Financial Development and Economic Volatility:

Does Finance Dampen or Magnify Shocks?

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Abstract: We extend the recent empirical literature on the link between financial development and economic volatility by focusing on the channels through which financial development impacts economic volatility. Specifically, we use a panel data set for 1960-97 and 63 countries to investigate whether a well-developed financial sector dampens the impact that the volatility of terms of trade changes, inflation and government expenditure has on the volatility of real per capita GDP growth rates. We find robust evidence that a higher level of financial development dampens the positive effect of the volatility of terms of trade changes on economic volatility, especially in high-income countries, while it magnifies the impact of inflation volatility in non-high income countries. We do not find a robust effect of finance on the volatility of government expenditures. These results are consistent with our model that predicts that real sector shocks are dampened in their effect on output volatility by a well developed financial sector, while monetary shocks are magnified and propagated through the financial sector.

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1. Introduction

Do economies with higher levels of financial development experience more or less volatility in economic growth rates? What are the channels through which financial development affects growth volatility? While the recent empirical and theoretical literature has established a positive impact of financial sector development on economic growth, the potential links between financial development and the volatility of economic growth have not been studied thoroughly yet.[1] Still, the extent and depth of financial and economic crises in the developing world in the last decade has brought to the forefront the question whether and to what extent output fluctuations can be related to the weaknesses or to the inadequate development of the financial sector. Explaining the determinants of growth volatility is important for policy makers who want to secure a high and stable growth rate for their economies.

This paper tries to shed some light on the links between financial development and growth volatility in a panel of 63 countries and 38 years. Specifically, we analyze whether the financial sector dampens or magnifies the effect of real and monetary shocks on the real economy. Previous papers have found that financial development reduces macroeconomic volatility and that the level of financial development is a more relevant determinant of output fluctuations than other factors such as labor market rigidities (Easterly, Islam, and Stiglitz, 2000). Denizer, Iygun, and Owen (2000) find that the level of financial development, while reducing the overall volatility of national income, affects differently the volatility of consumption and investment. None of these papers, however, has tried to identify the channels through which financial development potentially affects growth volatility.

Our work builds on three different strands of literature. First, we build on a large theoretical and empirical literature on the relationship between financial development and

[1] See King and Levine (1993a,b) and Levine and Zervos (1998) for correlation between financial intermediary and stock market development and economic growth. Levine, Loayza and Beck (2000), Beck, Levine and Loayza (2000), Neusser and Kugler (1998) and Rousseau and Wachtel (2000) provide evidence for a causal impact of financial development on economic growth. Also, Demirgüç-Kunt and Maksimovic (1998) show that firms in countries with an active stock market and large banking sector grow faster than predicted by individual firm characteristics. Rajan and Zingales (1998) show that industries that rely more heavily on external finance grow faster in countries with better-developed financial systems.

economic growth.[2] Financial intermediaries and markets emerge to lower the costs of researching potential investments and projects, exerting corporate control, managing risks and mobilizing savings. Economies with better developed financial intermediaries and markets therefore enjoy higher growth rates. This literature, however, does not explore the impact of financial development on the volatility of economic growth rates. Ramey and Ramey (1995), on the other hand, explore the empirical relationship between growth and growth volatility and find that economies with higher growth volatility experience lower long-run growth rates, controlling for other potential country-specific determinants of growth.

A second relevant strand of literature has studied the implications of capital market imperfections on the propagation of real sector shocks. In particular, Bernanke and Gertler (1990) show that shocks to the net worth of borrowers amplify economic up- and downturns, through an accelerator effect on investment. Acemoglu and Zilibotti (1997) show that the interaction of investment indivisibility and the resulting inability to diversify risk not only impedes economic development, but also results in high economic volatility. Finally, Kiyotaki and Moore (1997) show that capital market imperfections can amplify the effects of temporary productivity shocks and make them more persistent, through their effect on the net wealth of credit constrained borrowers.

A third related line of work is the literature on the credit channel of monetary policy (Bernanke and Blinder, 1988 and Kashyap and Stein, 1995).[3] According to the credit channel view, monetary policy impacts the real economy not only through its effects on the bond market, but also through its effects on banks' supply of loans. A number of papers show that liquidity constraints become binding for small firms in the U.S. – that depend more on bank loans than large firms – after the Fed tightens its monetary policy.[4] Kashyap and Stein (1995) present evidence for the U.S. that smaller banks' lending volume is more affected than large banks' by changes in monetary policy. While this literature focuses on the U.S. and the impact of monetary policy on firms and banks of different size, we will analyze the impact that financial development has on the

[2] For an overview of the theoretical literature, see Levine (1997). For the empirical literature, see the previous footnote.
[3] See also the literature cited in Kashyap and Stein (1995).

role of financial intermediaries in propagating monetary policy shocks into the real economy.

This paper makes several contributions. First, we explore whether financial development helps decrease the effect of terms of trade, inflation and government expenditure volatility on economic growth volatility. While we regard terms of trade shocks as real shocks and inflation shocks as monetary shocks, we do not take an a-priori stand on the nature of government expenditure shocks, since their impact can be felt through real or monetary channels. Therefore we also explore whether the financial sector has a different impact in high and non-high income countries.

Second, we connect our empirical analysis to theory. Building on a model by Bacchetta and Caminal (2000), we show that shocks to the economy are dampened or magnified by financial sector development depending on their nature. While real sector shocks are dampened by a higher level of financial development, monetary shocks, i.e. shocks to the banks' balance sheets, are magnified by financial development. While the results for real sector shocks match findings by other authors, the results for monetary shocks can be explained with the credit channel view of monetary policy. Firms depend more on external resources in financially developed economies and are therefore more exposed to monetary shocks that are transmitted through the financial sector.

We then test the hypotheses derived in the theoretical model in a panel data set of 63 countries and 38 years. Specifically, we regress the volatility of real per capita GDP growth on a measure of financial development, the volatility of terms of trade changes, inflation or government expenditures and an interaction term of financial development and the respective volatility measure, controlling for other potential determinants of growth volatility. To test the robustness of our results, we split the sample period in different ways and use different econometric methods. Furthermore, we conduct a variety of specification tests.

The results give support for the hypotheses derived in our model. We find a negative coefficient on the interaction of financial development and terms of trade volatility, interpreting it as a dampening effect of financial development on the impact of

[4] Among others, Gertler and Hubbard (1988), Gertler and Gilchrist (1994), Kashyap, Lamont, and Stein (1994), and Oliner and Rudebusch (1996). Compare also Kashyap and Stein (1995).

terms of trade volatility. This effect is especially strong in high-income countries. We find a positive coefficient on the interaction of financial development and inflation volatility and we interpret this as evidence of a magnifying role of the financial sector in the propagation of monetary shocks. Controlling for a separate interaction in high income countries, however, we find that this propagation effect only prevails in less developed economies. We do not find any robust evidence of an interaction between financial development and government expenditure volatility.

Overall, the evidence provided in this paper supports the notion that financial development exerts a dampening effect on GDP fluctuations but also that it interacts differently with shocks according to their source. Our findings indicate that it helps dampen the propagation of real shocks, especially in high-income countries. However, it magnifies the impact of monetary shocks on the real economy in non-high income countries.

The remainder of the paper is organized as follows. Section 2 presents a simple theoretical model and sets out the main testable hypotheses. Section 3 describes the data and the testing strategy. Section 4 provides a description of the main findings of the econometric analysis and relates them to the outcome suggested by the theoretical model. Section 5 presents sensitivity analysis and Section 6 concludes..

2. A Simple Model of Financial Development and Output Volatility

Our model is a simplified version of a model developed by Bacchetta and Caminal (2000). Specifically, we focus on the production side of the model and abstract from the microeconomic foundations of financial intermediation and the consumption side. Unlike in Bacchetta and Caminal, we will distinguish between the real sector and the financial sector. The latter, modeled as pure conduit for savings channeled from the surplus to the deficit sector, helps to introduce policy shocks. Although we allow for policy shocks in our model, we do not model the government explicitly.

2.1. The Real Sector

All individuals in our model are at the same time consumers and entrepreneurs. Although all entrepreneurs have access to the same production technology *f(k)*, they are endowed with different levels of wealth *b*. Specifically, we distinguish between two classes of entrepreneurs, High and Low, with high and low levels of wealth. The fraction β of agents are High entrepreneurs and the share (1-β) Low entrepreneurs. Entrepreneurs can use their wealth to invest in the production technology or they can deposit their wealth with banks, earning a riskless rate *r*. While High entrepreneurs can fully finance their investment and have excess funds, which they deposit with banks, Low entrepreneurs cannot fully finance their investment with their own funds. This might be due to investment indivisibility or required minimum investment. Due to asymmetric information about the type of investment entrepreneurs choose, and the resulting potential moral hazard problems, Low entrepreneurs face agency costs φ .

Assuming decreasing returns to scale in production, we can therefore write the profit maximization problem for the High entrepreneurs as follows:[5]

$$f'(k^H) = r \tag{1}$$

where the superscript *H* denotes High entrepreneurs. Since Low entrepreneurs (subscript L) face agency costs φ, their profit maximization problem implies

$$f'(k^L) = \varphi r, \varphi \geq 1 \tag{2}$$

The higher the agency costs, the lower the investment of Low entrepreneurs and therefore the higher their marginal productivity. Combining Eqs. (1) and (2) we obtain

$$\frac{f'(k^L)}{f'(k^H)} = \varphi \tag{3}$$

The higher the agency costs, the higher the ratio k^H/k^L and the larger the wedge between the marginal productivity of Low and High entrepreneurs. If we take the agency costs as a negative indicator of financial development, this also implies that the productivity wedge between Low and High entrepreneurs is larger in financially less developed economies.

[5] We assume that *f(k)* is twice differentiable, with positive first and negative second derivative. Furthermore, we assume $lim_{k\to 0} f'(k) = \infty$ and $lim_{k\to\infty} f'(k) = 0$ and $f'' > 0$.

Given the different levels of productivity, a reallocation of funds between the two entrepreneurial classes affects aggregate productivity and therefore output and growth in the economy. The larger agency costs and therefore the lower the level of financial development, the larger this composition effect.

2.2. The Financial Sector

High entrepreneurs deposit their excess funds with financial intermediaries whereas Low entrepreneurs borrow from banks, to complement their own funds. Banks operate in a perfectly competitive environment and face no costs. They are therefore simply a conduit for the flows from High to Low entrepreneurs, from the surplus to the deficit sector.

Following Bacchetta and Caminal, we assume ex-ante asymmetric information about the investment decision of borrowers and therefore potential moral hazard problems between the financial intermediaries and the borrowers. Unlike in the original model, we will not spell out the micro economic foundations here, but rather assume the following form for the agency costs and financial intermediation.

Assumption A: Agency costs φ are described by the following equation. $\varphi = \omega(1 - \frac{b^L}{k^L})$, where ω is a function of exogenously given technological parameters. Low entrepreneurs are offered credit at the deposit interest rate *r*, but are credit-constrained, in the sense that their investment level is sub-optimal.

The agency costs faced by Low entrepreneurs therefore increase in ω and in the leverage ratio k^L/b^L. Combining eq. (2) and Assumption A, we get

$$f'(k^L) = r\omega(1 - \frac{b^L}{k^L}) \qquad (4)$$

The demand for loanable funds by Low entrepreneurs therefore decreases in *r*, ω and k^L/b^L. The supply of loanable funds by High entrepreneurs, on the other hand, is only a function of the interest rate *r*.

Figure 1 depicts the market for loanable funds. Higher interest rates decrease the optimal investment level for High entrepreneurs and therefore increase the excess funds that High entrepreneurs will deposit with banks. Higher interest rates, however, will also decrease the optimal level of investment of Low entrepreneurs, so that the demand for loanable funds decreases. A higher level of agency costs will shift the demand for loanable funds to the left (from D_1 to D_2), which results in a lower level of loans k_2 and a lower interest rate. If due to monetary or fiscal policy changes, banks cannot channel all deposits to Low entrepreneurs, the supply schedule shifts to the left(S_1 to S_2), resulting in a lower level of loanable funds k_3 and a higher interest rate. Note that due to the decreasing returns to scale of the production technology, the sensitivity of loanable funds to interest rate changes increases with higher levels of agency costs.

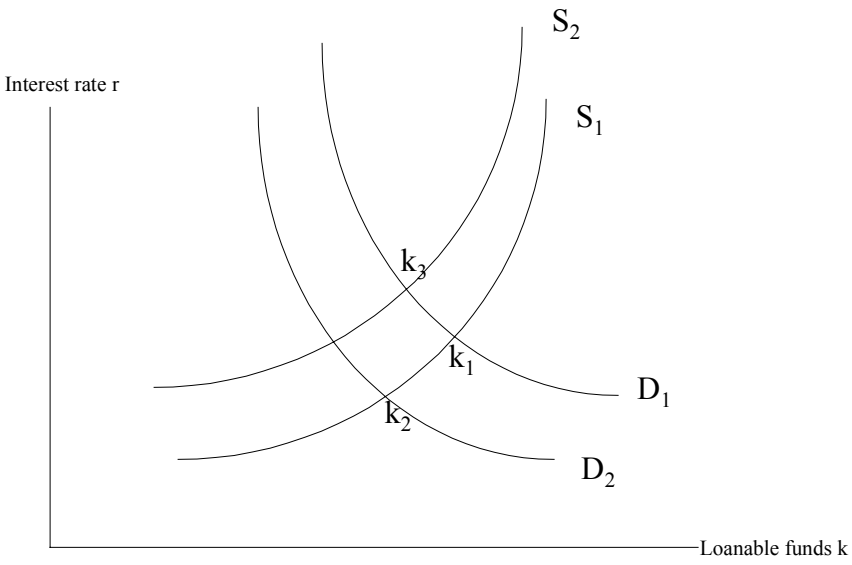

Figure 1: Supply and Demand for Loanable Funds

2.3 General Equilibrium

We embed the previously described partial model of entrepreneurs and banks into a simple two period model. Agents are born with endowments b^i_t, $i=H,L$, and invest and produce in both periods. They consume a constant share of first period's output at the end of the first period and invest the remainder as capital in the second period.[6] At the end of

[6] A constant saving rate can be obtained by assuming either log utility or a Leontief utility function.

the second period they consume output and die. In the next subsection we explore how shocks affect the change in output from the first to the second period, and how these changes differ under different levels of agency costs φ and therefore financial development.

The solution to the optimization problem of High entrepreneurs is given by

$$f'(k^H) = r \tag{1}$$

and

$$b_{t+1}^H = \gamma[f(k_t^H) + r_t(b_t^H - k_t^H)] \tag{5}$$

where γ is the savings rate. Similarly, the optimization problem for the Low entrepreneur yields:

$$f'(k^L) = r\omega(1 - \frac{b^L}{k^L}) \tag{4}$$

and

$$b_{t+1}^L = \gamma[f(k_t^L) + r_t(b_t^L - k_t^L)] \tag{6}$$

We can combine eqs. (1) and (4) as above:

$$\frac{f'(k^L)}{f'(k^H)} = \omega(1 - \frac{b^L}{k^L}) \tag{7}$$

Finally, the market clearance condition for financial markets yields:

$$\beta b_i^H + (1-\beta)b_i^L = \beta k_i^H + (1-\beta)k_i^L, i = t, t+1 \tag{8}$$

Eqs. (5) – (8) describe the model and allow us to derive the following result:[7]

Result 1: The relative investment of Low entrepreneurs k^L/k^H increases in the ratio of internal to total resources b^L/k^L and in their relative wealth share b^L/b^H, and decreases in agency costs ω. The positive effect of a higher b^L/k^L and b^L/b^H on k^L/k^H increases in the agency costs ω.

Higher internal resources and a decreased wealth inequality decrease the financing constraint and thereby increase the investment share of Low entrepreneurs.

[7] See Bacchetta and Caminal (2000).

They shift the loan demand curve outwards resulting in a higher level of loans and a higher interest rates. Higher agency costs, on the other hand, increase the financing constraint. The loan demand curve shifts inwards, resulting in a lower level of loans and lower interest rates. Note that the change in loanable funds is higher if the economy experiences high levels of agency costs, due to the higher sensitivity of the supply of loanable funds to changes in interest rates.

2.4. Shocks

We can now explore the effects that different shocks have on the relative composition of investment and output, and therefore output volatility. We will distinguish between shocks that affect only the real sector, i.e. the internal funds available to entrepreneurs of both classes and shocks that affect the financial sector and therefore the external funds available to Low entrepreneurs. We are especially interested in the effect that the agency costs, our measure of financial development, have on the scale of these output changes.

2.4.1 Real Shocks

Consider an unanticipated shock to the production function, that hits the economy during the first period, after all investment decision have been made, i.e. $y_t=\eta f(k_t)$. This productivity shock can be caused by either improved technology or by lower input prices. As can be seen from eqs. (5) and (6), the profits of the leveraged, i.e. the Low entrepreneurs, increase more than proportionally whereas the profits of the High entrepreneurs increase less than proportionally. This increases the relative wealth of Low entrepreneurs $b_{t+1}^{L} / b_{t+1}^{H}$ and therefore relative investment by Low entrepreneurs in the second period (Result 1). Since Low entrepreneurs produce at a higher marginal productivity than High entrepreneurs, this shift in relative investment towards Low entrepreneurs magnifies the effect of the productivity shock under imperfect capital markets.

We get similar results if we assume a shift in relative wealth $b_{t+1}^{L} / b_{t+1}^{H}$ without changes in the production function. Take for example redistributive policies that increase government expenditure and the relative wealth of Low entrepreneurs in the second

period. Another example would be a sales tax imposed on output that would levy a higher burden on Low entrepreneurs' wealth than High entrepreneurs' wealth. On the other hand, government expenditures financed by a tax on High entrepreneurs only, will not be amplified in a world of imperfect capital markets, since the effect is dampened by a relative wealth shift in favor of Low entrepreneurs.

Result 2: The effect of a shock that leads to a change in b^L/b^H is larger under asymmetric information than under perfect capital markets. The size of the output change increases in agency costs ω.

Financial development in the form of lower agency costs therefore helps dampen the effects of shocks to the production function and/or relative wealth on output volatility. Note that these shocks only affect the demand for loanable funds, but do not shift the supply curve. They affect the financial sector and banks' balance sheets only in the second round, through shifts in the loan demand curve.

2.4.2. Monetary Shocks

We now consider shocks that directly affect the supply of loanable funds by banks. Specifically, we consider monetary policies that affect the funds that banks have available for loans and the issue of government bonds that crowds out credits by banks to Low entrepreneurs.[8] Both a tightening of monetary policy and the issue of government bonds decreases the supply of loanable funds and increases the interest rate. The higher interest rate, however, decreases investment by High entrepreneurs and therefore dampens the crowding out. The higher agency costs ω, the higher the increase in the interest rate and the smaller the crowding out effect of monetary shocks. More financial development, in the form of lower agency costs therefore increases the output effect of monetary shocks.

[8] We assume that the proceeds of the government bonds are subsequently wasted, so that there is no output effect.

Result 3: The effect of a shock that changes the supply of loanable funds of Low entrepreneurs is smaller under asymmetric information than under perfect capital markets. The volatility of output decreases in agency costs ω.

The financial sector thus has a magnifying effect on monetary shocks. In financially more developed economies, low entrepreneurs depend more on external finance and therefore suffer more if banks' balance sheets are affected by tightening monetary policies or crowding out by government debt. Shocks that affect the financial sector in the first round, therefore are transmitted into the real sector, and this effect is stronger for financially more developed economies.

2.5. Testable Hypotheses

The theoretical model has shown that financial development can dampen or magnify the effect of shocks on growth volatility, depending on the nature of the shocks. Shocks that only affect the real sector in the first round, are dampened, whereas shocks that affect the financial sector directly, are magnified. In the following sections we will test these hypotheses in a panel of 63 countries and 38 years. We first have to identify shocks that affect only the real sector and shocks that directly affect the financial sector in the first round. We will use the volatility of the changes in terms of trade to proxy for real sector shocks and the volatility of the inflation rate to proxy for monetary shocks. The model would predict a dampening effect of financial development on the impact of terms of trade volatility on growth volatility and a magnifying effect on the impact of inflation volatility. We also choose the volatility of government expenditures, without hypothesizing about the expected sign. While shocks to government expenditures financed by higher sales taxes or redistributive policies can be considered real shocks, shocks to government expenditures financed by the issue of bonds or through the inflation tax can be considered monetary shocks. If we find a dampening effect of financial development on the effect of government expenditure volatility on growth volatility, this would imply that they constitute real shocks. If we find a magnifying effect of financial development, this would imply that they constitute monetary shocks.

Since countries might differ in the way they finance and use government expenditures, we will separate the effect that financial development has on the transmission of government expenditure volatility for high income countries. Similarly, we will test for a separate impact of financial development on the effect of the volatility of terms of trade and inflation for high income countries.

3. Data and Econometrics

In this section we describe the data and econometric methods used to test whether the impact of volatility in terms of trade, money supply, inflation, and government expenditure is amplified or diminished by financial development. We regress the standard deviation of growth against each shock, our measure of financial development and the interaction term of the latter two, as well as a limited set of control variables.

3.1. The Data

The data come primarily from published World Bank and IMF sources. We create three panel data sets by aggregating over different time periods on data from 1960 to 1997. This serves partly as a robustness check on the results, and partly to avoid the problems caused by aggregating on unusual initial- or end-year observations. Our constructed data sets are a three-period panel (aggregated over the periods 1960-72, 1973-85, and 1986-97 inclusive), a four-period panel (1960-69, 1970-78, 1979-87, 1988-97), and a six-period panel (1960-66, 1967-72, 1973-78, 1979-84, 1985-90, 1991-97). We maintain a consistent sample of 63 countries across all data sets, but the number of observations differs by aggregation. To avoid the impact of outliers we drop oil-exporting countries, as defined by the IFS, and extreme outliers. We will focus the discussion on the three-period panel, since it provides the most efficient estimates of standard deviations (i.e. based on the largest number of observations). Table 1 describes the data.

The dependent variable is the standard deviation of growth in real GDP per capita within a time period. For the three-period sample, this ranges from a minimum of less than one percent to about eleven percent, around a median of 2.5 percent (which is larger than the median growth rate for the sample of 2.1 percent per year).

The measure of financial development that we use is Private Credit, the value of credit from financial intermediaries to the private sector, divided by GDP (Beck, Demirgüç -Kunt and Levine, 1999). Unlike other measures of financial development that have been used in the empirical growth literature, such as the share of M2 in GDP, this measure is more than a simple measure of size or financial depth. Private Credit measures the most important activity of the financial intermediary sector, channeling funds from savers to investors, and more specifically, to investors in the private sector.[9] Private Credit thus excludes credits to governments, state-owned enterprises and cross-claims on other financial intermediaries. Furthermore, it includes credits not only by deposit money banks, but also by other nonbank financial intermediaries, such as finance companies and life insurance companies. Levine, Loayza and Beck (2000) and Beck, Levine, and Loayza (2000) show that Private Credit has a significantly positive and economically large impact on economic growth. To control for potential nonlinearity in the relationship between growth volatility and financial development, we include Private Credit in logs.

The shock variables are the standard deviations of terms of trade changes, inflation, and government expenditure as share of GDP over the corresponding periods.[10] In the sensitivity analysis we also consider the standard deviation of M2/GDP as additional measure of monetary shocks. The four shock variables are not predictably correlated with each other (Table 2). In the pure cross-section, countries with larger terms-of-trade shocks do not necessarily suffer large fiscal shocks. Paradoxically, they do experience more variable inflation, but lower variability in money supply. This would suggest a negative correlation between money and inflation – this table shows that the simple correlation coefficient is negative but insignificant. Volatility in government expenditure is correlated neither with inflation nor money supply volatility.

All four shock variables appear to be correlated with the dependent variable, growth volatility. The fourth row presents simple correlations, and the last shows the parameter estimates from a simple regression ($s.d.growth = \alpha + \beta \cdot shock + \varepsilon$). In the

[9] While this statement certainly deserves a qualification for more developed financial systems, it is still true for most developing economies.

[10] We have re-scaled the s.d. government expenditure variable to the same order of magnitude as the other shocks (dividing it by 100), in order to ease interpretation of the empirical results.

simple correlation, growth volatility decreases with more volatile money supply, but this disappears once we allow the intercept to differ from zero. The similarly weak correlation between growth volatility and government expenditure also disappears in the last row. Terms-of-trade shocks and inflation shocks remain correlated with growth volatility, albeit with much lower coefficients.

Table 2 does not control for other factors, nor for differences across countries or groups of countries. It may be that changes in money supply in wealthy countries reflect real changes in demand and economic activity. In that case, money supply volatility may be positively correlated with growth volatility, but not with inflation. In the multivariate analysis below, we include the log of real GDP per capita and a measure of trade openness (the log of (Exports plus Imports)/GDP). There is considerable evidence that wealthy countries are more stable. Easterly, Islam and Stiglitz (2000), for example, show that the standard deviation of growth in non-OECD countries is more than twice that in OECD countries. Greater openness, on the other hand, increases a country's exposure to changes in the terms of trade. Hausmann and Gavin (1996) have shown that external terms of trade shocks are associated with increased growth volatility; while Erdström and Singer (1993) and Lutz (1994) provide evidence that greater terms-of-trade volatility reduces growth.

Both the model presented above and casual examination of the data suggest that the impact of financial development on growth volatility may differ according to the level of economic development. For example, monetary policy may be less effective in more developed economies where firms have access to diverse sources of finance. Table 3 summarizes the data across income class as defined by the World Bank's *World Development Report*. This table shows that wealthy countries are significantly different from other countries in almost all respects. Wealthy countries have more stable growth rates, and the level of Private Credit is more than double that in non-wealthy countries. In general, they also experience fewer and smaller shocks to terms of trade and inflation. There is no distinction across income classes in the variability of government expenditure, but wealthy countries experience greater variability in money supply. Also, while wealthy countries are more open than average, the share of trade in GDP is on a par

with lower-middle-income countries.[11] It is likely that these structural differences between income classes affect both the direction and the magnitude of the impact of exogenous shocks. In the multivariate work below, we also test whether the intuitive interpretation of the data can be confirmed by more rigorous analysis.

3.2. Econometric Methodology

To test our hypotheses we will run the following regression:

$$y_{i,t} = \alpha \cdot Shock_{i,t} + \beta \cdot FD_{i,t} + \gamma \cdot Inter_{i,t} + \delta \cdot CV_{i,t,} + \mu_i + \varepsilon_{i,t}$$

where y is the standard deviation of real per capita GDP growth, *Shock* is either the standard deviation of terms of trade changes, inflation, government expenditures or M2/GDP, *FD* is our measure of financial development, Private Credit, *Inter* is the interaction of *Shock* and *FD*, *CV* is our set of control variables, μ is a country-specific effect, ε is the error term and i and t denote country and time period, respectively.

To overcome a number of potential errors in the data, we use three different estimation strategies. The data combine cross-country and time-series, which enables estimation by conventional panel-data techniques, random- or fixed-effects regressions. These panel-data estimators are asymptotically normal as $T \to \infty$, but in small samples, and especially when the number of groups exceeds the number of time periods, these estimators yield overly optimistic standard errors, and lead to overconfidence in the results. Our base regression is instead a pooled OLS using panel-corrected standard errors, as suggested by Beck and Katz (1995). This allows us to correct for errors that are both heteroscedastic (that is, they differ systematically across countries) and contemporaneously correlated within countries. While the parameter estimates are found by the conventional method $\hat{\beta} = (X'X)^{-1}X'Y$, the estimated variance matrix is given by $(X'X)^{-1}X\Omega X(X'X)^{-1}$, where $\Omega = \sum_i \sum_j x_{ij}\varepsilon_{ij}\varepsilon_{ij}x_{ij}$. This is similar to the Huber-White cluster (sandwich) error correction ($\Omega = \sum_i (\overline{x_i\varepsilon_j})(\overline{\varepsilon_j x_i})$), but while that method controls for differences in errors across groups, it does not allow for correlation within groups.

[11] These are medians, and do not control for the fact that many of the lower-middle-income countries are small states (e.g. Panama, Costa Rica, Papua New Guinea, Fiji) which depend heavily on trade.

Following the base results, we present a variety of specification test statistics, and adjust our method and interpretation accordingly. The first is a likelihood-ratio test of group-specific heteroscedasticity, following Greene (1993, p.397). Rejection of this test indicates that the errors differ significantly and systematically across countries. Second, we conduct an *ad-hoc* test for serial correlation, by estimating a common serial correlation coefficient $\bar{r} = \sum_i w_i r_i$, where r_i is the estimate of the within-country serial correlation, and w_i is a weight derived from the reciprocals of the variances, which increases the efficiency of the estimates (Greene, 1993, p.457). The *ad-hoc* nature of the test is that we consider the test significant if the serial correlation coefficient is close to or above 0.3, the rule-of-thumb for correction suggested by Grubb and Magee (1988). We correct for serial correlation using the Prais-Winsten method, which preserves the initial observation in each period. We present both sets of results, and in general, the differences between the results are larger where the estimated serial correlation is larger. Where we find significant serial correlation, we focus on the AR(1)-corrected estimates.

Finally, we test for the endogeneity of the private credit variable and its interactions. While we do not think that reverse causality is likely to be a problem, the results may be affected by omitted variables bias, especially considering the parsimonious set of conditioning variables. For example, our financial development measure may be correlated with some component of the error. In addition, the error term in panel data is composed of two parts: a truly random iid error ($\varepsilon_{i,t}$), and an unobserved country-specific component (μ_i). If financial development is correlated with the μ_i, the conventional random-effects estimator cannot be used, since it assumes no correlation between the regressors and the individual effects.

We simultaneously correct for both country-specific heterogeneity and endogeneity (correlation between the regressors and the idiosyncratic error) using the method suggested by Hausman and Taylor (1981) and Baltagi (1995), and developed by Over (1999). This is a generalized two-stage least squares procedure using the within effects (standard deviations) and between effects (country means) as instruments on data transformed by a weighted average of the within and between variance components. The intuition behind it is that while the included variables as well as the instruments may be

correlated with the error, both the country-specific means and standard deviations are orthogonal. Each instrument is thus used twice – once in means, and once in deviations. The elements of the omega (weighting) matrix are given by $\Omega^{-1/2} = (P/\sigma_{fe}) + (Q/\sigma_{be})$, where Q and P refer respectively to the within-country variable means and standard deviations, and σ_{fe} and σ_{be} refer respectively to the standard errors from the fixed-effects and between-effects regressions.

In the cases where we reject exogeneity, we also present the instrumental variables results. We use as instruments dummy variables indicating the legal origin of countries (Levine, Loayza, and Beck, 2000), a dummy variable indicating commodity exporters, and the urban population share in the total population. The set of instruments is both valid and sufficient: Sargan tests confirm that the instruments are exogenous to the error in the second-stage regression, and overidentification tests ensure that the models are adequately identified.

The interaction terms in these regressions are by definition correlated with their components (the shock variables and Private Credit). This gives rise to the problem of multicollinearity. While this does not necessarily bias the estimates, it does increase the size of the estimated variance, and, given the relatively small sample sizes, may cause instability in the parameter estimates. Examination of variance inflation factors (VIF)[12] reveals that volatility in terms of trade and money supply are the largest sources of collinearity, with VIFs exceeding 20 in the case of money supply. In our empirical results, this leads occasionally to the case where the parameter estimates on Private Credit and the interaction of Private Credit and the exogenous shock are individually insignificant, but jointly significant. We do not believe this to be a significant source of error, since the estimates are generally stable and consistent across samples and specifications. Also, we are primarily interested in the partial correlation of Private Credit and growth volatility given the shock – that is, in the linear combination of the two independent variables – for which the joint significance of the two estimates is the appropriate measure of accuracy.

4. The Main Results

This section presents the main results. We focus first on the regressions with one interaction term and subsequently on regressions with two interaction terms, specifically one overall interaction term and one for high-income countries only. The next section tests the robustness of the results.

4.1. Results With One Interaction Term

The results in Tables 4 - 6 provide evidence for a dampening impact of financial development on the transmission of terms of trade volatility to growth volatility and strong evidence for a magnifying impact of financial development on the transmission of inflation volatility. There is no evidence that financial development dampens or magnifies shocks in government expenditures. In the following we will discuss the results for each shock in turn.

The results in Table 4 indicate that in countries with a higher level of financial development the impact of terms of trade volatility on growth volatility is smaller. Although the interaction term of Private Credit and the standard deviations of terms of trade changes does not enter significantly in the 3-period sample (Columns 1 and 2), it is jointly significant with Private Credit. We interpret the negative sign on the interaction term as evidence for a dampening effect of financial development. The interaction term of Private Credit and the standard deviation of terms of trade changes enters significantly negative in the AR(1) regression of the 4-period panel (Column 4), but not in the OLS regression (Column 3). The interaction term and Private Credit are jointly significant at the 10%-level in both regressions. In the 6-period panel, finally, the interaction term enters insignificantly positive in the OLS (Column 5) specification and insignificantly negative in the AR(1) specification (Column 6). The interaction term and Private Credit enter jointly significantly only in the OLS specification. Given the relatively high serial correlation, however, we conjecture that these results are biased. In conclusion, the results in Table 4 are evidence that the financial sector can play a dampening role in economies that suffer from high terms of trade fluctuations.

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[12] The variance inflation factor for a variable X_j from a vector of regressors X is computed as $1/(1-R^2_j)$, where R^2_j is the multiple correlation coefficient from a regression of X_j on all other elements of X. A common rule of thumb is to be concerned with any value larger than 10.

The results in Table 5 indicate that in countries with higher levels of financial development the impact of inflation volatility on growth volatility is larger, thus providing evidence for a magnifying role of the financial sector in the transmission of monetary shocks to the real economy. In the 3-period panel, the interaction of Private Credit and the standard deviation of inflation enters significantly positive at the 10%-level (Columns 1 and 2). Furthermore, the interaction term and Private Credit are jointly significant in both regressions. While the interaction enters insignificantly positive in the 4-period and 6-period panel, it always enters jointly significant with Private Credit. In summary, we interpret these results as evidence in favor of a magnifying role of the financial sector in propagating monetary shocks to the real sector. Note, however, that given the negative sign on Private Credit and the distribution of the standard deviation of inflation, the overall effect of Private Credit on growth volatility is still negative for most countries in the sample.

The results in Table 6 do not indicate a robust interaction of financial development and the volatility of government expenditure volatility on growth volatility. The interaction term of Private Credit and the standard deviation of government expenditures enters negatively in both regressions in the 3-period panel (Columns 1 and 2) and the interaction term and Private Credit enter jointly significantly in both regressions. In the 4-period and the 6-period sample, however, the interaction term enters positively. Furthermore, the interaction term and Private Credit enter jointly significantly in three out of the four regressions (Columns 3-6). We therefore do not find robust evidence for either a dampening or a magnifying role of the financial sector in the propagation of government expenditure volatility. These results are confirmed, once we control for the endogeneity of Private Credit, as we will discuss in the next section.

4.2. Results With Two Interaction Terms

We now turn to the results with two interaction terms. Specifically, we include both an interaction term for all countries and an interaction term that takes the value zero for all countries that are not in the high income group. The second interaction term thus captures the additional marginal effect of the interaction of Private Credit and the respective volatility measure in high income countries. To assess the total effect of the

interaction on high income countries, we have to consider the sum of both interaction terms.

The results in Tables 7 - 9 provide evidence that the dampening effect of financial development on the propagation of terms of trade volatility is stronger for high income countries, while there is no magnifying role for the financial sector in propagating inflation volatility in high income countries. Furthermore, our previous findings that there is no robust interaction of financial development and the volatility of government expenditures is confirmed.

The Table 7 results indicate that the dampening role of the financial sector in the propagation of terms of trade volatility is stronger for high income countries. Since both interaction terms are negative in most of the six regressions, the total negative effect for high income countries is higher. Furthermore, Private Credit and the two interaction terms are jointly significant at the 10% level in all six regressions, indicating a significant impact for high-income countries, while Private Credit and the overall interaction term enter jointly significantly at the 10% level in only four out of six regressions. We can interpret this difference between high and non-high income countries as indicating that the financial sector provides additional services to the real economy in the high income countries that help dampen the effect of terms of trade volatility. Alternatively, we can interpret the smaller impact of financial development in non-high income countries as an indication that the financial sector is directly affected by terms of trade changes through abrupt changes in the exchange rate. High exposures to foreign currency holdings, as it was the case in the East Asian crisis, might then result in a magnifying role of the financial sector on the effect of terms of trade changes that offsets the original dampening effect.

The results in Table 8 are evidence that the financial sector does not have a magnifying role in the propagation of inflation variability in high income countries. While the results for the overall interaction term of Private Credit and the standard deviation of inflation are similar to the ones found in Table 5, the interaction term for high income countries enters negatively in all six regressions and significantly in the regressions for the 3-period panel. Furthermore, the sum of the two interaction terms is either close to zero or negative. This seems to indicate that the financial sector has a

amplifying role in the propagation of inflation shocks only in less developed economies. We can interpret the insignificant results for the high income countries as indication that banks can easily find alternative sources of funding in the case of tightening monetary policy and therefore do not propagate monetary shocks into the real economy. Alternatively, we can conclude that firms in high-income countries have alternative sources of funding and are therefore less affected by changes in banks' lending behavior.

The Table 9 results seem to indicate that there is a magnifying effect of financial development on the volatility of government expenditure in non-high income countries, but no significant impact for high-income countries. These results are not confirmed, however, by regressions that control for endogeneity of the regressors, as we will discuss in the next section.

5. Sensitivity Analysis

Our results for a magnifying role of the financial sector in the propagation of monetary shocks for non-high income countries are confirmed when we use the standard deviation of M2/GDP as indicator of monetary volatility. Tables 10 and 11 present the results. While the interaction term of M2/GDP volatility and Private Credit enters negative in the regression with just one interaction term (Table 10) – which is at odds with our results for inflation volatility – the interaction term of Private Credit and the overall interaction term has a positive coefficient in the regressions with two interaction terms (Table 11). The interaction term for the high income countries, however, has a significantly negative coefficient. Unlike in the regressions with inflation volatility, this negative impact does not offset completely the positive impact from the overall interaction term, so that there still seems to be a small magnifying role for financial intermediaries in high-income countries. Note that the standard deviation of M2/GDP enters negatively and in many cases significantly in the regressions in Table 11. This seems to indicate that higher volatility of M2/GDP actually decreases volatility. We can explain this somewhat perverse result by the observation that the standard deviation of M2/GDP is positively correlated with the level of M2/GDP, i.e. more monetized economies also experience a higher volatility in M2/GDP. This correlation might also

explain why we find a negative interaction term in the regressions with just one interaction term.

Our main results are robust to corrections for the endogeneity of the regressors. To assess the potential endogeneity, we apply the Davidson-MacKinnon test. The null hypothesis is that the ordinary least squares (OLS) estimator yields consistent estimates; that is, any endogeneity among the regressors would not have harmful effects on the OLS estimates. A rejection of the null indicates that endogenous regressors significantly influence the OLS estimates, and instrumental variables techniques are required (Davidson and MacKinnon 1993). We find evidence for endogeneity only in the regressions of government expenditure volatility and M2/GDP volatility. We therefore use the legal origin, a commodity exporter dummy and the urban population share as instruments for Private Credit. The results are presented in Tables 12 and 13.

Controlling for endogeneity in the regressions with government expenditure volatility does not change our main findings (Table 12). While the coefficient on the interaction of Private Credit and the standard deviation of government expenditures is negative in the 3-period and 4 period panel, it is positive in the 6-period panel (Columns 1-3). The results from the regressions with two interaction terms indicate that there is no robust effect of financial development on the propagation of the volatility of government expenditures for either high or non-high income countries. These results are somehow different from the results in Table 9 and seem to indicate that there is no role of the financial sector in the transmission of government expenditure shocks to the real economy in either high or non-high income countries.

Controlling for endogeneity in the regressions with M2/GDP volatility does not change our main findings (Table 13). While the regressions with one interaction term do not yield consistent results on the sign of the interaction term, the regressions with two interaction terms confirm our previous results. In non-high income countries, the volatility of M2/GDP volatility is magnified through a well-developed financial sector. This magnifying effect is still present in high-income countries, but significantly smaller.

6. Concluding Remarks

This paper explored potential channels through which financial development helps decrease growth volatility. While we find a dampening role for the financial sector in terms of trade shocks, we find a magnifying role in the propagation of monetary shocks in non-high income countries.

These results send a strong message to policy makers. A better developed financial sector can help decrease the impact of real sector shocks and thus decrease growth volatility. The financial sector, however, can only thrive in a stable monetary environment. High levels and volatility of inflation rates do not only impede the development of financial intermediaries and markets[13], but their impact on growth volatility is amplified by the financial sector.

[13] See Boyd, Levine, and Smith (2000).

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Table 1: Descriptive statistics

Sample	Variable	Median	Mean	SD	Min	Max	countries	observations
3-period							63	167
	S.D. GDP growth	0.025	0.034	0.020	0.006	0.110		
	real GDP/capita	3085.931	8202.977	9660.024	134.737	43885.680		
	(M+X)/GDP	50.077	60.609	46.457	9.432	364.052		
	Private credit	0.278	0.419	0.357	0.010	1.961		
	S.D. ToT changes	0.063	0.084	0.070	0.000	0.407		
	S.D. inflation	0.036	0.093	0.217	0.006	1.619		
	S.D. govt. expenditure	0.122	0.150	0.110	0.025	0.925		
	S.D. M2/GDP	0.049	0.086	0.100	0.004	0.776		
4-period							63	215
	S.D. GDP growth	0.025	0.033	0.020	0.005	0.116		
	real GDP/capita	2840.472	8365.529	9712.034	158.749	44223.316		
	(M+X)/GDP	51.129	60.943	44.746	9.903	378.472		
	Private credit	0.280	0.426	0.357	0.008	2.006		
	S.D. ToT changes	0.055	0.081	0.071	0.000	0.472		
	S.D. inflation	0.038	0.086	0.203	0.005	1.625		
	S.D. govt. expenditure	0.108	0.130	0.097	0.017	0.793		
	S.D. M2/GDP	0.037	0.071	0.099	0.003	0.946		
6-period							63	331
	S.D. GDP growth	0.024	0.031	0.022	0.004	0.135		
	real GDP/capita	2807.183	8222.894	9646.166	150.597	44026.164		
	(M+X)/GDP	50.896	60.819	46.765	9.129	395.609		
	Private credit	0.284	0.419	0.358	0.003	2.043		
	S.D. ToT changes	0.053	0.080	0.078	0.000	0.577		
	S.D. inflation	0.029	0.073	0.173	0.004	1.602		
	S.D. govt. expenditure	0.082	0.108	0.089	0.009	0.651		
	S.D. M2/GDP	0.025	0.051	0.095	0.003	1.325		

Table 2: Correlations, 1960-97

Variable	S.D. ToT changes	S.D. inflation	S.D. govt. expenditure	S.D. M2/GDP
S.D. inflation	0.355 ***			
S.D. govt. expenditure	0.115	0.159		
S.D. M2/GDP	-0.307 **	-0.112	-0.046	
S.D. GDP growth	0.550 ***	0.318 **	0.217 *	-0.218 *
S.D. GDP growth (slope estimate)	0.148 ***	0.021 ***	-0.039	0.027

*, **, *** denote significance at the 10%, 5% and 1% level, respectively

Table 3: Medians by income groups, 1960-97

	Income class			
Variable	High	Upper middle	Lower middle	Low
S.D. GDP growth	0.025	0.042	0.043	0.050
real GDP/capita	17073.930	3049.940	1267.880	292.907
(M+X)/GDP	55.206	40.615	54.546	38.876
Private credit	0.614	0.253	0.215	0.142
S.D. ToT changes	0.040	0.119	0.092	0.135
S.D. inflation	0.040	0.202	0.061	0.082
S.D. govt. expenditure	0.225	0.218	0.224	0.226
S.D. M2/GDP	0.184	0.116	0.106	0.073
countries	24	8	18	13

Table 4: Terms of Trade Volatility and Financial Development

Dependent variable: SDDGDP

Sample	3-period		4-period		6-period	
Method 1/	OLS	AR(1)	OLS	AR(1)	OLS	AR(1)
[1] Ln(real GDP/capita)	-0.0006	-0.0007	-0.0011	-0.0009	-0.0006	-0.0006
	(0.635)	*(0.418)*	*(0.336)*	*(0.314)*	*(0.535)*	*(0.509)*
[2] Ln(M+X/GDP)	0.0060	0.0044	0.0054	0.0036	0.0043	0.0053
	(0.006)	*(0.003)*	*(0.008)*	*(0.016)*	*(0.016)*	*(0.000)*
[3] Sd dToT	0.0935	0.1871	0.1490	0.2076	0.0600	0.1103
	(0.234)	*(0.001)*	*(0.001)*	*(0.000)*	*(0.216)*	*(0.002)*
[4] Sd dToT * Ln(Private credit)	-0.0059	-0.0250	-0.0197	-0.0335	0.0038	-0.0069
	(0.817)	*(0.172)*	*(0.249)*	*(0.006)*	*(0.824)*	*(0.579)*
[5] Ln(Private credit)	-0.0065	-0.0022	-0.0027	-0.0008	-0.0060	-0.0017
	(0.038)	*(0.319)*	*(0.268)*	*(0.672)*	*(0.009)*	*(0.345)*
[6] Intercept	0.0306	0.0157	0.0220	0.0144	0.0340	0.0078
	(0.008)	*(0.037)*	*(0.034)*	*(0.028)*	*(0.000)*	*(0.140)*
Joint significance tests						
All variables (Chi2, 5 df)	65.22	122.23	91.43	243.42	76.30	78.50
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
[4] and [5] (Chi2, 2 df)	8.73	8.47	5.05	11.05	9.52	2.36
	(0.013)	*(0.015)*	*(0.080)*	*(0.004)*	*(0.009)*	*(0.307)*
LR test of homoscedasticity	5352.34		13072.10		47594.10	
Chi-squared (62 df)	*(0.000)*		*(0.000)*		*(0.000)*	
Exogeneity test 2/	0.87		0.59		1.23	
F(2, NT-10)	*(0.421)*		*(0.556)*		*(0.292)*	
Serial correlation (rho)	0.1463		0.1844		0.2886	
Number of countries	63	63	63	63	63	63
Number of observations	167	167	217	217	331	331

Notes

1/ P-values in parentheses

2/ Davidson-Mackinnon test

Table 5: Inflation Volatility and Financial Development

Dependent variable: SDDGDP

Sample	3-period		4-period		6-period	
Method 1/	OLS	AR(1)	OLS	AR(1)	OLS	AR(1)
[1] Ln(real GDP/capita)	-0.0024	-0.0016	-0.0026	-0.0024	-0.0021	-0.0008
	(0.071)	*(0.050)*	*(0.026)*	*(0.007)*	*(0.048)*	*(0.353)*
[2] Ln(M+X/GDP)	0.0063	0.0044	0.0048	0.0025	0.0040	0.0058
	(0.005)	*(0.002)*	*(0.024)*	*(0.099)*	*(0.028)*	*(0.000)*
[3] Sd dinf	0.0025	0.0022	0.0034	0.0088	0.0080	0.0188
	(0.783)	*(0.819)*	*(0.780)*	*(0.492)*	*(0.426)*	*(0.062)*
[4] Sd dinf * Ln(Private credit)	0.0079	0.0110	0.0075	0.0070	0.0053	0.0053
	(0.065)	*(0.007)*	*(0.134)*	*(0.176)*	*(0.167)*	*(0.187)*
[5] Ln(Private credit)	-0.0071	-0.0070	-0.0059	-0.0051	-0.0062	-0.0039
	(0.006)	*(0.000)*	*(0.012)*	*(0.005)*	*(0.003)*	*(0.036)*
[6] Intercept	0.0504	0.0437	0.0532	0.0508	0.0515	0.0164
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.001)*
Joint significance tests						
All variables (Chi2, 5 df)	70.59	134.45	65.37	95.37	72.69	51.25
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
[4] and [5] (Chi2, 2 df)	9.97	21.52	7.6	8.93	9.53	5.26
	(0.007)	*(0.000)*	*(0.022)*	*(0.012)*	*(0.009)*	*(0.072)*
LR test of homoscedasticity	5401.69		12999.50		48123.10	
Chi-squared (62 df)	*(0.000)*		*(0.000)*		*(0.000)*	
Exogeneity test 2/	1.16		0.70		1.35	
F(2, NT-10)	*(0.317)*		*(0.496)*		*(0.262)*	
Serial correlation (rho)	0.1242		0.1080		0.2946	
Number of countries	63	63	63	63	63	63
Number of observations	167	167	217	217	331	331

Notes

1/ P-values in parentheses

2/ Davidson-Mackinnon test

Table 6: Volatility of Government Expenditures and Financial Development

Dependent variable: SDDGDP

Sample	3-period		4-period		6-period	
Method 1/	OLS	AR(1)	OLS	AR(1)	OLS	AR(1)
[1] Ln(real GDP/capita)	-0.0019	-0.0024	-0.0018	-0.0019	-0.0012	-0.0003
	(0.134)	*(0.003)*	*(0.109)*	*(0.025)*	*(0.215)*	*(0.751)*
[2] Ln(M+X/GDP)	0.0029	0.0021	0.0015	0.0002	0.0014	0.0036
	(0.156)	*(0.057)*	*(0.463)*	*(0.868)*	*(0.428)*	*(0.012)*
[3] Sd dgexp	0.0518	0.0902	-0.0079	0.0444	0.0128	0.0544
	(0.198)	*(0.009)*	*(0.837)*	*(0.203)*	*(0.615)*	*(0.033)*
[4] Sd dgexp * Ln(Private credit)	-0.0022	-0.0142	0.0182	0.0051	0.0121	0.0023
	(0.861)	*(0.169)*	*(0.124)*	*(0.626)*	*(0.112)*	*(0.760)*
[5] Ln(Private credit)	-0.0059	-0.0031	-0.0082	-0.0051	-0.0075	-0.0039
	(0.044)	*(0.126)*	*(0.003)*	*(0.016)*	*(0.001)*	*(0.051)*
[6] Intercept	0.0504	0.0433	0.0629	0.0488	0.0557	0.0160
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.001)*
Joint significance tests						
All variables (Chi2, 5 df)	67.45	124.75	76.92	108.27	71.23	59.62
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
[4] and [5] (Chi2, 2 df)	6.57	11.29	9.03	7.28	11.94	4.32
	(0.038)	*(0.004)*	*(0.011)*	*(0.026)*	*(0.003)*	*(0.115)*
LR test of homoscedasticity	5300.33		12990.40		48045.30	
Chi-squared (62 df)	*(0.000)*		*(0.000)*		*(0.000)*	
Exogeneity test 2/	3.137		3.264		3.531	
F(2, NT-10)	*(0.046)*		*(0.040)*		*(0.030)*	
Serial correlation (rho)	0.0908		0.1385		0.3020	
Number of countries	63	63	63	63	63	63
Number of observations	167	167	217	217	331	331

Notes

1/ P-values in parentheses

2/ Davidson-Mackinnon test

Table 7: Terms of Trade Volatility and Financial Development, 2 Interaction Terms

Dependent variable: SDDGDP

Sample	3-period		4-period		6-period	
Method 1/	OLS	AR(1)	OLS	AR(1)	OLS	AR(1)
[1] Ln(real GDP/capita)	-0.0003	0.0001	-0.0006	-0.0001	-0.0001	0.0009
	(0.842)	(0.944)	*(0.682)*	*(0.887)*	*(0.953)*	*(0.371)*
[2] Ln(M+X/GDP)	0.0059	0.0039	0.0052	0.0032	0.0041	0.0041
	(0.008)	(0.008)	*(0.011)*	*(0.032)*	*(0.024)*	*(0.006)*
[3] Sd dToT	0.0911	0.1557	0.1432	0.1853	0.0539	0.0692
	(0.253)	(0.012)	*(0.002)*	*(0.000)*	*(0.276)*	*(0.065)*
[4] Sd dToT * Ln(Private credit)	-0.0041	-0.0113	-0.0156	-0.0222	0.0079	0.0144
	(0.879)	(0.582)	*(0.412)*	*(0.135)*	*(0.660)*	*(0.300)*
[5] Sd dToT * Ln(Private credit)	-0.0075	-0.0125	-0.0111	-0.0114	-0.0126	-0.0250
(high-income countries)	*(0.517)*	(0.163)	*(0.340)*	*(0.186)*	*(0.188)*	*(0.002)*
[6] Ln(Private credit)	-0.0065	-0.0031	-0.0028	-0.0015	-0.0061	-0.0033
	(0.038)	(0.158)	*(0.254)*	*(0.426)*	*(0.008)*	*(0.075)*
[7] Intercept	0.0288	0.0150	0.0191	0.0126	0.0311	0.0068
	(0.018)	(0.051)	*(0.084)*	*(0.061)*	*(0.001)*	*(0.187)*
Joint significance tests						
All variables (Chi2, 6 df)	66.58	130.67	93.31	253.74	78.04	92.6
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
[4] and [5] (Chi2, 2 df)	0.62	3.76	3.43	9.30	1.76	9.57
	(0.733)	*(0.153)*	*(0.180)*	*(0.010)*	*(0.414)*	*(0.008)*
[4] and [6] (Chi2, 2 df)	8.19	6.37	3.97	5.56	9.01	3.17
	(0.017)	*(0.041)*	*(0.137)*	*(0.062)*	*(0.011)*	*(0.205)*
[4], [5] and [6] (Chi2, 3 df)	9.47	11.3	7.03	13.66	11.61	12.29
	(0.024)	*(0.010)*	*(0.071)*	*(0.003)*	*(0.009)*	*(0.006)*
LR test of homoscedasticity	5324.12		12979.7		48036.8	
Chi-squared (62 df)	*(0.000)*		*(0.000)*		*(0.000)*	
Exogeneity test 2/	0.94		0.40		1.27	
F(3, NT-11)	*(0.424)*		*(0.755)*		*(0.285)*	
Serial correlation (rho)	0.1418		0.1846		0.2880	
Number of countries	63	63	63	63	63	63
Number of observations	167	167	217	217	331	331

Notes

1/ P-values in parentheses

2/ Davidson-Mackinnon test

Table 8: Inflation Volatility and Financial Development, 2 Interaction Terms

Dependent variable: SDDGDP

Sample	3-period		4-period		6-period	
Method 1/	OLS	AR(1)	OLS	AR(1)	OLS	AR(1)
[1] Ln(real GDP/capita)	-0.0020	-0.0010	-0.0024	-0.0022	-0.0018	-0.0006
	(0.140)	*(0.237)*	*(0.050)*	*(0.019)*	*(0.083)*	*(0.479)*
[2] Ln(M+X/GDP)	0.0067	0.0045	0.0049	0.0025	0.0043	0.0057
	(0.003)	*(0.003)*	*(0.021)*	*(0.099)*	*(0.020)*	*(0.000)*
[3] Sd dinf	0.0016	0.0010	0.0029	0.0074	0.0076	0.0175
	(0.864)	*(0.920)*	*(0.811)*	*(0.561)*	*(0.446)*	*(0.077)*
[4] Sd dinf * Ln(Private credit)	0.0089	0.0117	0.0080	0.0077	0.0061	0.0069
	(0.048)	*(0.004)*	*(0.117)*	*(0.149)*	*(0.127)*	*(0.100)*
[5] Sd dinf * Ln(Private credit)	-0.0139	-0.0151	-0.0074	-0.0067	-0.0091	-0.0094
(high-income countries)	*(0.029)*	*(0.013)*	*(0.318)*	*(0.331)*	*(0.102)*	*(0.132)*
[6] Ln(Private credit)	-0.0072	-0.0074	-0.0060	-0.0054	-0.0063	-0.0042
	(0.005)	*(0.000)*	*(0.011)*	*(0.003)*	*(0.003)*	*(0.023)*
[7] Intercept	0.0459	0.0412	0.0510	0.0503	0.0489	0.0169
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.001)*
Joint significance tests						
All variables (Chi2, 6 df)	72.01	138.98	65.43	97.02	72.91	53.94
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
[4] and [5] (Chi2, 2 df)	6.3	11.54	2.76	2.37	3.58	3.61
	(0.043)	*(0.003)*	*(0.251)*	*(0.305)*	*(0.167)*	*(0.165)*
[4] and [6] (Chi2, 2 df)	10.79	23.75	7.91	10.15	9.99	6.8
	(0.005)	*(0.000)*	*(0.019)*	*(0.006)*	*(0.007)*	*(0.033)*
[4], [5] and [6] (Chi2, 3 df)	14.09	28.81	8.34	10.63	12.17	8.07
	(0.003)	*(0.000)*	*(0.040)*	*(0.014)*	*(0.007)*	*(0.045)*
LR test of homoscedasticity	5398.43		12967.4		48000.6	
Chi-squared (62 df)	*(0.000)*		*(0.000)*		*(0.000)*	
Exogeneity test 2/	1.09		0.90		1.46	
F(3, NT-11)	*(0.355)*		*(0.442)*		*(0.224)*	
Serial correlation (rho)	0.1255		0.1032		0.2850	
Number of countries	63	63	63	63	63	63
Number of observations	167	167	217	217	331	331

Notes

1/ P-values in parentheses

2/ Davidson-Mackinnon test

Table 9: Volatility of Government Expenditures and Financial Development, 2 Interaction Terms

Dependent variable: SDDGDP

Sample	3-period		4-period		6-period	
Method 1/	OLS	AR(1)	OLS	AR(1)	OLS	AR(1)
[1] Ln(real GDP/capita)	0.0004	-0.0002	0.0000	0.0001	0.0000	0.0011
	(0.784)	*(0.787)*	*(0.991)*	*(0.906)*	*(0.998)*	*(0.240)*
[2] Ln(M+X/GDP)	0.0024	0.0020	0.0010	-0.0013	0.0014	0.0025
	(0.219)	*(0.004)*	*(0.620)*	*(0.275)*	*(0.416)*	*(0.082)*
[3] Sd dgexp	0.0486	0.0694	-0.0097	0.0273	0.0113	0.0420
	(0.211)	*(0.008)*	*(0.796)*	*(0.375)*	*(0.648)*	*(0.078)*
[4] Sd dgexp * Ln(Private credit)	0.0073	0.0016	0.0259	0.0187	0.0158	0.0133
	(0.561)	*(0.849)*	*(0.032)*	*(0.052)*	*(0.043)*	*(0.088)*
[5] Sd dgexp * Ln(Private credit)	-0.0166	-0.0180	-0.0149	-0.0170	-0.0137	-0.0173
(high-income countries)	*(0.001)*	*(0.000)*	*(0.006)*	*(0.000)*	*(0.028)*	*(0.001)*
[6] Ln(Private credit)	-0.0068	-0.0040	-0.0089	-0.0067	-0.0079	-0.0053
	(0.017)	*(0.021)*	*(0.001)*	*(0.000)*	*(0.000)*	*(0.007)*
[7] Intercept	0.0368	0.0330	0.0524	0.0462	0.0475	0.0153
	(0.001)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.004)*
Joint significance tests						
All variables (Chi2, 6 df)	75.46	216.93	83.79	174.96	72.09	75.19
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
[4] and [5] (Chi2, 2 df)	11.17	39.16	8.97	20.26	6.47	11.11
	(0.004)	*(0.000)*	*(0.011)*	*(0.000)*	*(0.039)*	*(0.004)*
[4] and [6] (Chi2, 2 df)	6.41	7.57	11.09	12.66	13.45	7.53
	(0.041)	*(0.023)*	*(0.004)*	*(0.002)*	*(0.001)*	*(0.023)*
[4], [5] and [6] (Chi2, 3 df)	21.93	56.34	17.27	29.6	16.88	16.73
	(0.000)	*(0.000)*	*(0.001)*	*(0.000)*	*(0.001)*	*(0.001)*
LR test of homoscedasticity	5395.59		13006		48662.1	
Chi-squared (62 df)	*(0.000)*		*(0.000)*		*(0.000)*	
Exogeneity test 2/	1.65		1.83		2.20	
F(3, NT-11)	*(0.180)*		*(0.142)*		*(0.088)*	
Serial correlation (rho)	0.0168		0.0877		0.2751	
Number of countries	63	63	63	63	63	63
Number of observations	167	167	217	217	331	331

Notes

1/ P-values in parentheses

2/ Davidson-Mackinnon test

Table 10: Volatility of Money and Financial Development

Dependent variable: SDDGDP

Sample	3-period		4-period		6-period	
Method 1/	OLS	AR(1)	OLS	AR(1)	OLS	AR(1)
[1] Ln(real GDP/capita)	-0.0018	-0.0019	-0.0020	-0.0022	-0.0017	-0.0022
	(0.197)	*(0.132)*	*(0.104)*	*(0.048)*	*(0.108)*	*(0.008)*
[2] Ln(M+X/GDP)	0.0051	0.0065	0.0038	0.0051	0.0033	0.0073
	(0.032)	*(0.007)*	*(0.080)*	*(0.024)*	*(0.073)*	*(0.001)*
[3] Sd m2gdp	0.0396	0.0717	-0.0073	0.0157	0.0285	0.0524
	(0.517)	*(0.220)*	*(0.898)*	*(0.757)*	*(0.460)*	*(0.162)*
[4] Sd m2gdp * Ln(Private credit)	-0.0087	-0.0143	0.0027	-0.0007	-0.0047	-0.0090
	(0.565)	*(0.338)*	*(0.847)*	*(0.959)*	*(0.671)*	*(0.412)*
[5] Ln(Private credit)	-0.0081	-0.0079	-0.0073	-0.0070	-0.0072	-0.0049
	(0.002)	*(0.005)*	*(0.004)*	*(0.012)*	*(0.000)*	*(0.034)*
[6] Intercept	0.0547	0.0448	0.0587	0.0482	0.0553	0.0310
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
Joint significance tests						
All variables (Chi2, 5 df)	54.50	47.30	49.68	40.87	61.72	47.30
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
[4] and [5] (Chi2, 2 df)	13.74	12.64	9.75	7.79	15.55	7.62
	(0.001)	*(0.002)*	*(0.008)*	*(0.020)*	*(0.000)*	*(0.022)*
LR test of homoscedasticity	5194.48		12500.00		47626.70	
Chi-squared (62 df)	*(0.000)*		*(0.000)*		*(0.000)*	
Exogeneity test 2/	2.85		1.88		2.74	
F(2, NT-10)	*(0.061)*		*(0.155)*		*(0.066)*	
Serial correlation (rho)	0.1491		0.1727		0.3116	
Number of countries	63	63	63	63	63	63
Number of observations	167	167	213	213	329	329

1/ P-values in parentheses

2/ Davidson-Mackinnon test

Table 11: Volatility of Money and Financial Development, 2 Interaction Terms

Dependent variable: SDDGDP

Sample	3-period		4-period		6-period	
Method	OLS	AR(1)	OLS	AR(1)	OLS	AR(1)
[1] Ln(real GDP/capita)	0.0004	0.0004	-0.0001	0.0003	-0.0002	0.0011
	(0.814)	*(0.809)*	*(0.938)*	*(0.827)*	*(0.893)*	*(0.433)*
[2] Ln(M+X/GDP)	0.0048	0.0058	0.0032	0.0054	0.0027	0.0077
	(0.032)	*(0.034)*	*(0.114)*	*(0.032)*	*(0.134)*	*(0.006)*
[3] Sd m2gdp	-0.1638	-0.1139	-0.1915	-0.1318	-0.1800	-0.0846
	(0.081)	*(0.309)*	*(0.021)*	*(0.160)*	*(0.019)*	*(0.331)*
[4] Sd m2gdp * Ln(Private credit)	0.0699	0.0564	0.0745	0.0582	0.0754	0.0442
	(0.030)	*(0.138)*	*(0.012)*	*(0.096)*	*(0.007)*	*(0.171)*
[5] Sd m2gdp * Ln(Private credit)	-0.0316	-0.0277	-0.0295	-0.0241	-0.0329	-0.0208
(high-income countries)	*(0.005)*	*(0.030)*	*(0.007)*	*(0.061)*	*(0.001)*	*(0.082)*
[6] Ln(Private credit)	-0.0123	-0.0125	-0.0110	-0.0116	-0.0102	-0.0108
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
[7] Intercept	0.0526	0.0447	0.0579	0.0413	0.0557	0.0206
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.005)*
Joint significance tests						
All variables (Chi2, 6 df)	70.07	59.44	61.55	46.14	82.58	52.72
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
[4] and [5] (Chi2, 2 df)	8.51	3.25	7.22	1.95	12.87	2.51
	(0.014)	*(0.046)*	*(0.027)*	*(0.151)*	*(0.002)*	*(0.089)*
[4] and [6] (Chi2, 2 df)	19.71	8.62	16.09	7.97	22.67	8.15
	(0.000)	*(0.001)*	*(0.000)*	*(0.001)*	*(0.000)*	*(0.001)*
[4], [5] and [6] (Chi2, 3 df)	26.5	10.33	18.54	7.01	30.99	7.01
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
LR test of homoscedasticity	5188.94		12469.8		47567.1	
Chi-squared (62 df)	*(0.000)*		*(0.000)*		*(0.000)*	
Exogeneity test 2/	1.65		1.32		1.53	
F(3, NT-11)	*(0.180)*		*(0.269)*		*(0.207)*	
Serial correlation (rho)	0.0954		0.1644		0.2887	
Number of countries	63	63	63	63	63	63
Number of observations	167	167	213	213	329	329

Notes

1/ P-values in parentheses

2/ Davidson-Mackinnon test

Table 12: Volatility of Government Expenditures and Financial Development, IV Regressions

Dependent variable: SDDGDP, method = EC-2SLS 1/

	One interaction			Two interactions		
Sample	3-pd	4-pd	6-pd	3-pd	4-pd	6-pd
[1] Ln(real GDP/capita)	0.0003	0.0002	0.0015	0.0040	0.0033	0.0060
	(0.878)	*(0.924)*	*(0.454)*	*(0.107)*	*(0.153)*	*(0.034)*
[2] Ln(M+X/GDP)	0.0047	0.0032	0.0028	0.0035	0.0019	0.0034
	(0.121)	*(0.248)*	*(0.304)*	*(0.206)*	*(0.472)*	*(0.230)*
[3] Sd dgexp	0.0731	0.0412	-0.0500	0.0849	-0.0169	-0.0355
	(0.449)	*(0.680)*	*(0.585)*	*(0.347)*	*(0.852)*	*(0.676)*
[4] Sd dgexp * Ln(Private credit)	-0.0133	-0.0036	0.0296	-0.0021	0.0287	0.0323
	(0.689)	*(0.923)*	*(0.434)*	*(0.949)*	*(0.404)*	*(0.360)*
[5] Sd dgexp * Ln(Private credit)				-0.0293	-0.0242	-0.0432
(high-income countries)				*(0.014)*	*(0.010)*	*(0.024)*
[6] Ln(Private credit)	-0.0102	-0.0111	-0.0165	-0.0103	-0.0151	-0.0184
	(0.110)	*(0.030)*	*(0.005)*	*(0.087)*	*(0.006)*	*(0.002)*
[7] Intercept	0.0424	0.0526	0.0597	0.0164	0.0447	0.0307
	(0.010)	*(0.002)*	*(0.000)*	*(0.333)*	*(0.007)*	*(0.105)*
Joint significance tests						
All variables 2/	10.25	9.04	11.03	10.95	13.62	12.46
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
[4] and [5] F (2, 62)				4.13	3.44	2.73
				(0.021)	(0.038)	(0.073)
[4] and [6] F (2, 62)	3.25	2.99	4.87	3.12	4.35	5.97
	(0.046)	*(0.058)*	*(0.011)*	*(0.051)*	*(0.017)*	*(0.004)*
[4], [5], and [6] F (3, 62)				4.85	4.32	4.83
				(0.004)	*(0.008)*	*(0.004)*
Overid test 4/	0.002	0.002	0.003	0.002	0.002	0.001
	(1.000)	*(1.000)*	*(1.000)*	*(1.000)*	*(1.000)*	*(1.000)*
Sargan test 5/	0.526	0.454	0.702	0.176	0.330	0.414
	(0.895)	*(0.939)*	*(0.749)*	*(0.999)*	*(0.983)*	*(0.958)*
Number of countries	63	63	63	63	63	63
Number of observations	167	217	331	167	217	331

Notes

1/ P-values in parentheses

2/ For single interaction df = (5, NT-23)
For two interactions df = (6, NT-23)

4/ The null hypothesis is that the instruments are sufficient to identify the model.

5/ The null hypothesis is that the instruments are not correlated with the residual.

Table 13: Volatility of Money and Financial Development, IV Regressions

Dependent variable: SDDGDP, method = EC-2SLS 1/

	One interaction			Two interactions		
Sample	3-pd	4-pd	6-pd	3-pd	4-pd	6-pd
[1] Ln(real GDP/capita)	-0.0004	0.0005	0.0004	0.0072	0.0075	0.0064
	(0.865)	*(0.818)*	*(0.852)*	*(0.024)*	*(0.080)*	*(0.043)*
[2] Ln(M+X/GDP)	0.0060	0.0047	0.0041	0.0052	0.0025	0.0017
	(0.051)	*(0.094)*	*(0.092)*	*(0.070)*	*(0.385)*	*(0.452)*
[3] Sd m2gdp	-0.1304	0.0517	-0.0238	-1.0911	-1.0709	-1.3484
	(0.560)	*(0.773)*	*(0.916)*	*(0.010)*	*(0.106)*	*(0.020)*
[4] Sd m2gdp * Ln(Private credit)	0.0389	-0.0152	0.0102	0.3802	0.3726	0.4759
	(0.522)	*(0.768)*	*(0.884)*	*(0.008)*	*(0.101)*	*(0.014)*
[5] Sd m2gdp * Ln(Private credit)				-0.1049	-0.0988	-0.1107
(high-income countries)				*(0.003)*	*(0.068)*	*(0.004)*
[6] Ln(Private credit)	-0.0148	-0.0123	-0.0128	-0.0354	-0.0347	-0.0335
	(0.020)	*(0.052)*	*(0.033)*	*(0.000)*	*(0.011)*	*(0.002)*
[7] Intercept	0.0626	0.0524	0.0552	0.0734	0.0793	0.0831
	(0.000)	*(0.001)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
Joint significance tests						
All variables 2/	8.39	5.85	7.72	6.52	5.78	5.36
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
[4] and [5] F (2, 62)				4.47	1.80	4.16
				(0.015)	*(0.173)*	*(0.020)*
[4] and [6] F (2, 62)	17.20	14.40	14.18	8.75	5.11	5.30
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.009)*	*(0.008)*
[4], [5], and [6] F (3, 62)				6.33	4.62	4.80
				(0.001)	*(0.006)*	*(0.005)*
Overid test 4/	0.003	0.002	0.003	0.004	0.003	0.005
	(1.000)	*(1.000)*	*(1.000)*	*(1.000)*	*(1.000)*	*(1.000)*
Sargan test 5/	0.375	0.408	0.345	0.274	0.262	0.239
	(0.971)	*(0.959)*	*(0.980)*	*(0.992)*	*(0.994)*	*(0.996)*
Number of countries	63	63	63	63	63	63
Number of observations	167	213	329	167	213	329

Notes

1/ P-values in parentheses

2/ For single interaction df = (5, NT-23)
For two interactions df = (6, NT-23)

4/ The null hypothesis is that the instruments are sufficient to identify the model.

5/ The null hypothesis is that the instruments are not correlated with the residual.