.274]		[0.208]	
Stock market total value traded ratio (log)		-0.078		0.156		0.515
		[0.163]		[0.344]		[0.307]*
Stock market capitalization (log) * Terms of trade volatility (log)			-0.034		0.139	
			[0.101]		[0.069]**	
Stock market total value traded (log) * Terms of trade volatility (log)				0.069		0.233
				[0.127]		[0.096]**
Credit growth volatility (log)	0.401	0.443	0.307	0.468	0.239	0.251
	[0.171]**	[0.169]***	[0.111]***	[0.162]***	[0.124]*	[0.145]*
Inflation volatility (log)	-0.045	-0.126	-0.047	-0.179	0.130	0.118
	[0.148]	[0.143]	[0.101]	[0.146]	[0.099]	[0.091]
Agricultural value-added share	-0.449	-0.384	-0.420	-0.397	-0.626	-0.523
	[0.473]	[0.493]	[0.656]	[0.434]	[0.287]**	[0.248]**
Constant	2.658	2.912	2.766	2.798	1.505	1.051
	[3.663]	[3.844]	[4.316]	[3.540]	[2.143]	[1.862]
Observations	163	163	163	163	542	542
Number of countries	37	37	37	37	121	121
Hansen test p-values	0.91	0.71	0.68	0.85	0.39	0.27
AR(2) test (p-values)	0.47	0.50	0.51	0.54	0.72	0.59

Notes. Robust standard errors in brackets. *,**,***Denote significance at 10%, 5% and 1%, respectively. AR(2): Arellano and Bond test of second order autocorrelation.

V. Robustness Analysis: A Local Projection Approach

The objective of this section is to use a different econometric methodology to see if our findings hold. Since the paper looks at the impact of a terms of trade shock on growth volatility, it is also worthwhile to pay attention to the dynamic of the transmission of the shock—which the fixed effect and the System GMM estimators, previously used, are not designed to capture—: how fast is the transmission of the shock? What is the magnitude of the peak pass-through? and how persistent is the shock (temporary effect vs permanent effect)? Is the dynamic altered by banking sector and stock market development?

To answer similar questions, a standard approach in the literature is to estimate Vector Autoregressive models (VAR), inverting its estimates and then imposing sufficient identifying restrictions to obtain the impulse responses (see for instance Broda, 2004).

However, if it turns out that the VAR model does not coincide with the data generation process, this would lead to a misspecification, with potentially serious bias in the coefficient estimates. Jordà (2005) underlines that misspecification errors are compounded with the forecast horizon as an impulse response is a function of forecasts at increasingly distant horizons.

To avoid this drawback, we adopted the local projection approach developed by Jordà (2005). It consists in generating multi-step predictions using direct forecasting models that are re-estimated for each forecast horizon. The approach has the advantage of being robust to misspecification and is relatively straightforward to implement as it can be estimated using OLS. There has been a growing interest in the literature in estimating impulse responses using local projections techniques (see for instance Auerbach and Gorodnichenko, 2013; Ramey and Zubairy, 2014; Caselli and Roitman, 2015; Kpodar and Abdallah, 2017). Nevertheless, Teulings and Zubanov (2014) underscores that the local projection approach may be subject to a bias if innovations in the regressors between periods t and t+h are not controlled for when estimating the impulse response at horizon h. The model specification, incorporating the correction suggested by Teulings and Zubanov (2014), is as follows:

$$Vgrowth_{i,t+h} = \alpha_0 + \beta_k \sum_{k=0}^{n} Vtot_{i,t-k} + \gamma_j \sum_{j=1}^{h} Vtot_{i,t+h} + \delta_h Vtot_{i,t} * DFin_{i,t} + A_h X_{i,t+h} + u_i + \varepsilon_{i,t+h} \quad (2)$$

where $Vgrowth$ represents the volatility of real GDP growth; $Vtot$ is the volatility of terms of trade; $DFin$ is a dummy variable taking 1 beyond a given level of banking sector or stock market development and 0 otherwise; X is the same set of control variables used for fixed-effect/System-GMM model, which includes trade openness, financial volatility, inflation volatility, and the share of agricultural value added in GDP; u is the country-specific effect and e is the error term.

Even though the equation for the local projection approach relies on the same set of variables as the fixed-effect/System-GMM model and the specification is quite similar, the equation for the local projection differs slightly from several standpoints:

- The dependent variable $Vgrowth_{i,t+h}$ is the real GDP growth volatility at horizon h=0,1,2,3,4 and 5; allowing to estimate the impact of a terms of trade shocks on growth volatility up to five years after the shock.
- The second term of the equation includes lagged value of terms of trade shocks (n=4),[7] while the third term represents the Teulings and Zubanov (2014)'s adjustment factor to account for shocks occurring within the forecast horizon.
- For the sake of simplicity and to facilitate the graphical representation of the impulse response functions (IRFs), the financial depth variable is replaced by a dummy variable. For banking sector development, the dummy variable takes 1 for values

[7] The number of lags is informed by the construction of the volatility variable for terms of trade.

(continued…)

above the sample median for LICs, and zero otherwise. For stock market development, the dummy variable takes 1 if stock market capitalization is strictly positive, and zero otherwise (implying the country does not have stock markets).[8]

- The local projection is estimated with annual data as opposed to the 5 year-average data used for the fixed-effect/System GMM model. This increases the number of observations by three to 4 times, thereby allowing to estimate more precisely the coefficient estimates. Moreover, if our findings are confirmed, this would provide evidence that they are quite robust as they do not depend on data periodicity or averaging.

While the local projection approach brings some advantages, it also raises two main challenges. First, with annual data it is no longer possible to measure the volatility as the standard deviation of the residual relative to the estimated long-term trend over a given period. Instead, the measure of volatility in year t is calculated as the absolute value of the difference between the residual at year t and the average of the last 5 years (including the year t).[9] The second challenge, which is related to the first one, arises from the overlapping nature of the volatility variables. Since the volatility is defined relative to the average of the past 5 years, the error term has, by construction, a moving average form and is potentially autocorrelated, therefore coefficient estimates from standard statistical inference may be biased. To address this issue, we adopt a fixed effect estimator with Driscoll-Kraay standard errors[10] to estimate the IRFs instead of the standard fixed effect estimator. The Driscoll-Kraay fixed-effect estimator has the added advantage of proposing a nonparametric covariance matrix estimator that generates not only heteroskedasticity and autocorrelation-consistent standard errors, but also standard errors that are robust to cross-sectional dependence.

Figure 6, showing the unconditional impulse response,[11] indicates that growth volatility reacts quite rapidly to terms of trade shocks with the peak pass-through reached within a year after the shock. This confirms the previous findings that terms of trade shocks lead to growth volatility. The effect dies out thereafter and remains statistically insignificant in the outer years, implying that the effect is of a temporary nature rather than permanent.

---

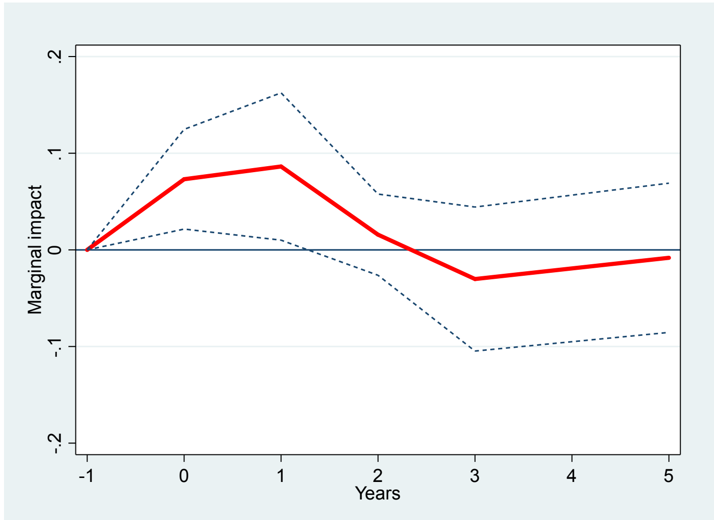
[8] Due to the very skewed distribution of stock market capitalization in the sample, taking the median value, similar to banking sector development, is not appropriate.

[9] As noted earlier, the residual is derived from an AR(1) process with a trend. For each country and for the entire period (1978-2012), the variable is regressed on its lagged value and a time trend.

[10] Driscoll and Kraay (1998).

[11] Equation (2) is estimated without the interaction term between the terms of trade shocks and the dummy variable for financial development.

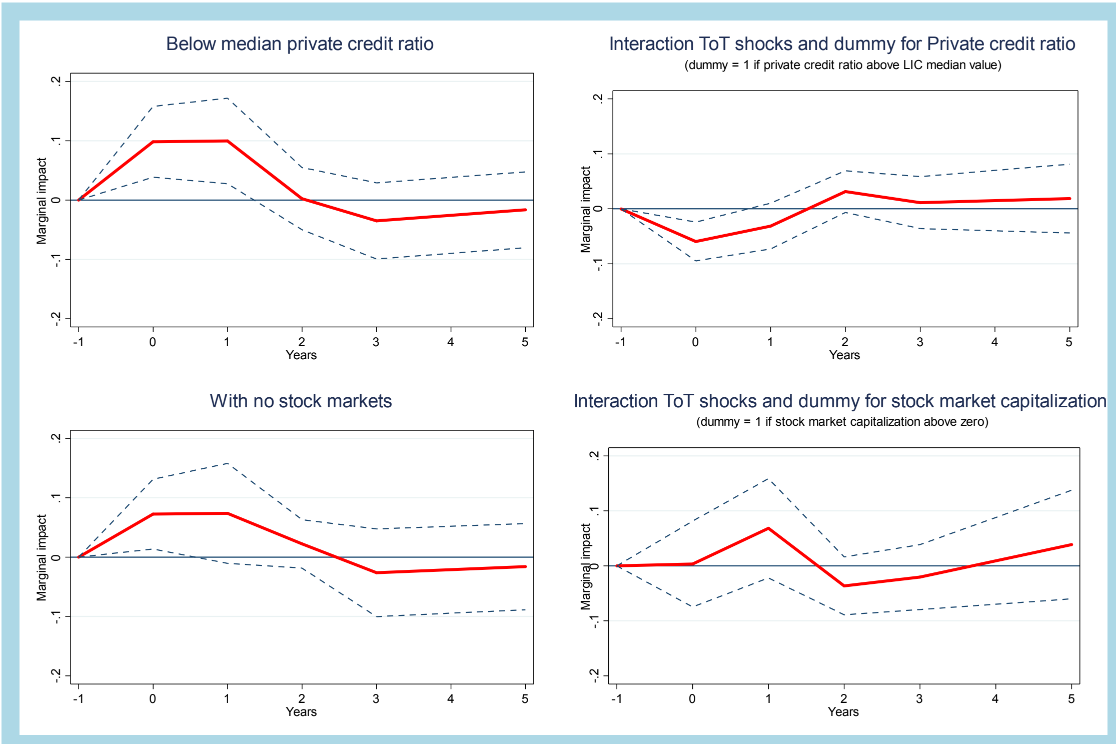
Figure 6. Terms of Trade Shocks and Growth Volatility in LICs: Unconditional IRF



Notes: The solid line depicts the impulse response of growth volatility to a terms of trade shock occurring at year 0. Dotted lines are the 90 percent confidence interval.
Source: authors' calculations.

Turning to the conditional IRFs, Figure 7 shows that for countries below the median private sector credit ratio, terms of trade shocks are positively associated with growth volatility, but the effect is smaller for countries above the median private sector credit ratio as evidenced by the negative and significant coefficient observed for the interaction term between terms of trade shocks and the financial depth dummy variable (top right chart in the panel). Nevertheless, when looking at countries with no stock markets, we observe also that terms of trade shocks magnify growth volatility, but the effect is not statistically different in countries with stock markets (as the interaction terms between terms of trade shocks and the stock market development dummy is not statistically significant). These results lend support to the previous findings that banking sector development may help cushion the effect of terms of trade shocks on growth volatility, whereas stock market development seems not to dampen (or amplify) it.

Figure 7. Terms of Trade Shocks and Growth Volatility in LICs: IRFs Conditional to Financial Depth



Notes: The solid line depicts the impulse response functions, whereas the dotted lines are the 90 percent confidence interval.
Source: authors' calculations.

VI. Conclusions

At the time when increased attention in policy is being paid at improving the global resilience of economies, it is appropriate to ask what role institutions play, especially finance. Our paper attempts to contribute to this debate by examining to what extent financial deepening could absorb or on the contrary amplify shocks and whether bank-based financial development is more resilient than a market-based one.

Focusing on a sample of 38 LICs over the period 1978-2012, this paper provides support to the hypothesis that banking sector development acts as a shock absorber in LICs. Expanding the sample to 121 developing countries, however, the results suggest this role of shock-absorber fades away as economies grow richer. Stock market development, by contrast, appears neither to be a shock absorber nor a shock amplifier for most economies. The findings hold regardless of the three econometric approaches used: (i) the fixed-effect estimator to control for country's unobservable time-invariant characteristics; (ii) the System GMM estimator to deal with potential endogeneity issues and; (iii) the local projection approach to uncover the dynamic response of growth volatility to terms of trade shocks.

Financial deepening achieved through the expansion of banks would thus be associated not only with the usual arguments of better access to finance, but also be more resilient in the face of external shocks, especially at early stages of economic development. Against this backdrop, the policies needed to achieve the development of a stable and sound banking system would also contribute in making the economy as a whole more resilient.

Our empirical analysis should, however, be seen as exploratory rather than providing any definite answers. While the development of bank-based financial systems seems to be associated with more resilient economies, nothing was said about the characteristics of these banks. The ownership structure of the banking system, for example, might be important, especially the presence of foreign banks. The integration of domestic with international capital markets might have an important impact on growth volatility. Furthermore, the regulatory and supervisory framework and the degree of competition might have an impact on the extent to which financial intermediaries serve as absorbers or as propagators of exogenous shocks. These questions are left for future research.

REFERENCES

Atkinson, A. B., and Joseph Stiglitz, 1980, *Lectures on Public Economics*, New York, McGraw–Hill.

Auerbach, A., and Y. Gorodnichenko, 2013, "Measuring the output responses to fiscal policy," *American Economic Journal: Economic Policy*, Vol. 4(2), 1–27.

Bardhan, P. S. Bowles, and H. Gintis, 2000, "Wealth Inequality, Wealth Constraints and Economic Performance" in Atkinson and Bourguignon (eds.), 2000, *Handbook of Income Distribution*, Vol 1, 541–603.

Beck, T., A. Demirgüç-Kunt and R. Levine, 2000, "A New Database on Financial Development and Structure," *World Bank Economic Review*, Vol. 14, 597–605.

Beck, T., M. Lundberg, and G. Majnoni, 2006, "Financial Intermediary Development and Growth Volatility: Do Intermediaries Dampen or Magnify Shocks?," *Journal of International Money and Finance*, Volume 25(7), 1146-1167.

Bernanke, B., and M. Gertler, 1990, "Financial Fragility and Economic Performance," *Quarterly Journal of Economics,* Vol. 105(1), 87-114.

Bester, H., 1985, "Screening vs. Rationing in Credit Markets with Adverse Selection," *American Economic Review,* Vol. 75, 850–5.

Bhide, A., 1993, "The Hidden Costs of Stock Market Liquidity", *Journal of Financial Intermediation*, Vol. 34, 1–51.

Blundell, R. and S. Bond, 1998, "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models," *Journal of Econometrics,* Vol 87, 115–43.

Boot, A. W., and Thakor, A. V., 1997, "Financial System Architecture", *Review of Financial Studies*, Vol. 10, 693–733.

Boyd, J. H., and Prescott, E. C., 1986, "Financial Intermediary-Coalitions", *Journal of Economic Theory*, Vol 38, 211–32.

Boyd, J. H. and Smith, B. D., 1998, "The Evolution of Debt and Equity Markets in Economic Development", *Economic Theory*, Vol. 12, 519–560.

Braun, M. and B. Larrain, 2005, "Finance and the Business Cycle: International, Inter-Industry Evidence", *Journal of Finance*, VOL. LX, NO. 3 JUNE 2005, 1097-1128.

Broda, C., 2004, Terms of trade and exchange rate regimes in developing countries, *Journal of International Economics*, Vol. 63(1), 31-58.

Caselli, F., and Roitman, A., 2015, "Non-Linear Exchange Rate Pass-Through in Emerging Markets," Working Paper 16/1, (Washington: International Monetary Fund).

Dabla-Norris, E. and N. Srivisal, 2013, "Revisiting the Link between Finance and Macroeconomic Volatility." IMF Working Paper 13/29 (Washington: International Monetary Fund).

Devinney, T. M., 1986, *Rationing in a Theory of the Banking Firm*, Studies in Contemporary Economics (Springer, New York, 1986) pp. VI +102.

Diamond, D., 1984, "Financial Intermediation and Delegated Monitoring", *Review of Economic Studies*, Vol. 51, 393–414.

Driscoll, John C. and A. C. Kraay, 1998, "Consistent Covariance Matrix Estimation with Spatially Dependent Panel Data," *Review of Economics and Statistics*, Vol. 80, 549-560.

Easterly, W. R., R. Islam and J. E. Stiglitz, 2001, "Shaken and Stirred: Explaining Growth Volatility", In Annual Bank Conference on Development Economics, ed. Boris Pleskovic and Nicholas Stern. Washington, D.C.: World Bank.

Gerschenkron, A., 1962, "Economic Backwardness in Historical Perspective, A Book of Essays." Harvard University Press, Cambridge, MA.

Greenwald, B., and J. Stiglitz, 1991, "Financial Market Imperfections and Business Cycles," *Quarterly Journal of Economics*, Vol. 108(1), 77-114.

Hoshi, T., Kashyap, A., and D. Sharfstein, 1991, Corporate Structure, Liquidty, and Investment: Evidence from Japanese Industrial Groups, *Quarterly Journal of Economics*, Vol. 106, 33–60.

Kiyotaki, N., and J. Moore, 1997, "Credit Cycles," *Journal of Political Economy*, Vol. 105(2), 211-248.

Kpodar, K. and C. Abdallah, 2017, "Dynamic Fuel Price Pass-Through: Evidence from a New Global Retail Fuel Price Database," *Energy Economics*, Vol. 66(C), 303-312.

Kpodar, K. and P. Imam, 2016, "Does a Regional Trade Agreement Lessen or Worsen Growth Volatility? An Empirical Investigation," *Review of International Economic,* Vol. 24(5), 949–79.

Koren, M. and S. Tenreyro, 2007, "Volatility and Development," *The Quarterly Journal of Economics*, Vol. 122, 243–87.

Kunieda, T., 2015, “Financial Development and Volatility of Growth Rates: New Evidence”. Available online: https://mpra.ub.uni-muenchen.de/11341/1/MPRA_paper_11341.pdf (accessed on 28 September 2015).

Larrain, B., 2006, “Do Banks Affect the Level and Composition of Industrial Volatility?” *Journal of Finance*. Vol. 61, 1897–1925.

Levine, R., 2002, “Bank-Based or Market-Based Financial Systems: Which Is Better?”, *Journal of Financial Intermediation*, Vol. 11, 398–428.

Newberry, D., 1977, “Risk Sharing, Sharecropping and Uncertain Labor Markets”, *Review of Economic Studies*, Vol 44(3), 585–94.

Raddatz, C., 2006, Liquidity needs and vulnerability to financial underdevelopment, *Journal of Financial Economics*, Vol. 80(3), 677-722.

Rajan, R. G., and L. Zingales, 1999, “Which Capitalism? Lessons from the East Asian Crisis”, *Journal of Applied Corporate Finance*, Vol. 11, 40–48

Ramakrishnan, R. T. S., and A.V. Thakor, 1984, “Information Reliability and Theory of Financial Intermediation”, *Review of Financial Studies*, Vol. 51, 415–432.

Ramey, G. and V. Ramey, 1995, “Cross-country Evidence on the Link Between Volatility and Growth,” *American Economic Review*, Vol. 85, 1138–51.

Ramey, V., Zubairy, S., 2014. Government Spending Multipliers in Good Times and in bad: Evidence from U.S. Historical Data. NBER Working Paper No. 20719.

Silva, G, 2002, “The Impact of Financial System Development on Business Cycles Volatility: Cross-country Evidence, *Journal of Macroeconomics*, Vol.2, 233-253.

Singh, R., 1992, “An Imperfect Information Approach to the Structure of the Financial System,” UNCTAD Discussion Paper No. 46 (Geneva: UNCTAD).

Singh, R., 1994, “Bank Credit, Small Firms, and the Design of a Financial System for Eastern Europe,” UNCTAD Discussion Paper No. 86 (Geneva: UNCTAD).

Singh, R., 1997, “Banks, Growth, and Geography,” UNCTAD Discussion Paper No. 127 (Geneva: UNCTAD).

Stiglitz, J., 1974, “Incentives and Risk Sharing in Sharecropping”, *Review of Economic Studies*, Vol. 41(2), 219–55.

Stiglitz, J., 1985, “Credit Markets and The Control of Capital”, *Journal of Money, Credit and Banking*, Vol 17, 133–152.

Stiglitz, J. E., and A. Weiss, 1981, "Credit Rationing in Markets with Imperfect Information," *American Economic Review,* Vol. 71(3), 393–410.

Teulings, C., Zubanov, N., 2014, "Is economic recovery a myth? Robust estimation of impulse response functions," *Journal of Applied Economics*, Vol. 29(3), 497–514.

Tiryaki, G.F, 2003, Financial Development and Economic Fluctuations. *METU Studies in Dev*elopment, Vol. 30, 89–106.

Townsend, R., 1982, "Optimal Multiperiod Contracts and the Gain from Enduring Relationships under Private Information", *Journal of Political Economy*, Vol. 90(6), 1166–86.

Wei, F. and Y. Kong, 2016, Financial Development, Financial Structure, and Macroeconomic Volatility: Evidence from China, Sustainability 2016, Vol. 8(11), 1116.

World Bank, 2017, Crisis Response and Resilience to Systemic Shocks: Lessons from IEG Evaluations, Washington DC.

Yeh, C.C., H.C. Huang, P. C. Lin, 2013, "Financial Structure on Growth and Volatility". *Economic Modeling*, Vol. 35, 391–400.

Table A1. Summary Statistics and Correlation Matrix

Summary Statistics

Variable	Obsg	Mean	Std. Dev.	Min	Max
GDP growth volatility	320	0.04	0.04	0.00	0.43
GDP per capita (USD)	344	343.6	233.8	42.5	1,426.7
Trade openness (percent of GDP)	347	56.8	28.7	0.3	168.3
Terms of trade volatility	239	0.09	0.07	0.00	0.43
Private credit ratio (percent of GDP)	243	12.0	10.0	0.3	99.5
Liquid liability ratio (percent of GDP)	246	23.1	12.2	0.4	104.2
Stock market capitalization ratio (percent of GDP)	440	1.6	10.6	0.0	193.1
Stock market total value traded (percent of GDP)	440	0.5	8.3	0.0	173.6
Volatility of private credit ratio	292	0.19	0.12	0.00	0.77
Inflation volatility	252	0.09	0.18	0.00	1.88
Political stability	173	-0.85	0.86	-3.14	0.96
Agricultural value-added share (percent of GDP)	331	37.6	13.9	8.9	77.7

Correlation Matrix

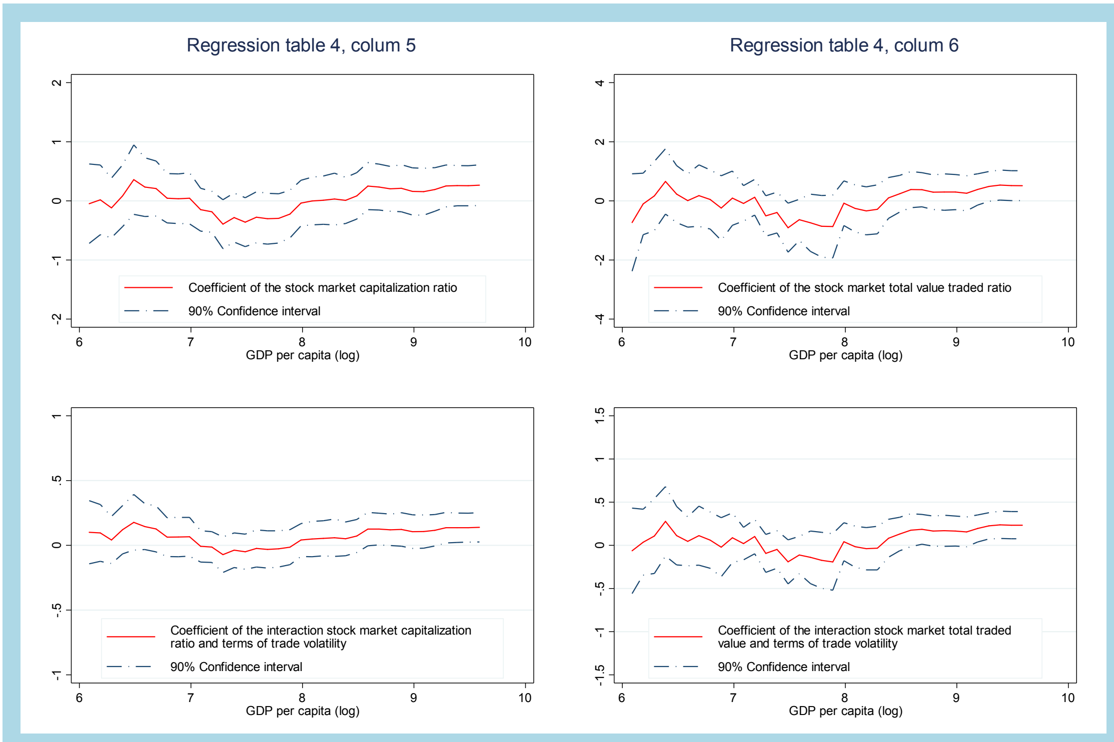
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
GDP growth volatility	(1)	1.00											
GDP per capita	(2)	-0.18*	1.00										
Trade openness	(3)	-0.01	0.37*	1.00									
Terms of trade volatility	(4)	0.11*	-0.15*	-0.25*	1.00								
Private credit ratio	(5)	-0.19*	0.41*	0.42*	-0.27*	1.00							
Liquid liability ratio	(6)	-0.19*	0.46*	0.26*	-0.30*	0.78*	1.00						
Stock market capitalization ratio	(7)	-0.03	0.15*	0.09*	-0.10	0.16*	0.17*	1.00					
Stock market total value traded	(8)	0.02	0.06	0.06	-0.04	0.08	0.07	0.89*	1.00				
Volatility of private credit ratio	(9)	0.32*	-0.11*	0.00	0.16*	-0.27*	-0.27*	0.21*	0.22*	1.00			
Inflation volatility	(10)	0.06	-0.14*	0.01	0.21*	-0.19*	-0.22*	0.16*	0.21*	0.36*	1.00		
Political stability	(11)	-0.29*	0.23*	0.11	-0.01	0.18*	0.15*	0.00	-0.02	-0.08	-0.33*	1.00	
Agricultural value-added share	(12)	0.24*	-0.54*	-0.40*	0.28*	-0.43*	-0.38*	-0.16*	-0.09*	0.15*	0.11	-0.24*	1.00

Notes. * significant at 1, 5 or 10 percent.

Table A2. Variable Definitions and Sources

Variables	Definition	Sources
GDP growth volatility	The standard deviation of the residual of the log of real GDP regressed on its lags value and a time trend (assuming an AR(1) process with a trend), calculated over a 5-year period	World Development Indicators and author's calculations
GDP per capita (USD)	The ratio of nominal GDP divided by the size of the population	International Monetary Fund
Trade openness (percent of GDP)	Sum of exports and imports of goods and services measured as a share of GDP	World Development Indicators
Terms of trade volatility	The standard deviation of the residual of the log of terms of trade index regressed on its lags value and a time trend, calculated over a 5-year period. The terms of trade index is calculated as the percentage ratio of the export unit value indexes to the import unit value indexes, measured relative to the base year 2000	World Development Indicators and author's calculations
Private credit ratio (percent of GDP)	The private credit ratio is the total amount of credit by deposit money banks to the private sector divided by GDP	Financial Development and Structure Dataset
Liquid liability ratio (percent of GDP)	Total currency plus demand and interest-bearing liabilities of banks and other financial intermediaries divided by GDP	Financial Development and Structure Dataset
Stock market capitalization ratio (percent of GDP)	Total value of listed shares divided by GDP	Financial Development and Structure Dataset
Stock market total value traded (percent of GDP)	Total shares traded on the stock market exchange divided by GDP	Financial Development and Structure Dataset
Volatility of private credit ratio	The standard deviation of the residual of the log of private credit ratio regressed on its lags value and a time trend, calculated over a 5-year period.	Financial Development and Structure Dataset and authors' calculations
Inflation volatility	The standard deviation of the residual of the log of Consumer Price Index regressed on its lags value and a time trend, calculated over a 5-year period	World Development Indicators and author's calculations
Political stability	Political Stability and Absence of Violence/Terrorism (Estimate)	World Bank Governance Database
Agricultural value-added share (percent of GDP)	Ratio of agricultural value added over GDP	World Development Indicators

Figure A1. Robustness of the Estimated Effect of Stock Market Development on Growth Volatility in Developing Countries



Source. Authors' calculations.

Notes. A data point on the red line represents the coefficient on the stock market development (or its interaction term with terms of trade volatility) estimated on a sample of countries with a GDP per capital level below the corresponding x-axis value. As GDP per capita increases, the coefficients converge toward the full sample estimates shown in table 4, column 5 and 6.

"Sur quoi la fondera-t-il l'économie du monde qu'il veut gouverner? Sera-ce sur le caprice de chaque particulier? Quelle confusion! Sera-ce sur la justice? Il l'ignore."

Pascal

Contact
www.ferdi.fr
contact@ferdi.fr
+33 (0)4 73 17 75 30