FINANCE, GROWTH AND FRAGILITY

by

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Abstract

We utilise a new international database of financial fragility indicators for 124 countries from 1998 to 2012 to investigate the effects of fragility on the finance-growth nexus. Cross-country growth regressions suggest that both financial fragility and private credit have negative effects on GDP growth over this period. The results are robust to controlling for systemic banking crises, confirming that financial fragility has additional negative effects on growth, even if a banking crisis is avoided. We also present results using interactions which suggest that (a) a large volume of impaired loans can amplify the negative effects of private credit on growth and (b) a sufficiently high z-score can eradicate the negative effects of private credit on growth.

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1. Introduction

In the aftermath of the 2007-2009 global financial crisis, the view that finance is good for growth,[1] which has dominated the thinking of policy makers for nearly three decades,[2] is coming under renewed scrutiny. New evidence shows that the relationship between finance and growth has vanished in more recent data (e.g., Rousseau and Wachtel, 2011; Demetriades and Rousseau, 2016) or that it can turn negative once a certain threshold of financial development has been reached (e.g., Arcand, et al., 2015). This literature argues that the weakening or reversal of the finance-growth nexus reflects the effects of systemic banking crises on growth, which are themselves widely documented (e.g., Laeven and Valencia, 2013). Others have suggested that financial development, particularly where it occurs through deregulation or liberalization, diverts human capital away from technological innovation into less productive activities by artificially inflating reward structures in finance (e.g., Ang, 2011; Andrianova et al., 2012; Kneer, 2013).

An alternative and perhaps more obvious channel through which the potentially positive effects of financial development on growth can be weakened or reversed is that of financial fragility. Low credit quality, inadequate bank capital buffers and low profitability are likely to result in a reduction of credit for long-term investment, as banks try to improve their capital ratios by reducing the total amount of risk-weighted assets (the denominator).

[1] Levine (2003), for example, states that "…countries with better-developed financial systems tend to grow faster - specifically, those with (i) large, privately owned banks that funnel credit to private enterprises and (ii) liquid stock exchanges….The size of the banking system and the liquidity of stock markets are each positively linked to growth. Simultaneity bias does not seem to be the cause of this result."

[2] Exceptions include Demetriades and Hussein (1996), who provide time-series evidence suggesting that finance follows growth in LDCs more often than not, and Andrianova et al. (2008), who suggest that privatising government-owned banks can be detrimental to financial development and growth when contract enforcement and regulation are weak. See also Deidda and Fatouh (2002) and Rioja and Valev (2004), who suggest a non-monotone relationship between finance and growth.

High levels of impaired loans may also increase the cost of new credit to firms and households as banks attempt to recoup lost interest income by raising lending rates. Furthermore, under-capitalised banks may engage in regulatory arbitrage by moving towards riskier assets with higher short-term returns within the same regulatory risk category.[3] At the extreme, under-capitalised banks may gamble for resurrection, by financing highly risky investments, such as pursuing 'white elephant' (i.e., unprofitable) projects (Llewellyn, 1999). To sum-up, financial fragility is likely to erode the ability of banks to finance productive investment and growth, even if it does not lead to a full-blown crisis.

Although the possible effects of weak bank balance sheets on bank lending are reasonably well understood,[4] the effects of financial fragility on growth remain relatively under-researched in the empirical literature. This is partly because their estimation would normally require using explicit and reliable measures of financial fragility, which, until recently, have not been widely available.[5] Another plausible reason why the effects of financial fragility on growth may have remained under-researched could be that financial fragility has been closely linked to financial crises – after all, fragility itself is often defined as vulnerability of a financial system to crisis. Researchers may, therefore, interpret financial crises and financial fragility as more-or-less synonymous and choose to study the effects of crises on growth, using banking crisis dummies that are relatively abundant in the literature (e.g., Laeven and Valencia, 2013).

[3] They can, for example, shift towards riskier sovereign bonds, which continue to carry a zero regulatory risk weight.

[4] See, for example, chapter 5 "Financial Systems in Distress" in World Bank (1989).

[5] Loayza and Ranciere (2006) provide an empirical analysis of the effects of financial fragility on growth without using explicit measures of fragility. They do this by ascribing the negative short-run effects of financial development on growth to financial fragility.

It is, however, important to investigate the extent to which financial fragility has effects on growth over and above the effects of crises, not least because many countries may be able to avoid a full-blown crisis but could stagnate for decades because of financial fragility. Quantifying the effects of financial fragility on growth may also shed light on the extent to which the weakening or reversal of the finance-growth nexus can be attributed to financial fragility. To this end, we utilise a new international database on financial fragility for 124 countries from 1998 through 2012 developed by Andrianova et al. (2015) to investigate the effects of fragility on the finance-growth nexus. Unlike previous datasets that contain indicators of financial fragility for commercial banks (e.g., the World Bank's *World Development Indicators*), this database includes all types of deposit-taking institutions as well as investment banks. It is, therefore, shown to produce more reliable estimates of financial fragility, particularly in countries where financial intermediaries such as real estate and mortgage banks, cooperative banks, savings banks, Islamic banks or investment banks play a prominent role. In countries like Germany, for example, focusing on commercial banks alone can over-estimate financial fragility. By contrast, in the United States, if real estate and mortgage banks and investment banks are excluded – which are known to have played an important role in the build-up to the sub-prime crisis – financial fragility will be under-estimated.[6]

Our results reveal that financial fragility has significant negative effects on growth, independently of the effects of banking crises. These effects are economically large, suggesting that avoiding a crisis is not sufficient to eliminate the sizeable effects of financial fragility on growth. They also show that private credit – which has been the main indicator used to capture financial deepening in the finance-growth literature – has negative effects on

[6] In certain countries the activities of investment banks are not entirely separate from their commercial counterparts, further warranting the inclusion of investment banks.

growth in the period under study, and that these effects are surprisingly robust but can be mitigated by very low levels of financial fragility.

The rest of the paper is organised as follows. Section 2 presents the data and the empirical strategy. Section 3 presents the baseline regressions and shows that the effects of financial fragility are robust to the inclusion of banking crisis dummies. Section 4 presents additional insights into the relationship between financial fragility, financial development and growth by analysing interactions between private credit and financial fragility indicators. Section 5 summarises and concludes.

2. Empirical strategy and data

2.1 Estimation

To estimate the benchmark relationship between financial development and economic growth, we follow the specification of King and Levine (1993). In addition, we include financial fragility in the set of conditioning variables. Equation 1 shows this variant of the Barro growth regression where *Y* represents growth, *FD* financial development, *FF* a measure of financial fragility, and *X* the vector of covariates. Subscript *i* indexes individual countries, whereas *t* indexes time. The error term is denoted by *ε*.

$$Y_{i,t} = \alpha + \beta X_{i,t} + \gamma FD_{i,t} + \delta FF_{i,t} + \varepsilon_{i,t} \qquad (1)$$

The coefficients of interest are both γ and δ, where the first measures the impact of financial deepening on growth and the latter measures the responsiveness of growth to financial fragility. To help identify the coefficients and reduce simultaneity bias, we use an instrumental variable (IV) strategy. Specifically, we use the predetermined values of the explanatory variables at the start of each period as instruments, thus exploiting some of the time series variation in the data. Equations 2 and 3 represent the IV estimator where Equation

2 represents fitted values with a circumflex, and for brevity, Equation 3 represents only the financial development first stage of the IV equation.

$$Y_{i,t} = \alpha + \beta \hat{X}_{i,t} + \gamma \widehat{FD}_{i,t} + \delta \widehat{FF}_{i,t} + \varepsilon_{i,t} \quad (2)$$

$$\widehat{FD}_{i,t} = \alpha + \beta X_{i,t} + \gamma FD_{i,0} + \delta FF_{i,t} + \eta_{i,t} \quad (3)$$

Given that the initial values of the financial fragility measures, trade openness to GDP, government spending to GDP, and schooling are used to instrument their respective period averages, our model is exactly identified. In other specifications we interact the financial development variable with our selected financial fragility measures as outlined in Equation 4.

$$Y_{i,t} = \alpha + \beta \hat{X}_{i,t} + \gamma \widehat{FD}_{i,t} + \rho \widehat{FD * FF}_{i,t} + \varepsilon_{i,t} \quad (4)$$

2.2 Data

We use data for 124 countries over the time period 2000-2011.[7] Both the number of countries and time period are based upon the availability of our indicators of financial fragility. The data are averaged across four non-overlapping three-year periods. We do this to smooth the financial and macroeconomic data and to avoid sample bias, where otherwise the sample may be dominated by countries that report more reliable and historical data. Ideally, a longer time dimension in our data would be better since it would allow smoothing over four or five year periods. However, as we bring several databases together to address the growth effects of financial fragility, this ultimately limits both the duration of the study and the length of each cross section. Table 1 includes summary statistics.

Insert Table 1 here

[7] Depending on the specification, the number of countries and observations falls from the theoretical maximum of 124 countries and 496 observations, as the time series is averaged into four 3-year periods.

We bring the data together from *World Development Indicators* (2016), the *New International Database of Financial Fragility* (2015), and the list of financial crises from the database developed by Laeven and Valencia (2013). The dependent variable is growth in GDP per capita, and along with trade openness, secondary schooling, government spending and private credit, is from *World Development Indicators*. Growth over the time period is generally positive and when graphed appears normally distributed. Over 68% of the annual growth rates in the sample lie within the range of 0.6-8.3%. In the specifications, we include the natural logarithm of initial GDP per capita to measure the "catching up effect" in which countries that tend to be more developed tend to have lower growth rates due to conditional convergence. Trade openness to GDP is measured as a percentage and exhibits large values in the right hand side of the distribution, but these are accountable and comprised of nations such as Singapore that, despite their small size, are engaged in high trade activity. Government spending is also reported as a ratio to GDP and is measured in percentage terms. Schooling is measured as the gross secondary schooling enrolment ratio, traditional in the literature, where the variable is logged following King and Levine (1993). Private credit is the variable that we use to measure financial development. The variable is measured as a percentage of domestic credit to the private sector divided by GDP. It is a commonly used variable to measure deepening of the financial sector in the academic literature, as it measures the intermediation ability of the financial sector.

The financial fragility variables are from the *New International Database of Financial Fragility* developed by Andrianova et al. (2015). Four measures are used in this paper and include the impaired loans ratio, provision coverage, leverage and the Z-Score. The *impaired loans ratio* is measured as the number of impaired loans (loans where payment is 90 days past its due date) divided by total gross loans, multiplied by 100 to provide a percentage. A higher ratio implies greater financial fragility. *Provision coverage* is measured as the number

of reserves that cover potential losses (impaired loans) and is also in percentage terms. Greater provision coverage will imply that more precautionary measures are put in place that increase financial soundness, therefore a positive value represents less fragility. *Leverage* is measured as total assets divided by equity. Finally, the *Z-Score* measures the distance the banking sector is from insolvency. A greater Z-Score therefore implies greater financial stability (or lower fragility), where a unit increase represents a one standard deviation move away from insolvency.

The correlations between the financial development measure private credit and the fragility variables reported in Table 2 and are generally low, with the highest correlation observed between leverage and private credit (0.32).

Insert Table 2 here

In our preferred specifications we also include a dummy variable to indicate whether a given country experienced a financial crisis in a given time period following work by Rousseau and Wachtel (2011). The financial crisis dummy variable is available from the Laeven and Valencia (2013) dataset and ends in 2011, which is the main reason why our sample concludes in the same year.

3. Baseline Results and Regional Variation

3.1 Baseline Regressions

Table 3 presents the benchmark estimations. Column 1 replicates the standard King and Levine (1993) regression using our new data, which in contrast to their work for the 1960-1989 period, now shows a negative and significant coefficient on private credit. The coefficient suggests that a ten percentage point increase in private credit is associated with 0.14 percentage points of additional growth, ceteris paribus.[8] The remaining control variables

[8] In supplementary regressions (not reported), we test for a non-linear relationship between finance and growth, by including the square of private credit in all the regressions in Table 3. When including this additional variable, neither the level or square term of private credit is significant but in some columns the

enter the specifications with their expected signs, although only trade openness and government spending are significant at the 5% and 1% levels, respectively.

Insert Table 3 here

Columns 2-5 add our financial fragility variables to the specification one at a time. In column 2, we include impaired loans and it enters with the expected negative sign and is significant at the 5% level. A 10 percentage point increase in the ratio of impaired loans to total loans, indicating greater fragility, has large repercussions on economic growth, reducing it by 0.6 percentage points. The inclusion of impaired loans also reduces the magnitude of the coefficient on the private credit variable by 25%. In column 3, the fragility variable is provision coverage, which enters with its expected positive sign at the 10% level. A 10 percentage point increase in coverage may enhance economic growth by only 0.03 percentage points, but the negative coefficient on private credit declines in magnitude to less than 0.01.

We introduce leverage in column 4 of Table 3, where it enters with a positive sign. A 10 unit increase in leverage may increase economic growth by 0.35 percentage points. This may seem surprising given the recent emphasis of regulators on the deleterious effects of leverage on banking risks, but we note that we are already controlling directly for the potentially negative effects of balance sheet quality. Any remaining effects may then capture the efficiency of intermediation, and are therefore likely to be positive, as suggested by Rousseau (1998). The coefficient on private credit is negative and now statistically significant at the 1% level, and its magnitude is similar to that observed in column 1.

The Z-Score serves as our final measure of financial fragility in column 5 of Table 3. It enters the specification with the expected positive sign, as an increase in the Z-Score

variables are jointly significant. Nevertheless, all the indicators of financial fragility are unaffected when including the squared term into the specifications, therefore we have reason to believe that the inclusion of a squared term in the specifications is unnecessary.

represents a decrease in fragility, but is not statistically significant. The final column of Table 1 places all of the financial fragility indicators into the specification simultaneously. The results suggest that a 10 percentage point increase in private credit is associated with a fall in growth by 0.14 percentage points, just as in column 1. The magnitude of the impaired loans variable is similar to that reported in column 2, but its significance level falls to the 10% level. The coefficient on leverage, on the other hand, increases in magnitude where a 10 unit increase in leverage relates to growth that is 0.48 percentage points higher. In this specification, provision coverage is now insignificant.

The control variables for columns 2-6 that include the financial fragility measures all enter with their expected signs. Trade openness is positive and significant throughout all five additional columns, and government spending retains its significance in all five additional columns. There is some weak evidence of the "catching-up effect" as in columns 2 and 6 the coefficient on initial GDP per capita is negative and significant at the 5% level.

3.2 Introducing regional variation

Figure 1 shows the variation in growth rates across four broadly-defined regions worldwide. First, we see that the Eastern European and Central Asian countries (predominantly former countries within the Soviet Union) exhibit a very high average growth rate over the sample period, just short of 6%.[9] The next highest growth rate is then that of sub-Saharan Africa, averaging approximately 5%. Interestingly we observe the lowest average growth for Latin America and the Caribbean, although it is not too dissimilar to the average for the remaining countries in our sample.

Insert Figure 1 here

[9] To classify countries into regions we use World Bank classifications. The statistics in Figure 1 are unweighted averages of the countries within each region.

While the original King and Levine (1993) paper uses 84 countries in its preferred empirical specifications, our addition of many former Soviet states and estimation over a more recent time period serves to differentiate our work from it. The structural differences in former Communist states needs to be accounted for, of course, as does that of the dysfunctional credit markets that are widespread in sub-Saharan Africa. Whilst the growth rate of Latin America is incredibly similar to the remaining sample, during the early sample period, Latin America had widespread crises across several countries. In particular, Uruguay's banking system almost collapsed in 2002, where government intervention was required after a run on the banks by depositors. As a result, Table 4 includes three regional dummies, corresponding to the regions in Figure 1, into the regression specification.

Insert Table 4 here

The presentation of results in Table 4 follows that of Table 3, where in the first column we estimate the benchmark specification omitting all of the financial fragility variables. The coefficient on private credit is negative and significant as in the corresponding column of Table 3, although the variable is now statistically significant at the 1% level. Both trade openness and government spending remain significant, although the former is now only significant at the 10% level. Examining the regional dummies, while the Sub-Saharan African dummy and Eastern European dummies are insignificant, the coefficient for Latin America and the Caribbean is statistically significant at the 1% level. Being located in this region depresses growth by 1.8 percentage points, which represents a large decline. We add our first fragility variable, impaired loans, into the specification in column 2, where it enters with a greater magnitude than in Table 3. A 10 percentage point increase in impaired loans may reduce the economic growth rate by as much as 0.7 percentage points. The coefficient on financial development is identical to that in column two of Table 3, and the estimate is more precise, with a lower standard error.

The third column of Table 4 includes provision coverage as the fragility variable, and it enters positively and significantly at the 10% level. The coefficient indicates that a 10 percentage point increase in provision coverage may increase economic growth by 0.04 percentage points. The coefficient on private credit is quite similar to that in column 2, although higher in magnitude than the corresponding column in Table 3. In column 4, the financial fragility indicator, leverage, is positive and significant at the 10% level. A 10 unit increase in leverage is related to growth that is 0.3 percentage points higher and private credit remains negative and significant. The Z-Score in column 5 of Table 4 is not statistically significant, although correctly signed, just as it is in Table 3 whereas the coefficient on private credit is negative and significant at the 5% level.

The regression reported in the final column in Table 4 includes all of our fragility indicators in a single specification. The coefficient on private credit is negative and significant, where a 10 percentage point increase may reduce economic growth by just over 0.1 percentage points. Three of the four fragility indicators are statistically significant. The impaired loans variable enters the specification negatively and both leverage and the Z-Score enter positively. Examining the control variables in Table 4, we find that trade openness has a coefficient slightly lower in magnitude than in the corresponding columns of Table 3 and is statistically significant at the 10% level. Government expenditure on the other hand has coefficient values that are slightly higher in magnitude but remains significant at the 1% level. The evidence of the catching up effect still occurs in columns 2 and 6. The inclusion of the regional dummies is important as documented by the results in Table 4. Being located in Latin America and the Caribbean may depress economic growth by approximately 2 percentage points, where this variable is statistically significant at the 1% level. Whilst the regional dummy on Sub-Saharan Africa is insignificant in Table 4, the regional dummy on Eastern Europe and Central Asia becomes significant in columns 4-6 lending further support

for the inclusion of regional effects. Location in Eastern Europe and Central Asia is seen as beneficial to economic growth with the estimates suggesting that it may increase growth between 1.17-1.40 percentage points.

4. Financial crises, fragility and growth

Rousseau and Wachtel (2011) recover the positive relationship between financial deepening and economic growth by controlling for financial crises. In Table 5 we introduce a dummy variable for a financial crisis into the specification to examine one of two things: first, whether like Rousseau and Wachtel (2011), we can uncover a positive relationship between finance and growth; and second, whether or not our financial fragility indicators have an additional impact on economic growth over and above financial crises. Whereas the financial fragility indicators are shown to be good crisis predictors (Demetriades et al., 2016), it is also very plausible that the indicators have an independent impact on the economy. For example, a financial system may be incredibly fragile and impede growth without the economy ever experiencing a financial crisis.

Insert Table 5 here

Table 5 presents the results when the financial crisis dummy is included in the specification. In the benchmark estimates reported in column 1, the magnitude of the coefficient on private credit falls compared to those reported in Tables 3 and 4. A 10 percentage point increase in private credit is shown to reduce growth by 0.12 percentage points, ceteris paribus. The crisis dummy enters with a large and negative coefficient as expected, and is significant at the 1% level. Having a financial crisis is shown to reduce annual economic growth by approximately 1.2 percentage points.

When we introduce our financial fragility variables in column 2, the impaired loans ratio remains negative and significant. This is important as it shows that even after

accounting for financial crises, a 10 percentage point increase in the impaired loans ratio may depress economic growth by 0.6 percentage points. Interestingly the coefficient on private credit is reduced and only just significant at the 10% level. Ceteris paribus, a 10 percentage point increase in financial depth is now only associated with a 0.085 reduction in growth, stripping away some of the negative effects of financial deepening once financial crises and poor loan portfolios enter the accounting.

When the chosen measure of fragility is provision coverage in column 3, it is not statistically significant in the regression specification, but so also is the coefficient on private credit. In column 4 of Table 5 the financial fragility indicator is leverage, which enters positively and significantly with a magnitude similar to previous Tables. The coefficient on financial deepening however, falls relative to those in Tables 3 and 4, although it remains negative and significant at the 5% level. The crisis dummy is still highly significant with a negative sign, where experiencing a financial crisis is associated with a reduction in growth by 1.4 percentage points. Column 5 of Table 5 replaces the leverage with the Z-Score. While the Z-Score is not significant, its coefficient is positive, and by introducing this fragility variable and the financial crisis dummy, the magnitude of private credit falls compared to the corresponding columns in Tables 3 and 4.

The final column of Table 5 shows the preferred regression. Here all four financial fragility indicators are entered together in addition to the regional and crisis dummies. While private credit is negative and significant at the 5% level, its magnitude, as in the previous columns, is lower than those reported in Tables 3 and 4. A 10 percentage point increase in financial depth is associated with just over a 0.1 percentage point decline in growth. Three of the four financial fragility variables are significant in this specification – impaired loans, leverage and the Z-Score – and all enter with their expected signs. A 10 percentage point increase in the impaired loans ratio may decrease growth by 0.65 percentage points, whereas

a 10 unit increase in leverage is associated with economic growth that is 0.46 percentage points higher. Finally, the Z-Score albeit significant only at the 10% level, suggests that a 10 percent increase in overall bank health may increase growth by approximately 0.3 percentage points. Finally, the financial crisis dummy is negative and significant, where having a crisis may reduce growth by approximately 1 percentage point. The covariates in Table 5 are incredibly similar to those of Table 4, where trade openness, government spending and the reginal dummy of Latin America and the Caribbean all remain statistically significant, with their expected signs. In column two and six, initial GDP per capita is negative and significant providing evidence of a catching up effect, and the dummy for the region of Eastern Europe and Central Asia is positive and significant at the 10% level in columns 4-6.

Importantly the results suggest that, even with the inclusion of the financial crisis dummy, the positive relationship between financial deepening and economic growth is not recovered, and moreover, that the fragility indicators have an independent impact on depressing economic growth in addition to their effects through financial crises. In further robustness tests, we restricted the sample size to 288 in columns 1-5 to examine whether or not the reduced sample was driving the results in the final column. Whilst, the financial fragility indicators are unaffected with a smaller sample when they are examined individually, the private credit variable loses significance in a couple of columns. Overall based on this evidence, we are confident that the results are not affected by sample bias.

Table 6 offers some further evidence of the relationship between financial deepening, fragility and economic growth. Here we interact the financial fragility variables with private credit and evaluate the marginal effects of each interaction at the median. We would expect to see, as financial fragility decreases, the impact of private credit on economic growth become positive (or at least less negative).

Insert Table 6 here

Using the same additional covariates as the specifications in Table 5, when we evaluate the interaction of private credit with the ratio of impaired loans at the median value (of impaired loans) of 4.93%, the coefficient on private credit is still negative but is no longer significant. Examining Figure 2A, we see that the coefficient on private credit becomes negative and statistically significant only when impaired loans approach 6% of total gross loans.[10] The second specification, which includes provision coverage as the indicator of financial fragility, yields a negative coefficient when evaluated at the median of 91% on private credit that is negative and significant, albeit at the 10% level. However, as Figure 2B shows, once provision coverage approaches 100% (i.e., all impaired loans are provisioned for), the negative effect of private credit on growth vanishes. This presents a solid argument for banks to keep a close eye on the amount of reserves they hold to cover any troublesome loans. Column 3 considers the interaction between financial deepening and leverage. At the median leverage value of 10.82, private credit is negative and statistically significant, although increasing leverage seems to reduce those negative effects. Since decreases in the ratio of capital to assets, despite their implications for a rising debt ratio, could be viewed as a measure of confidence in the banking sector (e.g., Rousseau, 1998; Jaremski and Rousseau, 2015), we could be seeing opposing forces at work as leverage rises, both positive and negative, but with the positive effects taking on additional influence. The final column of Table 6 interacts the Z-Score with private credit. At the median value of 14.5 the coefficient on private credit is negative and significant at the 5% level. However, increasing the Z-Score, as shown in Figure 2D, shows the negative aspect of financial deepening on growth disappearing as the Z-score reaches 20. More importantly, a healthy financial system (i.e., Z-Score of approximately 40) begins to turn the coefficient on private credit positive. This suggests that policies focused more on the stability of the financial system (inverse of

[10] In addition to the coefficient, the 95% confidence intervals are graphed in Figures 2A-2D.

fragility) could work toward regaining the potential benefits of financial development on growth.

Insert Figure 2 (panels A-D) here

5. Summary and concluding remarks

Our findings suggest that the relationship between financial development and growth has been changing. Specifically, both financial fragility and private credit appear to have negative effects on GDP growth during 1998-2012, over and above the negative effects of systemic banking crises. A large volume of impaired loans is shown to amplify the negative effects of private credit on growth while a sufficiently high Z-score, reflecting a healthy banking system, can eradicate the negative effects of private credit on growth. Our results suggest that regulators need to focus their attention on improving bank balance sheets by addressing non-performing loans and increasing capital buffers that can make banks more resilient to future shocks. Addressing financial fragility will not only help to avoid banking crises, but could well help to regenerate the virtuous cycle between finance and growth.

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Table 1: Summary Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
Economic Growth	4.45	3.86	-10.26	29.77
Private Credit	46.77	46.32	0.41	202.01
Impaired Loans	7.50	7.36	0.19	60.60
Provision Coverage	118.93	89.08	2.24	664.39
Leverage	12.94	8.61	2.32	100.94
Z-Score	14.89	10.68	-9.45	69.81
Initial GDP per capita	14225.43	14974.68	503.96	75777.40
Trade Openness	84.18	55.09	20.58	418.20
Secondary Schooling	72.02	32.61	6.88	157.30
Government Spending	15.49	6.09	2.80	45.70

Table 2: Correlation Matrix

	Private Credit	Impaired Loans	Provision Coverage	Leverage	Z-Score
Private Credit	1				
Impaired Loans	-0.26	1			
Provision Coverage	-0.05	-0.31	1		
Leverage	0.32	0.05	-0.16	1	
Z-Score	0.16	-0.17	-0.12	-0.08	1

Table 3: Dependent Variable - Annual Growth (%) Three Year Averages

	(1)	(2)	(3)	(4)	(5)	(6)
Private Credit	-0.0144**	-0.0108*	-0.0097*	-0.0157***	-0.0132**	-0.0143**
	(0.0056)	(0.0056)	(0.0059)	(0.0052)	(0.0052)	(0.0058)
Impaired Loans		-0.0604**				-0.0592*
		(0.0306)				(0.0310)
Provision Coverage			0.0038*			0.0035
			(0.0023)			(0.0023)
Leverage				0.0347**		0.0483***
				(0.0170)		(0.0148)
Z-Score					0.0134	0.0234
					(0.0164)	(0.0173)
GDP per capita	-0.2334	-0.8276**	-0.6310	-0.4290	-0.4304	-0.8264**
	(0.3913)	(0.4156)	(0.4045)	(0.3205)	(0.3203)	(0.4095)
Trade Openness	0.0154**	0.0086***	0.0089***	0.0088***	0.0080***	0.0104***
	(0.0074)	(0.0033)	(0.0034)	(0.0028)	(0.0028)	(0.0034)
Secondary Schooling	0.1415	0.9821	0.6796	0.6600	0.5726	1.0189
	(0.6991)	(0.6340)	(0.6449)	(0.5562)	(0.5485)	(0.6371)
Government Expenditure	-0.1518***	-0.1166***	-0.1068***	-0.1131***	-0.1153***	-0.1098***
	(0.0351)	(0.0372)	(0.0398)	(0.0264)	(0.0261)	(0.0403)
Constant	7.7501***	9.7354***	8.0916***	6.8279***	7.4314***	8.0393***
	(1.8039)	(2.5433)	(2.2257)	(1.9335)	(1.8385)	(2.6129)

R-Squared	0.14	0.15	0.12	0.11	0.11	0.16
Observations	347	293	293	335	340	288

Notes: All estimates are from two-stage least squares using robust standard errors and with standard errors in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. All covariates with the exception of initial GDP are instrumented using their initial values in each period.

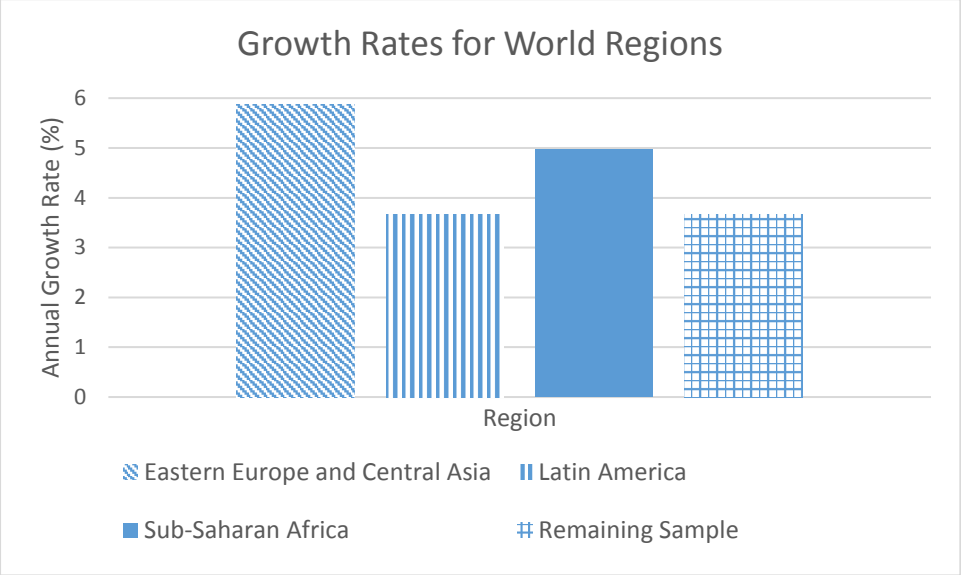

Figure 1. Average annual growth rates by region, 1998-2012.

Table 4: Dependent Variable - Annual Growth (%) Three Year Averages

	(1)	(2)	(3)	(4)	(5)	(6)
Private Credit	-0.0151***	-0.0108**	-0.0109**	-0.0141***	-0.0125**	-0.0135***
	(0.0057)	(0.0054)	(0.0055)	(0.0050)	(0.0050)	(0.0052)
Impaired Loans		-0.0681**				-0.0654**
		(0.0313)				(0.0306)
Provision Coverage			0.0043*			0.0036
			(0.0025)			(0.0023)
Leverage				0.0300*		0.0463***
				(0.0174)		(0.0149)
Z-Score					0.0228	0.0353**
					(0.0162)	(0.0177)
GDP per capita	-0.1896	-0.7781*	-0.5381	-0.4278	-0.4295	-0.7417*
	(0.4104)	(0.4136)	(0.4032)	(0.3247)	(0.3229)	(0.4078)
Trade Openness	0.0134*	0.0057*	0.0058*	0.0065**	0.0058**	0.0068**
	(0.0072)	(0.0030)	(0.0030)	(0.0026)	(0.0025)	(0.0031)
Secondary Schooling	-0.0899	0.5143	0.2983	0.3146	0.1731	0.6643
	(0.6500)	(0.6517)	(0.6472)	(0.5693)	(0.5666)	(0.6557)
Government Expenditure	-0.1772***	-0.1647***	-0.1578***	-0.1409***	-0.1440***	-0.1714***
	(0.0398)	(0.0435)	(0.0447)	(0.0305)	(0.0306)	(0.0454)
Eastern Europe & Central Asia	0.9164	1.1131	0.9365	1.1685*	1.2036*	1.3974*
	(0.6802)	(0.7147)	(0.7582)	(0.6817)	(0.6830)	(0.7664)
Sub-Saharan Africa	-0.4222	-0.8463	-0.7669	-0.4977	-0.6542	-0.4496
	(0.5389)	(0.5666)	(0.5891)	(0.5200)	(0.4905)	(0.5886)
Latin America	-1.7880***	-1.8940***	-2.1188***	-1.6070***	-1.6779***	-1.9558***
	(0.4522)	(0.4742)	(0.4952)	(0.4730)	(0.4425)	(0.4993)
Constant	9.1697***	12.6212***	10.2738***	9.0468***	9.7775***	10.0137***
	(2.0973)	(2.6572)	(2.3421)	(2.1228)	(1.9622)	(2.7435)
R-Squared	0.18	0.21	0.18	0.16	0.16	0.23
Observations	347	293	293	335	340	288

Notes: All estimates are from two-stage least squares regressions using robust standard errors and with standard errors in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels,

respectively. All covariates with the exception of initial GDP and the dummies are instrumented using their initial values in each period.

Table 5: Dependent Variable - Annual Growth (%) Three Year Averages

	(1)	(2)	(3)	(4)	(5)	(6)
Private Credit	-0.0123** (0.0056)	-0.0085* (0.0052)	-0.0084 (0.0052)	-0.0109** (0.0047)	-0.0097** (0.0048)	-0.0114** (0.0049)
Impaired Loans		-0.0604** (0.0305)				-0.0645** (0.0300)
Provision Coverage			0.0038 (0.0025)			0.0032 (0.0024)
Leverage				0.0322** (0.0158)		0.0459*** (0.0140)
Z-Score					0.0146 (0.0161)	0.0285* (0.0175)
GDP per capita	-0.0848 (0.4060)	-0.6541 (0.4151)	-0.4350 (0.4002)	-0.3047 (0.3200)	-0.3227 (0.3197)	-0.6576 (0.4085)
Trade Openness	0.0126* (0.0073)	0.0051* (0.0030)	0.0052* (0.0030)	0.0057** (0.0025)	0.0051** (0.0025)	0.0063** (0.0031)
Secondary Schooling	-0.2464 (0.6487)	0.3453 (0.6524)	0.1447 (0.6482)	0.1409 (0.5652)	0.0238 (0.5622)	0.5400 (0.6496)
Government Expenditure	-0.1730*** (0.0399)	-0.1584*** (0.0438)	-0.1519*** (0.0447)	-0.1339*** (0.0305)	-0.1376*** (0.0307)	-0.1633*** (0.0458)
Eastern Europe & Central Asia	1.0793 (0.6741)	1.2220* (0.7103)	1.0728 (0.7487)	1.3684** (0.6739)	1.3055* (0.6765)	1.4531* (0.7609)
Sub-Saharan Africa	-0.4381 (0.5329)	-0.8743 (0.5639)	-0.8060 (0.5816)	-0.5200 (0.5082)	-0.6754 (0.4855)	-0.5135 (0.5805)
Latin America	-1.7170*** (0.4352)	-1.8254*** (0.4606)	-2.0196*** (0.4767)	-1.5288*** (0.4527)	-1.6174*** (0.4286)	-1.8974*** (0.4903)
Crisis Dummy	-1.1975*** (0.4612)	-1.0072** (0.4570)	-1.0685** (0.4698)	-1.4315*** (0.4776)	-1.1762** (0.4627)	-0.9326** (0.4615)
Constant	8.8509*** (2.0650)	12.1021*** (2.6548)	10.0022*** (2.3009)	8.5640*** (2.0957)	9.5079*** (1.9313)	9.8653*** (2.7380)
R-Squared	0.19	0.22	0.19	0.18	0.18	0.23
Observations	347	293	293	335	340	288

Notes: All estimates are from two-stage least squares using robust standard errors and with standard errors in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. All covariates with the exception of initial GDP and the dummies are instrumented using their initial values in each period.

Table 6: Marginal Effect of Interaction Variables at Median

Variable Name	Impaired Loans	Provision Coverage	Leverage	Z-Score
Coefficient	-0.0085 (0.0053)	-0.0087* (0.0052)	-0.0140*** (0.0051)	-0.0101** (0.0048)
Median Value	4.93	91.10	10.82	14.52

Notes: All estimates are from IV regressions using robust standard errors with standard errors in parentheses. The regression specification includes all the covariates from Table 5, with the exception of the fragility indicators that are now interacted with private credit. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

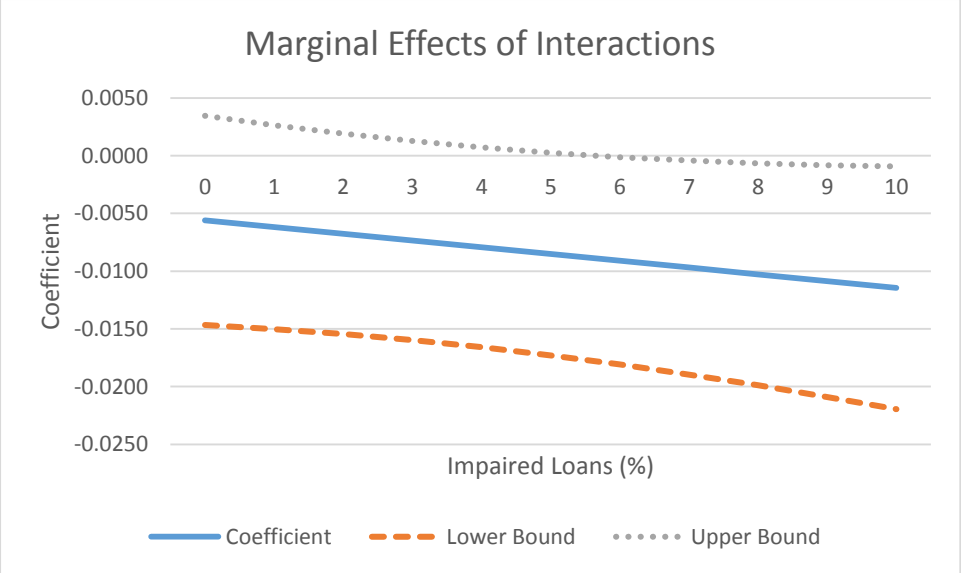

Figure 2A

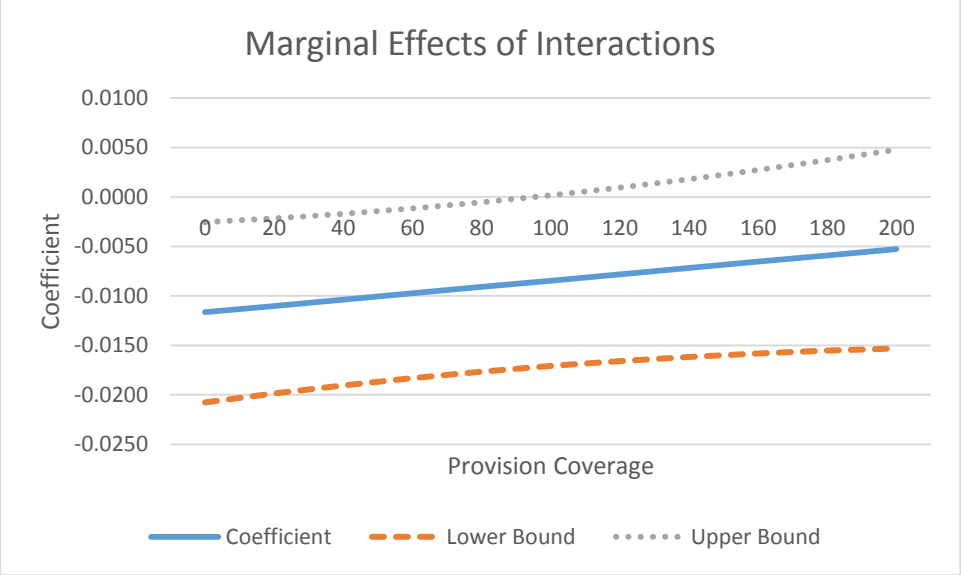

Figure 2B

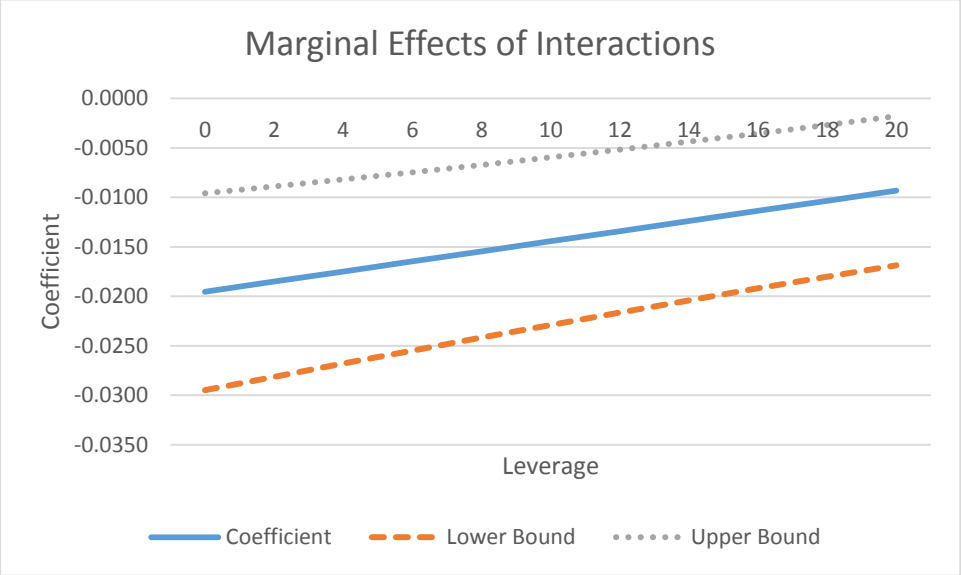

Figure 2C

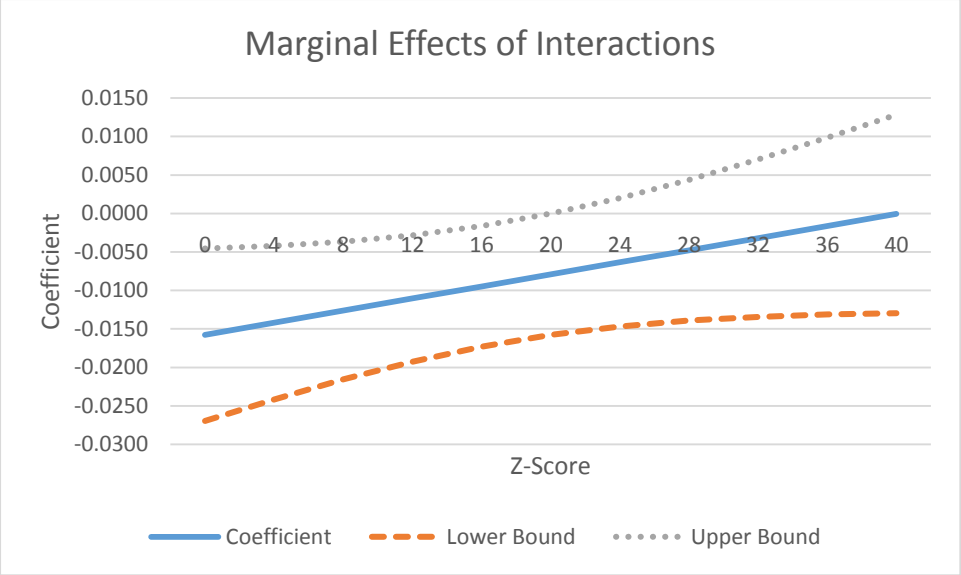
Marginal Effects of Interactions
0.0150
0.0100
0.0050
0.0000
-0.0050
-0.0100
-0.0150
-0.0200
-0.0250
-0.0300
Coefficient
0
4
8
12
16
20
24
28
32
36
40
Z-Score
Coefficient
Lower Bound
Upper Bound

Figure 2D