Finance and Output Volatility During the Global Financial Crisis

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Abstract
This paper assesses the effectiveness of financial depth and financial inclusion in the mitigation of output volatility during the 2008-2010 Global Financial Crisis. The paper also evaluates whether finance is more effective in countries with more developed financial systems, higher levels of economic developments, sounder banking systems, and better political stability. Employing a cross-sectional dataset covering more than 100 countries, our results indicate the ability of finance in subduing output volatility during the crisis. Our evidence is also concrete in suggesting the ability of finance in reducing output volatility in more financially developed, advanced, and politically stable countries. However, the evidence is unclear on whether finance is beneficial for countries characterized by low, intermediate, or high banking stability. In addition to these findings, the preponderance of evidence tends to suggest the better ability of financial usage as compared to financial access in mitigating aggregate fluctuations during the crisis. Finally, our additional analysis reveals that finance functions well in stabilizing output when output volatility is high.

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1. Introduction

During the 2008-2010 Global Financial Crisis (GFC), economies around the world experienced heightened output volatility. However, the degree of output fluctuations during the period varied quite markedly across countries. While there could be various explanations for these variations, the role of finance in dampening or magnifying aggregate fluctuations has re-emerged and placed under the spotlight. On one hand, through channels such as consumption smoothing, relaxation of financial constraints, improvement in information, reduction in agency costs, and diversification, financial development helps to dampen aggregate fluctuations. On the other hand, the rapid expansion – or, rather, over expansion – of the financial sector has been viewed to be not only a drag on economic growth but also the main factor that aggravates real downturns during crises. More recently, with policy emphasis on promoting access to financial services by households and small firms, some have added financial inclusion to the debate on the relations between finance and output volatility.[1]

Empirically, recent studies have not provided a concrete evidence on whether finance helps to mitigate aggregate fluctuations. Karaman and Yildirim-Karaman (2019), for instance, provide evidence for the reduced negative effect of uncertainty on output in a more financially-developed economy. Likewise, Ahamed and Mallick (2019) highlight the contribution of financial inclusion to bank stability. Meanwhile, Lopez and Winkler (2019) note lower reduction in credit during turbulent periods in countries with more inclusive banking sectors. Since economic stability is closely linked to financial stability, these studies hint that output will be less volatile in more financially developed or inclusive countries. Against these favourable impacts of finance, Cavoli *et al.* (2020) document the trade-off between financial inclusion and output stability. Feghali *et al.* (2021) further note the adverse effect of especially credit inclusion on bank soundness. Finally, while Xue (2020) documents the volatility-dampening effect of financial development in especially countries with low financial development, he also suggests the aggravation of output volatility as a result of inflation volatility in developed financial markets. Thus, whether finance dampens or magnifies output volatility remains open for further inquiry.

In this paper, we continue this line of inquiry by analysing the empirical relation between finance and output volatility. Our analysis contributes to the literature

[1] Financial inclusion can be considered as a key dimension of financial development. It is related but distinct from financial depth, normally measured by private credit to GDP ratio and widely used as a measure of financial development in the literature.

in various aspects. First, we examine the finance–output volatility relationship exclusively during the GFC. From the aforementioned studies, Cavoli *et al.* (2020) and Xu (2020) evaluate the relations between finance and output volatility covering both normal and crisis periods. By controlling for the effect of the GFC or recession dummy in their empirical analyses, their findings only portray the relations between finance and output volatility in general or on average. Since it is during a period of crisis that economic dynamics and relations are likely shaken up and that economic resilience is of utmost importance, we examine the issue against the backdrop of the GFC. Second, we consider both financial depth and financial inclusion in the analysis. With the increasing recognition that finance can be a drag to growth when it is oversized and that financial inclusion is a key enabler of sustainable development, the emphasis in the finance–macroeconomy nexus has swayed away from financial depth towards financial inclusion. However, we believe that financial depth remains relevant especially for less financially-developed countries, and hence bring into the analysis the question of 'financial size or financial inclusion or both' in cyclical fluctuations. We further disaggregate financial inclusion into its access/availability and usage dimensions to shed further light on the subject. Finally, we consider whether the relations between finance and output volatility are contingent on the levels of financial depth/financial inclusion, economic development, banking sector stability, and political stability. We also look at the impact of finance across distribution of output volatility to gain additional insight.

Our paper offers several findings. We find both financial depth and financial inclusion to be important in mitigating output volatility during the GFC, and that they have a better ability in reducing economic instability in more financially developed, advanced, and politically stable countries. Further, disaggregating financial inclusion into its access and usage dimensions, we find the stabilizing role of financial usage to be more apparent. Finally, finance is effective in reducing output volatility when it is needed most; that is, during periods of high economic instability. Thus, while there are concerns regarding the potential harm resulting from financial expansion, the deepening of the financial sector with a focus on expanding financial usage would serve as a stabilizing force during economic downturns especially, when output volatility is high. Moreover, for the stabilizing role of finance to be effective, financial depth and inclusion must be accompanied by policies that bring economies to above minimum levels of financial development, economic development, and political stability.

The rest of the paper is structured as follows. In the next section, we review

related literature and state the hypotheses to be tested. Then, section 3 describes the models and data used in the analysis. Section 4 presents and discusses the estimation results. The final section, section 5, concludes with a summary of the main findings and remarks.

2. Related Literature and Hypothesis

2.1 Finance–Output Volatility Relations

In the literature, there are strong theoretical underpinnings for volatility-dampening effects of financial development. These favourable effects relate directly to the roles of financial development in relaxing financial constraints, mitigating risk, and addressing information problems. Financial development in general and financial inclusion in particular, by allowing firms and households access to financial services, enable firms to manage production risks (Levine, 1997) and households to smooth their consumption (Mehrotra and Yetman, 2015). Diversification brought by financial development, where funds are not only pooled from various sources but also allocated to various sectors, also contributes to lower output volatility via reduction in aggregate risk (Greenwood and Jovanovic, 1990). Further, with better ability to generate information regarding risk and return of alternative investments, financial development enables more efficient allocation of financial resources (Levine, 1997) and alleviates credit market imperfections and accordingly moderates the financial accelerator effect (Bernanke and Gertler, 1989, 1990). Some scholars also argue that financial development strengthens a country's capacity to absorb shocks (Denizer *et al.*, 2002) and renders monetary policy more effective (Cavoli *et al.*, 2020), leading to reduction in output volatility.

These output-stabilizing effects of financial development notwithstanding, some scholars argue that finance can be related to heightened output volatility. The expansion of credit accompanied by relaxed lending standards is a major concern emerging from the development of the financial sector (Mehrotra and Yetman, 2015; Morgan and Pontines, 2018). Being highly leveraged, economic agents may not only be vulnerable to risk but also have less ability to absorb shocks. As a result of potential relentless expansion of credit, financial development can magnify output volatility especially during periods of crisis. Furthermore, by reducing the problems of information asymmetry and hence agency costs, financial development may not necessarily lead to lower output volatility. As explained by Cavoli *et al.* (2020), the reduction in agency costs would lead to more capital being allocated to those firms that do not have sufficient internal funds. These low value firms normally have high marginal productivity of capital. Accordingly, output volatility can be magnified.

Empirically, there is a mixed picture on the output–volatility effect of financial development.[2] Early studies, such as Aghion et *al.* (2010) and Dabla-Norris and Srivisal (2013), provide evidence that financial depth measured by private credit to GDP ratio mitigates output volatility and reduces the impacts of adverse shocks. In a more recent study, Karaman and Yildirim-Karaman (2019) examine whether financial development alters the real impact of uncertainty, using a panel sample of 50 countries from 1971 to 2009. Using bank assets and alternatively private credit (both as share of gross domestic product [GDP]) as financial development proxies, they document no adverse impacts of uncertainty in countries at the higher end of financial development. Xue (2020) further provides support for the contribution of finance in reducing growth volatility in countries with low financial development. Against these findings, others have noted that financial development may not always be beneficial. For instance, Beck et *al.* (2006) and most recently Xue (2020) provide evidence that financial intermediaries magnify the effect of inflation volatility on output volatility. The unfavourable effect of finance on output fluctuations is further noted by Quardrini (2011) and Huang et *al.* (2014).

With increasing interest in financial inclusion, an aspect of financial development that is related to but distinct from the more-commonly-used financial depth, several studies have linked financial inclusion to financial and economic stability. Lopez and Winkler (2019) relate financial busts during the GFC and other crises to the initial level and progress of financial inclusion. Using data covering 189 countries from 2004 to 2017, they document evidence suggesting lower declines in credit and borrower growth during periods of crisis in more financially inclusive countries. Ahamed and Mallick (2019) focus on the relation between financial inclusion and bank stability, using a panel dataset comprising 2,653 banks from 86 countries; results from their analysis suggest positive contribution of financial inclusion to bank stability. As argued by Fernandez *et al.* (2016), banking stability helps mitigate economic volatility. Accordingly, by extension, financial inclusion should dampen growth volatility.

Feghali *et al.* (2021), however, note that financial inclusion may not necessarily be beneficial to financial stability. Making a distinction between access to payments and savings accounts and access to credit, they hypothesize potential adverse effects of access to credit. Using cross-country data from 130 economies, they

[2] While the literature on finance–output volatility, especially financial depth–output volatility, is extensive, we only review several recent studies. Readers are referred to references therein for earlier studies on the subject.

find support for the hypothesis. Moreover, they note that the adverse effects of credit inclusion are more pronounced in countries with more competitive banking sectors. Cavoli *et al.* (2020) directly examine whether financial inclusion amplifies output volatility in emerging and developing economies. Using a sample of 103 countries, they document the trade-off between financial inclusion and output stability. They document further evidence that, although the trade-off tends to be more significant in lower-income countries, the worsening output volatility applies to all countries when financial inclusion is accompanied by excessive credit growth.

Thus, based on these studies, the finance – output volatility nexus remains open for further inquiry. Cavoli *et al.* (2020), Xue (2020), and other studies evaluate the relations between finance and output volatility in both normal and crisis periods. Accordingly, the results they obtain portray the relations between finance and output volatility in general or on average and, hence, may not be extended to times of crisis. Moreover, in most cases, studies focus on either financial depth or financial inclusion. In contributing to this line of studies, our analysis addresses 'financial depth versus financial inclusion' in the absorbance or amplification of adverse shocks. Our (null) hypothesis is:

$\mathbf{H}_{01}$: there is no significant relation between financial development (depth and inclusion) and output volatility during the global financial crisis (GFC).

We follow the approach taken by Lopez and Winkler (2019) in that, given the GFC, we address whether pre-crisis financial depth or inclusion mitigates output volatility during the GFC period.

2.2. Conditionalities in Finance–Output Volatility Relations

The literature on the relation between finance and economic outcomes also considers various moderating factors. Essentially, there are four main factors that have been identified as being potentially important: financial development, economic development, financial or bank stability, and institutional quality.

Too much finance has become a major concern especially since the GFC. While financial development is generally beneficial, it may put a drag on or even negatively affect real activity once it surpasses a certain threshold. It is likely that, initially, financial development brings benefits through mitigation of risk, reduction in information problems, and relaxation of liquidity constraints. However, these benefits may be nullified or outweighed by the increasing leverage and exposure to risk that accompany further financial expansion. This non-monotonic or inverted U-shaped relation between financial depth and economic growth

receives empirical supports from the works by Cecchetti and Karroubi (2012), Law and Singh (2014), Breitenlechner *et al.* (2015), Samargandi *et al.* (2015), and Law *et al.* (2018), to name a few. The evidence that finance brings benefit in terms of dampening macroeconomic volatility when it is not oversized is also empirically supported by Ma and Song (2018), based on panel data from 68 countries over the period 1996-2012. However, when it becomes oversized, macroeconomic volatility is amplified following further growth in the financial sector. This finding is further reaffirmed by Xue (2021), where, as noted above, the contribution of finance in reducing growth volatility is apparent only in countries with low financial development. Breitenlechner *et al.* (2015) further note that the negative effect of oversized financial sector can be considerable during crises. We investigate this further in the present paper by stating the following hypothesis:

H_{02}: the relation between finance and output volatility during the global financial crisis (GFC) does not depend on the level of financial depth or inclusion.

We expect that finance will reduce output volatility at the initial stage of financial development and increases it once it surpasses a certain threshold.

In addition to the level of financial development, some scholars have pointed to the importance of economic development in shaping the relationships between finance and real activity. Arguably, an economy must reach a certain critical stage beyond which not only the demand for financial services would increase but investment opportunities would be further expanded, which would allow finance to play a greater role in promoting real activities (Ehigiamusoe and Samsurijan, 2021). In an oft-cited paper by Rioja and Valev (2004), the growth benefit of financial development is apparent in high- and middle-income countries. Meanwhile, for less developed countries, the relationship between finance and economic growth is not significant. These findings are generally supported by subsequent studies documenting more concrete evidence for the positive effects of finance on growth in developed countries (Ehigiamusoe and Samsurijan, 2021). Few studies on finance and output volatility have noted similar results. For instance, apart from evaluating non-linear relations between finance and macroeconomic volatility, Ma and Song (2018) also examine potential difference between developed and developing countries. They observe differences in financial development thresholds between the two groups of countries beyond which financial development heightens macroeconomic volatility. Further, as found by Cavoli *et al.* (2020), lower income countries have more significant trade-off between financial inclusion and output

stability. To evaluate this trade-off further, we state the following hypothesis:

H_{03}: the relation between finance and output volatility during the global financial crisis (GFC) does not depend on the level of economic development.

We posit that, in line with the literature, countries which have reached a certain level of economic development would be able to benefit more from financial development, in our case, in dampening growth volatility.

Another factor which potentially moderates the relationship between finance and output volatility is financial or banking stability. Arguably, financial stability is directly associated with the ability of economic agents to manage risk, process information, make decisions, and allocate financial resources (Jayakumar *et al.*, 2018). This means that the benefits of finance can be better materialized in an environment of financial stability. By contrast, in line with the view that finance can help mitigate the effects of uncertainty (Karaman and Yildirim-Karaman, 2019), financial development can substitute financial stability in equipping economic agents to deal with shocks. Various studies have linked financial or banking stability to economic growth (Jokipii and Monnin, 2013; Creel *et al.*, 2015; Jayakumar *et al.*, 2018) and output volatility (Fernandez et al., 2016). All document favourable real effects of financial stability. However, in an earlier study, Braun and Larrain (2005) show that financial development dampens output volatility in especially sectors that are financial vulnerable. Here, we explore further the moderating role of specifically banking stability on finance–output volatility by stating the following hypothesis.

H_{04}: the relation between finance and output volatility during the global financial crisis (GFC) does not depend on banking stability

While banking stability is good for growth and growth volatility, we leave open whether financial depth and inclusion can substitute banking stability in mitigating cyclical fluctuations.

Finally, since North's (1989, 1990) seminal works on the economics of institutions, institutional quality has been acknowledged not only to have a direct impact on economic outcomes but also to serve as a requisite for effective development policies. The recent overview of the literature linking institutions, financial development, and economic growth by Fernandez and Tamayo (2017) highlights the key roles of institutions in determining the severity of information asymmetry or market frictions, efficiency of enforcement, and transaction

costs. In their opinion, institutions that protect private property rights and have efficient judicial systems and strong social norms have the potential to ameliorate information friction. Taking lead from North (1990), Avom et *al.* (2021) further argue that quality institutions would provide more stable exchange structures. Therefore, it should be expected that financial development or financial inclusion policies would be more effective when scaffolded by sound institutions.

In empirically assessing the roles of institutions in influencing economic outcomes and moderating the economic impacts of policies, existing studies have employed various proxies of institutions. These include civil liberty, economic freedom, control of corruption, political stability, regulatory quality, rule of law, and social capital. It is generally evident from existing studies that institutions matter; see Fernandez and Tamayo (2017) and Ehigiamusoe and Sansurijan (2021) for excellent recent surveys of the literature. We add further to this strand of literature by examining whether institutions matter during uncertain times. Our analysis focuses on political stability and its role in moderating the effects of financial depth and inclusion on output volatility during the GFC. We believe that political stability should accurately capture the quality of institutions, since political stability is normally linked to property right protection, effective enforcement, and policy certainty. Our hypothesis is:

H_{05}: the relation between finance and output volatility during the global financial crisis (GFC) does not depend on political stability

We expect that financial depth and financial inclusion would be more effective in stabilizing output volatility in countries that are more politically stable.

3. Empirical Models and Data

3.1. Models

In assessing the relationships between finance and output volatility, we specify the following regression models:

$$ln\sigma_{i,gfc} = \alpha + \beta_1 Fin_{i,0507} + \theta X_{i,0507} + \varepsilon_i \quad (1)$$

$$ln\sigma_{i,gfc} = \alpha + \beta_1 Fin_{i,0507} + \theta X_{i,0507} + \gamma(Fin_{i,0507} \times x_{i,0507}) + \varepsilon_i \quad (2)$$

Where $ln\sigma$ is output volatility (in natural logarithm) during the GFC period, Fin is a measure of financial depth/inclusion, X is a set of controlled variables, and x is a variable from the set of controlled variables that conditions finance–volatility

relations (henceforth, the conditioning or moderating variable). We include in the set of controlled variables those that are normally considered in the literature. They include economic development, government spending, trade openness, banking sector stability, and political stability. Both financial depth/inclusion and controlled variables are measured by their average values prior to the GFC (i.e. over 2005-2007) to mitigate the problem of endogeneity. We estimate both models using the least squares estimation method with robust standard errors.

Model (1) is a linear additive model. Model (2) extends (1) by allowing the effect of finance on output volatility to vary by the value of $x_{i,0507}$, which is alternatively financial depth/inclusion, economic development, banking sector stability, and political stability. In (1), β_1 measures the marginal effect of finance on output volatility during the GFC period for any given levels of control variables. In other words, this marginal effect holds for any country in the sample regardless of the country's $X_{i,0507}$. With the introduction of the interaction term, β_1 in (2) cannot be interpreted as such. The interaction term in (2) makes the marginal effect of finance contingent on the value of $x_{i,0507}$:

$$\frac{\partial ln\sigma}{\partial Fin} = \beta_1 + x_{i,0507} \quad (3)$$

Thus, the marginal effect of finance on output volatility cannot be simply based on the significance or insignificance of individual coefficients in (3). It must be assessed for all possible values of the moderating factor, i.e. $x_{i,0507}$, to avoid the problems of understating or overstating interaction results (Kingsley *et al.*, 2017).

3.2. Data

We compile data from three World Bank databases: World Development Indicators, Global Financial Development, and Worldwide Governance Indicators. Starting with all countries in the databases, we filter out countries that have no data relevant for the present study. This leads us to 124 countries in the sample. Then, performing Cook's (1977) distance outlier test, we further remove up to 6 countries from the sample.[3] Table 1 provides the summary statistics and pairwise correlations of the variables.[4] We explain the key variables in more details and controlled variables in brief below.

[3] While Note that we consider four alternative measures of finance: financial depth, financial inclusion, financial inclusion (access), and financial inclusion (usage). The common outliers for all models with these indicators of finance are Bangladesh, Guyana, Mozambique, and Zimbabwe. Additional countries detected as outliers are: (i) models using financial depth – the Republic of the Congo and Lao PDR, (ii) models using financial inclusion – Norway, (iii) models using access dimension of financial inclusion – Equatorial Guinea and Norway, and (iv) models using usage dimension of financial inclusion – Japan and Lao PDR.

[4] Theses statistics and correlation coefficients are based on data used in models that employ financial inclusion as an indicator of finance (119 countries).

Table 1: Descriptive Statistics and Correlations

(a) Descriptive Statistics

Variables	Description	Mean	Std. Dev	Min	Max
Output Volatility ($ln\sigma$)	Standard deviation of GDP per capita growth over 2008-2010 (in natural log)	1.115	0.694	-0.694	2.559
Financial Depth (*FD*)	Average credit to private sector to GDP ratio over 2005-2007 (in natural log)	3.583	1.009	0.815	5.583
Financial Inclusion overall (*FI*)	Financial inclusion index constructed using four financial inclusion indicators (Branches, ATMs, Bank Credit and Bank Deposits) averaged over 2005-2007	0.162	0.130	0.0001	0.559
Financial Inclusion (Access) (*FIA*)	Access dimension of financial inclusion constructed using bank branches per 100,000 adults and ATMs per 100,000 adults averaged over 2005-2007	0.178	0.164	0.0001	0.780
Financial Inclusion (Usage) (*FIU*)	Usage dimension of financial inclusion constructed using bank credit to GDP and bank deposits to GDP ratios averaged over 2005-2007	0.150	0.122	0.0008	0.569
Economic Development (*lny*)	Average real GDP per capita over 2005-2007 (in natural log)	8.856	1.431	5.412	11.572
Government Spending (*lng*)	Average government consumption to GDP ratio over 2005-2007 (in natural log)	2.680	0.364	1.486	3.621
Trade Openness (*lntr*)	Average exports plus imports to GDP ratio over 2005-2007 (in natural log)	4.446	0.495	3.263	6.024
Bank Stability (*lnz*)	Average Z-score over 2005-2007 (in natural log)	2.424	0.656	-0.254	4.010
Political Stability (*psta*)	Average political stability index over 2005-2007 from the Worldwide Governance Indicators	0.006	0.933	-2.158	1.528

(b) Correlations

	$ln\sigma$	*FD*	*FI*	*FIA*	*FIU*	*lny*	*lng*	$ln\sigma$	*lnz*	*psta*
$ln\sigma$	1.000									
FD	0.071	1.000								
FI	0.134	0.833	1.000							
FIA	0.156	0.722	0.948	1.000						
FIU	0.079	0.846	0.918	0.746	1.000					
lny	0.323	0.679	0.780	0.757	0.679	1.000				
lng	0.093	0.439	0.380	0.397	0.291	0.303	1.000			
lntr	0.336	0.130	0.176	0.060	0.295	0.229	0.081	1.000		
lnz	-0.138	0.131	0.069	0.005	0.145	0.071	-0.090	0.017	1.000	
psta	0.259	0.552	0.604	0.559	0.556	0.697	0.378	0.402	-0.025	1.000

Sources: World Development Indicators, Worldwide Governance Indicators, and Global Financial Development.

Output Volatility: the dependent variable is output volatility, measured as the standard deviation of growth rate of GDP per capita over the GFC period. Since the GFC period is the focus of the present analysis, its specification requires deliberation. In the literature, some refer the GFC as the 2007-2009 financial crisis and others as the 2008-2009 financial crisis. While the crisis started in mid-2007, the United States (US) National Bureau of Economic Research dated the beginning

of US recession as December 2007. Moreover, the early stage of the crisis relates to a segment of the US financial market (Mishkin, 2011) and its effect was confined mainly in advanced economies (Berglof *et al.*, 2009). As most countries in our sample are from developing countries, we define the beginning of the crisis to be 2008, in line with Cull and Martinez-Peria (2013), Coleman and Feler (2015), and Ibrahim and Rizvi (2018). We then specify the crisis period to run through 2010 as we believe that real activities still felt the consequences of the GFC until 2010. Based on this, output volatility during the GFC is based on GDP per capita growth rate over 2008-2010. We should note here that using a three year period for the measurement of output volatility is also consistent with the literature (Cavoli *et al.*, 2020). Following Fernandez *et al.* (2016), we express output volatility in natural logarithm ($ln\sigma$).

Finance: We employ both financial depth and financial inclusion. In line with the convention in the literature, the financial depth indicator is the natural logarithm of credit to the private sector to GDP ratio (FD). It is the average value over the three years prior to the GFC; that is, 2005-2007. As for financial inclusion measures, we first gather data on the following four financial inclusion indicators for 2005-2007: (1) the number of bank branches per 100,000 adult population, (2) the number of ATMs per 100,000 adult population, (3) bank credit to GDP ratio, and (4) bank deposits to GDP ratio. Then, we follow the steps taken by Van *et al.* (2021), based on the approaches by Sarma and Pais (2011) and Park and Mercado (2015), to compute overall financial inclusion, the access dimension of financial inclusion, and the usage dimension of financial inclusion for each country. As in Van *et al.* (2021), the first two indicators represent the access or availability of banking sectors. Meanwhile, we take both bank credit and deposit to represent the usage dimension. [5]

In constructing financial inclusion, we first take the three-year average value for each of the four indicators by country. Then, we compute the index that ranges between 0 and 1 for each indicator as (Sarma, 2008):

$$d_i = \frac{A_i - m_i}{M_i - m_i}, i = 1,...,4 \quad (4)$$

Where A is the actual value of indicator i and M and m are their respective maximum and minimum values. The index of financial inclusion (FI) is then calculated as:

[5] Van et al. (2021) only employ bank credit to represent the usage dimension of financial access.

$$FI_i = 1 - \frac{\sqrt{(1-d_1)^2 + (1-d_2)^2 + (1-d_3)^2 + (1-d_{41})^2}}{\sqrt{4}} \quad (5)$$

Equations (5) is the normalized inverse Euclidean distance, which yields the index that lies between 0 and 1 with the larger value to represent higher financial inclusion. The indexes for the access/availability (*FIA*) and usage dimensions (*FIU*) of financial inclusion are constructed in the same manner.

Controlled Variables: As noted above, our list of controlled variables includes economic development, government spending, trade openness, banking sector stability and political stability. In line with Beck *et al.* (2006), Ahmed and Suardi (2009), and Coric and Pugh (2013), we use real GDP per capita in natural logarithm (*lny*) to represent economic development. Meanwhile, government spending and trade openness are represented by the natural logarithm of, respectively, government consumption to GDP ratio (*lng*) and exports plus imports to GDP ratio (lntr) (Coric and Pugh, 2013; and Xue 2020). The inclusion of trade openness is to control for the extent of economic globalization of a country. Following Fernandez *et al.* (2016), we also include bank stability, represented by the Z-score, which measures the distance from insolvency. Due to its high skewness, we use the natural logarithm of the Z-score in the analysis (*lnz*). Finally, we also control for political stability of a nation (*psta*) to represent its institutional setting, in line with Ahmed and Suardi (2009). While we acknowledge that there may be more factors that might affect output volatility, we believe that these controlled variables are sufficient to capture economic, financial, and political sources of output volatility.

4. Estimation Results

Our results are presented in three parts. The first part analyses the relations between output volatility on one hand, and financial depth and overall financial inclusion on the other hand. Then, the second part extends the analysis to the access and usage dimensions of financial inclusion. The final part performs further analysis.

4.1. Finance–Output Volatility Relations

Table 2 and Table 3 report the regression results using respectively financial depth and financial inclusion as a measure of finance. In each table, the first regression corresponds to linear additive model (1). In regressions (2)-(5), we interact the financial indicator with respectively itself, real GDP per capita, bank stability, and political stability. To ease interpretation, we graph the marginal effects of financial depth and inclusion on output volatility respectively in Figure

1 and Figure 2. Overall, we find no distinguishable difference between financial depth and financial inclusion in their mitigation of output volatility during the GFC.

From Table 2, we may note a negative and significant coefficient of financial depth in regression (1). This means that a country with higher financial depth tends to experience lower output volatility during the GFC. The estimated coefficient suggests that a one standard deviation increase in financial depth is associated with the reduction in growth volatility by 22% (-0.218×1.009 = 0.220), all else equal. This amounts to roughly 32% of the standard deviation of output volatility. As may be observed in Table 3, we document the same result for financial inclusion. The estimated coefficient of financial inclusion in regression (1) (-1.565) suggests that a one standard deviation increase in financial inclusion is related to the reduction in output volatility by roughly 20%. From these results, we may infer that both financial depth and financial inclusion are equally important in mitigating output volatility during the GFC.

We further note the presence of conditionalities or moderating factors in the relations between finance and growth volatility as manifested in regressions (2) to (5) of Table 2 and Table 3. First, against our expectation, we note the benefit of finance in dampening volatility during the crisis only in countries at the higher ends of financial depth and financial inclusion. From panel (a) of Figures (1) and (2), the marginal effects of both financial depth and inclusion are negative over their entire ranges but turn significant only when they exceed certain thresholds. This result contradicts Ma and Song (2018) and Xue (2021), who document the amplifying effect of financial development on output volatility when it surpasses a certain financial development threshold. However, it should be noted that their findings apply generally to periods of financial normalcy, so the earlier findings that finance heightens output volatility when it is above a certain threshold may not necessarily be extended to the crisis periods.

Second, for the macroeconomic volatility dampening effect of finance to be materialized, countries must reach certain critical thresholds of economic development and political stability. Although the coefficients of finance (Financial Depth in Table 2 and Financial Inclusion in Table 3, regression (3)) and of its interaction with economic development are individually insignificant, the marginal plots in panel (b) of Figure 1 and Figure 2 reveal significant mitigating effects of financial depth and financial inclusion on output volatility when real GDP per capita surpasses certain threshold levels: roughly 8 when financial depth is used and 9.5 when financial inclusion is used.[6] Likewise, we also observe the importance of political stability for finance to contribute to the reduction in output volatility.

As may be noted from regression (5) of Table 2 and Table 3, the negative and significant coefficients of FD and FI indicate that both FD and FI do mitigate output volatility during the GFC in countries with average level of political stability.[7] From the corresponding plots in Figure 1 and Figure 2 (panel (d)), we may further note that in countries with low levels of political stability, finance does not seem to have any significant impact on output volatility. Then, as countries become more stable politically beyond certain levels, the marginal effects of both FD and FI turn negative and significant. These results are in line with existing evidence that the close relation between finance and real activity is more apparent for developed countries as opposed to developing countries, as well as for countries with better institutional quality.

[6] These results aptly demonstrate that, if we rely solely on the insignificance of the coefficients of finance and of its interaction with economic development, we might have missed the significance of finance in affecting output volatility.

[7] Since the political stability index is normalized, where its value ranges from -2.5 to 2.5, the coefficient of financial indicator measures its marginal effect on output volatility when the political stability index of a country is at its mean value (i.e. 0).

Table 2: Output Volatility–Financial Depth Relations

	Regression				
	(1)	(2)	(3)	(4)	(5)
$FD_{i,0507}$	-0.218***	-0.181	0.314	-0.308**	-0.217***
	(0.004)	(0.526)	(0.408)	(0.024)	(0.004)
$lny_{i,0507}$	0.214***	0.215***	0.416***	0.211***	0.220***
	(0.001)	(0.002)	(0.008)	(0.002)	(0.001)
$lng_{i,0507}$	0.069	0.064	0.046	0.065	0.025
	(0.640)	(0.674)	(0.755)	(0.658)	(0.870)
$lntr_{i,0507}$	0.428***	0.427***	0.394***	0.426***	0.421***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
$lnz_{i,0507}$	-0.150**	-0.152*	-0.153**	-0.316	-0.164**
	(0.050)	(0.057)	(0.045)	(0.259)	(0.038)
$psta_{i,0507}$	-0.036	-0.035	-0.011	-0.033	0.206
	(0.716)	(0.720)	(0.910)	(0.735)	(0.442)
$FD^{2}_{i,0507}$		-0.005			
		(0.895)			
$FD_{i,0507} \times lny_{i,0507}$			-0.060		
			(0.141)		
$FD_{i,0507} \times lnz_{i,0507}$				0.041	
				(0.489)	
$FD_{i,0507} \times psta_{i,0507}$					-0.068
					(0.292)
Constant	-1.714*	-1.760	-3.240**	-1.295	-1.551
	(0.087)	(0.113)	(0.040)	(0.278)	(0.132)
N	118	118	118	118	118
r2	0.235	0.235	0.249	0.237	0.242

The model is $ln\sigma_i = \alpha + \beta_1 FD_{i,0507} + \theta_1 lny_{i,0507} + \theta_2 lng_{i,0507} + \theta_3 lntr_{i,0507} + \theta_4 lnz_{i,0507} + \theta_5 psta_{i,0507} + \gamma(FD_{i,0507} \times x_i) + \varepsilon_i$, where $ln\sigma_i$ is output volatility during the GFC computed as the standard deviation of GDP per capita growth over 2008-2010 (in natural log), $FD_{i,0507}$ is the average credit to the private sector to GDP ratio over 2005-2007 (in natural logarithm), $lny_{i,0507}$ is average real GDP per capita over 2005-2007 (in natural logarithm), $lng_{i,0507}$ is average government expenditure to GDP ratio over 2005-2007 (in natural logarithm), $lntr_{i,0507}$ is average exports plus imports to GDP ratio over 2005-2007, $lnz_{i,0507}$ is the average bank stability measured by the Z-score over 2005-2007 (in natural logarithm), $psta_{i,0507}$ is the average political stability index over 2005-2007, and x_i is the conditioning variable (alternatively, $FD_{i,0507}$, $lny_{i,0507}$, $lnz_{i,0507}$, and $pstab_{i,0507}$).
p-values in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Finally, assessing whether banking stability plays a moderating role in finance–output volatility relations, we note that the FD and FI coefficients in regression (4) of respectively Table 2 and Table 3 are negative and statistically significant. However, the coefficients of their interaction with banking stability as represented by the Z-score are statistically insignificant. The corresponding plots of the marginal effects in Figure 1 and Figure 2 (panel (c)) indicate that both financial depth and financial inclusion help mitigate output volatility in countries with less stable banking systems. Our result, which is in line with Braun and Larrain (2005), provides an indication of potential substitutability between finance and banking stability in subduing output volatility. Given the recurring threats to financial

stability from various sources, such as the GFC, oil price shocks, the US-China trade war, and the Covid-19 pandemic, the promotion of financial development (depth and inclusion) is necessary to mitigate macroeconomic instability during the periods of crisis.

Table 3: Output Volatility–Financial Inclusion Relations

	Regression				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
$FI_{i,0507}$	-1.5650***	-0.7842	3.0636	-2.1308**	-1.0971**
	(0.002)	(0.614)	(0.393)	(0.045)	(0.046)
$lny_{i,0507}$	0.2599***	0.2481***	0.2858***	0.2564***	0.2468***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
$lng_{i,0507}$	0.0593	0.0370	0.0146	0.0580	0.0038
	(0.726)	(0.827)	(0.931)	(0.733)	(0.982)
$lntr_{i,0507}$	0.4106***	0.4068***	0.3895***	0.4062***	0.4088***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$lnz_{i,0507}$	-0.1690**	-0.1765**	-0.1742**	-0.2242	-0.1910**
	(0.029)	(0.023)	(0.023)	(0.141)	(0.017)
$pstab_{i,0507}$	-0.0518	-0.0524	-0.0383	-0.0477	0.0376
	(0.594)	(0.592)	(0.694)	(0.628)	(0.781)
$FI^{2}_{i,0507}$		-1.4426			
		(0.555)			
$FI_{i,0507} \times lny_{i,0507}$			-0.4443		
			(0.202)		
$FI_{i,0507} \times lnz_{i,0507}$				0.2498	
				(0.540)	
$FI_{i,0507} \times psta_{i,0507}$					-0.6516
					(0.176)
Constant	-2.5082**	-2.3726**	-2.5594**	-2.3277**	-2.2096**
	(0.017)	(0.022)	(0.015)	(0.043)	(0.041)
N	119	119	119	119	119
r2	0.2388	0.2400	0.2464	0.2401	0.2462

The model is $lnvoly_i = \alpha + \beta_1 FI_{i,0507} + \theta_1 lny_{i,0507} + \theta_2 lng_{i,0507} + \theta_3 lntr_{i,0507} + \theta_4 lnz_{i,0507} + \theta_5 psta_{i,0507} + \gamma(FI_{i,0507} \times x_i) + \varepsilon_i$, where $lnvoly_i$ is output volatility during the GFC computed as the standard deviation of GDP per capita growth over 2008-2010 (in natural log), $FI_{i,0507}$ is the average financial inclusion index over 2005-2007, $lny_{i,0507}$ is average real GDP per capita over 2005-2007 (in natural logarithm), $lng_{i,0507}$ is average government expenditure to GDP ratio over 2005-2007 (in natural logarithm), $lntr_{i,0507}$ is average exports plus imports to GDP ratio over 2005-2007, $lnz_{i,0507}$ is the average bank stability measured by the Z-score over 2005-2007 (in natural logarithm), $pstab_{i,0507}$ is the average political stability index over 2005-2007, and x_i is the conditioning variable (alternatively, $FI_{i,0507}$, $lny_{i,0507}$, $lnz_{i,0507}$, and $psta_{i,0507}$).
p-values in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

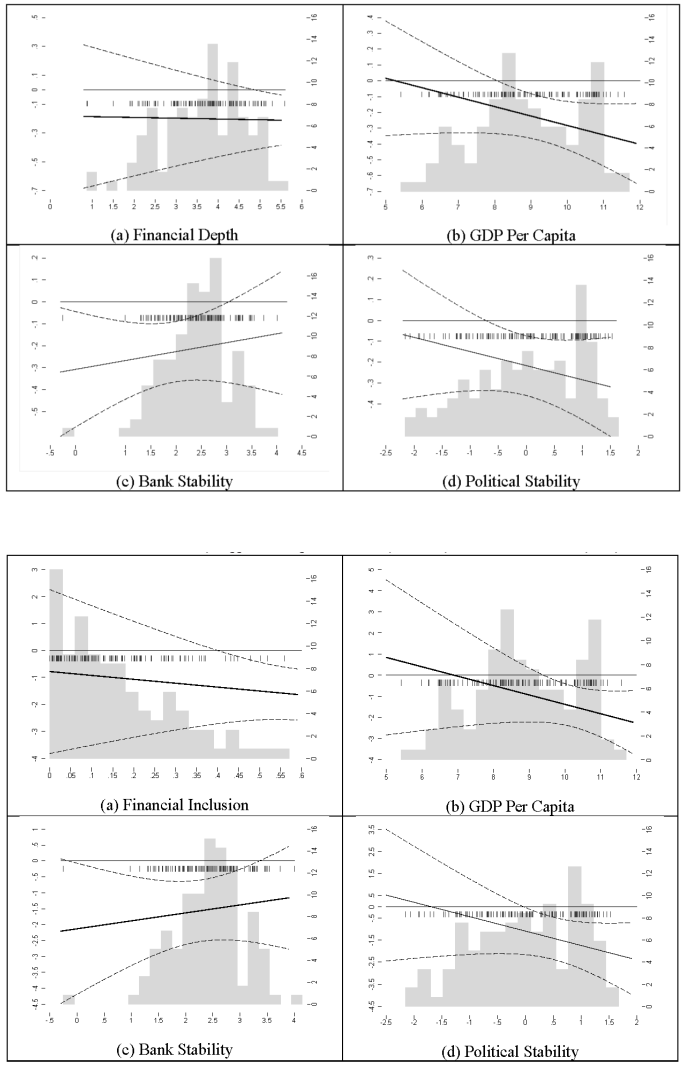


Figure 2: Marginal Effects of Financial Inclusion on Output Volatility

As for the controlled variables, we may note the following findings. First, we find the coefficients of real GDP per capital to be positive and significant. This result is in line with the power law that relates firm growth volatility directly to firm size (Gabaix, 2016), which in our case is a country's growth volatility to its level of development. We also note that countries that are more open prior to the GFC experience higher output volatility, as suggested by significant coefficients of the trade openness. Perhaps, these countries are more exposed to global shocks. As should be expected, the strength of the banking sector is also important to shield an economy from amplified macroeconomic fluctuations. From Table 2 and Table

3, the coefficients of bank stability are negative and significant, meaning that the sounder or more stable the banking system, the lower output volatility would be during the GFC. Finally, we do not find government spending and political stability to have had independent roles in affecting output volatility during the crisis.[8]

4.2. Access and Usage Dimensions of Financial Inclusion

In this sub-section, we differentiate between the dimensions of access (number of bank branches and ATMs) and usage (bank credits and deposits) in financial inclusion, and examine their roles in lowering output volatility during the GFC. Tables 4 and 5 present the estimation results for respectively financial access and financial usages and their impacts on output volatility, where regression (1) of the tables corresponds to the linear additive model while regressions (2)-(5) consider conditionalities in the financial inclusion–output volatility relations. The plots of marginal effects of financial inclusion (access and usage) for the models with an interaction term are given in Figures 3 and 4. In general, the role of the usage dimension of financial inclusion in the mitigation of output volatility during the GFC is more apparent. Indeed, the results for financial inclusion (usage) as presented in Table 5 echo well those from Table 3 (overall financial inclusion).

First, from regression (1), we find the coefficient of financial access (FIA) to be indistinguishable from 0 (Table 4), while the coefficient of financial access usage (FIU) to be negative and significant at 1% significance level. Second, relying on the plots of marginal effects of financial inclusion for proper interpretation (Figure 3 and Figure 4), we find the marginal effects of FIA are insignificant at all levels of financial inclusion and bank stability (Figure 3(a) and Figure 3(c)). By contrast, FIU is noted to have dampened output volatility once it surpasses a threshold (Figure 4(a)). Likewise, it reduces output volatility at almost all levels of bank stability, albeit the volatility drop is less as bank stability increases (Figure 4(c)). Third, while both dimensions of financial inclusion are effective in reducing output volatility in more developed countries, the financial access heightens output volatility for low income countries (Figure 3(b) and Figure 4(b)). Fourth, we note that both financial inclusion measures suppress output volatility during the GFC for more politically stable countries. The beneficial effect of FIU, however, comes at a lower threshold of political stability (Figure 3(d) and Figure 4(d)). Finally, as for other variables, the results remain largely similar.

Thus, these results provide further support for the beneficial effect of financial

[8] Note that our inferences of a controlled variable are based on regressions that it is not the constituent in the interaction term.

inclusion during economic crises, although some scholars have noted that it can, in general. endanger financial stability (Feghali *et al.*, 2021) and amplify output volatility (Cavoli *et al.*, 2020). Further, they indicate that mere expansion of bank branches or ATMs may not necessarily provide economic agents the ability to manage risks and absorb shocks. Instead, it is their inclusion in the uses of financial products (credit and deposits) that is relevant for them to, for example, address production risks or smooth consumption. Echoing our earlier conclusion, for the benefits of financial inclusion to be better materialized, a country must reach certain levels of economic development and political stability. This means that, although financial inclusion in itself can be a catalyst for economic development, there is a need for broader policy initiatives beyond financial inclusion. Focusing on building quality institutions that ensure political stability and government effectiveness would go a long way in maintaining economic stability since quality institutions would enhance the benefits of financial inclusion not only directly but also indirectly through their impacts on economic development.

Table 4: Output Volatility–Financial Inclusion (Access) Relations

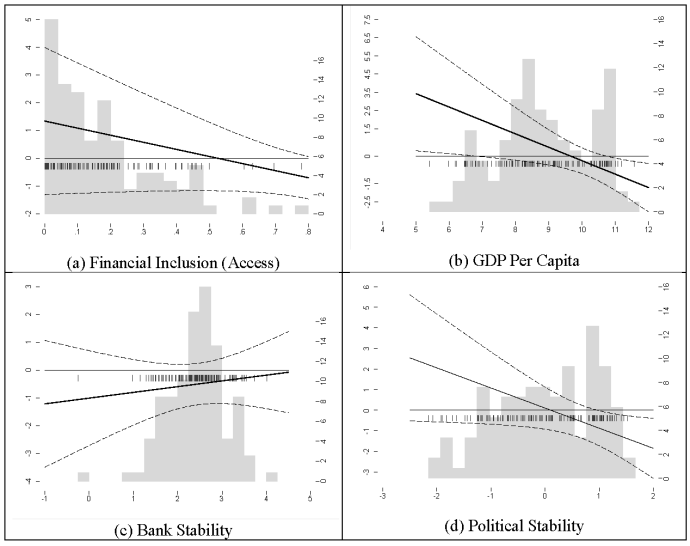
	Regression				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
$FIA_{i,0507}$	-0.5234	1.3421	7.1037**	-1.0093	0.0989
	(0.171)	(0.323)	(0.024)	(0.250)	(0.850)
$lny_{i,0507}$	0.1942***	0.1393*	0.2330***	0.1921***	0.1742**
	(0.008)	(0.093)	(0.002)	(0.008)	(0.019)
$lng_{i,0507}$	0.0847	0.0336	0.0033	0.0836	0.0021
	(0.637)	(0.853)	(0.985)	(0.643)	(0.991)
$lntr_{i,0507}$	0.3834***	0.3752***	0.3470***	0.3856***	0.3912***
	(0.003)	(0.003)	(0.005)	(0.003)	(0.002)
$lnz_{i,0507}$	-0.1579*	-0.1598**	-0.1486*	-0.2101	-0.1903**
	(0.053)	(0.046)	(0.061)	(0.148)	(0.021)
$pstab_{i,0507}$	-0.0600	-0.0618	-0.0336	-0.0570	0.0765
	(0.542)	(0.534)	(0.734)	(0.566)	(0.564)
$FIA^{2}_{i,0507}$		-2.5558			
		(0.114)			
$FIA_{i,0507} \times lny_{i,0507}$			-0.7361**		
			(0.017)		
$FIA_{i,0507} \times lnz_{i,0507}$				0.2070	
				(0.516)	
$FIA_{i,0507} \times pstab_{i,0507}$					-0.9764**
					(0.042)
Constant	-2.0672**	-1.5883	-2.1217**	-1.9318*	-1.6527
	(0.046)	(0.135)	(0.036)	(0.076)	(0.122)
N	118	118	118	118	118
r2	0.1999	0.2109	0.2288	0.2014	0.2230

The model is $lnvoly_i = \alpha + \beta_1 FIA_{i,0507} + \theta_1 lny_{i,0507} + \theta_2 lng_{i,0507} + \theta_3 lntr_{i,0507} + \theta_4 lnz_{i,0507} + \theta_5 psta_{i,0507} + \gamma(FIA_{i,0507} \times x_i) + \varepsilon_i$, where $lnvoly_i$ is output volatility during the GFC computed as the standard deviation of GDP per capita growth over 2008-2010 (in natural log), $FIA_{i,0507}$ is the average financial inclusion (access) index over 2005-2007, $lny_{i,0507}$ is average real GDP per capita over 2005-2007 (in natural logarithm), $lng_{i,0507}$ is average government expenditure to GDP ratio over 2005-2007 (in natural logarithm), $lntr_{i,0507}$ is average exports plus imports to GDP ratio over 2005-2007, $lnz_{i,0507}$ is the average bank stability measured by the Z-score over 2005-2007 (in natural logarithm), $pstab_{i,0507}$ is the average political stability index over 2005-2007, and x_i is the conditioning variable (alternatively, $FIA_{i,0507}$, $lny_{i,0507}$, $lnz_{i,0507}$, and $psta_{i,0507}$).
p-values in parentheses
* p < 0.10, ** p < 0.05, *** p < 0.01

Table 5: Output Volatility–Financial Inclusion (Usage) Relations

	Regression				
	(1)	(2)	(3)	(4)	(5)
$FIU_{i,0507}$	-1.9722***	-2.7149*	0.6697	-2.2344*	-1.7542***
	(0.000)	(0.092)	(0.835)	(0.067)	(0.000)
$lny_{i,0507}$	0.2199***	0.2256***	0.2445***	0.2194***	0.2179***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
$lng_{i,0507}$	-0.0232	0.0020	-0.0425	-0.0249	-0.0593
	(0.875)	(0.990)	(0.776)	(0.868)	(0.696)
$lntr_{i,0507}$	0.5524***	0.5420***	0.5447***	0.5473***	0.5519***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$lnz_{i,0507}$	-0.1318*	-0.1242	-0.1398*	-0.1541	-0.1473*
	(0.076)	(0.102)	(0.063)	(0.317)	(0.057)
$pstab_{i,0507}$	-0.0443	-0.0399	-0.0371	-0.0419	0.0157
	(0.638)	(0.680)	(0.690)	(0.665)	(0.898)
$FIU^2_{i,0507}$		1.5451			
		(0.584)			
$FIU_{i,0507} \times lny_{i,0507}$			-0.2650		
			(0.405)		
$FIU_{i,0507} \times lnz_{i,0507}$				0.1108	
				(0.816)	
$FIU_{i,0507} \times pstab_{i,0507}$					-0.4303
					(0.230)
Constant	-2.6180**	-2.6545***	-2.7439***	-2.5341**	-2.4699**
	(0.011)	(0.009)	(0.010)	(0.031)	(0.017)
N	118	118	118	118	118
r2	0.2572	0.2584	0.2601	0.2574	0.2612

The model is $lnvoly_i = \alpha + \beta_1 FIU_{i,0507} + \theta_1 lny_{i,0507} + \theta_2 lng_{i,0507} + \theta_3 lntr_{i,0507} + \theta_4 lnz_{i,0507} + \theta_5 psta_{i,0507} + \gamma(FIU_{i,0507} \times x_i) + \varepsilon_i$, where $lnvoly_i$ is output volatility during the GFC computed as the standard deviation of GDP per capita growth over 2008-2010 (in natural log), $FIU_{i,0507}$ is the average financial inclusion (usage) index over 2005-2007, $lny_{i,0507}$ is average real GDP per capita over 2005-2007 (in natural logarithm), $lng_{i,0507}$ is average government expenditure to GDP ratio over 2005-2007 (in natural logarithm), $lntr_{i,0507}$ is average exports plus imports to GDP ratio over 2005-2007, $lnz_{i,0507}$ is the average bank stability measured by the Z-score over 2005-2007 (in natural logarithm), $pstab_{i,0507}$ is the average political stability index over 2005-2007, and x_i is the conditioning variable (alternatively, $FIU_{i,0507}$, $lny_{i,0507}$, $lnz_{i,0507}$, and $psta_{i,0507}$).
p-values in parentheses
* *p* < 0.10, ** *p* < 0.05, *** *p* < 0.01



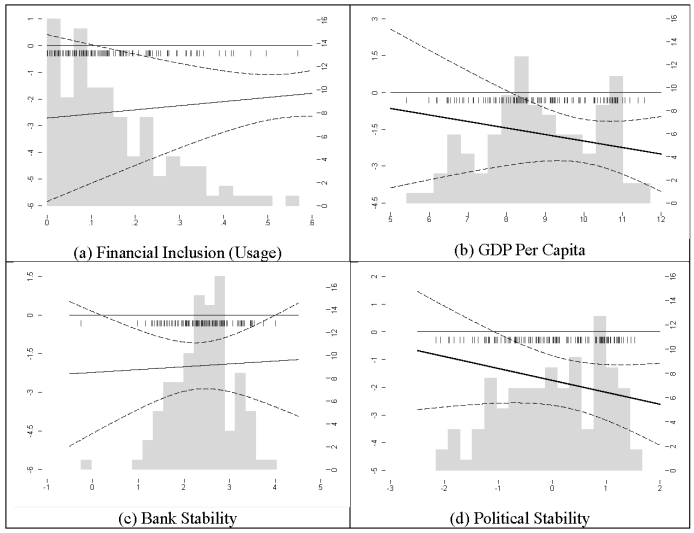


Figure 4: Marginal Effects of Financial Inclusion (Usage) on Output Volatility

4.3. Further Analysis

We perform further analysis to gain additional insights as well as to check for robustness. Our sample comprises countries at various levels of economic development, from low-income countries to high-income countries. The cross-sectional empirical setting that we employ means the vastly heterogenous nature of our sample can only be partly accounted for by the included controlled variables. Moreover, as hinted by Rioja and Valev (2004) and others, there is a

need for separate empirical treatments in analysing the implications of finance on economic activities for countries at different levels of income. In light of these, we form two sub-samples by excluding (i) low-income countries and (ii) Organisation for Economic Co-operation and Development (OECD) countries, and rerun analysis similar to 4.1 and 4.2 above. To conserve space, we summarize the results in Table 6, columns I and II.

The linear additive model reaffirms the above findings when we exclude low-income countries from the sample. Namely, output volatility during the GFC was lower in countries with higher levels of financial depth, financial inclusion (overall), and financial inclusion (usage) but was insignificantly related to financial inclusion (access). For the OECD-excluded sample, while other key results prevail, the coefficient of financial inclusion (overall) turns insignificant. These results, thus, further emphasize the importance of financial depth and financial inclusion (usage) in lowering output volatility during a crunch time. However, financial inclusion in general and its access dimension may not necessarily be beneficial in non-OECD countries. Thus, as far as developing countries are concerned, the policy focus should be on encouraging non-banked individuals into the formal financial system. Further, in these countries, financial deepening remains crucial.

With one very minor departure, we document similar results on the moderating roles of financial depth (inclusion), economic development, bank stability, and political stability in finance–output volatility relations in middle- and high-income countries. The departure is financial depth, financial inclusion (overall), and financial inclusion (usage) lower output volatility, when the Z-score is at an intermediate range and not at the lower range as observed earlier. In the non-OECD sample, the results from models with interactions between financial depth and financial inclusion (usage) on one hand and the four moderating factors on the other hands are in uniformity with our earlier findings. Notably, the overall financial inclusion and its access dimension become irrelevant to output volatility regardless of the levels of financial inclusion, economic development, bank stability, and political stability. These results strengthen our recommendation that, for developing countries, the policy focus should be on deepening the banking sector and promoting the usage dimension of financial inclusion.

Next, with the ensuing sovereign debt crisis in Europe in 2011 and 2012, it may be argued that the real effects of the GFC continued even after 2010. Accordingly, we also measure growth volatility using a five-year window from 2008 to 2012 and re-estimate the models. The results are summarized in Table 6, column III. Although there are slight departures from the basic results, our earlier conclusions generally

remain. First, the linear additive model further reinforces the findings that output volatility is negatively related to financial depth, overall financial inclusion, and the usage dimension of financial inclusion, and is independent from the access dimension of financial inclusion. Second, considering moderating factors, we also observe similar results that financial depth and overall financial inclusion lowered output volatility for more financially developed, more economically developed, and more stable countries. However, unlike the basic results, financial depth and overall financial inclusion lowered output volatility for countries with more stable banking systems. Thus, the substitutability between finance and financial stability in the mitigation of output volatility as concluded earlier does not hold when we use a five-year window in computing growth volatility. Third, although the results uncover more significant roles of financial inclusion (access) where it is able to lower output volatility when financial inclusion (access), economic development, banking stability, and political stability are above thresholds, the impacts of financial inclusion (usage) are larger in magnitude in all cases. This further substantiates our earlier conclusion that the usage dimension was relatively more impactful than the access dimension in subduing output volatility during the GFC.

To see further whether our basic results on financial inclusion and its impacts on output volatility depend on how financial inclusion indicators are measured, we employ financial inclusion indexes constructed by Gutierrez-Romero and Ahamed (2021). Similar to ours, they construct an overall financial inclusion index, financial outreach index, and financial usage index. However, their inclusion indicators are from the International Monetary Fund's Financial Access Survey and based on the principal component approach. The results are summarized in Table 6, Column IV. In the additive model, we find all indicators of financial inclusion to be significant. This means that, while the significant negative effects of overall financial inclusion and financial usage prevail in these regressions, the earlier documented insignificant relation between financial outreach (access) is overturned. Further, all financial inclusion indicators are effective in bringing down output volatility when they surpass certain thresholds. Although we note that financial outreach may not be effective when banking stability is at the higher end and also that financial usage is likely ineffective when both banking stability and political stability are at higher ends, the results are definitive in noting that countries must reach a critical stage of development for the volatility-dampening effects of financial inclusion (overall, access and usage) to be materialized.

Finally, we also examine whether finance exerts different impacts along the distribution of output volatility using the quantile regression (Koenker and

Basset, 1978). We present only the results pertaining to the coefficients of finance indicators to conserve space in Table 7. As may be observed from the table, at higher output volatility levels, both financial depth and financial inclusion reduce output volatility. More specifically, we observe that financial depth and financial inclusion (access) lower output volatility at the 75th quantile and above, while the overall and usage dimension of financial inclusion stabilize output volatility at 50th quantile and above. This again tends to echo our conclusion that the stabilizing effect of financial usage is more apparent. Finally, we also should note that the impacts of finance on output volatility become stronger at higher quantiles of volatility distribution. Thus, during the GFC, finance did play its positive role when it was needed most; that is, during the period of high economic instability

Table 6: Further Analysis

Statement of Finding	**Results Basic**	**(I)**	**(II)**	**(III)**	**(IV)**
Linear Additive Models					
Negative and significant coefficient of FD	√	√	√	√	NA
Negative and significant coefficient of FI	√	√	×	√	√
Negative and significant coefficient of FIA	×	×	×	√	√
Negative and significant coefficient of FIU	√	√	√	√	√
Interactive Models (FD)					
FD lowers output volatility when FD is high	√	√	√	√	NA
FD lowers output volatility when GDP is high	√	√	√	√	NA
FD lowers income volatility when Z is high	×[a]	×[b]	×[a]	√	NA
FD lowers income volatility when PSTAB is high	√	√	√	√	NA
Interactive Models (FI)					
FI lowers output volatility when FI is high	√	√	×	√	√
FI lowers output volatility when GDP is high	√	√	×	√	√
FI lowers income volatility when Z-score is high	×[a]	×[b]	×	×[c]	√
FI lowers income volatility when PSTAB is high	√	√	×	√	√
Interactive Models (FIA)					
FIA lowers output volatility when FIA is high	×	×	×	√	√
FIA lowers output volatility when GDP is high	√	√	×	√	√
FIA lowers output volatility when Z-score is high	×	×	×	√	×b
FIA lowers income volatility when PSTAB is high	√	√	×	√	√
Interactive Models (FIU)					
FIU lowers output volatility when FIU is high	√	×[c]	√	×[c]	√
FIU lowers output volatility when GDP is high	√	√	√	√	√
FIU lowers income volatility when Z-score is high	×[b]	×[b]	×[b]	×[c]	×[b]
FIU lowers income volatility when PSTAB is high	√	√	√	√	×b

Notes: Basic: results from 4.1 and 4.2; (I): Exclusion of low-income countries; (II): Exclusion of OECD countries; (III): 5-year growth volatility; and (IV) Financial Inclusion Indices by Gutierrez-Romero and Ahamed (2021).

√: statement of finding is supported; ×: statement of finding is not supported; a significant marginal effect below the threshold; b significant marginal effect in the intermediate range of moderating variable; c significant marginal effect at all levels of moderating variables.

Table 7: Quantile Regression Results

VARIABLES	(1) q10	(2) q25	(3) q50	(4) q75	(5) q90
Final Depth (FD)					
$FD_{i,0507}$	0.152	0.107	-0.535	-0.864***	-1.126*
	(0.222)	(0.423)	(0.134)	(0.000)	(0.081)
Overall Finance Inclusion (FI)					
$FI_{i,0507}$	1.771	-1.443	-4.181**	-7.833***	-10.69**
	(0.135)	(0.448)	(0.038)	(0.000)	(0.038)
Financial Access (FIA)					
$FIA_{i,0507}$	1.921	-0.688	-1.809	-3.268*	-6.514***
	(0.103)	(0.526)	(0.401)	(0.684)	(0.002)
Financial Usage (FIU)					
$FIU_{i,0507}$	1.746	-3.348	-5.101**	-7.519***	-8.327**
	(0.150)	(0.790)	(0.037)	(0.001)	(0.026)

p-values in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5. Conclusion

This paper continues the debate on the nexus between finance and economic outcomes by examining the roles of financial depth and financial inclusion in ameliorating or worsening output volatility during the 2008-2010 GFC. In the paper, we examine whether the relations between finance and growth volatility are contingent on the levels of financial development, economic development, financial stability, and political stability. As a further analysis, we assess whether finance would play a more effective stabilizing role when output volatility is high. Finally, we also distinguish between access and usage dimensions of financial inclusion and assess their contributions to output volatility during the GFC.

Using a cross-national data set of more than 100 countries, we uncover three interesting results. First, both financial depth and financial inclusion tend to mitigate output volatility during the GFC and their ability in reducing economic instability is more apparent in more financially developed, advanced, and politically stable countries. However, our results are uncertain whether financial depth and financial inclusion complement or substitute banking stability in reducing output volatility during the period. Second, disaggregating financial inclusion into its access and usage dimensions, we find the stabilizing role of financial usage to be more important. Finally, finance is effective in reducing output volatility when it is

needed most during a period of high economic instability.

Based on these findings, we argue that the recent concern regarding potential harm from financial expansion should not be over emphasized. Even though there is a need to contain risk seeded during a 'normal' financial period from the increase in the size and depth of the financial sector, as some have noted, financial development remains a key factor in arresting output volatility during crises. Therefore, from a practical or policy point of view, policy makers and monetary authorities should emphasize initiatives that promote efficiency and usage of financial services. In other words, increasing availability of financial services per se may not be sufficient. Instead, financial inclusion should mean each individual has access to financial products and use them for their economic activities. In addition, policy initiatives must be put in place to further propel the levels of financial and economic development of a country to reach a certain threshold levels such that the benefits of financial development and inclusion can be fully materialized. To further strengthen the beneficial effects of finance, the government should safeguard the political stability of the country, which might include the transparent implementation of economic policies, formulation of credible policy framework, and reduction of corruption.

These policy recommendations notwithstanding, additional research should be conducted to shed more light on the potential benefit or harm of finance. As our focus is on output volatility, future research could be extended to cover other aspects of socio-economic outcomes such as poverty, income inequality, and climate change. In addition, future analysis could also evaluate potential indirect effects of financial development and inclusion. In a globalized world, one aspect would be whether finance can indirectly shield economies from various adverse global shocks and risks and heightened uncertainty of recent years, such as certain geopolitical risks and the Covid-19 health crisis. This extension would allow us to have more concrete evidence on the roles of finance in the economy.

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