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Finance and Macroeconomic Volatility

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Abstract

Countries with more developed financial sectors experience less fluctuations in real per capita output, consumption and investment growth. However, the manner in which the financial sector develops matters. The relative importance of banks in the financial system is important in explaining consumption and investment volatility, and the proportion of credit provided to the private sector explains the volatility of consumption and output. The main results are generated using fixed-effects estimation with panel data from 70 countries covering the years 1956 through 1998.

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1. Introduction

The Southeast Asian turmoil of the late 1990s brought to the forefront the role finance can play in propagating and dampening macroeconomic fluctuations. In this paper, we investigate this role, providing empirical evidence on the link between the depth and structure of a country's financial sector and the severity of its business cycles. We have two important findings: First, countries with more developed financial sectors experience less fluctuations in output, consumption, and investment growth. And second, the type of finance matters. Private sector finance is particularly important in reducing macroeconomic volatility. Specifically, we show that the relative supply of credit from banks is effective in reducing consumption and investment volatility, while a greater supply of credit to the private sector in general reduces consumption and per capita income volatility. Overall, these results suggest that the risk management and information processing provided by banks may be particularly important in reducing consumption and investment volatility, while the simple availability of credit to the private sector helps to smooth consumption and GDP.

We find evidence for these conclusions in two different cross-country data sets. Our main data set is a panel of 70 countries spanning the years 1956 to 1998, which we divide into four time periods. We observe the four different measures of financial development employed by King and Levine (1993a, 1993b) at the beginning of each time period and then examine their effects on the subsequent variability of real consumption, investment, and per capita GDP growth using fixed-effects estimation and controlling for other factors that may be associated with the level of macroeconomic volatility, such as inflation and foreign exchange rate variability, government spending, income per capita, and average growth rates. In addition, we find supporting evidence in a cross-sectional data set with which we examine macroeconomic fluctuations over a greater period of time, controlling for various characteristics of countries that have been linked to financial development, such as the strength of accounting standards, contract enforcement, and the level of corruption. We also show that our main results are robust to different estimation techniques.

Our analysis is related to three different strands in the literature. The first relevant

line of work is the one on finance and development which conjectures that well-developed financial systems should strengthen an economy's ability to absorb shocks, and therefore, help to reduce cyclical fluctuations. Most of the papers in this strand are theoretical, however, and in contrast to our empirical work below which examines consumption and investment volatility in addition to GDP variability, their focus is generally on aggregate output fluctuations. In a recent paper, Aghion, Banerjee, and Piketty (1999) develop a macroeconomic model based on micro-foundations which combines financial market imperfections and unequal access to investment opportunities. They show that economies with less developed financial systems will tend to be more volatile and experience slower growth. In their model, low levels of financial development and the separation of savers from investors result in macroeconomic fluctuations with the economy converging to a cycle around its steady-state growth path. In contrast, when there exists a fully functioning capital market, the economy converges to a stable growth path along which fluctuations are only due to exogenous shocks. Intuitively, their result derives from the fact that when the financial sector is not as well developed, the supply of and the demand for credit is more cyclical. In particular, investors are more likely to get locked out of credit markets when the economy faces a bad shock, only to rush back in when the economy sustains a good shock. Aghion et al. point out that the financial sector tends to be less developed in non-industrialized countries and that this may be one reason why those economies experience more volatility. Acemoglu and Zilibotti (1997) also imply an important link between financial development and volatility by highlighting the role that diversification plays in reducing risk. They demonstrate that when there are indivisible investment projects, in the early stages of development, diversification is not possible. As wealth accumulates, however, diversification becomes possible, investment increases, and investment risk and volatility is reduced. In another related paper, Aghion, Bachetta, and Banerjee (2000) show that volatility is most likely to occur for open economies with intermediate levels of financial development.

The second relevant line of work has studied the effects of financial market imperfections and the underlying informational asymmetries on output fluctuations. For example, Bernanke and Gertler (1989, 1990), Greenwald and Stiglitz (1993), and Kiy-

otaki and Moore (1997) develop dynamic general economic equilibrium models where asymmetric information in financial markets exacerbates output volatility. While the role financial market imperfections play in generating macroeconomic volatility has not been empirically analyzed directly, the empirical evidence at the micro level is supportive of the idea that asymmetric information has real effects. Fazzari, et al. (1998) show that fixed investment depends on firms' cash flow, which would not be the case if capital markets were perfect. Microeconomic evidence of the importance of asymmetric information has also been found by examining the behavior of firms that are more likely to be subject to information asymmetries. For example, Gertler and Gilchrist (1994) confirm this and find that the impact of monetary policy changes is larger for smaller firms compared to the large ones. Kashyap and Stein (1995, 2000) find similar results for banks and show that monetary tightening affects smaller banks more than large banks. These findings are most relevant to what we discuss below to the extent that the degree of asymmetry of information varies from one country to another. It may well be that low or high levels of financial development are related to the ability of economies to generate and process information.[1] Put differently, financial development indicators may proxy for the effects of financial imperfections arising from information asymmetries or other structural constraints. Thus, a negative relationship between financial development and volatility would generally support the hypothesized role of asymmetric information in propagating business cycles.

The third strand of the literature to which our work is more generally related is the large and growing body of work–both empirical and theoretical–on the role of financial development in long run macroeconomic performance. According to these papers, financial intermediaries reduce the costs of acquiring information and help to lower transactions costs (Gertler, 1988 and Levine, 1997). In doing so, they help ameliorate information asymmetries, improve corporate governance, and lead to better resource allocation. As a result, higher levels of financial market development lead to faster economic growth (Boyd and Prescott, 1986, Fischer, 1993, Goldsmith, 1969, Greenwood and Jovanovic, 1990 and King and Levine, 1993a, 1993b). Furthermore, financial institutions improve

[1] See, for example, Dewatripoint and Maskin (1995) and Diamond (1984).

risk management, provide liquidity and channel funds to most productive uses (Bencivenga and Smith, 1991, and Greenwood and Smith, 1997). The empirical literature is supportive of this view,[2] and cross-country findings are complemented by those at the industry level. For example, Rajan and Zingales (1998) and Carlin and Mayer (1999) find that in countries with developed financial markets, industries that rely relatively more on external financing tend to grow faster. In contrast, in countries with poorly developed financial systems, industries that depend on external financing grow relatively more slowly. At the firm level, new research shows that strong legal and market institutions are associated with firm growth at rates faster than that which could be realized using internal funds (Demirguc-Kunt and Maksimovic, 1998, 1999). While this literature does not focus on the macroeconomic role of credit markets, it conjectures that well developed financial systems are likely to better absorb shocks and that banks may influence the magnitude of cyclical fluctuations. For example, Levine (1998) notes that banks may affect the magnitude of cyclical fluctuations–a view that is consistent with all existing empirical studies. Finally, Ramey and Ramey (1995) show that countries with higher volatility grow slower and allow us to make a more direct connection to the growth literature. Our findings support the idea that an additional channel through which financial development may affect growth is by reducing volatility.

In summary, existing literature implies several routes through which finance can affect macroeconomic cycles. First, more developed financial markets and institutions may more efficiently match savers and investors, allowing the economy to absorb shocks more easily. The financial sector may also facilitate diversification (at both the microeconomic and macroeconomic level) which would reduce risk and volatility. Or third, financial development may be a proxy for the extent of information asymmetries which may themselves cause increased volatility. Initial empirical evidence is suggestive of a role for financial development in dampening macroeconomic fluctuations. Iyigun and Owen (1999) present some preliminary evidence that the amount of credit provided to the private sector is particularly important in smoothing consumption and output variability in economies in which there are relatively more low-income individuals. In addition,

[2]See, for example, King and Levine (1993a, b), Levine (1997, 1998) and Levine and Zervos (1998).

Easterly, Islam, and Stiglitz (2000) use a cross-country framework to show that credit allocated to the private sector can reduce output fluctuations but flexible labor market institutions do not. This paper contributes to the works mentioned above by building on these initial empirical results to more thoroughly investigate the effects of both the extent and nature of financial development on output, consumption, and investment growth variability. Thus, it offers a combined test of the empirical implications of all of the hypotheses discussed above.

The remainder of our paper is organized as follows: In section 2, we discuss our estimation strategy and data. In section 3, we present our main results and conduct a sensitivity analysis. And in section 4, we conclude.

2. Estimation Strategy and Data

As discussed above, existing studies provide the theoretical motivation for our work. While each contribution relies on different mechanisms, the literature asserts that, in general, financial development should reduce macroeconomic volatility. A test of this prediction at the macro level can be accomplished using the following empirical framework:

$$V_{i,t} = \mu_i \ + \ \lambda_t \ + \ \beta_1 FINDEV_{i,t-1} \ + \ \beta_2 X_{i,t} \ + \ \upsilon_{i,t} \tag{1}$$

where $V_{i,t}$ is the standard deviation of real per capita consumption, investment, or income growth at time t for country i, μ_i is a country-specific effect, λ_t is a time specific effect, $FINDEV_{i,t-1}$ is a measure of financial development in country i in the preceding period, $X_{i,t}$ includes additional control variables that may help to explain volatility and $\upsilon_{i,t}$ is the variability in consumption, output, or investment growth not explained by the regressors.[3] We assume that $\upsilon_{i,t}$ is uncorrelated with the regressors and is distributed

[3]We estimate equation (1) using a fixed-effects estimation. Random effects estimation, if appropriate, would provide more efficient estimates. However, one can argue on theoretical grounds that random effects is not appropriate because it is likely that the country specific effects are correlated with the regressors. Results from Hausman tests are mixed but, overall, suggest that a fixed effects strategy is appropriate–the random-effects model is rejected at the 5 percent significance level for 6 of the 12

normally with a mean of zero and a variance of $\sigma^2_{i,t}$.[4]

The control variables in X_t include the average growth rate of real per capita income, consumption or investment at time t, $GROWTH_t$, the average level of real per capita income, consumption or investment at time $t-1$, $MEAN_{t-1}$, the mean and standard deviation of inflation over the period, $INFMEAN_t$, $INFSTDEV_t$, the mean and standard deviation of government spending as a share of GDP, $GOVMEAN_t$, $GOVSTDEV_t$, the degree of openness of the economy as measured by the ratio of exports plus imports to GDP, $OPEN_t$, the standard deviation of exchange rate changes, $FXVOL_t$, and an index of the type of political regime, $POLITY_t$. $GROWTH_t$ and $MEAN_{t-1}$ are included because the standard deviation of growth rates may be correlated with the initial level and the growth rate of the dependent variables, with more developed or faster growing economies exhibiting less variability.[5] $GOVMEAN_t$ and $GOVSTDEV_t$, are taken into account to control for the effects of changes in government spending on macroeconomic fluctuations. Similarly, the political environment, $POLITY$, may also affect economic stability. We include $OPEN_t$ and $FXVOL_t$ to control for the effects of external shocks on domestic macroeconomic volatilities and interact the two variables on the theory that exchange rate volatility should affect investment, consumption and output volatility differently in economies that are more open. Finally, we also consider measures of inflation and its variability because they will be correlated with output growth variability when the aggregate supply curve is upward sloping.[6]

To measure financial development, $FINDEV$, we use four measures proposed by King and Levine (1993a): LLY, which is M2 divided by GDP; $PRIVY$, the ratio of claims on the nonfinancial private sector to GDP; $PRIVATE$, the ratio of claims on the

specifications in Table 2. (In the cases in which the random-effects model is not rejected, results of random effects estimations are similar to those reported in Table 2.) Of course, use of the fixed-effects estimations restricts the interpretation of our results to analysis of within-country effects.

[4]In addition to adopting this assumption on the distribution of errors because of its intuitive appeal for cross-country data, we also confirmed it with a Cook-Weisberg test for heteroscedasticity.

[5]See, for example, Ramey and Ramey (1995). Also, we measure $MEAN$ at time $t-1$ because it is the stage of development at the beginning of the period that is the most economically meaningful. However, our results are not sensitive to the time period in which we measure $MEAN$.

[6]For a recent survey of the vast literature on the output and inflation tradeoff, see Erceg, Henderson and Levin (forthcoming).

nonfinancial private sector to total domestic credit (excluding credit to money banks); and $BANK$, the ratio of deposit money bank domestic assets to deposit money bank domestic assets plus central bank domestic assets.[7] While all of these measures are positively associated with financial development, each one captures a slightly different aspect of it. LLY is a measure of the overall size of the financial system, while $BANK$ measures the relative importance of banks within the financial system. $PRIVY$ and $PRIVATE$ measure the extent to which financial services are provided to the private sector, with $PRIVATE$ being a more direct measure of how credit is allocated to the private vs. the public sector. Thus, LLY and $PRIVY$ are more general measures of overall development, while $PRIVATE$ and $BANK$ attempt to gauge the nature of the development.

We use annual data from 70 countries for the period 1956 to 1998. The majority of our data is extracted from the IMF's International Financial Statistics. The exceptions are the average level of real GDP, real consumption and real investment per capita ($MEAN$), which are calculated from the Penn World Tables 5.6, and the political regime and stability variables ($POLITY$), which come from the 1996 version of the POLITY III Dataset.[8] In order to calculate our volatility measure, the standard deviation of the growth rate of GDP and its components, we need to collapse several years of data into one time period. An ideal characterization of the amplitude of the business cycle in each country and each time period would require a large number of annual observations to capture both the upturns and downturns of the business cycle. However, we face a tradeoff: as we increase the number of years in each period, perhaps increasing the accuracy with which we characterize volatility, we reduce the number of periods we can use in our fixed effects estimation, reducing its efficiency. Nonetheless, we are able to create 4 time periods while still measuring volatility over a relatively long period of time–

[7] See King and Levine (1993a) for a detailed description of the calculation of these measures.

[8] The POLITY III dataset includes ten different variables which aim to measure the level of institutional democracy and autocracy across countries over time. The results presented here use the variable $XRCOMP$, the extent to which executives are chosen through competitive elections. Our results are robust to using alternative measures from this dataset: The $POLITY$ variable was never statistically significant in any of the estimations possibly because, for many countries, these variables do not change much over time. Therefore, it is difficult to identify their impact in a fixed-effects estimation. The complete data can be accessed at http://garnet1.acns.fsu.edu/ phensel/intlpoli.html.

9 years. Specifically, to obtain our measure of financial development at the beginning of the period, we use average values of $BANK$, LLY, $PRIVATE$, and $PRIVY$ over the periods 1956-60, 1966-1969, 1975-1978, and 1984-1987.[9] The four time periods for all other variables except $MEAN$ correspond to 1960-1968, 1969-1977, 1978-1987, and 1987-1998.

In summary, our main data set contains a panel of 70 countries and 4 time periods. For each period we observe financial development at the beginning of the period and then observe subsequent fluctuations.

[Table 1 about here.]

Table 1 presents summary statistics from the main data set and shows that the volatility of real per capita GDP growth, real per capita consumption growth, and real per capita investment growth are all positively associated, with the strongest correlation being that between consumption and GDP. In addition, with one exception, all financial development indicators are negatively correlated with macroeconomic volatility. However, despite the fact that each of the 4 indicators attempt to measure financial development, the correlations between these variables are rather low, suggesting that each indicator is in fact capturing a slightly different feature of the financial system.

3. Results

3.1. Initial Estimates

Table 2 presents the results of the estimation of equation (1) for the standard deviation of real per capita GDP, consumption, and investment growth, using each of the four financial development indicators.

[Table 2 about here.]

In general the results in Table 2 suggest that financial development is associated

[9] We average the financial development measures over 4 years to smooth through any temporary events that might be affecting the financial system in any given year.

with less volatility in GDP, consumption, and investment; however the importance of specific indicators varies across dependent variables. Only $BANK$, the relative importance of the banking industry, is significant for all three estimations. $PRIVATE$ is significant in the GDP and consumption estimation (though the coefficient retains the negative sign in the investment regression). $PRIVY$ is not significantly related to any of the dependent variables and flips signs across the estimations. At this point we will only note that the relative size of the entire financial sector, LLY, is significant only in the consumption regression, but it has an inconsistent sign. While we defer a more comprehensive discussion of this result until Section 3.2 when we discuss the robustness of all our results, we will note at this time that we do not find this relationship to be robust.

Interestingly, of all our other control variables, only two consistently enter the estimation in Table 2 in a statistically significant way. The standard deviation of the inflation rate is positively related to GDP and consumption variability and exchange rate volatility is positively related to all three dependent variables. However, our failure to find a statistically significant relationship between either $MEAN$ or $GROWTH$ and the standard deviation of output, consumption or investment does not contradict earlier work that has shown that economies with less fluctuations grow faster in the long run. Each of our time periods consists of only 9 years. Thus, our results do not allow us to make inferences about long-run relationships.

Tables 1 and 2 present relatively low correlations between financial development indicators and varying levels of explanatory power for each different indicator in our 3 main regressions. Taken together, this suggests that different aspects of financial development may affect volatility of GDP and its components differently. To determine which financial development indicator has the strongest relationship with volatility, we conduct a "horse race" and put all four measures of financial development into each regression. The results of this experiment are displayed in Table 3.

[Table 3 about here.]

These results show that $BANK$ (the relative importance of banks) and $PRIVATE$ (the percentage of credit that is funneled to the private sector) both retain some explanatory power in the GDP and consumption regressions. Furthermore, results in the third column of Table 3 show that $BANK$ is negatively related to investment volatility, but the positive coefficient on $PRIVY$ now also becomes significant. The $PRIVY$ result, however, will not be robust in subsequent estimations.

One interpretation of the results in Table 3 is that it is not just the overall size of the financial sector but the way in which the financial sector develops that matters in reducing fluctuations. Higher values of $PRIVATE$ suggest that a larger percentage of credit is finding its way to the private sector and into the hands of households, allowing them to better smooth consumption. Similarly, higher values of $BANK$ associated with greater importance of the banking sector may also indicate greater availability of credit for households because banks may be an important source of consumer loans. Because consumption is such a large component of GDP, it is not surprising that this effect is then funneled through to GDP. On the other hand, the results in column 3 of Table 3 show that the relative availability of bank credit is the aspect of the financial system that reduces investment volatility. Perhaps banks may be in the best position to reduce information asymmetries and develop longer term relationships with borrowers, thus reducing the volatility of investment.

The effect of financial development on macroeconomic fluctuations is economically meaningful. In our sample, the standard deviation of $PRIVATE$ is .368 and the standard deviation of $BANK$ is .200. Using the results in Table 2, one can calculate that a one standard deviation increase in $PRIVATE$ reduces the standard deviation of real per capita GDP growth by .85 (about 14 percent) and reduces the standard deviation of real consumption growth by a similar magnitude (0.87 or about 14 percent). A one standard deviation increase in $BANK$ reduces GDP volatility by 1.64 (about 28 percent), consumption volatility by 1.86 (about 32 percent), and investment volatility by 1.99 (about 14 percent).

Although our measures of financial development may indirectly incorporate international capital flows, our results suggest that the domestic financial system is still

important in determining volatility. Specifically, $BANK$ is a measure of the importance of banks residing in that country. One possible interpretation of this result is that if international capital flows exacerbate investment volatility, a stronger banking sector reduces their relative importance.

3.2. Sensitivity Analysis

The previous section establishes that higher values of $PRIVATE$ are associated with lower values of consumption and GDP volatility, that higher values of $BANK$ are associated with lower values of output, consumption and investment volatility, and that higher values of LLY are associated with higher values of consumption volatility. In this section we examine how robust these results are to different data selection and estimation techniques.

As explained in Section 2, our main data set contains a measure of financial development at the beginning of a time period and a measure of subsequent macroeconomic variability. However, the years we use to calculate initial financial development immediately precede those years which we use to calculate subsequent volatility. In order to determine if our results are sensitive to the time period in which we measure financial development, in Table 4 we repeat the estimations presented in Table 2, but this time we measure financial development with a five year lag between the last year we use in the financial development measure and the first year we use in the variability measure (i.e., financial development is measured over the periods 1951-55, 1961-1964, 1971-1973, and 1979-1982). These results confirm our initial findings for consumption and output variability, however, in this case $BANK$ becomes insignificant in the investment regression while $PRIVATE$ becomes significant.

[Table 4 about here.]

Although our data set is a relatively large macro data set, our analysis still may be sensitive to outliers. We therefore provide another estimate of the relationship between financial development and fluctuations this time using a robust regression technique that

identifies outliers and removes them or places a smaller weight on them in the estimation. Essentially, our procedure excludes observations for which Cook's D is greater than 1 and then iteratively selects weights for the remaining observations based on the size of the absolute residuals, with large-residual observations receiving the lowest weights.[10] Results of this procedure are presented in Table 5.

[Table 5 about here.]

Table 5 shows that our major conclusions are also robust to the new estimation procedure: $PRIVATE$ reduces fluctuations in GDP and consumption, and $BANK$ reduces fluctuations in consumption and investment. However, the investment regressions provide conflicting evidence. Now, $PRIVATE$ enters positively and significantly in the investment regressions. Taken together with the results in Table 4, this result suggests that the relationship between investment volatility and financial development may be more complex than that which is captured by our approach.[11]

As we alluded to earlier, the robust regression technique reduces the size of the LLY coefficient in the consumption equation considerably, rendering it statistically insignificant. One reason why the LLY result may be particularly sensitive to outliers is that, in addition to identifying countries with large financial sectors, high values of M2/GDP might also be signaling a central bank that has not been successful in stabilizing the economy. Thus, we can observe higher than average M2/GDP being associated with larger than average fluctuations. In some of our observations this type of instability may be extreme. Since these few observations are not representative of the entire data set, when they are removed, the initially positive effect we identified becomes insignificant. While it is difficult to test this conjecture directly, it is supported by the fact that

[10] See Hamilton (1991) for more details on this procedure.

[11] With robust regression techniques, both the negative association of $BANK$ and the positive association of $PRIVATE$ survives in a horse race similar to that displayed in Table 3. However, the effect of $BANK$ on investment volatility remains the most important of the two indicators. The results in Table 5 indicate that a one standard deviation increase in $BANK$ reduces the standard deviation of investment by 1.72, while a one standard deviation increase in $PRIVATE$ increases it by .96.

when we square LLY and include it in the regressions, we find a U-shaped relationship between LLY and fluctuations in output, consumption, and investment, indicating that at lower levels of LLY, an increase reduces volatility, but at very high levels, it increases it. We do not find this same quadratic relationship with our other measures of financial development.[12]

$PRIVY$ may also be subject to the criticism that it is linked to stabilization policy implemented by the central bank, but the link may not be as direct. While total credit to the private sector is likely to increase during a monetary expansion, the central bank has only indirect control over it through use of its interest rate or money supply policy levers. Even so, our inability to disentangle these two measures of the overall size of the financial system from monetary policy actions could be a reason why the results for these two measures do not consistently associate financial development with smoother business cycles. However, the two measures that we find to be the most robustly related to volatility, $BANK$ and $PRIVATE$ are ratios that should not vary systematically in the short-run with a change in monetary policy.

We also considered if our results were sensitive to an alternative means of measuring volatility. In the results presented in Tables 1 through 5, volatility of our macroeconomic variables is calculated using the standard deviations of annual growth rates over a period of years. While this technique characterizes volatility over approximately a decade, it requires us to collapse over 40 years of data into 4 time periods. An alternative measure of volatility that would potentially offer more efficient estimation of the relationship of interest is to use the variability of the error term from a GARCH process to calculate the variance of each of our macroeconomic series on an annual basis.[13] Of course, since the GARCH process uses data from all time periods to estimate the variance in any given year, we are no longer able to get a "clean" look at initial levels of financial development

[12] A full set of results for all estimations not detailed in the text is available from the authors upon request.

[13] Specifically, for all variables in our estimation for which we previously calculated standard deviations (both dependent and independent variables), we now calculate the variance of the error term from a GARCH(1,1) process for that series. Using the coefficients on the estimated GARCH(1,1) equation, we transform the variance of the error term to obtain the variance of the dependent variable in the GARCH estimation. Results from this procedure are available upon request.

and subsequent volatility as we do in our main estimations. Thus, we present these results only as supplementary to our initial findings. Nonetheless, the results from this procedure confirm many of our initial findings–$PRIVATE$ is negatively related to the variability of GDP, consumption, and investment growth and $BANK$ is negatively related to GDP variability. Consistent with the mixed nature of results we have reported for investment variability, $BANK$ is positively associated with the variability of investment calculated in this manner.

Finally, an additional possibility that we consider here is that our finding of a negative association between financial development and reduced volatility is being driven by the developed countries in our sample which have both developed financial sectors and lower macroeconomic volatility. Although we do not report the results here, we confirmed that our major conclusions still hold even when we drop high income countries from our sample.[14] Our results are also robust to using a logarithmic specification for either of our three dependent variables or for the measure of financial development. Thus, the relationship we identify is not likely to be the result of a an omitted variable common to high income countries that also are likely to have more developed financial sectors.

3.3. Further Discussion

So far, our results indicate that the manner in which the financial sector develops could have important implications for the severity of the business cycle. Others have suggested that the financial system is in fact influenced by several important underlying characteristics of the economy (e.g., La Porta et al., 1997, 1998, Levine, 1998, 1999, and Demirguc-Kunt and Levine, 1999).

These characteristics may be linked to macroeconomic fluctuations and it would be desirable to separate them out from the country-specific fixed effect we estimate above. While panel data is not available to allow us to do this in our main estimation, we are able to implement a cross-country regression for a subset of the countries in our panel.

The additional variables we add to the cross-country regressions are from La Porta

[14]We considered countries that had income in the top quartile to be high-income countries. These countries had real per capita incomes greater than $11,000 in the last period.

et al. (1998). In all, we add 5 different variables. $ACCOUNT$ is an index of the strength of accounting standards ranging from a low of 0 to a high of 90. High values of $ACCOUNT$ indicate that companies in that country are required to have more comprehensive financial statements. $ENFORCE$ is an indicator of the enforceability of contracts. It is actually an average of two separate indices–one which assesses the law and order tradition of an economy and the second which assesses the chances that a given government will change the provisions of a contract once it has been signed. $ENFORCE$ ranges from 1 to 10 with higher values indicating stronger enforcement of contracts. $CORRUPT$ is an index of corruption ranging from one to ten with lower values indicating a greater incidence of government officials demanding special payments. $STRUCTURE$ is an index of the extent to which the financial system is based on the stock market rather than banks. Higher values of $STRUCTURE$ imply that the market is relatively more important than banks. Finally, our data contains dummy variables for the legal origin of a country, $ORIGIN$ (i.e., French, English, Scandinavian or German).[15]

To implement our cross country estimation, we collapse our data into two time periods and modify equation (1) to estimate

$$V_{i,t} = \mu_i \ + \ \lambda_t \ + \ \beta_1 FINDEV_{i,t-1} \ + \ \beta_2 X_{i,t} \ + \ \beta_3 Z_{i,t-1} \ + \ \upsilon_{i,t} \qquad (2)$$

where $Z_{i,t-1}$ includes $ACCOUNT$, $ENFORCE$, $CORRUPT$, and $STRUCTURE$.

We measure $Z_{i,t-1}$ in the initial time period (1976-1980) and then measure subsequent volatility and $X_{i,t}$ over the period 1980 to 1998.[16] Thus, our cross-country data set gives us some advantages. It allows the inclusion of additional variables and gives us the ability to measure volatility over a much longer period of time. Moreover, the additional variables in our cross-country data set also allow us to assess whether or not our main results are affected by endogeneity. Reverse causation may also be an issue in this

[15]For a more detailed discussion of the definitions of these variables, see also Demirguc-Kunt and Levine (1999).

[16]Since we view these additional variables included in Z as country characteristics that are essentially fixed over the time period of the data, the exact timing of when we measure them should be inconsequental.

relationship–more stable economies may promote greater financial sector development.[17] Clearly, the legal origin of a country, which has been linked to financial development, is a predetermined and exogenous variable in the above estimations.[18] Hence, we are able to use it to instrument for financial development in our cross-country data set. Our cross-country data set also has some important disadvantages compared to the panel we used for the main results. Not the least of which is the small size of our data set; data availability restricts our analysis to only 27 countries. In addition, while we believe that the additional variables we add are important components of the country-specific fixed effect, we do not believe they include all important country characteristics. As a result of these disadvantages, we are cautious in our interpretation of the cross-country results and present them only as supplementary to our main results. Table 6 presents the results of this estimation for the variability of per capita consumption growth.[19]

[Table 6 about here.]

Our results for the per capita consumption growth regressions are generally supportive of the conclusions we drew above. Higher levels of $BANK$, $PRIVATE$ and $PRIVY$ are associated with lower volatility of per capita consumption. Per capita GDP and investment regressions, not reported here, generate negative but insignificant coefficients in three of the four GDP regressions and all of the investment regressions.

The coefficients on the additional country characteristics we were able to include in the cross-country regressions also suggest some interesting conclusions. Stronger accounting standards are associated with lower variability of consumption in two regressions, while exchange rate volatility is robustly and positively related to consumption variability in three out of four specifications. Surprisingly, less corrupt governments are

[17] While our use of initial financial development and subsequent volatility somewhat addresses this issue, it is interesting to reverse this estimation and examine the effect of initial volatility and subsequent financial development. When we use the two non-overlapping periods of financial development and volatility in the panel data, however, we find no evidence for this reverse causality.

[18] For more detailed discussions, see La Porta et al (1998) and Beck, Levine and Loayza (2000a, 2000b).

[19] We were not able to obtain statistically significant results for the financial development variables in the GDP and investment estimations, and we do not report them here.

associated with higher variability of consumption in all four regressions. One possible explanation for this counter-intuitive result is that the elements of corruption that create volatility manifest themselves in enforceability of contracts and in the strength of accounting standards. Thus, the positive relationship we find between corruption and stability is only a partial effect after controlling for the most damaging effects of corruption. This conjecture is supported by the fact that the raw correlations between corruption and volatility indicate that more corrupt economies have greater volatility. A possible interpretation of our finding is that, after controlling for these variables, consistent and predictable corruption has a stabilizing component. Finally, $STRUCTURE$, the reliance of the economy on the stock market relative to banks, enters positively and significantly in two of the four consumption regressions. These results would be consistent with a wealth effect that stimulated consumption through appreciation in stock market wealth. However, it is doubtful that this effect would be identifiable in aggregate data for most of the countries in our sample.

4. Conclusion

There exist at least three different but related strands in the economic literature which assert or imply that financial development should reduce macroeconomic volatility. Panel data from 70 countries covering the years between 1956 through 1998 reveal evidence in support of this hypothesis.

In particular, we have shown above that countries with more developed financial sectors experience less fluctuations in real per capita output, consumption and investment growth. However, we have also demonstrated that the manner in which the financial sector develops matters. The importance of banks in the financial system is the most robust in explaining consumption and investment volatility, whereas the relative amount of credit supplied to the private sector has the most explanatory power for the volatility of consumption and output. These results appear to be robust to different estimation techniques and data selection strategies. Although our data and methodology do not allow us to distinguish between the different mechanisms through which financial development

affects volatility, our general findings suggest that the risk management and information processing provided by banks may be particularly important in reducing consumption and investment volatility, while the simple availability of credit to the private sector helps to smooth consumption and GDP.

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Table 1: Descriptive Statistics and the Correlation Matrix

	Mean	*Std. Dev.*	$SDGDP$	$SDCONS$	$SDINV$	$BANK$	LLY	$PRIVATE$	$PRIVY$
$SDGDP$	5.88	4.93	1	.85	.59	−.349	−.004	−.210	−.265
$SDCONS$	6.20	5.81	...	1	.65	−.377	.08	−.197	−.249
$SDINV$	14.0	8.93	...	...	1	−.313	−.116	−.066	−.293
$BANK$	.727	.200	...	...	...	1	.048	.375	.410
LLY	.147	.077	...	...	...	...	1	−.004	.253
$PRIVATE$	.714	.368	...	...	...	...	...	1	.170
$PRIVY$	.282	.219	...	...	...	...	...	...	1

Table 2: Fixed Effects Estimation

Dependent Variable: STANDARD DEVIATIONS OF GDP, CONSUMPTION, AND INVESTMENT GROWTH
(Annual Rates)

	GDP				C				I			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$BANK_{t-1}$	−8.18* (2.89)	...	...	...	−9.30* (3.02)	...	...	...	−9.97* (4.82)	...	...	...
LLY_{t-1}	...	8.40 (5.56)	...	...	...	11.1* (5.20)	...	...	...	9.92 (8.95)	...	...
$PRIVATE_{t-1}$	...	...	−2.31* (.643)	...	...	...	−2.37* (.662)	...	...	...	−1.32 (1.84)	...
$PRIVY_{t-1}$	...	...	...	−2.06 (2.74)	...	...	...	−.968 (2.66)	...	...	...	4.96 (4.77)
$GROWTH_t$	.219 (.212)	.174 (.216)	.193 (.216)	.170 (.220)	.330 (.310)	.234 (.319)	.280 (.311)	.252 (.316)	.083 (.123)	.117 (.122)	.084 (.122)	.098 (.116)
$MEAN_{t-1}$	.151 (.230)	.014 (.255)	−.008 (.250)	.003 (.240)	.237 (.404)	.066 (.429)	−.144 (.431)	−.052 (.410)	−.246 (.588)	−.517 (.593)	−.559 (.571)	−.569 (.546)
$INFMEAN_t$	−.016 (.044)	−.030 (.045)	−.044 (.046)	−.029 (.045)	−.029 (.048)	−.025 (.049)	−.062 (.050)	−.023 (.049)	−.011 (.079)	−.009 (.081)	−.043 (.081)	−.009 (.080)
$INFSTDEV_t$	.046 (.031)	.056** (.032)	.067* (.032)	.053** (.032)	.074* (.034)	.066** (.034)	.099* (.037)	.064** (.034)	.049 (.076)	.043 (.079)	.076 (.079)	.043 (.078)
$FXVOL_t$	10.8* (4.73)	11.7* (5.07)	13.0* (5.12)	11.7* (5.26)	9.20* (4.10)	10.0* (4.47)	12.0* (4.43)	10.3* (4.66)	17.9* (6.73)	18.9* (7.01)	20.1* (7.07)	20.0* (7.05)
No. of obs.	198	192	197	198	199	192	198	198	198	191	197	197
R^2	.56	.53	.55	.54	.62	.59	.61	.59	.68	.67	.68	.67

Note: Country-specific and time-specific fixed effects estimate. Heteroskedasticity-corrected standard errors are in parentheses. *, ** respectively denote significance at the 5 percent and 10 percent levels. The variables $GOVMEAN$, $GOVSTDEV$, $POLITY$, $OPEN, OPEN * FXVOL$ are included but not shown.

Table 3: Fixed Effects Estimation with all Finance Variables

Dependent Variable: STANDARD DEVIATIONS OF GDP, CONSUMPTION, AND INVESTMENT GROWTH
(Annual Rates)

	GDP	C	I
	(1)	(2)	(3)
$BANK_{t-1}$	-6.88^{*}	-7.23^{*}	-9.81^{**}
	(2.91)	(2.94)	(5.44)
LLY_{t-1}	5.26	7.38	7.59
	(5.69)	(5.62)	(8.96)
$PRIVATE_{t-1}$	-1.54^{*}	-1.49^{*}	$-.354$
	(.583)	(.539)	(1.66)
$PRIVY_{t-1}$	1.25	2.78	9.18^{**}
	(2.73)	(2.55)	(5.40)
$GROWTH_t$	.216	.270	.085
	(.209)	(.309)	(.124)
$MEAN_{t-1}$	.153	.254	$-.403$
	(.222)	(.379)	(.617)
$INFMEAN_t$	$-.031$	$-.026$	.004
	(.046)	(.049)	(.080)
$INFSTDEV_t$	$.057^{**}$	$.068^{**}$	.038
	(.031)	(.035)	(.075)
$FXVOL_t$	12.1^{*}	10.5^{*}	18.8^{*}
	(5.12)	(4.45)	(6.90)
$No.\ of\ obs.$	190	190	189
R^2	.56	.61	.68

Note: Country-specific and time-specific fixed effects estimate. Heteroskedasticity-corrected standard errors are in parentheses. *, ** respectively denote significance at the 5 percent and 10 percent levels. The variables $GOVMEAN$, $GOVSTDEV$, $POLITY$, $OPEN, OPEN * FXVOL$ are included but not shown.

Table 4: Fixed Effects Estimation (5 year lags)

Dependent Variable: STANDARD DEVIATIONS OF GDP, CONSUMPTION, AND INVESTMENT GROWTH
(Annual Rates)

	GDP				C				I			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$BANK_{t-1}$	−6.47** (3.59)	...	...	...	−7.33* (3.43)	...	...	...	−5.06 (4.43)	...	...	...
LLY_{t-1}	...	5.00 (3.59)	...	...	...	7.22* (3.48)	...	...	...	−3.49 (8.08)	...	...
$PRIVATE_{t-1}$	...	...	−3.27* (1.47)	...	...	...	−2.84** (1.49)	...	...	...	−3.55* (1.65)	...
$PRIVY_{t-1}$	...	...	...	−.010 (2.19)	...	...	...	−.704 (2.21)	...	...	...	.619 (4.97)
$GROWTH_t$	.187 (.234)	.169 (.213)	.186 (.222)	.175 (.220)	.229 (.350)	.234 (.312)	.252 (.333)	.251 (.318)	−.012 (.123)	.115 (.122)	.024 (.120)	.101 (.121)
$MEAN_{t-1}$	.136 (.227)	−.020 (.269)	.168 (.247)	−.036 (.253)	.238 (.414)	.023 (.436)	.113 (.438)	−.105 (.433)	−.574 (.560)	−.688 (.617)	−.615 (.548)	−.501 (.581)
$INFMEAN_t$	−.034 (.047)	−.025 (.045)	−.021 (.048)	−.028 (.045)	−.051 (.051)	−.016 (.049)	−.053 (.053)	−.023 (.050)	−.015 (.081)	−.016 (.081)	−.025 (.086)	−.010 (.081)
$INFSTDEV_t$	.072** (.036)	.055** (.032)	.055 (.035)	.055** (.032)	.106* (.037)	.063** (.034)	.096* (.040)	.064** (.034)	.072 (.081)	.045 (.079)	.066 (.080)	.042 (.080)
$FXVOL_t$	10.5* (4.97)	11.0* (5.14)	12.2* (5.01)	11.8* (5.13)	9.23* (4.38)	8.74** (4.60)	10.7* (4.55)	10.5* (4.54)	17.6* (7.06)	19.4* (6.68)	17.6* (7.13)	19.5* (7.04)
No. of obs.	190	198	188	195	191	198	189	195	190	197	188	194
R^2	.55	.53	.57	.54	.62	.59	.61	.59	.69	.66	.69	.67

Note: Country-specific and time-specific fixed effects estimate. Heteroskedasticity-corrected standard errors are in parentheses. *, ** respectively denote significance at the 5 percent and 10 percent levels. The variables $GOVMEAN$, $GOVSTDEV$, $POLITY$, $OPEN, OPEN * FXVOL$ are included but not shown.

Table 5: Fixed Effects Robust Regressions

Dependent Variable: STANDARD DEVIATIONS OF GDP, CONSUMPTION, AND INVESTMENT GROWTH
(Annual Rates)

	GDP				C				I			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$BANK_{t-1}$	.426 (1.41)	...	...	...	−5.38* (1.56)	...	...	...	−8.58* (3.95)	...	...	...
LLY_{t-1}	...	−.844 (4.50)	...	...	...	.676 (2.93)	...	...	...	−.460 (9.83)	...	...
$PRIVATE_{t-1}$	...	...	−1.68* (.497)	...	...	...	−1.78* (.512)	...	...	...	2.60* (.924)	...
$PRIVY_{t-1}$	...	...	...	−2.32 (1.70)	...	...	...	−.577 (1.68)	...	...	...	4.24 (4.67)
$GROWTH_t$	.135* (.063)	.016 (.074)	.025 (.070)	.122** (.066)	−.047 (.082)	−.103** (.056)	.034 (.083)	−.062 (.075)	−.063 (.082)	−.176* (.072)	−.262 (.350)	.049 (.082)
$MEAN_{t-1}$	.060 (.120)	.059 (.139)	.027 (.130)	.107 (.123)	.322 (.227)	.005 (.150)	.125 (.223)	.196 (.203)	−.098 (.495)	−.015 (.430)	.265 (.349)	.097 (.488)
$INFMEAN_t$	.024 (.021)	.028 (.025)	−.030 (.024)	.024 (.022)	−.043** (.024)	−.016 (.016)	−.079* (.024)	−.005 (.022)	−.045* (.605)	.105* (.053)	−.057 (.043)	−.046 (.062)
$INFSTDEV_t$	.051* (.021)	.043** (.024)	.078* (.024)	.050* (.022)	.074* (.023)	.078* (.016)	.088* (.024)	.058* (.021)	.179* (.059)	−.016 (.051)	.089* (.043)	.134* (.060)
$FXVOL_t$	.437 (1.71)	2.84 (1.97)	6.53* (1.91)	1.90 (1.80)	6.37* (1.93)	2.65* (1.29)	13.4* (1.97)	2.20 (1.78)	7.13 (5.00)	9.31* (4.23)	18.2* (3.60)	10.9* (4.99)
No. of obs.	198	192	197	198	199	192	198	197	198	190	197	197

Note: Country-specific and time-specific fixed effects estimate. *, ** respectively denote significance at the 5 percent and 10 percent levels. The variables $GOVMEAN$, $GOVSTDEV$, $POLITY$, $OPEN$, $OPEN * FXVOL$ are included but not shown.

Table 6: Two-Stage Least Squares Estimation

Dependent Variable: STANDARD DEVIATION OF CONSUMPTION GROWTH
(Annual Rates)

	C			
	(1)	(2)	(3)	(4)
$BANK_{t-1}$	-6.23^{**}	...	...	...
	(3.45)			
LLY_{t-1}	...	1.78	...	...
		(5.16)		
$PRIVATE_{t-1}$			-3.41^{**}	...
			(1.56)	
$PRIVY_{t-1}$	...	...	...	-2.25^{*}
				(1.24)
$ACCOUNT_{t-1}$	$-.049$	$-.079$	$-.076^{*}$	$-.097^{*}$
	(.029)	(.060)	(.024)	(.022)
$ENFORCE_{t-1}$	$-.334$	$-.474$	.073	$-.174$
	(.582)	(.356)	(.368)	(.303)
$CORRUPT_{t-1}$	$.395^{*}$	$.500^{*}$	$.434^{*}$	$.386^{*}$
	(.195)	(.230)	(.123)	(.140)
$STRUCTURE_{t-1}$	.442	$-.105$	$.530^{*}$	$.738^{*}$
	(.313)	(.430)	(.241)	(.359)
$FXVOL_t$	2.80	7.74^{*}	7.71^{*}	9.27^{*}
	(5.46)	(3.41)	(3.35)	(2.81)
No. of obs.	27	25	26	26
R^2	.91	.96	.97	.97

Note: Country-specific and time-specific fixed effects estimate. Heteroskedasticity-corrected standard errors are in parentheses. *, ** respectively denote significance at the 5 percent and 10 percent levels. The variables $MEAN$, $GROWTH$, $INFMEAN$, $INFSTDEV$, $GOVMEAN$, $GOVSTDEV$, $POLITY$, $OPEN$, and $OPEN * FXVOL$ included but not shown.