# FINANCIAL DEVELOPMENT AND THE MAGNITUDE OF BUSINESS CYCLE VOLATILITY

**by**

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**Keywords***:* Business Cycles; Volatility; Financial Development; Banking; Stock Markets

## Abstract

This paper empirically analyzes the effect of financial development on business cycle volatility by using panel data from 70 countries for the period between 1990 and 2010. It also studies whether macroeconomic volatility depends on the type of the financial system: market-based versus bank-based. Using a generalized method of moments (GMM) technique, we find that countries with more developed stock markets and banking sectors have less volatility in output, with the stock market development having a more robust effect. We also show that countries with relatively more market-based financial systems appear to experience more macroeconomic stability. Our empirical results are consistent with the theoretical view that financial development helps to overcome information frictions and corporate governance issues, mitigates shocks more easily, and eases diversification of risks, thereby dampening the amplitude of volatility.

# FİNANSAL GELİŞMELER VE MAKROEKONOMİK DALGALANMALAR

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**Anahtar Kelimeler***:* Makroekonomik Dalgalanmalar; Oynaklık; Finansal Gelişme; Bankacılık; Hisse Senedi Pazarı

## Özet

Bu çalışma, finansal gelişimin makroekonomik dalgalanmalardaki oynaklığa etkisini 70 ülkenin 1990 ile 2010 yılları arasındaki panel verilerini kullanarak ampirik olarak incelemektedir. Bu çalışmada aynı zamanda makroekonomik oynaklığın finansal sistemlerin tipine bağlılığı da incelenmektedir: piyasa-tabanlı veya banka-tabanlı. Dinamik GMM (Generalized Method of Moments) tekniği kullanılarak yapılan bu çalışma, finansal sistemleri gelişmiş ülkelerde büyümedeki oynaklığın daha az olduğunu ve hisse senedi pazarının daha kuvvetli bir etkiye sahip olduğunu göstermiştir. Aynı zamanda kısmen piyasa-tabanlı finansal sistemli ülkelerin daha fazla makroekonomik istikrara sahip olduklarını ortaya koymuştur. Bulduğumuz ampirik sonuçlar teorik görüşlerle tutarlı olarak, finansal gelişmenin asimetrik bilgileri azalttığını, kurumsal yönetime yardımcı olduğunu, şokları daha kolaylıkla azalttığını ve riskin dağıtılmasını kolaylaştırdığını ve bu yollarla oynaklığı azalttığını göstermiştir.

**CONTENTS**

## 1. Introduction

The idea that financial development plays a vital role in economic activity has a long tradition in economics. Although a large body of literature has empirically and theoretically studied the role of financial development in long-run economic growth (Levine (1997) provides an excellent discussion), empirical evidence on the implications of financial markets and institutions for macroeconomic volatility is scarce. This paper broadly focuses on the relationship between financial development and business cycle volatility for both developed and developing countries to fill this gap.

In this paper, we empirically test the following issues: first, does financial development dampen the volatility of business cycles?[1] Second, does the relationship between financial development and macroeconomic volatility depend on the type of the financial system: market-based versus bank-based? We follow the approach suggested in Morgan et al. (2004) to obtain a time varying measure of output growth volatility. Therefore, we are able to exploit the panel structure of the data of a large group of countries. We construct a large international data set consisting of 70 developed and developing countries over the 1990-2010 period. Financial development is measured through banking sector development and financial market development: We use deposit money bank credit to the domestic private sector as a share of GDP and alternatively bank assets divided by GDP to proxy for the development of the banking sector. We use the value of listed shares on a country's stock exchanges as a share of GDP and alternatively the value of stock market transactions as a share of GDP to proxy for the development of financial markets. In addition, we construct the variables that represent the type of the financial system, market-based versus bank-based, by taking the ratio of stock market size to credit size. We also construct a dummy variable flagging membership of the OECD countries based on the assumption that there may be additional fixed factors in the form of institutional development associated with OECD membership that affect output stability (Huizinga and Zhu (2006)). Finally, to investigate the impact of the 2008 financial crisis, we include a dummy variable that captures the post-crisis period (*post2007*, 2008-2010) since financial crises give rise to large deviations from the steady state (Brunnermeier and Sannikov (2009)).

[1] We are treating volatility in real per capita GDP growth as a measure of business cycle or macro-economic volatility.

Using the Arellano-Bond system generalized method of moments (GMM) technique, we find that countries with more developed financial markets and banking sectors are characterized by less per capita output growth volatility with the stock market development having a more robust effect. In addition, we find that relatively more market-based financial systems experience a lower volatility in real per capita GDP growth. Our results also show that financial development does not have a different effect on volatility in OECD countries compared to the other countries in the sample. We also find that stock market development has an extra negative effect on business cycle volatility during the 2008 crisis period.

The existing literature on financial development and business cycle volatility has shown that financial development has a dampening impact on macroeconomic volatility. Fidrmuc and Scharler (2012), Ferreira da Silva (2002), Beck et al. (2006), Huizinga and Zhu (2006), and Denizer et al. (2002) also study empirically the relationship between finance and business cycle volatility. Fidrmuc and Scharler (2012) empirically analyze a sample of OECD economies.[2] They find that banking sector development plays essentially no role on fluctuations in output growth, while countries characterized by developed stock markets experience less pronounced fluctuations. Huizinga and Zhu (2006) find that countries with a relatively heavy reliance on stock markets are characterized by smoother business cycles.[3] They interpret this result as evidence in favor of the hypothesis that costly bankruptcies are more prevalent in bank-based financial systems. On the other hand, Da Silva (2002) shows that the type of the financial system does not affect the main result that more developed credit markets lead to less volatile business cycles. She argues that both theoretical and empirical evidence are not conclusive with regards to which kind of financial system structure leads to reduced asymmetric information problems and lower business cycles volatility. Therefore, she argues that there is no role for financial structure to affect output volatility.[4] Beck et al. (2006) argue that the influence of financial intermediary

[2] They use data for a sample of OECD countries from 1995 to 2005: Australia, Austria, Belgium, Canada, Germany, Denmark, Finland, France, Ireland, Italy, Japan, Netherlands, Norway, New Zealand, Portugal, Spain, Sweden, Switzerland, United Kingdom and the United States.

[3] They use instruments for the financial sector variables relying on the study of Porte et al. (1998) and apply FGLS estimation technique. We instead apply the Arellano-Bond system generalized method of moments (GMMs) estimation technique to deal with potential endogeneity issues.

[4] She classifies a country as having a bank or market-based financial system on the basis of whether a financial system is dominated by universal banks or stock market. Classification dummies are then included in regressions on the basis of study of Black and Moersch (1998). In this paper, we use a more

development is ambiguous and depends on the type of shock that hits the economy. Denizer et al. (2000) find that economies relying more on the stock market relative to banks experience more volatile consumption due to stock market wealth effects. Financial development can dampen real shocks, but it tends to magnify monetary shocks. On average, the dampening and magnifying effects of financial intermediaries may cancel out over the business cycle due to both real and monetary shocks.

This paper contributes to the literature on several fronts. First, this study presents a comprehensive empirical investigation of the relationship between financial development and the volatility of business cycles. Second, recent empirical studies provide evidence only for industrialized countries. For instance, Fidrmuc and Scharter (2012) only concentrate on a sample of OECD countries for a shorter time period. However, attempts to lay out the effect of financial development on macroeconomic volatility for developing countries and newly industrialized countries are very scarce. Therefore, we use data for both developed and developing countries in this study. We also study whether macroeconomic volatility depends on the type of the financial system: market-based versus bank-based. Our results are different from Da Silva (2002), who finds that the type of the financial structure does not help to explain output volatility. Third, differently from the literature, this paper also analyzes the effects of recent global financial crisis on output fluctuations. Another contribution of this paper is to extend the literature on the proxy for financial development indicators. We use proxies for financial development indicators from the studies of Beck and Levine (2004), Levine and Zervos (1998) and Demirguc-Kunt, Feyen and Levine (2012).

The remainder of the paper is organized as follows: Section 2 discusses how financial development and financial system type may influence the business cycle and surveys the theoretical literature. Section 3 describes the data and our empirical strategy. Section 4 summarizes the empirical results and Section 5 concludes.

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continuous approach to measuring the type of the financial system by taking the ratio of stock market size to credit size or alternatively to bank assets as a measure.

## 2. Theoretical Motivation

Financial development might affect the volatility of business cycles through several routes: First, well-developed financial systems may strengthen an economy's ability to mitigate shocks, and as a result, help to reduce cyclical fluctuations. That is, more developed financial systems can absorb shocks in an economy more easily by matching savers and investors more efficiently. In their paper, Aghion, Banerjee, and Piketty (1999) set a simple macroeconomic model based on micro-foundations which combines financial market imperfections together with unequal access to investment opportunities across individuals. They demonstrate that economies with less developed financial systems would experience more volatility and slower growth. In their model, levels of financial development and the degree of separation between savers and investors determine the magnitude of the macroeconomic fluctuations. The higher the degree of separation between savers and investors, the larger is the growth volatility. Aghion et al. point out that one reason why non-industrialized economies experience more volatility can be attributed to the less developed financial sector in these countries.

Second, the financial markets and institutions may also ease diversification at both the microeconomic and macroeconomic levels, which would mitigate risk and volatility. Acemoglu and Zilibotti (1997) argue that there is an important link between financial development and volatility since diversification plays a vital role in reducing risk. They demonstrate that in the early stages of development, indivisible investment projects limit the degree of diversification of idiosyncratic risk, and therefore, discourage investment in risky projects which are more productive. These have a negative effect on capital accumulation and lead to large growth volatility.

Third, financial development may also facilitate dealing with asymmetric information which may lead to more volatile business cycles. That is, financial system development might reduce volatility through reducing the cost of acquiring information. Bernanke et al. (1999) argue that credit market frictions, originating from agency problems, have a significant influence in business cycle dynamics since financial frictions amplify and propagate shocks to the macroeconomy. This problem would be more pronounced in the financially underdeveloped countries since underdeveloped financial markets are characterized by imperfect information and costly enforcement of contracts that prevent smooth functioning of the financial market. In their model,

Greenwald and Stiglitz (1993) also demonstrate that developed financial markets dampen volatility by reducing information.

Finally, financial development may influence the volatility of output growth through corporate governance. In his model, Philippon (2006) argues that managers of poorly governed firms overinvest and the owners of these firms tolerate this behavior to a greater extent in good times. Consequently, shocks are amplified due to the cyclical behavior of corporate control resulting in higher volatility of real activity. In contrast, developed financial systems are associated with better governance and thus less volatile output growth by providing strong investor rights. However, it is not clear theoretically, whether banks or markets are superior in the routes explained above.

Therefore, investigating the degree to which financial system development might impact the fluctuations in economic activity is important since business cycle volatility has been associated with lower growth rates in output and investment (Barro, 1991; Ramey and Ramey, 1994). In addition, more volatile business cycles can lead to substantial decreases in employment and output in the presence of asymmetric information (Aizenman and Powell, 1997).

It may also be important to distinguish between markets and intermediaries since banking sector development and financial market development may have different implications for business cycle volatility. According to Allen and Gale (1999), financial markets tend to be superior in terms of gathering information in uncertain situations since the limited liability of financial intermediaries causes them to take too much risk, which may lead to initial asset price inflation and ultimately to financial crises and economic recessions. In their model, Huizinga and Zhu (2006) argue that debt finance is relatively cheap in the sense that debt holders need to verify relatively few profitability states, but debt finance may lead to costly bankruptcy. At the aggregate level, a more debt-based financial structure leads to a higher bankruptcy rate.

On the other hand, Chakraborty, Ray and Tridip (2006) theoretically analyze the relative merits of bank-based and market-based financial systems for growth and development in an endogenous growth model where a bank-based or market-based system emerges endogenously from firm-financing choices. From a growth perspective, they argue that it is not certain that one type of system is invariably better than the other and what matters for growth is the efficiency of the country's financial and legal

institutions, rather than the type of its financial system. According to their model, bank-based systems have some advantages over those that are market-based: Firstly, levels of investment and per capita GDP are higher under a bank-based system since bank monitoring resolves some of the agency problems and enables firms to borrow more. Market-based system plays no such role and results in a lower amount of external finance available to all firms. Secondly, bank-based systems allow greater participation in manufacturing activities, by providing external finance to a larger number of entrepreneurs. In addition, Stiglitz (1985) argues that banks are more effective in enforcing good governance of firms, due to free-rider and principal agent problems which are inherent in atomistic markets. Thus, it is not clear theoretically, whether banks or markets are superior in enforcing good governance.

From the above discussion, we can conclude that development of the financial systems may affect the volatility of business cycles through several routes; however, it is not clear theoretically, whether banks or markets are superior in these routes. Therefore, it is important to empirically test the effects of financial development and the type of the financial system on business cycle volatility. This paper is one step in deriving a better understanding of the dynamic relationships among output volatility, financial institutions, and financial markets.

## 3. Data and Empirical Strategy

The data analyzed in this study cover 70 countries ranging from 1990 to 2010.[5] Annual financial sector data are from Beck, Demirguc-Kunt and Levine (2000, updated in 2012), while macroeconomic variables are from the World Development Indicators (World Bank, 2012). We use annual data because of the availability of detailed data on the structure of financial sector and to be able to explore the business cycle volatility of a large group of countries, including a group of large lower middle income developing countries, which have usually been ignored in previous research. Detailed variable definitions and data sources are provided in Appendix A.

Volatility in real per capita GDP growth is measured as an indicator for macroeconomic volatility. Growth rate is calculated by taking the first-difference of the

[5] Detailed information about data is presented in Appendix A.

log of real per capita GDP, which equals the first-difference of logarithm of GDP per capita in constant 2005 U.S. dollars.

To construct a measure of output growth volatility, we follow Morgan et al. (2004) and estimate the regression:

$$\Delta log y_{it} = \lambda_i + \lambda_t + u_{it}$$

for each country in the sample, where $y_{it}$ is real per capita GDP, $\lambda_i$ and $\lambda_t$ denote country and time fixed effects, respectively. The absolute value of the estimated residual from this regression, $u_{it}$, is used to calculate the measure of volatility following Kalemli-Ozcan et al. (2010):

$$vola_{it} = |u_{it}|$$

Since $vola_{it}$ varies across countries and also across time, we are able to exploit the panel structure of the data which allows us to concentrate on a sample of 70 countries, which include both developed and developing economies.

### *3.1. Indicators of the financial system development*

The relation between financial system development and macroeconomic volatility is related to the efficiency of financial institutions and markets in processing information, monitoring and managing risk. Since it is virtually impossible to accurately measure how financial development affects macroeconomic volatility over time, the indicators used in this study constitute only proxies for financial development.

In particular, we use Private credit, $credit_{it}$, which equals deposit money bank credit to the domestic private sector as a share of GDP to proxy for the development of the banking sector as in (Beck and Levine, 2004; Levine and Zervos, 1998). Private credit is the main indicator to measure the development of the banking sector. Alternatively, we estimate specifications where we use Bank assets, $assets_{it}$, divided by GDP to indicate banking sector development.

The preferred proxy to measure financial market development is the Stock market capitalization, $capital_{it}$, which simply measures the value of listed shares on a country's stock exchanges as a share of GDP (see Beck and Levine, 2004). Since developed financial markets require more listed shares of assets, a high value of stock

market capitalization indicates a relatively more developed financial market. In addition, we consider Stock value traded, $value_{it}$, which equals the value of stock market transactions as a share of GDP as an alternative indicator for the development of financial markets (see Demirguc-Kunt, Feyen and Levine, 2012). All financial development variables are in logs. Table 1 below shows the descriptive statistics.

**Table 1:** Descriptive Statistics

| | **Mean** | **Std.Dev** | **Min** | **Max** |
|---|---|---|---|---|
| volatility | .2629784 | 1.183722 | -7.34635 | 3.13905 |
| credit | .6433142 | .4624829 | .0329 | 2.7292 |
| assets | .7638046 | .4935329 | .0502 | 2.9891 |
| capital | .5680167 | .6102132 | .0001 | 5.6946 |
| value | .3623168 | .6099338 | .0001 | 7.2654 |

Notes: Descriptive Statistics calculated over the period 1990 to 2010. Financial variables are reported as ratios to GDP.

Table 2 shows the correlation matrix of the financial development variables and our measure of business cycle volatility. These correlations highlight key features about the financial development and business cycle volatility. First, bank and stock market development are negatively correlated with macroeconomic fluctuations. Second, the positive correlation between bank and stock market development indicators suggests that financial development involves both more developed banks and markets. Third, the positive high correlation between $credit_{it}$ and $assets_{it}$ indicates that it is appropriate to use $assets_{it}$ as an alternative measure for the banking sector development. Moreover, the positive high correlation between $capital_{it}$ and $value_{it}$ shows that it is appropriate to use $value_{it}$ as an alternative measure for stock market development.

**Table 2:** Correlation Matrix of Financial Variables and Volatility

| | **volatility** | **credit** | **assets** | **capital** | **value** |
|---|---|---|---|---|---|
| **volatility** | 1.0000 | | | | |
| **credit** | -0.1206 | 1.0000 | | | |
| **assets** | -0.1367 | 0.9692 | 1.0000 | | |
| **capital** | -0.1275 | 0.6093 | 0.5962 | 1.0000 | |
| **value** | -0.1297 | 0.5644 | 0.5780 | 0.7608 | 1.0000 |

Notes: Correlations calculated over the period 1990 to 2010.

We also construct variables for the type of the financial system: market-based versus bank-based, *FinType*, defined as stock market capitalization divided by private sector claims of deposit banks (equaling ($capital_{it}/credit_{it}$)). Considering the high correlation between $credit_{it}$ and $assets_{it}$, we construct the *FinType-alt* variable, defined as stock market capitalization divided by bank assets (equaling ($capital_{it}/assets_{it}$)) as an alternative measure for the type of financial system.[6] Countries with a relatively large *FinType* or *FinType-alt* variables thus have relatively stock market-based financial systems.

*3.2. Control Variables*

To assess the independent link between financial development and business cycle volatility, we use several additional explanatory variables that potentially affect output volatility. First, trade openness, $trade_{it}$, is the log ratio of the sum of exports and imports of goods and services to GDP. This variable measures an economy's openness to trade in goods and services. Several studies suggest that business cycle volatility may be related to openness (Rodrik, 1998; Lane, 2003). The effect of trade openness on business cycle volatility is controversial in the literature. On the one hand, trade links can increase volatility due to the increased transmission of foreign shocks to the domestic economy. Di Giovanni and Levchenko (2009), using firm level data, find that trade openness increases volatility. On the other hand, greater openness allows risks to be shared more efficiently across countries, which may have a stabilizing effect on the cycle. Haddad et al. (2010) find that openness reduces volatility if countries are sufficiently diversified.

Second, government size, $gov_{it}$, is the log ratio of general government final consumption expenditure to GDP. We include this variable since government size may influence business cycle volatility as suggested by Fat´as and Mihov (2001), and Andres et al. (2008). Fat´as and Mihov (2001) argue that there is a strong negative correlation between government size and output volatility both for the OECD countries and across US states. In addition, Andres et al. (2008) analysis demonstrates that adding nominal rigidities and costs of capital adjustment to an otherwise standard RBC model can

[6] We alternatively apply the same method for the ratio of $value_{it}/ credit_{it}$ and $value_{it}/ assets_{it}$. Since the results are similar, we only present results of *FinType* and *FinType-alt* in our tables.

generate a negative correlation between government size and the volatility of output. They argue that the stabilizing effect is only due to a composition effect and it is not present for the volatility of private output.

Third, we also add inflation, $infn_{it}$, and the volatility of inflation, $vol\_infn_{it}$, as control variables (see Fountas and Karanasos, 2007). Fountas and Karanasos (2007) argue that inflation is a positive determinant of uncertainty about inflation and there is mixed evidence regarding the effect of inflation uncertainty on inflation and output growth. Inflation is calculated as the log change in the consumer price index obtained from the IMF's International Financial Statistics database and the volatility of inflation is obtained analogous to the volatility of output. Data used for the construction of control variables are taken from the World Development Indicators (World Bank, 2012).

In addition, the variable OECD is a dummy variable flagging membership of the OECD.[7] This variable is included on the assumption that there may be additional fixed factors in the form of institutional development associated with OECD membership that affect output stability (Huizinga and Zhu (2006).[8] Finally, to investigate the impact of the 2008 financial crisis, we include a dummy variable that captures the post-crisis period (*post2007*, 2008-2010). According to Brunnermeier and Sannikov (2009), financial crisis give rise to large deviations from the steady state. In this sense, it is important to control for the crisis period since during the crisis period business cycle volatility may drive output too far away from the steady state.

### *3.3. Estimation Method*

To test how financial development and the type of the financial system affect macroeconomic volatility, we run a set of regressions, with the volatility of real per capita GDP growth as the dependent variable.

To explain the volatility of real per capita GDP growth, we use the following dynamic regressions of the general form:

[7] In the Appendix A, we provide information about the OECD member country list, which includes the 31 countries.

[8] We also separately use G-7 as a dummy variable flagging membership of the G-7 countries. The results are provided in Appendix B.

$$logvola_{it} = \alpha logFIN_{it} + \beta X_{\ it} + \gamma logvola_{it-1} + \varepsilon_{it}$$

where $FIN_{it}$ is financial system development which is captured by using either of the following variables: $credit_{it}$, $asset_{it}$, $capital_{it}$ or $value_{it}$. $X_{it}$ is a vector of control variables, which are trade openness, government size, inflation, and the volatility of inflation and it also includes the dummies for OECD countries and 2008 crisis period. $\varepsilon_{it} = \alpha_i + v_{it}$ where $\alpha_i$ denotes the unobserved country-specific time-invariant effects; and $v_{it}$ is the residual disturbance term, which has zero mean, constant variance, and is uncorrelated across time and countries. As $vola_{it-1}$ is correlated with $\alpha_i$ because $vola_{it-1}$ is a function of $\alpha_i$, we also include the lagged dependent variable to capture the persistence in $vola_{it}$.

Besides the above regression, we also run a regression in which we introduce banking sector development and stock market development in the same regression. Our purpose is to test whether banking sector and stock market development have different implications for business cycle volatility.

We also run a set of regressions which include interaction terms. First, we add an interaction term between financial development and the dummy for OECD countries to test whether the interaction between $FIN_{it}$ and $OECD$ is relevant for business cycle volatility.[9] In addition, we also introduce an interaction term between financial development and the dummy for 2008 global financial crisis to test whether the interaction between $FIN_{it}$ and $Post2007$ is relevant for business cycle volatility.

In the regressions, we should consider the potential endogeneity issues since the financial variables are likely to be affected by business cycle volatility in part. For instance, $credit_{it}$ may be partly affected by the business cycle as bank credit is likely to be high in booms and low in recessions because of procyclical volatility in demand for, and the supply of, bank loans. Even though our dependent variable is the volatility of GDP growth, and not GDP growth itself, the cyclicality of $credit_{it}$ may still give rise to reverse causality. Therefore, although the panel structure of our data set allows us to exploit the time variation in the financial system variables in addition to the cross-sectional variation, the time variation is likely to indicate business cycle volatility to some extent, which complicates the identification of a causal effect.

[9] We apply the same method for G-7 countries and the results are presented in Appendix B.

To cope with potential endogeneity issues, we use the Arellano-Bond system generalized method of moments (GMM) estimator (see Arellano and Bover, 1995; Blundell and Bond, 1998) and treat $vola_{it}$ and the explanatory variables as endogenous variables. As instruments, we use three lags of the variables. Throughout the analysis, we calculate robust SEs, allowing for heteroscedasticity of unknown form. A generalized method of moments (GMM) technique is used in the tests conducted here for two reasons. First, the GMM is more efficient than two-stage least squares in the presence of heteroscedasticity, which is very common in panel data. Second, the fixed-effects IV estimators with weak instruments are likely to be biased in the way of the OLS estimators.

## 4. Estimation results

In Table 3, we present the results of our baseline regression. Columns (I) and (II) indicate that our proxies for financial market development, $capital_{it}$ and $value_{it}$, have negative effects on output growth volatility and they are significant at 1% and 5% levels of confidence respectively. Holding the other factors constant, a 10 percent increase in stock market capitalization or stock value traded relative to GDP, would reduce the output volatility by approximately 1.5% or 0.5% respectively.

Similarly, Columns (IV) and (V) reveal that the indicators of banking sector development, $credit_{it}$ and $assets_{it}$, are negatively signed and significant at 5% level of confidence. If private credits or bank asset relative to GDP were 10% greater, output volatility would decrease by 2.4% or 2% respectively. Thus, our results suggest that countries characterized by developed financial markets and banking sector experience less volatile business cycles.

Finally, in Columns (VI) and (VII), we replace the proxy variables for financial development by the *FinType* or *FinType-alt* variables to see whether the volatility of output is affected by the relative size of financial markets relative to banking sector. Throughout Columns (VI) and (VII), we see that the *Fintype* and *Fintype-alt* variables enter the regressions with negative and statistically significant coefficients. This suggests that countries with relatively market-based financial systems experience a lower volatility of output.

**Table 3:** Output growth volatility and financial systems development, system GMM

| | (I) | (II) | (III) | (IV) | (V) | (VI) |
|---|---|---|---|---|---|---|
| **capital$_{it}$** | -0. 146*** | | | | | |
| | (0.049) | | | | | |
| **value$_{it}$** | | -0.054** | | | | |
| | | (0.027) | | | | |
| **credit$_{it}$** | | | -0.240** | | | |
| | | | (0.112) | | | |
| **asset$_{it}$** | | | | -0.191** | | |
| | | | | (0.092) | | |
| **fintype$_{it}$** | | | | | -0.114** | |
| | | | | | (0.052) | |
| **fintype-alt$_{it}$** | | | | | | -0.106* |
| | | | | | | (0.058) |
| **vola$_{it-1}$** | 0.152*** | 0.146*** | 0.137*** | 0.135*** | 0.150*** | 0.154*** |
| | (0.038) | (0.039) | (0.038) | (0.038) | (0.037) | (0.038) |
| **trade$_{it}$** | 0.591** | 0.312 | 0.519 | 0.402 | 0.369 | 0.317 |
| | (0.264) | (0.261) | (0.340) | (0.315) | (0.266) | (0.264) |
| **gov$_{it}$** | -0.024 | 0.058 | 0.256 | 0.216 | -0.017 | -0.015 |
| | (0.222) | (0.206) | (0.230) | (0.218) | (0.226) | (0.224) |
| **infn$_{it}$** | 0.047 | 0.076* | 0.069 | 0.084* | 0.084* | 0.092** |
| | (0.043) | (0.039) | (0.044) | (0.044) | (0.042) | (0.043) |
| **vol_inf$_{it}$** | 0.072* | 0.075* | 0.108*** | 0.116*** | 0.068* | 0.072* |
| | (0.038) | (0.039) | (0.040) | (0.038) | (0.039) | (0.038) |
| **Post2007** | 0.181* | 0.169* | 0.237** | 0.192* | 0.197** | 0.188* |
| | (0.100) | (0.098) | (0.103) | (0.097) | (0.092) | (0.094) |
| **OECD$_{i}$** | -0.103 | -0.065 | -0.137 | -0.168 | -0.181 | -0.203 |
| | (0.155) | (0.151) | (0.168) | (0.164) | (0.158) | (0.153) |
| **constant** | 0.294 | 0.600 | 1.006** | 1.116** | 0.558 | 0.648 |
| | (0.518) | (0.454) | (0.473) | (0.476) | (0.501) | (0.498) |
| **Observations** | 1,259 | 1,252 | 1,257 | 1,273 | 1,238 | 1,226 |
| **Hansen_J-test** | 67.624 | 68.385 | 66.959 | 64.762 | 64.669 | 62.172 |
| | [1.000] | [1.000] | [1.000] | [1.000] | [1.000] | [1.000] |
| **AB-AR1** | -6.811 | -6.782 | -6.736 | -6.816 | -6.712 | -6.709 |
| | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] |
| **AB-AR2** | 0.72 | 0.65 | 0.514 | 0.628 | 0.891 | 0.851 |
| | [0.472] | [0.516] | [0.607] | [0.53] | [0.373] | [0.395] |

Notes: Dependent variable is vola$_{it}$. Explanatory variables are treated as endogenous, and they are instrumented with all their lags up to a maximum of three lags (GMM instruments). Time dummies are included as external instruments. Robust t-statistics are reported in brackets. AB-AR1 and AB-AR2 are the Arellano–Bond statistics for first- and second- autocorrelation of residuals. Robust SEs are in parantheses. p-values are in square brackets. ***, ** and * Denote significance at the 1%, 5%, and 10% levels, respectively.

Turning to the control variables, we see that trade openness, $trade_{it}$, has a positive effect on the magnitude of output growth volatility. Although the effect is significant in Column (I), it is insignificant in the rest of columns. We also find that the effect of government size, $gov_{it}$, does not have a consistent pattern across the

regressions and it is insignificant. Although the level of the inflation rate is positive and insignificant in Columns (II) and (IV), in the rest of columns it is positive and significant. The size of inflation fluctuations is associated with larger output growth volatility and significant in all specifications considered. Moreover, the first lag of the dependent variable is positively signed and significant at the 1% level in all specifications considered.

The OECD dummy is negatively related with output growth volatility but statistically insignificant. Finally, the post-crisis dummy is significantly and positively related with output growth volatility (at 5% or 10% level).

The Arellano–Bond test of residual autocorrelation of second order shows that autocorrelation is sufficiently captured by the lagged dependent variable. Similarly, the Hansen J-test of over-identifying restrictions does not reject the null that the instruments are uncorrelated with the error term in the second-stage estimation.

Overall, we conclude that stock market development and banking sector development are conducive to reduce the volatility of output growth and the volatility of output growth is negatively related to the development of the financial markets relative to the banking sectors.

In Table 4, we simultaneously add financial market development and banking sector development indicators in the same regression. Columns (I) and (V) indicate that our proxies for financial market development, $capital_{it}$, has negative effects on output growth volatility and it is significant at 5% and 5% level of confidence respectively. Our alternative proxies for financial market development, $value_{it}$ has negative effects on volatility but statistically insignificant. Similarly, the indicators of banking sector development, $credit_{it}$ and $assets_{it}$, are negatively signed but insignificant. The result of control variables, the OECD dummy, the post-crisis dummy, the Arellano–Bond test and the Hansen J-test are similar to Table 3.

The empirical results of this regression show that stock market development can be effective at reducing the output growth volatility; however, banking sector development has a less clear role in affecting output growth volatility. In addition, countries with a relatively stock market based financial system appear to experience a lower volatility in GDP growth.

**Table 4:** Output volatility and financial development, system GMM: Simultaneous regression

$$\log vola_{it} = \delta MRKDEV_{it} + \lambda BNKDEV_{it} + \beta X_{it} + \gamma \log vola_{it-1} + \varepsilon_{it}$$

| | (I) | (II) | (III) | (IV) |
|---|---|---|---|---|
| **capital$_{it}$** | -0.136** | | -0.142*** | |
| | (0.062) | | (0.054) | |
| **value$_{it}$** | | -0.040 | | -0.040 |
| | | (0.029) | | (0.026) |
| **credit$_{it}$** | -0.100 | -0.181* | | |
| | (0.116) | (0.103) | | |
| **asset$_{it}$** | | | -0.049 | -0.120 |
| | | | (0.098) | (0.090) |
| **fintype$_{it}$** | | | | |
| **vola$_{it-1}$** | 0.144*** | 0.136*** | 0.140*** | 0.131*** |
| | (0.038) | (0.039) | (0.038) | (0.037) |
| **trade$_{it}$** | 0.611** | 0.403 | 0.516* | 0.293 |
| | (0.262) | (0.280) | (0.263) | (0.269) |
| **gov$_{it}$** | 0.034 | 0.092 | 0.078 | 0.123 |
| | (0.208) | (0.201) | (0.205) | (0.198) |
| **infn$_{it}$** | 0.033 | 0.036 | 0.041 | 0.056 |
| | (0.044) | (0.041) | (0.045) | (0.041) |
| **vol_inf$_{it}$** | 0.102*** | 0.118*** | 0.106*** | 0.113*** |
| | (0.037) | (0.039) | (0.038) | (0.038) |
| **Post2007** | 0.254** | 0.256** | 0.223** | 0.218** |
| | (0.101) | (0.101) | (0.097) | (0.096) |
| **OECD$_i$** | -0.046 | 0.009 | -0.106 | -0.059 |
| | (0.161) | (0.151) | (0.159) | (0.156) |
| **constant** | 0.355 | 0.518 | 0.554 | 0.739 |
| | (0.484) | (0.442) | (0.486) | (0.460) |
| **Observations** | 1,226 | 1,220 | 1,238 | 1,232 |
| **Hansen_J-test** | 62.312 | 65.993 | 62.107 | 68.586 |
| | 1 | 1 | 1 | 1 |
| **AB-AR1** | -6.68 | -6.652 | -6.701 | -6.686 |
| | 0 | 0 | 0 | 0 |
| **AB-AR2** | 0.779 | 0.705 | 0.846 | 0.763 |
| | 0.436 | 0.481 | 0.397 | 0.445 |

Notes: Dependent variable is vol$_{it}$. Explanatory variables are treated as endogenous, and they are instrumented with all their lags up to a maximum of three lags (GMM instruments). Time dummies are included as external instruments. Robust t-statistics are reported in brackets. AB-AR1 and AB-AR2 are the Arellano–Bond statistics for first- and second- autocorrelation of residuals. Robust SEs are in parantheses. p-values are in square brackets. ***, ** and * Denote significance at the 1%, 5%, and 10% levels, respectively.

**Table 5:** Output volatility and financial development, system GMM: with Dummy_OECD*FINDEV

$$logvola_{it} = \alpha logFIN_{it} + Dummy_{OECD} * logFIN_{it} + \beta X_{\ it} + \gamma logvola_{it-1} + \varepsilon_{it}$$

| | (I) | (II) | (III) | (IV) | (V) |
|---|---|---|---|---|---|
| **capital$_{it}$** | -0.143*** | | | | |
| | (0.053) | | | | |
| **Doecdcapital$_{it}$** | -0.009 | | | | |
| | (0.117) | | | | |
| **value$_{it}$** | | -0.052* | | | |
| | | (0.030) | | | |
| **Doecdvalue$_{it}$** | | -0.005 | | | |
| | | (0.066) | | | |
| **credit$_{it}$** | | | -0.212 | | |
| | | | (0.135) | | |
| **Doecdcredit$_{it}$** | | | -0.093 | | |
| | | | (0.229) | | |
| **logasset$_{it}$** | | | | -0.191 | |
| | | | | (0.127) | |
| **Doecdasset$_{it}$** | | | | 0.001 | |
| | | | | (0.241) | |
| **fintype$_{it}$** | | | | | -0.131** |
| | | | | | (0.058) |
| **Doecdfintype$_{it}$** | | | | | 0.047 |
| | | | | | (0.104) |
| **vol$_{it-1}$** | 0.152*** | 0.145*** | 0.135*** | 0.135*** | 0.149*** |
| | (0.039) | (0.038) | (0.038) | (0.038) | (0.037) |
| **trade$_{it}$** | 0.586** | 0.306 | 0.482 | 0.403 | 0.380 |
| | (0.280) | (0.281) | (0.349) | (0.336) | (0.271) |
| **gov$_{it}$** | -0.028 | 0.058 | 0.252 | 0.216 | -0.009 |
| | (0.224) | (0.206) | (0.230) | (0.218) | (0.222) |
| **infn$_{it}$** | 0.046 | 0.075* | 0.068 | 0.084* | 0.086** |
| | (0.045) | (0.041) | (0.044) | (0.044) | (0.042) |
| **vol_inf$_{it}$** | 0.072* | 0.076* | 0.113*** | 0.116*** | 0.068* |
| | (0.039) | (0.039) | (0.041) | (0.040) | (0.039) |
| **Post2007** | 0.180* | 0.169* | 0.245** | 0.192* | 0.201** |
| | (0.100) | (0.098) | (0.108) | (0.098) | (0.093) |
| **OECD$_i$** | -0.110 | -0.076 | -0.181 | -0.168 | -0.155 |
| | (0.178) | (0.211) | (0.201) | (0.175) | (0.174) |
| **constant** | 0.291 | 0.605 | 1.041** | 1.116** | 0.571 |
| | (0.520) | (0.457) | (0.488) | (0.481) | (0.494) |
| **Observations** | 1,259 | 1,252 | 1,257 | 1,273 | 1,238 |
| **Hansen_J-test** | 67,583 | 67,792 | 62,669 | 64,685 | 64,722 |
| | 1 | 1 | 1 | 1 | 1 |
| **AB-AR1** | -6,817 | -6,781 | -6,739 | -6,812 | -6,71 |
| | 0 | 0 | 0 | 0 | 0 |
| **AB-AR2** | 0,719 | 0,646 | 0,518 | 0,627 | 0,891 |
| | 0,472 | 0,518 | 0,605 | 0,531 | 0,373 |

Notes: Same as Table 3.

In Table 5, we add the interaction term of dummy for OECD countries and financial development indicators in the regression. Our purpose is to understand whether the effect of financial market development or banking sector development on business cycle volatility differs for OECD countries. That is, we are testing the response of business cycle volatility to financial development across countries and whether the slope change accordingly. Our proxies for financial market development, $capital_{it}$ and $value_{it}$ have negative effects on output growth volatility, and they are significant at 1% and 10% level of confidence, respectively. On the other hand, the indicators of banking sector development, $credit_{it}$ and $assets_{it}$, are negatively signed but insignificant. These results show that stock market development is effective in dampening the output growth volatility, while banking sector development has a less clear role.

The interaction terms are insignificant in all of the regressions showing that financial development does not have a different effect on volatility in OECD countries compared to the other countries in the sample.

In Table 6, we add the interaction term of dummy for 2008 crisis and financial development indicators in the regression. Our purpose is to understand whether the effect of financial market development or banking sector development on business cycle volatility is different for the crisis period (*post2007*). Our proxies for financial market development, $capital_{it}$ and $value_{it}$ have negative effects on output growth volatility but only $capital_{it}$ is significant at 1% level of confidence. The indicators of banking sector development, $credit_{it}$ and $assets_{it}$, are negatively signed and significant at 5% level of confidence. The empirical results of this regression show that stock market development is effective in dampening the volatility of output. Similarly, banking sector development has an effective role in dampening the volatility of output.

The interaction terms are negatively signed but statistically insignificant except for $capital_{it}$. This negative sign shows that stock market development has an extra negative effect on business cycle volatility during the 2008 crisis period. However, for other financial development indicators we do not get such an effect.

**Table 6:** Output volatility and financial development, system GMM: with Dummy_Crisis*FINDEV in the case of dummy for OECD countries

$$logvola_{it} = \alpha logFIN_{it} + Dummy\_crisis * logFIN_{it} + \beta X_{it} + \gamma logvola_{it-1} + \varepsilon_{it}$$

| | (I) | (II) | (III) | (IV) | (V) |
|---|---|---|---|---|---|
| **capital$_{it}$** | -0.133*** | | | | |
| | (0.049) | | | | |
| **Dcrisiscapital$_{it}$** | -0.209* | | | | |
| | (0.111) | | | | |
| **value$_{it}$** | | -0.049 | | | |
| | | (0.030) | | | |
| **Dcrisisvalue$_{it}$** | | -0.023 | | | |
| | | (0.048) | | | |
| **credit$_{it}$** | | | -0.237** | | |
| | | | (0.114) | | |
| **Dcrisiscredit$_{it}$** | | | -0.051 | | |
| | | | (0.140) | | |
| **asset$_{it}$** | | | | -0.219** | |
| | | | | (0.104) | |
| **Dcrisisasset$_{it}$** | | | | 0.153 | |
| | | | | (0.136) | |
| **fintype$_{it}$** | | | | | -0.086* |
| | | | | | (0.050) |
| **Dcrisisfintype$_{it}$** | | | | | -0.213 |
| | | | | | (0.131) |
| **vol$_{it-1}$** | 0.148*** | 0.145*** | 0.136*** | 0.137*** | 0.151*** |
| | (0.039) | (0.039) | (0.038) | (0.038) | (0.038) |
| **trade$_{it}$** | 0.627** | 0.315 | 0.528 | 0.399 | 0.375 |
| | (0.266) | (0.261) | (0.339) | (0.315) | (0.264) |
| **gov$_{it}$** | -0.021 | 0.064 | 0.260 | 0.214 | -0.016 |
| | (0.226) | (0.208) | (0.234) | (0.216) | (0.225) |
| **infn$_{it}$** | 0.057 | 0.079** | 0.069 | 0.078* | 0.095** |
| | (0.044) | (0.039) | (0.044) | (0.043) | (0.043) |
| **vol_inf$_{it}$** | 0.073* | 0.076* | 0.109*** | 0.114*** | 0.067* |
| | (0.038) | (0.039) | (0.040) | (0.038) | (0.039) |
| **Post2007** | 0.019 | 0.125 | 0.215* | 0.242** | 0.092 |
| | (0.152) | (0.149) | (0.117) | (0.104) | (0.126) |
| **OECD$_i$** | -0.120 | -0.071 | -0.134 | -0.160 | -0.201 |
| | (0.157) | (0.154) | (0.169) | (0.160) | (0.161) |
| **constant** | 0.360 | 0.634 | 1.015** | 1.070** | 0.618 |
| | (0.531) | (0.469) | (0.481) | (0.469) | (0.501) |
| **Observations** | 1,259 | 1,252 | 1,257 | 1,273 | 1,238 |
| **Hansen J-test** | 60,848 | 68,129 | 66,335 | 67,522 | 63,145 |
| | 1 | 1 | 1 | 1 | 1 |
| **AB-AR1** | -6,815 | -6,798 | -6,735 | -6,819 | -6,701 |
| | 0 | 0 | 0 | 0 | 0 |
| **AB-AR2** | 0,724 | 0,639 | 0,51 | 0,629 | 0,922 |
| | 0,469 | 0,523 | 0,61 | 0,529 | 0,356 |

Notes: Same as Table 3.

## 5. Conclusion

We empirically analyze the effect of financial system development on business cycle volatility. We also investigate whether macroeconomic volatility depends on the type of the financial system: market-based versus bank-based. Our results show that economies characterized by more developed financial systems, and in particular with developed financial markets, experience less volatility in output growth. That is, stock market development is effective in dampening the output growth volatility, while banking sector development has a less clear role. We also find that financial development does not have a different effect on volatility in OECD countries compared to the other countries in the sample. In addition, our results show that stock market development has an extra negative effect on business cycle volatility during the 2008 crisis period. Moreover, we find that countries with a relatively stock market based financial system appear to experience less volatility in real per capita GDP growth. Our results suggest that a country with both banking sector development and a relatively more developed stock market can achieve higher macroeconomic stability. With respect to the theoretical motivation for the analysis discussed in Section 2, our results are consistent with the idea that financial development helps to mitigate shocks, eases risk diversification, and gathers information efficiently. In addition, our results are also in line with the idea that financial development helps to overcome corporate governance issues and therefore maintains macroeconomic stability.

**Appendix A:** Variable definitions, sources and list of countries

| Variable name | Source | Definition |
|---|---|---|
| ***Log Real GDP per capita*** | World Development Indicators, World Bank | Logarithm of real GDP per capita(constant 2005 USD) |
| $\boldsymbol{credit_{it}}$ | Thorsten Beck, Asli Demirgüç-Kunt and Ross Levine, 2000 (updated April 2013) | Private credits by deposit money banks in relation to GDP in logs. |
| $\boldsymbol{assets_{it}}$ | Thorsten Beck, Asli Demirgüç-Kunt and Ross Levine, 2000 (updated April 2013) | Deposit money bank assets in relation to GDP in logs. |
| $\boldsymbol{capital_{it}}$ | Thorsten Beck, Asli Demirgüç-Kunt and Ross Levine, 2000 (updated April 2013) | Stock market capitalization in relation to GDP in logs. |
| $\boldsymbol{value_{it}}$ | Thorsten Beck, Asli Demirgüç-Kunt and Ross Levine, 2000 (updated April 2013) | Stock market total value traded in relation to GDP in logs. |
| $\boldsymbol{trade_{it}}$ | World Development Indicators, World Bank | Exports and Imports in relation to GDP in logs. |
| $\boldsymbol{gov_{it}}$ | World Development Indicators, World Bank | Government expenditures in relation to GDP in logs. |
| $\boldsymbol{inf_{it}}$ | World Development Indicators, World Bank | Annual inflation rate in logs. |
| $\boldsymbol{vol_{inf}}$ | Own estimation. | Inflation volatility. |
| $\boldsymbol{vola_{it}}$ | Own estimation. | Volatility in real per capita GDP growth. |
| ***FinType*** | Own estimation | Type of financial system: $capital_{it/}$ $credit_{it}$ |
| ***FinType-alt*** | Own estimation. | Type of financial system: $capital_{it/}$ $assets_{it}$ |
| $\boldsymbol{OECD_i}$ | Own estimation. | Dummy variable for OECD members. |
| ***Post2007*** | Own estimation | Dummy variable for 2008 crisis. |

## List of Countries:

| Country | Income Group | Mean (volatility) | Mean (credit) | Mean (capital) |
|---|---|---|---|---|
| **Argentina** | Upper-middle-income economies | 1,460164 | -1,891541 | -1,625941 |
| **Australia** | High-income OECD members | -0,1388566 | -0,2106875 | -0,1913331 |
| **Austria** | High-income OECD members | -0,2807114 | 0,008228 | -1,755391 |
| **Barbados** | High-income nonOECD members | 0,3689148 | -0,6113991 | -0,399657 |
| **Belgium** | High-income OECD members | -0,1957684 | -0,3419608 | -0,6371753 |
| **Botswana** | Upper-middle-income economies | 0,3518065 | -1,925039 | -1,818131 |
| **Brazil** | Upper-middle-income economies | 0,1871568 | -1,107788 | -1,465866 |
| **Canada** | High-income OECD members | -0,1639202 | -0,0774288 | -0,1839112 |
| **China** | Upper-middle-income economies | -0,2050887 | -0,0480035 | -1,353781 |
| **Colombia** | Upper-middle-income economies | -0,3862144 | -1,330731 | -1,80985 |
| **Cote d'Ivoire** | Lower-middle-income economies | 0,4318925 | -1,713631 | -2,206866 |
| **Croatia** | High-income nonOECD members | 0,0906848 | -0,8972833 | -1,635532 |
| **Cyprus** | High-income nonOECD members | 0,4804489 | 0,3838901 | -1,072313 |
| **Czech Republic** | High-income OECD members | 0,2282819 | -0,7636951 | -1,480481 |
| **Denmark** | High-income OECD members | -0,2088522 | -0,3449076 | -0,7447766 |
| **Ecuador** | Upper-middle-income economies | 0,1794418 | -1,506011 | -2,584321 |
| **Egypt, Arab Rep.** | Lower-middle-income economies | -0,5712194 | -1,00184 | -1,465675 |
| **Estonia** | High-income OECD members | 0,9548517 | -0,9715211 | -1,440619 |
| **Finland** | High-income OECD members | 0,2679061 | -0,3711272 | -0,468311 |
| **France** | High-income OECD members | -0,1035371 | -0,0878094 | -0,5767596 |
| **Germany** | High-income OECD members | -0,1749005 | 0,0720532 | -0,9689484 |
| **Ghana** | Lower-middle-income economies | -0,1221245 | -2,508873 | -2,220492 |
| **Greece** | High-income OECD members | 0,108355 | -0,7408819 | -1,161781 |
| **Hong Kong SAR, China** | High-income nonOECD members | 0,3931148 | 0,3656625 | 1,034672 |
| **Hungary** | High-income OECD members | 0,366061 | -1,090114 | -1,972522 |
| **Iceland** | High-income OECD members | 0,2697906 | -0,1558363 | -0,7530437 |
| **India** | Lower-middle-income economies | -0,0261968 | -1,250249 | -1,032977 |
| **Indonesia** | Lower-middle-income economies | 0,5076559 | -1,195116 | -1,625879 |
| **Iran, Islamic Rep.** | Upper-middle-income economies | 0,6627252 | -1,548114 | -2,115661 |
| **Ireland** | High-income OECD members | -0,3866941 | -0,0736071 | -0,7338205 |
| **Israel** | High-income OECD members | 0,0360409 | -0,3292365 | -0,7377068 |
| **Italy** | High-income OECD members | 0,0828274 | -0,3381874 | -1,288168 |
| **Japan** | High-income OECD members | -0,2025156 | 0,3345217 | -0,2830764 |
| **Jordan** | Upper-middle-income economies | 0,648627 | -0,3852435 | -0,1017219 |
| **Korea, Rep.** | High-income OECD members | 0,6653606 | -0,3876234 | -0,7647626 |
| **Kuwait** | High-income nonOECD members | 0,3144847 | -0,8811504 | -0,2346463 |
| **Lithuania** | Upper-middle-income economies | 1,635521 | -1,647935 | -1,93844 |
| **Luxembourg** | High-income OECD members | 0,3927482 | 0,1762583 | 0,3353724 |
| **Malaysia** | Upper-middle-income economies | 0,2568211 | 0,0740363 | 0,3900463 |
| **Malta** | High-income nonOECD members | 0,5804136 | -0,015434 | -1,248643 |
| **Mauritius** | Upper-middle-income economies | 0,46551 | -0,6422244 | -1,137143 |
| **Mexico** | Upper-middle-income economies | 0,3393523 | -1,697075 | -1,357169 |
| **Mongolia** | Lower-middle-income economies | 0,9032691 | -2,023246 | -3,331735 |

| | | | | |
|---|---|---|---|---|
| **Morocco** | Lower-middle-income economies | 0,8631097 | -0,89433 | -1,411639 |
| **Netherlands** | High-income OECD members | -0,6345121 | 0,2076384 | -0,1668666 |
| **New Zealand** | High-income OECD members | 0,2778537 | 0,0250401 | -0,9485908 |
| **Norway** | High-income OECD members | 0,1485579 | -0,4550624 | -1,007066 |
| **Pakistan** | Lower-middle-income economies | -0,1295483 | -1,454647 | -1,819986 |
| **Panama** | Upper-middle-income economies | 0,5848313 | -0,3837311 | -1,59386 |
| **Peru** | Upper-middle-income economies | 0,8451159 | -1,880207 | -1,629743 |
| **Philippines** | Lower-middle-income economies | -0,5349191 | -1,265876 | -0,8362357 |
| **Poland** | High-income OECD members | 0,093357 | -1,474562 | -2,31781 |
| **Portugal** | High-income OECD members | 0,4534302 | -0,0168119 | -1,300799 |
| **Romania** | Upper-middle-income economies | 1,303249 | -1,947187 | -3,119344 |
| **Russian Federation** | Upper-middle-income economies | 1,590063 | -1,799702 | -2,163606 |
| **Saudi Arabia** | High-income nonOECD members | 0,4054948 | -1,342686 | -0,6564263 |
| **Singapore** | High-income nonOECD members | 0,4993005 | -0,0873479 | 0,4326391 |
| **Slovak Republic** | High-income OECD members | 1,065093 | -0,8906098 | -2,889378 |
| **Slovenia** | High-income OECD members | 0,3616466 | -0,9808873 | -1,96402 |
| **South Africa** | Upper-middle-income economies | -0,2819402 | -0,4582877 | 0,4794104 |
| **Spain** | High-income OECD members | 0,1002571 | 0,0343459 | -0,6435993 |
| **Sri Lanka** | Lower-middle-income economies | -0,3802899 | -1,526431 | -1,953376 |
| **Sweden** | High-income OECD members | -0,133037 | -0,5195639 | -0,2042244 |
| **Switzerland** | High-income OECD members | -0,4995117 | 0,4439718 | 0,5194958 |
| **Thailand** | Upper-middle-income economies | 0,5995958 | 0,0486423 | -0,7035803 |
| **Trinidad and Tobago** | High-income nonOECD members | 0,4589113 | -1,241352 | -0,9732445 |
| **Tunisia** | Upper-middle-income economies | 0,1524373 | -0,6252924 | -2,261594 |
| **Turkey** | Upper-middle-income economies | 0,9292123 | -1,773192 | -1,738957 |
| **United Kingdom** | High-income OECD members | 0,1956294 | 0,277899 | 0,2053864 |
| **United States** | High-income OECD members | -0,2428677 | -0,6597672 | 0,0640739 |

Note 1: According to World Bank classification, we consider high income countries as developed and upper-middle and lower-middle income countries as developing countries.
Note 2: G-7 countries are: Canada, France, Germany, Italy, Japan, United Kingdom and United States.

**Appendix B:** Additional Tables

**Table 7:** Output volatility and financial development, system GMM: Simultaneous regression with interaction terms

$$\log vola_{it} = \delta MRKDEV_{it} + \lambda BNKDEV_{it} + \theta MRKDEV_{it} * BNKDEV_{it} + \beta X_{it} + \gamma \log vola_{it-1} + \varepsilon_{it}$$

| | (I) | (II) | (III) | (IV) |
|---|---|---|---|---|
| **capital$_{it}$** | -0.171** | -0.187*** | | |
| | (0.076) | (0.059) | | |
| **value$_{it}$** | | | -0.047 | -0.047* |
| | | | (0.031) | (0.027) |
| **credit$_{it}$** | -0.142 | | -0.212* | |
| | (0.093) | | (0.114) | |
| **asset$_{it}$** | | -0.112 | | -0.179 |
| | | (0.080) | | (0.120) |
| **credit*capital$_{it}$** | -0.062 | | | |
| | (0.048) | | | |
| **credit*value$_{it}$** | | | -0.019 | |
| | | | (0.029) | |
| **asset*capital$_{it}$** | | -0.066 | | |
| | | (0.048) | | |
| **asset*value$_{it}$** | | | | -0.021 |
| | | | | (0.029) |
| **fintype$_{it}$** | | | | |
| **vola$_{it-1}$** | 0.145*** | 0.146*** | 0.136*** | 0.132*** |
| | (0.036) | (0.036) | (0.038) | (0.037) |
| **trade$_{it}$** | 0.692*** | 0.588** | 0.392 | 0.309 |
| | (0.214) | (0.226) | (0.249) | (0.230) |
| **gov$_{it}$** | 0.015 | 0.008 | 0.068 | 0.078 |
| | (0.185) | (0.177) | (0.173) | (0.167) |
| **infn$_{it}$** | 0.061 | 0.035 | 0.043 | 0.052 |
| | (0.044) | (0.045) | (0.043) | (0.043) |
| **vol_inf$_{it}$** | 0.101*** | 0.114*** | 0.106*** | 0.122*** |
| | (0.035) | (0.036) | (0.037) | (0.037) |
| **Post2007** | 0.229** | 0.213** | 0.250** | 0.214** |
| | (0.095) | (0.094) | (0.098) | (0.094) |
| **OECD$_i$** | -0.075 | -0.120 | -0.028 | -0.082 |
| | (0.146) | (0.156) | (0.141) | (0.153) |
| **constant** | 0.429 | 0.418 | 0.487 | 0.676 |
| | (0.447) | (0.452) | (0.419) | (0.421) |
| **Observations** | 1,226 | 1,238 | 1,220 | 1,232 |
| **HansenJ-test** | 62.312 | 65.231 | 62.326 | 62.385 |
| | 1 | 1 | 1 | 1 |
| **AB-AR1** | -6.68 | -6.606 | -6.633 | -6.623 |
| | 0 | 0 | 0 | 0 |
| **AB-AR2** | 0.779 | 0.942 | 0.694 | 0.793 |
| | 0.436 | 0.346 | 0.488 | 0.428 |

Notes: Same as Table 3.

In Table 7, we simultaneously add financial market development and banking sector development indicators in the regression as well as the interaction term. Our purpose is to understand whether the effect of financial market development on business cycle volatility differs depending on the value of banking sector development; similarly, whether the effect of banking sector development on business cycle volatility differs depending on the value of financial market development. Our proxies for financial market development, $capital_{it}$ and $value_{it}$ have negative effects on output growth volatility and they are significant. On the other hand, the indicators of banking sector development, $credit_{it}$ and $assets_{it}$, are negatively signed but insignificant. These results show that stock market development is effective in dampening the output growth volatility, while banking sector development has a less clear role.

The interaction terms are insignificant in all of the regressions showing that the effect of financial market development on business cycle volatility does not differ depending on the value of banking sector development; similarly, the effect of banking sector development on business cycle volatility does not differ depending on the value of financial market development.

In Table 8, we add the interaction term of dummy for G-7 countries and financial development indicators in the regression. Our purpose is to understand whether the effect of financial market development or banking sector development on business cycle volatility is different for G-7 countries. Our proxies for financial market development, $capital_{it}$ and $value_{it}$ have negative effects on output growth volatility, and they are significant at 1% and 5% level of confidence, respectively. In addition, the indicators of banking sector development, $credit_{it}$ and $assets_{it}$, are negatively signed, and they are significant at 5% levels of confidence. These results show that stock market development and banking sector development are effective in dampening the output growth volatility.

The interaction terms are insignificant in all of the regressions showing that financial development does not a have different effect on volatility in G-7 countries compared to the other countries in the sample.

**Table 8:** Output volatility and financial development, system GMM: with Dummy_G7*FINDEV

$$logvola_{it} = \alpha logFIN_{it} + Dummy_{G7} * logFIN_{it} + \beta X_{\ it} + \gamma logvola_{it-1} + \varepsilon_{it}$$

| | (I) | (II) | (III) | (IV) | (V) |
|---|---|---|---|---|---|
| **capital$_{it}$** | -0.157*** | | | | |
| | (0.046) | | | | |
| **DG7capital$_{it}$** | 0.465 | | | | |
| | (0.458) | | | | |
| **value$_{it}$** | | -0.063** | | | |
| | | (0.027) | | | |
| **DG7value$_{it}$** | | 0.202 | | | |
| | | (0.232) | | | |
| **credit$_{it}$** | | | -0.280** | | |
| | | | (0.112) | | |
| **DG7credit$_{it}$** | | | 0.946 | | |
| | | | (0.822) | | |
| **asset$_{it}$** | | | | -0.220** | |
| | | | | (0.093) | |
| **DG7asset$_{it}$** | | | | 0.395 | |
| | | | | (0.821) | |
| **fintype$_{it}$** | | | | | -0.136** |
| | | | | | (0.055) |
| **DG7fintype$_{it}$** | | | | | 0.714 |
| | | | | | (0.491) |
| **vol$_{it-1}$** | 0.151*** | 0.146*** | 0.139*** | 0.137*** | 0.147*** |
| | (0.038) | (0.039) | (0.038) | (0.038) | (0.037) |
| **trade$_{it}$** | 0.582** | 0.305 | 0.534 | 0.386 | 0.365 |
| | (0.280) | (0.289) | (0.372) | (0.339) | (0.279) |
| **gov$_{it}$** | -0.092 | 0.018 | 0.173 | 0.105 | -0.166 |
| | (0.197) | (0.191) | (0.222) | (0.197) | (0.189) |
| **infn$_{it}$** | 0.046 | 0.077* | 0.061 | 0.079* | 0.089** |
| | (0.045) | (0.040) | (0.046) | (0.046) | (0.044) |
| **vol_inf$_{it}$** | 0.073* | 0.075* | 0.108*** | 0.118*** | 0.073* |
| | (0.039) | (0.039) | (0.039) | (0.037) | (0.040) |
| **Post2007** | 0.189* | 0.163* | 0.234** | 0.196* | 0.231** |
| | (0.100) | (0.097) | (0.106) | (0.101) | (0.095) |
| **G7$_i$** | 0.160 | 0.169 | 0.046 | -0.113 | 0.432 |
| | (0.386) | (0.394) | (0.365) | (0.416) | (0.489) |
| **constant** | 0.118 | 0.475 | 0.743* | 0.826** | 0.213 |
| | (0.435) | (0.394) | (0.429) | (0.412) | (0.424) |
| **Observations** | 1,259 | 1,252 | 1,257 | 1,273 | 1,238 |
| **Hansen J-test** | 62,375 | 66,508 | 67,354 | 65,389 | 62,692 |
| | 1 | 1 | 1 | 1 | 1 |
| **AB-AR1** | -6,799 | -6,778 | -6,735 | -6,813 | -6,674 |
| | 0 | 0 | 0 | 0 | 0 |
| **AB-AR2** | 0,715 | 0,659 | 0,533 | 0,649 | 0,887 |
| | 0,475 | 0,51 | 0,594 | 0,516 | 0,375 |

Notes: Same as Table 3.

**Table 9:** Output volatility and financial development, system GMM: with Dummy_Crisis*FINDEV in the case of dummy for G-7 countries

$$logvola_{it} = \alpha logFIN_{it} + Dummy_{crisis} * logFIN_{it} + \beta X_{it} + \gamma logvola_{it-1} + \varepsilon_{it}$$

| | (I) | (II) | (III) | (IV) | (V) |
|---|---|---|---|---|---|
| **capital$_{it}$** | -0.136*** | | | | |
| | (0.047) | | | | |
| **Dcrisiscapital$_{it}$** | -0.201* | | | | |
| | (0.110) | | | | |
| **value$_{it}$** | | -0.053* | | | |
| | | (0.029) | | | |
| **Dcrisisvalue$_{it}$** | | -0.020 | | | |
| | | (0.047) | | | |
| **credit$_{it}$** | | | -0.276** | | |
| | | | (0.114) | | |
| **Dcrisiscredit$_{it}$** | | | -0.062 | | |
| | | | (0.139) | | |
| **asset$_{it}$** | | | | -0.247** | |
| | | | | (0.106) | |
| **Dcrisisasset$_{it}$** | | | | 0.161 | |
| | | | | (0.139) | |
| **fintype$_{it}$** | | | | | -0.073 |
| | | | | | (0.051) |
| **Dcrisisfintype$_{it}$** | | | | | -0.200 |
| | | | | | (0.128) |
| **vol$_{it-1}$** | 0.150*** | 0.146*** | 0.137*** | 0.138*** | 0.154*** |
| | (0.039) | (0.039) | (0.038) | (0.038) | (0.038) |
| **trade$_{it}$** | 0.598** | 0.303 | 0.577 | 0.395 | 0.327 |
| | (0.282) | (0.286) | (0.368) | (0.340) | (0.276) |
| **gov$_{it}$** | -0.122 | 0.009 | 0.175 | 0.106 | -0.173 |
| | (0.196) | (0.190) | (0.228) | (0.196) | (0.188) |
| **infn$_{it}$** | 0.058 | 0.080** | 0.067 | 0.074 | 0.101** |
| | (0.046) | (0.040) | (0.046) | (0.046) | (0.045) |
| **vol_inf$_{it}$** | 0.075* | 0.076* | 0.113*** | 0.118*** | 0.071* |
| | (0.039) | (0.039) | (0.039) | (0.037) | (0.039) |
| **Post2007** | 0.033 | 0.136 | 0.229* | 0.257** | 0.108 |
| | (0.149) | (0.146) | (0.117) | (0.105) | (0.123) |
| **G7$_i$** | -0.033 | 0.018 | 0.099 | -0.021 | -0.045 |
| | (0.334) | (0.328) | (0.371) | (0.392) | (0.332) |
| **constant** | 0.132 | 0.498 | 0.760* | 0.787* | 0.287 |
| | (0.441) | (0.401) | (0.440) | (0.413) | (0.417) |
| **Observations** | 1,259 | 1,252 | 1,257 | 1,273 | 1,238 |
| **Hansen J-test** | 60,673 | 66,631 | 67,088 | 65,038 | 65,649 |
| | 1 | 1 | 1 | 1 | 1 |
| **AB-AR1** | -6,829 | -6,8 | -6,733 | -6,813 | -6,718 |
| | 0 | 0 | 0 | 0 | 0 |
| **AB-AR2** | 0,749 | 0,653 | 0,536 | 0,651 | 0,965 |
| | 0,454 | 0,514 | 0,592 | 0,515 | 0,334 |

Notes: Same as Table 3.

In Table 9, we add the interaction term of dummy for 2007 crisis and financial development indicators in the regression. Our purpose is to understand whether the effect of financial market development or banking sector development on business cycle volatility is different for the crisis period (*post2007*). Our proxies for financial market development, $capital_{it}$ and $value_{it}$ have negative effects on output growth volatility, and they are significant at 1% and 5% level of confidence, respectively. In addition, the indicators of banking sector development, $credit_{it}$ and $assets_{it}$, are negatively signed, and they are significant at and 5% levels of confidence. The empirical results of this regression show that stock market development and banking sector development are effective in dampening the output growth volatility.

The interactions term are negatively signed except $assets_{it}$ but they are insignificant except for $capital_{it}$ at 10% level of confidence. This negative sign shows that stock market development has an extra negative effect on business cycle volatility during the 2008 crisis period. However, for other financial development indicators we do not get such an effect.

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