Banking Concentration and Financial Openness

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Abstract

We examine how the level of financial development in the banking sector depends on both the degree of capital account openness and the degree of bank concentration across countries in the long run. Using data on 136 countries, we find that based on the level of economic development, financial openness has differing relations to credit market activity and this relation may depend on bank concentration. For example, in high income countries, financial openness is robustly associated with higher credit market activity but only in relatively concentrated banking systems. However, in developing countries, financial openness is not robustly associated with higher credit market activity and has no relation to bank concentration. Moreover, in contrast to previous works, we find that based on the level of economic development, this relationship depends on the degree of openness. In particular, for high income economies, banking concentration is negatively associated with credit market activity but this relation is weaker in economies that have lower capital account restrictions. For developing countries, the adverse relation is only robust in economies that are sufficiently open, and is exacerbated in economies that are more open.

JEL classifications: F21, F36, O4, G21

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1 Introduction

One of the most significant developments across countries over the past twenty-five years or so has been the move towards increasing "globalization." For example, there has been progress towards reducing impediments to trade through free trade agreements. On another dimension, countries have also been gradually removing restrictions on capital flows over time.

As discussed in Reinhardt et al. (2013), these moves regarding capital flows were initially concentrated among advanced countries beginning in the 1980s. Next, the process spread to emerging market economies in the early 1990s. Finally, the process began in low income countries in the second half of the decade but has been slow since that time. To see this, consider measurements of financial openness through the Chinn-Ito index (Chinn and Ito, 2006, 2008) for a sample of 136 different countries from 1997 - 2017. Among high income countries, the average measure of financial openness in 1997 stood at 0.772 and grew to 0.895 in 2017.[1] However, the advances in developing countries were modest – 0.372 in 1997 versus 0.392 in 2017.

Why have these patterns been so different across the stages of economic development? On the one hand, Reinhardt et al. (2013) describe that the degree of government imposed restrictions on capital flows leads to a reduction in the quality of a country's "social infrastructure" which is important for supporting income per worker and the size of an economy's stock of physical capital. As described by Hall and Jones (1999), economies with a good social infrastructure "get the prices right...so that individuals equate the social returns to their actions with private returns." That is, economies with a good social infrastructure favor productive investment rather than the diversion of resources which lead to low levels of output per worker. On the other hand, as mentioned by Eichengreen (2001), it could be that the degree of market imperfections varies in significant ways across the stages of economic development which lead to different results from increasing financial openness. For example, based on the theory of the second best, removing restrictions in an economy with numerous imperfections may not lead to better economic outcomes.

However, it may also be because economists are still in the early stages of trying to understand how removing capital restrictions has an economic impact. For example, based on initial surveys of the empirical literature on the impact of capital account openness, both Eichengreen (2001) and Edison et al. (2004) lament that the empirical results vary widely across countries. As they discuss, these differences depend on the various measures of financial openness as well as differences in the set of control variables across studies. In particular, the study of Chinn and Ito (2006) does not find that increasing the degree of capital account openness is associated with an increase in the level of financial development in the banking sector — which one would hope — since removing capital account restrictions should increase the efficiency of the banking system. This is problematic as previous work such as Beck et al. (2004) argues that the extension of credit promotes the amount of output per worker and higher levels of economic

[1]The index is normalized to range between 0 and 1 (a value of zero means that a country is completely closed, while a value of 1 means that a country is fully open). In this case, a value of 0.772 would mean that the average high income country in our sample is 77.2% open.

development. In this regard, the results from Chinn and Ito (2006) are disappointing.

Yet, in addition to the aforementioned changes towards globalization across countries, there have also been significant changes in the market structure of the banking system across countries over the same time-frame. In particular, developments in advanced countries such as the United States led to institutions that grew to be so large that they were deemed "too big to fail" during the Great Financial Crisis. In turn, such events led to the largest global recession since the Great Depression. Nevertheless, changes in the degree of banking concentration have not been the same across the level of income — in advanced countries, banks have become more concentrated while in the developing world, they have been less concentrated.[2]

How do the effects of financial openness depend on the market structure of the banking system? So far, existing research on financial openness does not account for this important feature of financial development.[3] Accounting for the market structure of the banking system seems quite relevant as it has been found that the conclusions from previous research can be sensitive to the set of control variables used in regression analysis. Moreover, as discussed by Beck et al. (2004), the banking system is the largest component of the financial system across countries. Consequently, it is generally the largest supplier of credit across countries. Thus, we argue that the structure of the banking system is also a critical component of a country's "social infrastructure" but this has not been addressed in the previous literature that studies the long-run relation between capital account restrictions and economic development.

To address this important gap in the existing literature, the objective of this paper is to empirically examine how the level of financial development in the banking sector depends on both the degree of capital account openness and the degree of concentration of the banking system. As previously stated, Chinn and Ito (2006) do not find that capital account openness contributes to the level of financial development in the banking sector even though it should enhance the efficiency of the local banking system across countries. However, there have been a number of contributions – *both empirical and theoretical* – which look at how banking concentration relates to the availability of credit. Consequently, it is quite logical that studies of financial openness on economic activity should also control for the market structure of the banking system in each economy.

[2]For example, our sample shows that the average three-firm concentration ratio in 1997 was 67.74 for advanced countries, while in 2017, it was 68.30. For developing countries, the average concentration ratio in 1997 was 69.19, while in 2017, it was 64.53.

[3]Based on the theoretical framework of Balmaceda et al. (2014), Fischer and Valenzuela (2013) provide an empirical investigation into how the relationship between credit market activity and financial openness depends on competition in the banking sector. They find that financial openness positively affects private credit in countries with a competitive banking sector before financial openness occurs while it vanishes and even becomes negative in countries with weak competition in the banking sector before financial openness takes place, suggesting that the stage of economic development is irrelevant. However, the model is parsimonious and falls short of controlling for a large number of determinants of financial development discussed in the literature. For example, they only control for openness, concentration, an interaction terms for openness and concentration along with a country fixed effect and a time fixed effect. In contrast, as we explain below, we also control for per capita GDP, the growth rate of the domestic money supply, trade openness, and measures of legal and institutional development which are standard in most of the literature that relates financial development to financial openness. As our results in many ways are the opposite of Fischer and Valenzuela (2013), one might conclude that their regression model is missing a number of important control variables. As a result, we revisit this question with a more comprehensive set of controls for financial development and challenge their results.

In beginning to address these important questions, we start by discussing the previous literature looking at the economic impact of banking concentration. Cetorelli and Gambera (2001) find that concentration lowers the overall growth of credit to firms. Further, Beck et al. (2004) using survey evidence across firms in different countries find that all firms – regardless of their size – face greater obstacles in obtaining funding in more concentrated banking markets.[4]

There have also been a number of theoretical contributions that look at the role of banking concentration for economic activity. First, Ghossoub et al. (2012) construct a monetary framework with a monopolistic bank to show that the monopolist distorts credit markets by withholding resources. As a result, the effect of monetary policy in monopolistic banking systems is exactly the opposite of what occurs in perfectly competitive economies. From this perspective, the qualitative impact of financial openness may also vary depending on the industrial organization of the banking system. Similarly, Ghossoub and Reed (2015) show the effects of monetary policy are weaker in economies dominated by a small number of large banks. Thus, the quantitative impact from removing capital restrictions may also depend on banking concentration. Finally, Ghossoub and Reed (2019) demonstrate that the level of capital accumulation in a monetary growth model with production externalities is lower if the degree of concentration is higher. In their framework with Cournot competition in capital markets, banks withhold more resources from the capital sector if the banking system is more concentrated. Thus, based on the arguments in Hall and Jones (1999), concentrated banking systems "get the prices wrong" and institutions do not "capture the social returns to their actions as private returns."

Consequently, it seems naive to believe that empirical work relating financial openness to financial development does not need to account for banking concentration. As the previous literature has shown, banking concentration has an important relation to credit market activity across countries. Moreover, the conclusions from the previous literature on banking concentration are also missing some important elements – regardless of the nature of previous work, there has not been attention devoted to studying how the relation between banking concentration and financial development may depend on the degree of access to international capital flows. Nor has there been attention devoted to considering how financial development's relation to openness may depend on the market structure of the banking system.

With this background in mind, we return to the important question: "*Why might the effects of openness depend on the degree of banking concentration?*" Notably, financial openness may have a positive effect only if the degree of banking concentration is high. If small banks are more fragile, they may not have the resources to take advantage of openness to finance economic activity. At the opposite end, large banks are able to absorb these risks and can be able to

[4]On the other hand, there have been other studies which focus specifically on business lending in the United States which produce somewhat different insights. First, Petersen and Rajan (1995) show that young, small businesses are able to obtain more funding in concentrated banking markets than competitive markets. This occurs as banks with market power are able to offer different lending terms than competitive intermediaries that have less market power. Further, Saidi and Streitz (2021) study lending to nonfinancial firms using Compustat data to show that such firms are able to obtain more favorable financing terms, particularly in industries where borrowers compete in markets as strategic substitutes. For a related discussion, see Poitevin (1989) and Giannetti and Saidi (2019).

provide loans with preferential conditions.[5] In addition, when banking markets are initially highly concentrated, financial liberalization (particularly in the form of foreign bank entry) can lead to the exclusion of smaller (or weaker) businesses from the credit market, while the stronger companies are served by international banks (Balmaceda et al., 2014). In these conditions, each type of bank specializes in the type of firm in which it has a comparative advantage, and this should lead to an increase in efficient lending.[6]

Secondly, *why might the effects of concentration depend on openness?* On the one hand, large banks can be useful to access funds at lower costs (monopsony power), reap scale economies and take risks by financing new firms (Petersen and Rajan, 1995). Opening the financial sector creates a threat for incumbent financial intermediaries limiting the negative impact of concentration on credit market activity. As a result, existing banks can be more willing to finance local firms and households, inducing an increase in financial development. Yet, in low-income countries, the threat may be not enough or demand may be too low to observe a positive impact.

We now turn to directly focusing on the structure and contribution of our work. To begin, we discuss the measure of financial openness that we employ in looking at the role of banking concentration and capital restrictions on the level of financial development in the banking sector across countries. As described in Eichengreen (2001), Edison et al. (2004), and Chinn and Ito (2006), there have been a number of different measures of financial openness that have been used in previous studies. In particular, Edison et al. (2004) argue that many of the different measures vary depending on whether they control for the intensity of capital controls or the mere presence of such controls. They note that studies including measures of the intensity of capital controls tend to be more informative and offer more compelling evidence that increasing financial openness can support economic activity. Yet, Chinn and Ito (2006) measure both the intensity of capital controls and whether the intensity of such controls takes into account how the direction of capital controls in addition to the various types of financial transactions matters. For these reasons, we use the Chinn-Ito measure in our study. Still, Chinn and Ito (2006) do not find that relaxing capital restrictions supports credit market activity. Instead, we will show that this is primarily due to the fact that measures of banking concentration are omitted in their analysis. In terms of our measure of banking concentration, we use the three-firm concentration ratio available from the World Bank. However, measures of bank concentration

[5]As discussed in Gao and Reed (2021), there is an extensive literature studying how the degree of banking concentration relates to the stability of an economy's financial system. Notably, one line of argument is based on the concentration–stability hypothesis in which increased concentration encourages banks to become more cautious to protect the present value of future rents. See, for example, Marcus (1984), Keeley (1990), Allen and Gale (2004), Beck et al. (2006), and Bretschger et al. (2012), among others. In contrast, an alternative argument favors the concentration-instability hypothesis in which large banks with market power may take on large amounts of risk. In particular, see Boyd and De Nicolo (2005). Other contributions obtain mixed results. In particular, Martinez-Miera and Repullo (2010) highlights the existence of a non-monotonic, U-shaped relationship between competition and stability. In contrast, Gao and Reed (2021) develop a framework extending Diamond and Dybvig (1983) and Ennis and Keister (2009) with sunspots and show that generally competitive banks are more fragile than concentrated institutions.

[6]They do note, however, that such an outcome would occur only if the entry of foreign banks does not raise the cost of funds for domestic banks.

are not generally available until 1996. In particular, in order to control for endogeneity and smooth out the impact of short-run fluctuations in economic activity, we look at 5 year averages for variables from 1998 - 2017 (a total of 20 years of data) as in Chinn and Prasad (2003) and Reinhardt et al. (2013).[7]

We proceed to share our results. To begin, we only look at the long-run implications of capital account openness and banking concentration on the amount of credit provided by deposit money banks as a percentage of GDP across countries. Upon controlling for country-level unobservables in our sample of high income countries, we find that increasing financial openness in a banking sector where concentration is near zero lowers the credit to GDP ratio in the banking sector. This is likely to be the case because borrowers are able to access funds from abroad in competitive banking systems. Alternatively, it might be for the reasons previously discussed – in less concentrated banking systems, banks are smaller and potentially more fragile. Under these conditions, forcing small banks to compete with outside sources of funds may render them to be even more fragile and unable to provide higher levels of credit funding.

Moreover, we find that higher degrees of concentration in economies that are completely closed also lower the amount of credit. Such findings are consistent with previous studies on the effects of banking concentration which do not account for financial openness. Yet, we also observe that the interaction term of capital account openness and banking concentration is positive – implying that the amount of credit provided at higher levels of financial openness is higher if the banking sector is more concentrated. Alternatively, one may view that the the relationship between bank concentration and credit market activity is weaker in more open economies.[8] This may follow the logic advanced earlier – in concentrated banking systems, large banks must compete with foreign sources of funding if openness is higher. *From this perspective, our results imply increasing financial openness supports the availability of credit – particularly in banking systems that are highly concentrated.* Among low and middle income countries, there is some support that banking concentration also lowers credit availability in that sample but there is not a significant relationship between the provision of credit and the degree of capital account openness.

Our benchmark framework looks at only the level-effects of concentration on credit market activity. We next look at an econometric specification that includes both the level-effects and the effects of changes in the degree of concentration. Yet, our results for high income economies are the same – increasing the level of capital account openness promotes credit market activity in banking systems that are highly concentrated. Similarly, we tend to see the same results among low income countries as we did in the level-effect only specification – concentration matters, but financial openness does not. However, we also perform a robustness check to look

[7]See also Beck et al. (2000), Levine et al. (2000), Boyd et al. (2001), Aghion et al. (2005), Baltagi et al. (2009), among others who have used a similar approach.

[8]This challenges work done by Beck et al. (2004) which suggests that a more concentrated banking system impedes credit market activity only for developing countries. Instead, we show that even for advanced economies, a more concentrated banking system is negatively correlated with lending if they have strict capital account regulations (even after controlling for economic and institutional development).

at credit provided by the overall financial system – in this specification, we find that financial openness matters! This is particularly the case as long as the degree of banking concentration is relatively low.

Consequently, one might view that the role of financial openness clearly depends on a country's stage of development. Financial openness promotes financial development in banking systems that are sufficiently concentrated in high income countries while it enhances credit extension in banking systems that are somewhat concentrated in low and middle income countries. In order to try to account for these differences, we look to see if there are other factors in developing countries that can help us understand this divergence.

Our first observation is that the role of external public debt plays a significant role in lower income countries. When accounting for the level of public debt in developing countries, the results are similar to the sample with high income countries. Banking concentration has a negative association to credit and financial openness but also has a negative relation in economies that have banking systems that are relatively concentrated. Yet, higher levels of financial openness support financial development in banking systems that are more concentrated. We also find that the availability of credit is higher in banking systems that are more open and have higher levels of indebtedness.

To conclude, we also consider the possibility that home bias across lower income countries may also contribute to the relationship between financial openness, banking concentration, and credit availability. In this case, domestic investors may choose to hold a large fraction (sometimes all) of their portfolio in domestic securities, despite the benefits of holding securities in world markets. Even though there is some financial integration, global risk sharing is limited by various restrictions that both domestic and foreign investors face when financial markets are not fully integrated (Lau et al., 2010). In fact, Lau et al. (2010) have shown that home bias tends to be higher in developing countries than in advanced economies. Therefore, a rise in banking concentration in the presence of home bias can reduce credit market activity even as developing countries become more financially open.

To investigate this hypothesis, we consider how the relationship between banking concentration and credit market activity depends on financial openness and home bias in developing economies. As a result, we add home bias as an interaction term to banking concentration and financial openness. In order to get a proxy for home bias, we follow Lau et al. (2010) by dividing the portion of domestic investors' holdings in their local equity markets by the country's world-market capitalization weight.[9] The data for constructing this proxy are from the World Bank Development Indicators and the Coordinated Portfolio Investment Survey (CPIS) obtained from the IMF database. As in the case of the specification with public debt, we find results regarding banking concentration and financial openness that are also consistent with the evidence for high income countries. We also find that financial openness helps improve the availability of credit in economies with higher levels of home bias.

In closing, though we have pursued a large number of different specifications, the bulk of

[9]See also Chan et al. (2005).

our evidence supports the same conclusions regardless of the stages of development – banking concentration reduces the availability of credit across countries, but relaxing capital flow restrictions weakens the adverse association to credit. From this perspective, financial openness promotes the availability on credit – particularly in countries with more concentrated banking systems.

2 Data and Summary Statistics

2.1 Data description

The data are drawn from a number of sources, primarily the *World Bank's World Development Indicators*, the IMF's *International Financial Statistics*, and the Financial Development and Structure Dataset put together by Beck et al. (2010), who updated it to 2017. Our analysis is based upon data from 1997-2017 and is recorded at an annual frequency, spanning 136 countries. Refer to Table 10 in the appendix for a list of all countries used in our analysis.

The dependent variable in a large percentage of the analysis is the level of domestic credit to private sector by banks (relative to GDP).[10,11] As an alternative measure of credit market activity, we use the level of domestic credit to the private sector as a percentage of GDP (which includes lending from both banks and non-bank financial corporations).[12]

The variable used for measuring the market structure in the banking sector is the 3-firm concentration ratio. If the size distribution of the banking system is more asymmetric, then the largest institutions will hold a larger proportion of assets in the banking system.

To measure a country's degree of capital account openness, we use the normalised Chinn-Ito index developed by Chinn and Ito (2006, 2008). It is based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). It is updated to 2017.

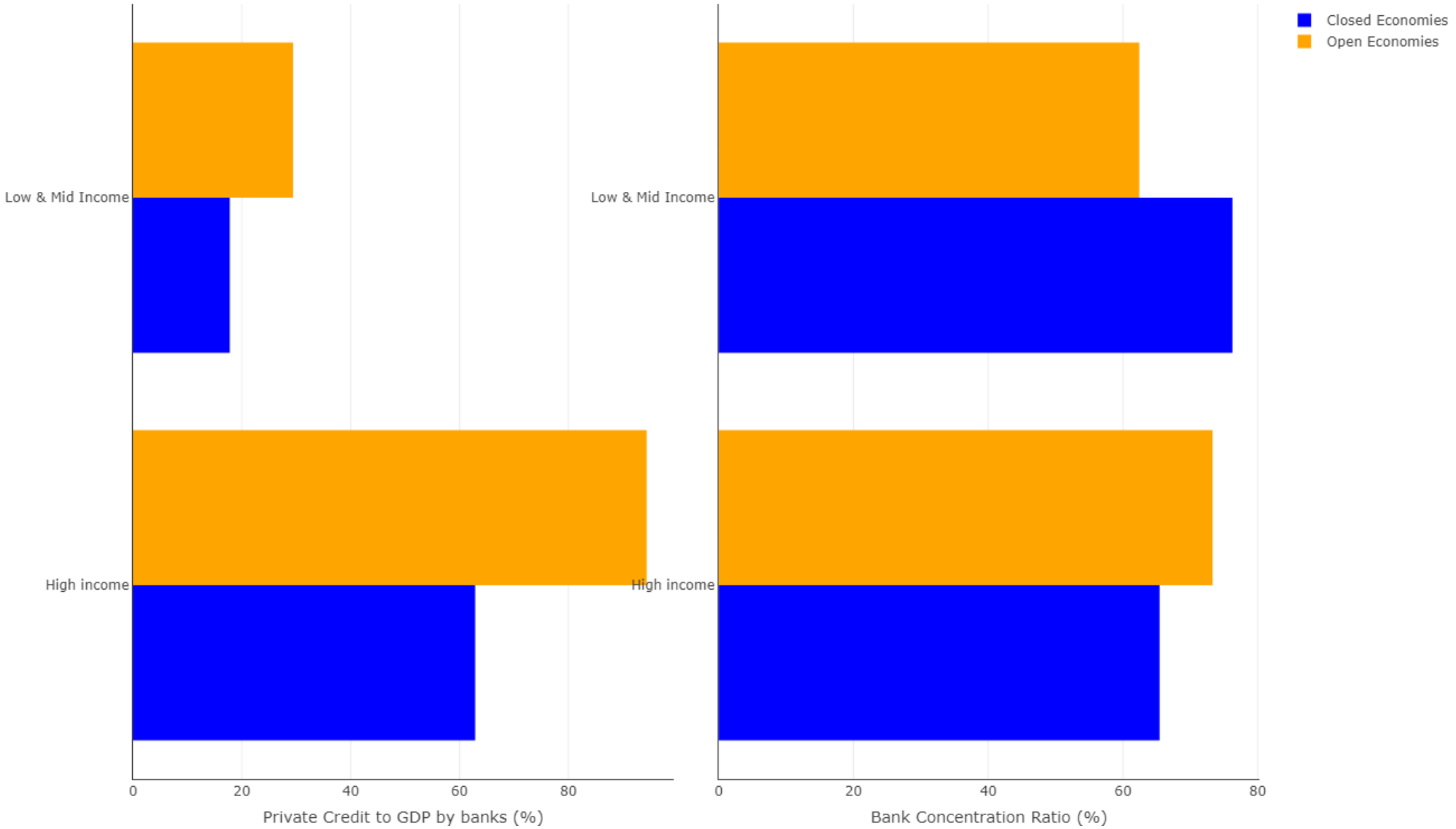


Figure 1: Closed and Open Economies defined by the Median

2.2 Visualizing the data

In this section, we take a look at the data. The left panel of Figure 1 shows the median private credit to GDP by the banking sector across income groups over the sample period. For low and middle income countries, they are grouped into a closed capital account group if the degree of initial capital account openness preceding each five-year period is less than or equal to the median capital account openness for the full sample. If the the degree of initial capital account openness preceding each five-year period is above the median value, then low and middle income countries are grouped into an open capital account group. The same method is used to separate high income countries into closed and open capital account groups.[13]

Among countries that have a relatively open capital account, at the median, the level of financial development in the banking sector is higher than that in countries with a relatively closed capital account. In particular, low and middle income countries that have a relatively open capital account seem to be more financially developed at the median level of development. Notably, the disparity in the level of financial development among high income countries is even greater at the median. To elaborate, high income countries that have a relatively open capital account seem to have a much higher level of financial development than high income countries that have a relatively closed capital account at the median.

The right panel of Figure 1 shows the median bank concentration ratio over the sample period. For low and middle income countries, relatively closed economies have a higher level of concentration in the banking sector than economies that are relatively open at the median. This suggests that the banking sector seems to be less concentrated in developing countries where government policies are less likely to impede the flow of private capital across countries. By contrast, the level of concentration in the banking sector for high income economies is roughly the same at the median.

[10]See for example, Levine and Zervos (1998), Beck et al. (2000), Levine et al. (2000), Boyd et al. (2001), Shen and Lee (2006), Chinn and Ito (2006), Detragiache et al. (2008), Giuliano and Ruiz-Arranz (2009), Schaeck et al. (2009), among others who use private credit to GDP by banks as a proxy for financial development.

[11]We take averages of the dependent variable and all the controls except for banking concentration, capital account openness, income, and the money stock for which we employ the initial value (i.e. the value for the year preceding the 5-year average). If the first or the last year is missing within the 5-year time frame, we replace the 5-year average with the corresponding 4-year average. If two observations are are missing within the 5-year window, we replace the 5-year average with the corresponding 3-year average, and so on.

[12]See for example, King and Levine (1993a,b), Benhabib and Spiegel (2000), Diallo and Koch (2018), among others who use this measure as a proxy for financial development. Further, we consider other measures of financial development whose results are not reported due to space constraints. In particular, we use the ratio of total assets of deposit money banks to GDP as in Boyd et al. (2001). In addition, we use the ratio of credit issued to the private sector by banks and other financial institutions to GDP, which excludes credit issued by monetary authorities (see, for example, Levine et al., 2000; Beck et al., 2000, 2004; Djankov et al., 2007). Finally, we consider the ratio of liquid liabilities of the financial system to GDP as in King and Levine (1993a,b). Our results are qualitatively the same when using these other measures of financial development.

[13]For high-income countries, there are only 34 observations which are at or below the sample median, compared to 145 observations that are above it. To ensure that there is an adequate number of relatively "closed" countries, we place a high-income country into the closed group if its level of initial capital account openness is below the median value among the sample high-income countries; this splits the sample of high-income countries in approximately half (i.e. 85 observations in the closed and 94 observations in the open group).

3 Empirical Specification and Results

3.1 Model

We study how the relationship between financial openness on credit market activity depends on the level of banking concentration across countries. In the spirit of Reinhardt et al. (2013), we have the following econometric specification:

$$\left(\frac{\text{Private Credit}}{\text{GDP}}\right)_{i,t} = \alpha_i + \beta_1 OPEN_{i,t-1} + \beta_2 CR_{i,t-1} + \beta_3 CR_{i,t-1} * OPEN_{i,t-1} + \beta_4 M1_{i,t-1} + \beta_5 GDP_{i,t-1} + \Gamma X_{i,t} + \epsilon_{i,t} \tag{1}$$

where the dependent variable is the level of domestic credit to private sector by banks (relative to GDP), $OPEN_{i,t-1}$ (initialka_open) reflects the level of capital account openness, $CR_{i,t-1}$ (initialcr) refers to the three-firm banking concentration ratio, $M1_{i,t-1}$ (log(initialM1stock)) captures the log of the money stock in the economy, while $GDP_{i,t-1}$ (log(initialrgdppc)) refers to the log of real GDP per capita and $\epsilon_{i,t}$ is the error term.

To focus on the time-dimension of the data while smoothing out the impact of short run fluctuations, we use a panel of non-overlapping five-year averages (see for example, Chinn and Prasad, 2003; Reinhardt et al., 2013) over the period 1998-2017.[14] $CR_{i,t-1}$, $OPEN_{i,t-1}$, $M1_{i,t-1}$ and $GDP_{i,t-1}$ are in initial terms. That is, they represent the year that precedes the the 5-year average. In particular, $CR_{i,t-1}$ is in initial terms to avoid the possibility of capturing the effect of credit market activity on banking concentration.[15] Moreover, the same line of reasoning applies to having $GDP_{i,t-1}$ expressed in initial terms. Similar to $CR_{i,t-1}$, we want to avoid the possibility of capturing the effect of financial development on GDP per capita. The decision to have strict or loose capital account restrictions ($OPEN_{i,t-1}$) is viewed as a policy choice being uncorrelated to the level of financial development in the following period. In this manner, shifts in the level of financial development in the current period will not be associated with the previous period's policy choice. Thus, it is also expressed in initial terms. Further, the stock of money in the economy is also viewed as predetermined and uncorrelated to the level of financial development in the following period, and also expressed in initial terms.

[14] Since we are focused on long-run relations, using non-overlapping five-year averages smooths out the impact of short-run fluctuations across our sample. Some of these short-run fluctuations include the global financial crisis and the shift from deregulation to re-regulation in the financial system. For the former, a useful exercise would be to split the data into before and after the crisis. However, there would be too few observations given our empirical framework. In regards to the latter, Barth et al. (2013) provide data on banking regulations across countries. Unfortunately, there are not enough observations across time to be implemented in our framework.

[15] We still went ahead and tested if the initial level of bank concentration (along with its interaction with the measure of initial financial openness) is endogenous. However, to find an appropriate instrument for bank concentration is challenging (see Diallo and Koch (2018) for a more detailed discussion). To overcome this, we use the method of Lewbel (2012), which can be applied to generate instruments for potentially endogenous regressors in the absence of external instruments (or to supplement external instruments to improve efficiency). To identify these instruments, there must be a vector of exogenous variables, denoted by Z, and the errors must be heteroskedatic. Thus, we use the first of the two-stage procedure proposed by Lewbel (2012) to construct instruments. In the first stage, initial bank concentration and its interaction with the measure of initial financial openness are regressed on all of the control variables (including external instruments) and the vectors of residuals are stored. The residuals are then used to create instruments if we observe heteroskedasticity in the first-stage regressions. The valid instruments are calculated as $(Z - \bar{Z})\epsilon$, where $\bar{Z}$ is the mean of Z and ϵ is the residuals from the first stage regression. From here, we use the instruments to test if initial bank concentration and its interaction is endogenous, and we find that they are not. More details can be found in the Appendix.

$X_{i,t}$ is a vector of control variables that have been found to be poignant determinants of the level of financial development. These include real GDP growth per capita (grrgdppercap), the rate of money growth (M1growth), openness to trade (tradeopen), and measures of legal and institutional development (a measure of the level of corruption (corrupt), law and order (laworder), and the quality of the bureaucratic system (bq), respectively. In these indexes, higher values indicate better conditions.) To account for the rate of change in the level of banking concentration across countries, we also include the growth rate of banking concentration (grconcentration).[16] For the complete definitions of all variables along with the data sources, please refer to Table 9 in the appendix. Further, summary statistics and pairwise correlations are located in the appendix.

To access whether the relation between banking concentration and financial development depends on financial openness across income groups, we split the data into advanced and developing countries.[17] In subsequent specifications, we change the vector of control variables $X_{i,t}$ to include measures of financial risk that countries may face, as well as the share of foreign banks in the banking sector. As a final robustness check, we look at alternative measures of credit market activity, such as the level of domestic credit to the private sector as a percentage of GDP in other analyses. We then include time fixed effects on the level of domestic credit to private sector by banks (relative to GDP).

3.2 Empirical Results

3.2.1 A Model without the Rate of Change in Banking Concentration

In this section, we begin to study the long-run relations of financial development with financial openness and banking concentration. We are particularly interested in how the between openness and financial development depend on the degree of concentration. Moreover, as discussed in the introduction, we would like to add to the existing literature on the correlation of banking concentration with credit market activity by looking at how its association with concentration depends on the degree of openness.

Table 1 reports the empirical results for the determinants of credit provided to the private sector by deposit money banks as a percentage of GDP. Column (1) shows results in the absence of controlling for country-specific unobservables while column (2) controls for country-fixed effects.

[16] We posit that the level of financial development depends on rate of change in the level of banking concentration across countries. In particular, Janicki and Prescott (2006) have highlighted the sharp rise in the level of concentration in the banking system since the mid-1990's in the United States (see also, for example, Ennis, 2001). Further, Bremus et al. (2013) note that changes in the size distribution of banks can have macroeconomic outcomes on credit and output, while McCord and Prescott (2014) note that large changes in the size distribution of banks can impact the allocation of credit and by extension, bank lending. Coupled with the 7% decline in the average level of banking concentration across our sample of developing countries between 1997 and 2017, we look to see if the rate of change in concentration has any bearing on financial development.

[17] We call advanced countries high income countries as classified by the World Bank. We consider developing countries to be nations that are classified as low income, lower middle income or upper middle income by the World Bank.

Table 1: Private Credit to GDP by Banks, Financial Openness and Banking Concentration

	Dependent variable:					
	Credit/GDP by Banks					
	Full		HIC		LIC	
	(1)	(2)	(3)	(4)	(5)	(6)
initialka_open	-0.102	23.555	-29.407	-60.204*	1.446	15.344
	(24.609)	(20.154)	(40.552)	(33.764)	(18.053)	(9.721)
initialcr	-0.205	-0.129	-0.287	-1.433***	-0.339***	-0.040
	(0.143)	(0.113)	(0.571)	(0.540)	(0.129)	(0.064)
initialcr:initialka_open	0.249	-0.224	0.319	1.141**	0.155	-0.122
	(0.282)	(0.172)	(0.603)	(0.507)	(0.228)	(0.118)
log(initialM1stock)	1.813**	4.769***	0.542	9.590**	1.389	3.653**
	(0.907)	(1.596)	(1.887)	(4.328)	(1.037)	(1.511)
log(initialrgdppc)	5.425**	8.114	14.265	12.726	4.537*	9.381
	(2.177)	(8.283)	(11.318)	(20.217)	(2.334)	(6.905)
grrgdppercap	-0.036	-1.093***	-2.766**	-2.781**	0.980	-0.240
	(0.839)	(0.391)	(1.101)	(1.082)	(1.084)	(0.339)
M1growth	-91.211*	41.107	63.884	41.176	-164.319***	-13.824
	(53.054)	(49.411)	(100.424)	(86.268)	(53.380)	(31.863)
tradeopen	15.969**	9.716	15.033	13.553	28.804***	9.249*
	(7.852)	(7.759)	(11.047)	(15.498)	(9.377)	(4.904)
corrupt	-4.617	2.281	6.329	5.554	-4.634*	1.076
	(3.999)	(2.677)	(7.633)	(5.888)	(2.442)	(2.395)
laworder	9.667***	2.397	9.746*	8.987	5.274**	-0.121
	(2.111)	(2.624)	(5.603)	(6.552)	(2.208)	(2.954)
bq	12.800***	-4.868	24.775***	13.241**	8.445***	-5.410*
	(3.274)	(4.708)	(9.290)	(6.376)	(2.786)	(3.268)
Constant	-81.994***	-79.435	-189.507**	-183.17	-44.474	-80.826*
	(24.426)	(60.965)	(85.998)	(179.026)	(29.998)	(42.730)
Observations	301	301	104	104	197	197
Country-fixed effects	No	Yes	No	Yes	No	Yes
R^2 (within)		0.357		0.493		0.537
R^2 (overall)	0.643	0.312	0.570	0.288	0.491	0.144

The dependent variable is private credit to GDP ratio by banks. The dependent and explanatory variables are averaged over 5-year periods covering 1998–2017 (except when stated otherwise)."Initial" refers to the year before the respective 5-year period. Standard errors are robust to heteroskedasticity. *Note:* *p<0.1; **p<0.05; ***p<0.01.

Columns (1) and (2) indicate that financial openness is not related to the level of credit market activity. Also, when looking at the full sample reported in columns (1) and (2), it does not appear that banking concentration is correlated with financial development. From the interaction terms in columns (1) and (2), we see a similar story. That is, the association of banking concentration with private credit does not appear to depend on the level of financial openness.

In contrast to columns (1) and (2), columns (3) and (4) of Table 1 focus on credit market activity in high income countries. As with columns (1) and (2), they show results in the absence of controlling for country-specific unobservables and controlling for country-fixed effects respectively. In column (3), the results concerning the relations of financial openness and banking concentration on credit market activity are similar to the results from the full sample reported in columns (1) and (2). In particular, increasing the level of financial openness has no robust relation to credit market activity. Similarly, among high income countries in our sample, a more concentrated banking system is not robustly correlated with financial development. Moreover, the association of financial openness seems to be unrelated to the degree of banking concentration.

However, when controlling for country-fixed effects in column (4) of Table 1, we see that both banking concentration and financial openness have robust relations to credit market activity in advanced economies. To begin, we start by describing β_1 which by itself measures the relation of credit market activity to capital account openness when the bank concentration ratio is equal to zero. That is, it measures the relation to capital account openness for economies that are perfectly competitive. Based upon the point estimate for β_1, if capital account openness were to increase from 0 to 0.1, then that would be associated with a fall in the credit ratio by about 6.02 percentage points. Therefore, this shows that there is a negative correlation between capital account openness and credit market activity. This is consistent with the previous literature such as Chinn and Ito (2006) that does not control for the degree of banking concentration.

We next turn to describing the association of the independent variable measuring concentration. The point estimate for β_2 indicates the association to banking concentration when the level of capital account openness is equal to zero. That is, it measures the correlation to concentration for economies that are completely closed. Notably an increase in banking concentration by one-percentage point is associated with a lower credit to GDP ratio in the banking sector by about 1.433 percentage points. This is also consistent with previous studies that look at the relationship between banking concentration and credit market activity across countries.

We now turn to one of our principal questions: "*How does the association between financial openness and credit market activity depend on the degree of banking concentration?*" We can study this question by looking at the combined relations of parameters β_1 (which controls for openness) and β_3 (the coefficient for the interactive term of openness and concentration). In particular, we are interested in the following result:

$$\frac{\partial(\text{Private Credit/GDP})}{\partial\ \text{initialka_open}} = \beta_1 + \beta_3 \times \text{initialcr}$$

This equation shows that the relationship between credit market activity and financial openness is allowed to depend on the degree of banking concentration. Our result from column (4) of Table 1 on β_3, the coefficient of the interactive term, shows that the correlation between capital account openness and credit extension is positive as a banking system becomes more concentrated. Notably, in banking systems that are fully concentrated, an increase in capital account openness from 0 to 0.1 is associated with an increase in the credit to GDP ratio by nearly 55 percentage points (-60.2 + 114.1). From this perspective, relaxing capital account restrictions in highly concentrated banking systems can lead to a large and positive relationship with financial development. This result follows the logic mentioned in the introduction – in less concentrated banking systems, banks are smaller and potentially more fragile. Thus, they are unable to offer more credit when faced with competition from other countries. However, large banks are stable and able to withstand the increase in competition.

As we have previously stressed, we also want to use our framework to show how relaxing capital account restrictions helps relieve the negative relation between banking concentration and credit activity. While previous work such as Cetorelli and Gambera (2001) and Beck et al. (2004) find that concentration adversely affects credit market activity, there has not yet been work that has examined how its correlation with banking concentration depends on a country's level of capital account restrictions. In this manner, we examine the following result:

$$\frac{\partial(\text{Private Credit/GDP})}{\partial \text{ initialcr}} = \beta_2 + \beta_3 \times \text{initialka_open}$$

Based upon the coefficient, β_2, we see that an increase in banking concentration in economies that are completely closed is associated with lower credit extension by about 1.43 percentage points. However, the same increase in concentration in countries that are completely open is associated with an increase in credit extension by over 100 percentage points (-1.43 + 114.1). That is, the increase in concentration in open economies is correlated with a rise in credit extension by about double. Again, we see that increasing financial openness can improve credit market activity – especially, in highly concentrated banking systems. As discussed in the introduction, in concentrated banking systems, opening incumbent firms to international competition forces them to offer more credit.

Columns (5) and (6) of Table 1 look at the determinants of credit in low and middle income (developing) economies. In column (5) of Table 1 (which does not control for country-fixed effects), financial openness by itself has no robust association with financial development. Yet, in contrast to the previous results on banking concentration for advanced countries without fixed effects, we do find that for developing economies, a higher level of banking concentration is robustly associated with a decline in financial development among developing economies. However, in contrast to advanced countries, financial openness initially does not appear to associated with how concentration is adversely related to credit market activity and vice versa. Column (5) follows the specification in column (3) where the coefficient of the interactive term is also not statistically significant.

However, in column (6), which controls for country-fixed effects, we see that improvements

in financial openness do not seem to be robustly correlated with credit market activity in developing countries. Similarly, the coefficient on the association between the level of banking concentration and bank lending becomes statistically insignificant. From this perspective, it appears that neither the market structure of the banking system nor the level of capital account openness matter for credit market activity in low and middle income countries. Thus, there is only limited evidence that the structure of the financial system matters for credit activity in developing countries. However, we should also note that there are significantly more coefficients to estimate in the sample of low and middle income countries with fixed effects. In particular, there are nearly twice as many dummy variables to estimate in the sample of low and middle income countries than in the high income sample. Hence, we argue that the results in the absence of fixed effects are quite informative.

In Table 2, we add controls for two components of financial risk put together by the *International Country Risk Guide* (ICRG) to our vector of controls, $X_{i,t}$. The first component of the financial risk rating we use is the Current Account as a Percentage of Exports of Goods and Services (catoexp). The second component is the Net International Liquidity as Months of Import Cover (totalreserve). This provides a comparative liquidity risk ratio that indicates how many months of imports can be financed with reserves. By controlling for these components, we can assess how a country's ability to finance its official, commercial, and trade debt obligations is related to its financial development. Furthermore, we consider that in many countries, banking systems may have a foreign presence. As a result, we also controlled for the share of foreign-owed banks as a percent of total banks (frgnbnkshare) put together by Claessens and Van Horen (2014, 2015).[18]

In columns (1)-(3) of Table 2, we present the results from the full sample, which control for country-fixed effects. To begin, column (1) only adds the Current Account as a Percentage of Exports of Goods and Services to the set of controls, while column (2) only adds the Net International Liquidity as Months of Import Cover. However, column (3) adds both variables to the set of controls, along with the share of foreign-owned banks in the banking system. As in Table 1, the results from the full sample show that neither banking concentration nor financial openness are robustly associated with credit market activity. However, columns (1) and (3) of Table 2 show that, on average, a country's ability to finance its debt obligations is important in promoting credit market activity. This suggests that countries with greater ability to fund their current account balance with income from exports can increase their level of financial development. Nevertheless, columns (2) and (3) indicate that the Net International Liquidity as Months of Import Cover of a nation is not important for financial development. Further, column (3) shows that the share of foreign-owned banks is not important for financial development. Overall, these results are consistent with our previous findings for the full sample in that neither concentration nor financial openness matter for the level of credit market activity.

[18]We also control for other variables whose results are not reported due to space constraints. In particular, these include the fiscal balance to GDP ratio, population growth, inflation, and the investment to GDP ratio. Moreover, we control for stock price volatility as a measure of financial volatility for each country. Ultimately, our main results are unaffected by controlling for these variables. Results can be made available upon request.

Table 2: Private Credit to GDP by Banks, Banking Concentration and Financial Openness: Adding Controls

	Dependent variable:								
	Credit/GDP by Banks								
	Full			HIC			LIC		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
initialka_open	21.188	23.393	19.001	-56.485*	-62.002*	-72.693*	13.298	15.491	12.922
	(19.051)	(19.947)	(18.717)	(33.488)	(35.823)	(41.176)	(9.168)	(9.810)	(9.010)
initialcr	-0.124	-0.135	-0.154	-1.323**	-1.460***	-1.541***	-0.039	-0.039	-0.052
	(0.108)	(0.120)	(0.120)	(0.517)	(0.565)	(0.591)	(0.064)	(0.066)	(0.061)
initialcr:initialka_open	-0.201	-0.211	-0.161	1.039**	1.167**	1.297**	-0.100	-0.118	-0.083
	(0.170)	(0.169)	(0.163)	(0.505)	(0.532)	(0.600)	(0.120)	(0.122)	(0.122)
log(initialM1stock)	3.802**	4.416***	3.519**	7.985	11.275*	7.436	3.128**	3.542**	3.039*
	(1.553)	(1.645)	(1.687)	(6.056)	(5.972)	(7.472)	(1.529)	(1.534)	(1.700)
log(initialrgdppc)	13.785*	9.341	13.599*	21.570	7.037	22.201	12.729*	9.458	11.737*
	(7.272)	(8.867)	(7.657)	(26.862)	(21.715)	(29.166)	(6.606)	(7.196)	(6.624)
grrgdppercap	-0.891**	-1.116***	-0.884**	-2.331**	-2.758**	-2.021	-0.096	-0.257	-0.128
	(0.377)	(0.399)	(0.385)	(1.165)	(1.097)	(1.234)	(0.319)	(0.348)	(0.327)
M1growth	41.228	45.235	42.716	23.605	31.865	15.437	-14.619	-13.163	-14.781
	(48.626)	(50.954)	(50.822)	(88.973)	(93.117)	(86.701)	(31.099)	(32.466)	(33.922)
tradeopen	13.766*	9.783	16.974*	17.972	14.062	16.244	12.271**	9.315*	16.834***
	(7.820)	(7.915)	(8.776)	(14.733)	(15.344)	(16.086)	(4.847)	(5.038)	(5.257)
corrupt	2.380	2.212	2.294	5.551	5.864	4.608	1.223	0.973	0.894
	(2.558)	(2.691)	(2.605)	(5.880)	(5.707)	(6.192)	(2.260)	(2.494)	(2.197)
laworder	2.358	2.301	2.533	9.933	9.529	10.686	-0.180	-0.175	-0.081
	(2.679)	(2.659)	(2.851)	(6.173)	(7.011)	(7.225)	(3.074)	(2.918)	(3.313)
bq	-2.473	-1.978	-2.310	10.293	13.274**	6.350	-3.612	-3.365	-4.288
	(4.704)	(4.776)	(5.044)	(7.321)	(6.581)	(8.339)	(3.571)	(3.736)	(3.710)
catoexp	-0.106**		-0.122*	-0.250		-0.242	-0.070**		-0.086**
	(0.053)		(0.067)	(0.217)		(0.208)	(0.030)		(0.037)
totalreserve		0.136	0.226		-0.150	0.002		0.152	0.333
		(0.356)	(0.365)		(0.530)	(0.546)		(0.468)	(0.473)
frgnbnkshare			0.073			0.460*			0.077
			(0.150)			(0.273)			(0.149)
Constant	-126.858***	-92.506	-127.501**	-257.550	-146.162	-250.798	-107.261**	-84.448*	-104.254**
	(56.428)	(68.525)	(59.693)	(214.594)	(183.368)	(223.489)	(42.021)	(45.922)	(41.578)
Observations	298	288	267	102	102	97	196	186	170
Country-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 (within)	0.366	0.355	0.373	0.499	0.491	0.509	0.550	0.536	0.571
R^2 (overall)	0.474	0.385	0.455	0.379	0.236	0.358	0.199	0.162	0.182

The dependent variable is private credit to GDP ratio by banks. The dependent and explanatory variables are averaged over 5-year periods covering 1998–2017 (except when stated otherwise)."Initial" refers to the year before the respective 5-year period. Standard errors are robust to heteroskedasticity. All regressions control for country-fixed effects. *Note:* *p<0.1; **p<0.05; ***p<0.01.

Columns (4)-(6) of Table 2 concentrate on high income economies within the sample. We start by discussing the association of banking concentration and capital account openness with credit market activity individually. Here, we see a contrast to the full sample. Following the insights from Table 1, improvements in the level of financial openness are associated with a lower issuance of domestic credit to GDP by banks in economies where banking systems are perfectly competitive (the concentration ratio is equal to zero). This result is statistically significant at the 10% level in columns (4) and (5) (which adds the Current Account as a Percentage of Exports and Net International Liquidity as Months of Import Cover to the set of controls, respectively), but is insignificant at all levels in column (6) (which adds both Current Account as a Percentage of Exports and Net International Liquidity as Months of Import Cover along with the share of foreign-owned banks to the set of controls). Further, a highly concentrated banking system in advanced economies is robustly correlated with a reduction in credit to the private sector by deposit money banks in countries that are completely closed. In comparison to our previous results which do not account for financial risk or foreign-owned bank share, the correlation between concentration and credit market activity is larger when we include the liquidity ratio and foreign-owned bank share. However, it is smaller in the other regressions.

Moreover, we see that based on the interaction term, the relationship between capital account openness and credit market activity significantly improves in banking systems that are more concentrated. Thus, controlling for the components of financial risk individually and collectively does not alter our assessment of how credit market activity is related to capital account openness and banking concentration. In particular, there is a weak negative relationship between financial openness and credit market activity when controlling for financial risk individually. Further, banking concentration is negatively correlated with credit market activity whether or not we control for an advanced country's level of financial risk. To sum up, financial openness matters – in economies with perfectly competitive banking systems as well as concentrated systems. However, openness matters more in concentrated banking systems. Moreover, banking concentration is negatively correlated with credit market activity but this relation is weaker in economies that are more open. Yet, financial risk by itself does not seem to be important for credit market activity in high income countries.

In columns (7)-(9) of Table 2, we see the results for developing economies in the sample. The structure of controls in columns (7)-(9) follows the controls in columns (4)-(6). The results are similar to those reported for the developing countries in column (6) of Table 1. In particular, less restrictive policies regarding the flow of private credit across countries appear to be unrelated to credit market activity in developing countries. In addition, a more concentrated banking system is not robustly correlated with credit market activity in the banking sector. Further, the correlation between credit market activity and banking concentration does not appear to depend on the level of financial openness. From this point of view, the structure of the financial system is irrelevant for credit market activity in low and middle income countries but not for high income economies. Yet, we again assert that the lack of statistical significance here could be due to the large number of coefficients that need to be estimated in fixed effects. However,

in contrast to the results for high income countries, there is a fair amount of evidence that financial risk matters – columns (7) and (9) of Table 2 show that a reduction in the current account-to-export ratio is important in improving credit market activity in developing countries.

Table 3: Additional robustness checks on the dependent variable.

	Dependent variable:					
	Priv. Sector			Banks (Time FE)		
	Full	HIC	LIC	Full	HIC	LIC
	(1)	(2)	(3)	(4)	(5)	(6)
initialka_open	29.039	-43.861	17.515	22.158	-72.091**	13.449
	(21.508)	(34.266)	(10.774)	(19.815)	(30.203)	(9.440)
initialcr	-0.079	-1.321**	0.046	-0.175	-1.842***	-0.051
	(0.141)	(0.538)	(0.067)	(0.114)	(0.407)	(0.062)
initialcr:initialka_open	-0.331*	0.962*	-0.200*	-0.225	1.522***	-0.101
	(0.191)	(0.508)	(0.120)	(0.170)	(0.396)	(0.113)
log(initialM1stock)	3.003*	8.939**	3.127**	-0.693	-3.966	3.119
	(1.549)	(4.496)	(1.223)	(3.236)	(5.024)	(2.419)
log(initialrgdppc)	22.120***	18.175	15.406**	1.603	-7.321	7.747
	(7.018)	(19.336)	(7.518)	(9.049)	(24.831)	(7.170)
grrgdppercap	-1.249***	-2.633**	-0.052	-1.435***	-4.451***	-0.213
	(0.475)	(1.139)	(0.463)	(0.519)	(0.852)	(0.354)
M1growth	50.110	36.229	-5.443	4.717	-64.725	-12.714
	(54.164)	(85.395)	(29.876)	(52.285)	(71.812)	(33.949)
tradeopen	11.857	12.702	13.494***	4.999	3.545	10.459**
	(8.630)	(16.297)	(4.518)	(8.614)	(15.521)	(5.110)
corrupt	2.074	4.447	1.700	1.181	-4.005	1.517
	(2.981)	(5.670)	(2.255)	(2.760)	(4.812)	(2.512)
laworder	-0.551	3.644	-2.704	2.604	23.130***	-0.125
	(2.730)	(6.626)	(2.378)	(2.779)	(5.522)	(2.947)
bq	-2.959	19.880***	-4.680	-2.438	3.459	-5.645*
	(7.330)	(6.881)	(5.411)	(5.389)	(6.309)	(3.137)
Constant	-172.022***	-225.900	-120.592**	48.280	196.869	-61.262
	(59.453)	(175.597)	(48.148)	(84.903)	(267.832)	(55.629)
Observations	277	103	174	301	104	197
Country-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2 (within)	0.362	0.511	0.521	0.208	0.530	0.263
R^2 (overall)	0.471	0.521	0.145	0.194	0.139	0.143

In columns (1)-(3), the dependent variable is private credit to GDP ratio. In columns (4)-(6), the dependent variable is private credit to GDP ratio by banks and we include time fixed effects. The dependent and explanatory variables are averaged over 5-year periods covering 1998–2017 (except when stated otherwise). "Initial" refers to the year before the respective 5-year period. Standard errors are robust to heteroskedasticity. All regressions control for country-fixed effects. *Note:* *p<0.1; **p<0.05; ***p<0.01.

We now look at other measures of financial development. We first highlight the fact that the rise of shadow banks has been an important feature in the credit market. As a result, commercial banks are not the only source of credit market activity. Hence, we look at domestic credit to the private sector (relative to GDP). Not only does this include lending from deposit money banks, but also other financial corporations such as finance and leasing companies, money lenders, insurance corporations, pension funds, and foreign exchange companies.[19] Columns (1)-(3) of Table 3 show that our main results are largely unaffected when using this as our dependent variable. That is, the level of financial openness does not matter for broader financial development in across countries. Moreover, the market structure of the banking system does not matter for credit market activity in developing economies, but it does matter in advanced economies. Further, the association between banking concentration and credit market activity depends on the level of financial openness in high income countries. However, the coefficient on the interaction term in column (3) of Table 3 is significant at the 10% level, which suggests that the correlation between banking concentration and broader credit market activity in low and middle income countries depends on financial openness.

Finally, in order to control for variation in credit market activity in the banking system over time, we include time fixed effects. The results are reported in columns (4)-(6) of Table 3. Our results show that adding time fixed effects does not alter our main results.[20]

3.2.2 A Model with the Rate of Change in Banking Concentration

In the previous section, our analysis of the relationship between credit market activity and banking concentration is based on the premise that this relation is solely a level-effect. However, the rate of change in banking concentration may be related to credit market activity. Hence, in order to isolate the level effects of concentration, we need to control separately for a possible rate-of-change effect on financial development. Consequently, in this section, we consider the rate-of-change effect that banking concentration may have on credit market activity. This is done by adding the growth rate of banking concentration to our set of controls, $X_{i,t}$.

Table 4 reports the results for the determinants of credit provided to the private sector by deposit money banks as a percentage of GDP. The results which do not control for country-specific unobservables are in column (1), while column (2) controls for country-fixed effects. When looking at the full sample reported in columns (1) and (2), it seems that financial openness appears to be irrelevant in explaining the level of credit market activity. In addition, a more concentrated banking system is not robustly associated with financial development. The interaction term in column (1) of Table 4 indicates that the association between financial

[19] See World Bank Development Indicators for more details.

[20] As previously mentioned, we also consider other proxies for financial development. However, the results from these considerations were not reported due to space constraints. In particular, we follow Boyd et al. (2001) and consider the ratio of total assets of‘deposit money banks to GDP. Further, as in Levine et al. (2000), we consider the ratio of credit issued to the private sector by banks and other financial institutions to GDP (see also Beck et al. (2000, 2004), Djankov et al. (2007), among others). We also follow King and Levine (1993a,b) and consider the ratio of liquid liabilities of the financial system to GDP. Again, our main results are largely unaffected by using these variables as proxies for financial development. Results can be made available upon request.

Table 4: Private Credit to GDP by Banks, Banking Concentration and Financial Openness

	Dependent variable:					
	Credit/GDP by Banks					
	Full		HIC		LIC	
	(1)	(2)	(3)	(4)	(5)	(6)
initialka_open	-0.972	24.794	-32.043	-50.880**	0.905	16.048*
	(24.483)	(18.373)	(40.079)	(25.024)	(17.894)	(9.698)
initialcr	-0.234	-0.269	-0.354	-1.672***	-0.357***	-0.072
	(0.150)	(0.177)	(0.639)	(0.389)	(0.132)	(0.081)
initialcr:initialka_open	0.254	-0.286*	0.354	0.957**	0.154	-0.145
	(0.282)	(0.167)	(0.611)	(0.421)	(0.228)	(0.114)
log(initialM1stock)	1.801**	4.675***	0.565	9.581**	1.378	3.713**
	(0.906)	(1.558)	(1.891)	(4.179)	(1.037)	(1.520)
log(initialrgdppc)	5.473**	3.633	15.080	1.825	4.485*	8.281
	(2.166)	(8.393)	(12.072)	(18.838)	(2.342)	(6.702)
grrgdppercap	-0.085	-1.253***	-2.607**	-2.611***	0.929	-0.310
	(0.823)	(0.412)	(1.219)	(0.818)	(1.074)	(0.343)
M1growth	-91.743*	33.271	56.601	7.006	-163.833***	-11.308
	(52.902)	(42.643)	(101.588)	(74.025)	(53.377)	(32.089)
tradeopen	16.043**	10.831	15.127	15.346	28.969***	9.367*
	(7.760)	(7.440)	(10.899)	(17.054)	(9.450)	(4.907)
corrupt	-4.394	2.518	6.194	1.007	-4.410*	1.424
	(3.984)	(2.670)	(7.843)	(5.755)	(2.485)	(2.384)
laworder	9.693***	-0.171	9.874*	1.547	5.217**	-0.644
	(2.125)	(2.700)	(5.719)	(6.584)	(2.190)	(3.143)
bq	12.823***	-6.940	24.334***	9.928	8.378***	-6.181*
	(3.269)	(5.163)	(9.422)	(8.385)	(2.771)	(3.295)
grconcentration	-59.618	-170.515**	-72.148	-367.539***	-37.237	-39.765
	(54.247)	(72.276)	(170.240)	(104.364)	(43.427)	(31.832)
Constant	-80.366***	-15.160	-192.342**	-0.180	-42.449	-67.842
	(24.244)	(70.178)	(87.847)	(169.306)	(29.969)	(42.822)
Observations	301	301	104	104	197	197
Country-fixed effects	No	Yes	No	Yes	No	Yes
R^2 (within)		0.400		0.571		0.542
R^2 (overall)	0.644	0.057	0.571	0.105	0.492	0.122

The dependent variable is private credit to GDP ratio by banks. The dependent and explanatory variables are averaged over 5-year periods covering 1998–2017 (except when stated otherwise)."Initial" refers to the year before the respective 5-year period. Standard errors are robust to heteroskedasticity. *Note:* *p<0.1; **p<0.05; ***p<0.01.

openness and private credit does not appear to depend on the level of banking concentration.

However, column (2) shows that the coefficient on the interaction term is statistically significant at the 10% level. In essence, there is weak evidence to support the view that the correlation between financial openness and credit market activity is independent of concentration levels in the banking sector in column (1), but enters significantly at the 10% level in column (2). Similarly, the correlation between banking concentration and credit market activity depends on financial openness. Though the results in column (1) are similar to the purely long run results of the previous section, column (2) serves up differing observations. In particular, the coefficient on the rate of change of concentration (as measured by the growth rate in banking concentration) is statistically insignificant in the absence of controlling for country-specific unobservables in column (1). However, in column (2) of Table 4, concentration growth is robustly correlated with a reduction in credit market activity.

Columns (3) and (4) of Table 4 look at the determinants of credit in high income economies. Similar to columns (1) and (2), they show results in the absence of controlling for country-specific unobservables and controlling for country-fixed effects respectively. In column (3), the relations of credit market activity to banking concentration and financial openness are similar to the results from the full sample reported in column (1). In particular, among high income countries in our sample, increasing the level of financial openness has no robust relation to credit market activity. In a similar manner, a more concentrated banking system is not robustly related to financial development. Moreover, the correlation between credit market activity and a more concentrated banking system in advanced economies is unrelated to levels of financial openness.

In contrast, column (4) indicates that domestic lending in advanced countries is negatively related to financial openness. The reasons for this are reinforced from our discussion in the previous section. Further, a highly concentrated banking system in advanced economies is robustly associated with lower credit to the private sector by deposit money banks. Moreover, the statistically significant and positive value of the coefficient on the interaction term highlights that the relationship between financial openness and credit market activity is significantly weakened in advanced economies with greater banking concentration. Hence, in advanced countries, increasing financial openness supports the availability of credit – particularly in banking systems that are highly concentrated. Column (4) also shows that concentration growth is robustly associated with a reduction in credit market activity in advanced economies, while column (3) indicates that it is a non-factor for domestic lending.

Columns (5) and (6) of Table 4 look at the determinants of credit in low and middle income (developing) economies. Column (5) of Table 4 does not control for country-fixed effects. We see that for developing economies, financial openness alone has no robust relation to financial development. However, banking concentration is robustly associated with reduced credit market activity. As the interaction term enters insignificantly, the negative correlation between banking concentration and credit market activity in developing countries is independent of the level of financial openness.

In column (6), which controls for country-fixed effects, there is now weak association between financial openness and credit market activity. In particular, more financially open borders improve domestic lending in developing economies. This could be because of the banking sector's improved access to foreign funds which enables them to lend more domestically. However, the association between concentration and bank lending becomes statistically zero. An important observation from columns (5) and (6) is the insignificance of the coefficient on concentration growth. This suggests that there is no robust relation between domestic lending by the banking sector and the rate of change in bank concentration in developing countries.

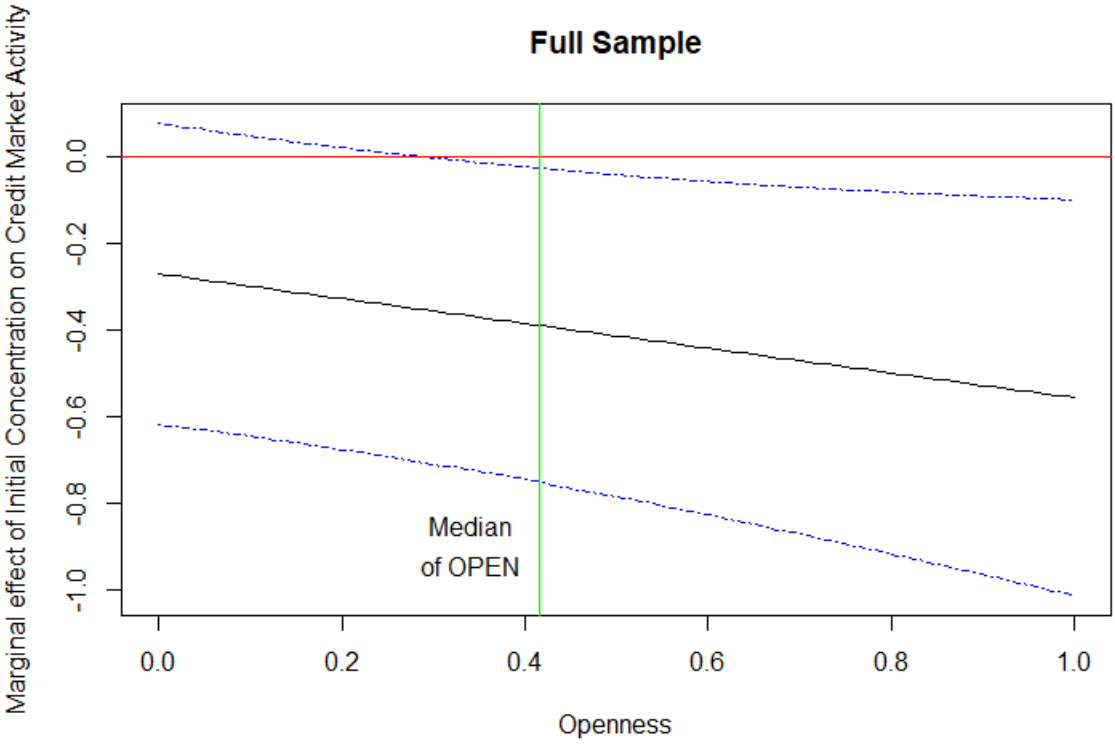
In the main, we find that financial openness is important for domestic lending in advanced countries (when country-specific unobservables are controlled for), particularly when banking systems are highly concentrated. Therefore, if an advanced nation is intent on improving credit access to the private sector, the level of banking concentration within such an economy must be reduced. Further, banking concentration is a significant issue for financial development in advanced countries, and its association strongly depends on the level of financial openness. However, the association of greater concentration in the banking sector with domestic lending in advanced countries is weaker as they become more financially open.

For developing countries, when controlling for such unobservables, we see that financial openness has a weak positive relation to domestic financial development. Further, there is some evidence that a less concentrated banking system is robustly associated with financial development in the long-run. However, this association is not robust to controlling for country-specific unobservables. Nonetheless, our results show that the correlation between banking concentration and credit market activity does not robustly depend on financial openness and vice versa. Again, we continue to believe that our results which do not control for country-fixed effects are still quite informative as there are substantially more coefficients to estimate in the developing countries sample. Consequently, when controlling for country-specific unobservables, improvements in the level of financial development in developing countries would significantly depend on factors such as the size of the money stock and openness to trade.

How do the effects of concentration depend on openness? Most of our previous analysis has emphasized how the association of financial openness with credit market activity depends on the level of banking concentration. However, we have also shown that banking concentration can have a negative relation to the credit market. In our analysis that follows below, we turn to examining another dimension of credit market activity – instead, we will show how the relationship between banking concentration and financial development depends on the severity of a country's capital account restrictions.

To begin, Figure 2 shows the relationship between banking concentration and financial development in the banking sector at different levels of financial openness for the full sample. It is based on column (2) of Table 4. The dashed lines represent the 95% confidence interval. Our illustration implies that the relationship becomes significantly negative for an index of financial openness above 0.29. Recall that we classified countries as financially closed if during each five-year period, the level of initial capital account openness is less than or equal to the

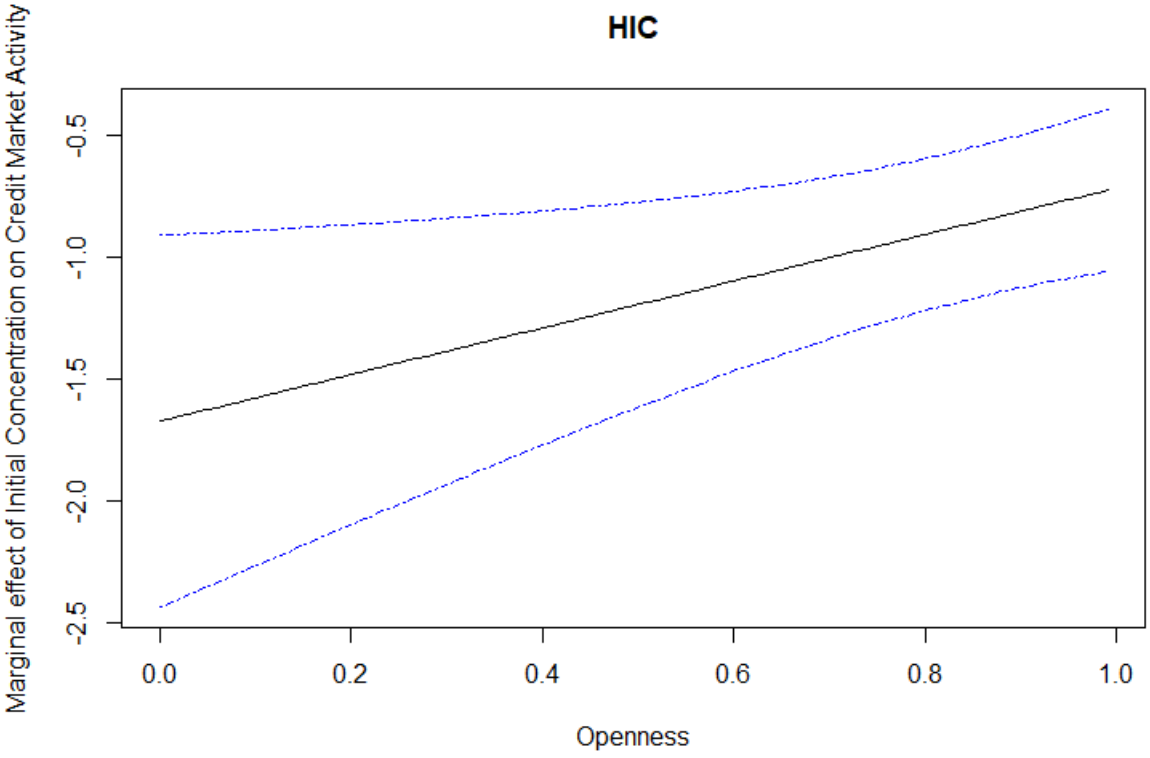
median value. For the full sample, the median value is an index of 0.42 and is represented by the vertical line in Figure 2. Therefore, starting from a position of being a relatively closed economy, the negative relationship between banking concentration and credit market activity in the banking sector is significantly exacerbated as countries become more financially open. Put differently, banking concentration reduces credit market activity in countries that are "sufficiently open".



The solid line gives the marginal effect of initial banking concentration on private credit-to-GDP ratio by banks for different levels of the index of initial capital account openness, conditional on the standard control variables. It corresponds to the regression in column (2) of Table 4, which controls for country-fixed effects. The dashed lines give the 95% confidence interval while the solid vertical line represents the median level of initial capital account openness for the full sample.

Figure 2: Marginal effect of banking concentration on the level of financial development for different levels of capital account openness (Full Sample).

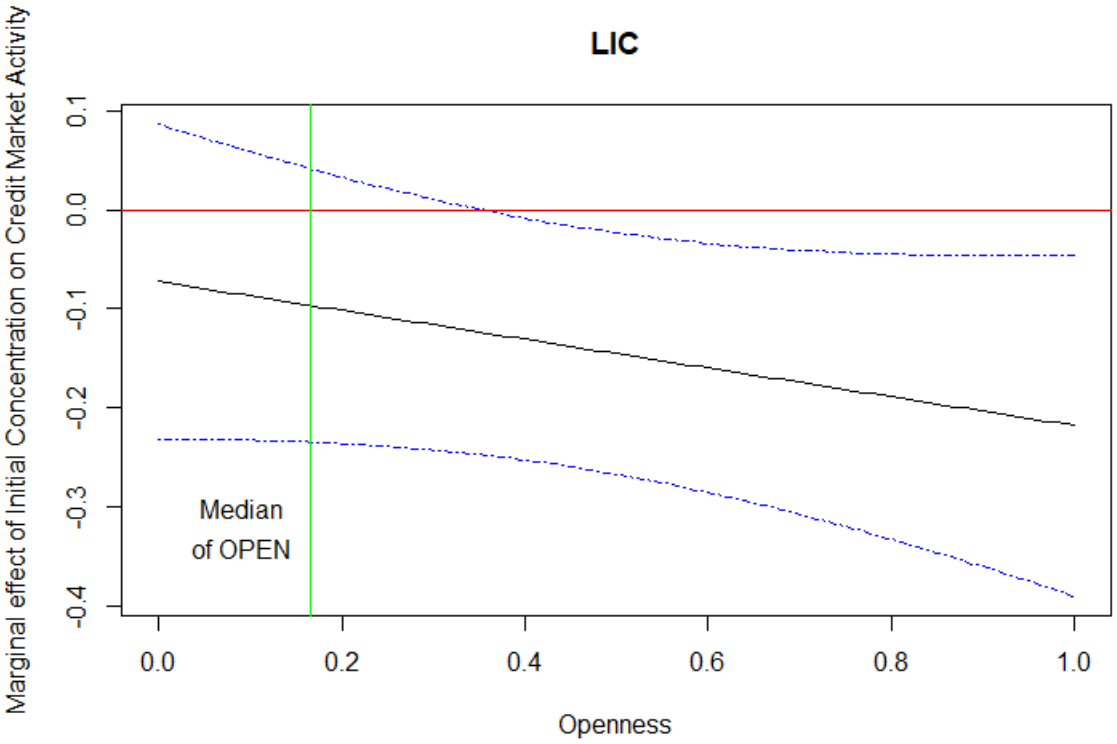
Figure 3 shows the relationship between banking concentration and financial development in the banking sector at different levels of capital account openness for high income countries. It is based on column (4) of Table 4. The blue dashed lines represent the 95% confidence interval. It shows that the negative relationship between banking concentration and credit market activity is weakened as high income countries become more financially open, regardless of the level of capital account openness.



The solid line gives the marginal effect of initial banking concentration on private credit-to-GDP ratio by banks for different levels of the index of initial capital account openness, conditional on the standard control variables. It corresponds to the regression in column (4) of Table 4, which controls for country-fixed effects. The dashed lines give the 95% confidence interval.

Figure 3: Marginal effect of banking concentration on the level of financial development for different levels of capital account openness (High Income Countries).

Next, Figure 4 shows the relationship between banking concentration and financial development in the banking sector at different levels of capital account openness for low income countries. The blue dashed lines represent the 95% confidence interval. It is based on column (6) of Table 4. Our illustration implies that the relationship becomes significantly negative for an index of financial openness above 0.35. Based on our classification of financially closed and open developing countries, the threshold is 0.17. In particular, a developing country is considered to be financially closed if their index for capital account openness is at or below 0.17, which is the median level of capital account openness among developing countries and the green line in Figure 4. In other words, the negative relationship between banking concentration and credit market activity in the banking sector is strengthened as the index for capital account openness increases. However, for this relationship to be significant, a developing country would have to be at a relatively high level of financial openness. Put differently, banking concentration is negatively associated with credit market activity in developing countries that are relatively open.



The solid line gives the marginal effect of initial banking concentration on private credit-to-GDP ratio by banks for different levels of the index of initial capital account openness, conditional on the standard control variables. It corresponds to the regression in column (6) of Table 4, which controls for country-fixed effects. The dashed lines give the 95% confidence interval while the solid vertical line represents the median level of initial capital account openness for the sample of developing countries.

Figure 4: Marginal effect of banking concentration on the level of financial development for different levels of capital account openness (Low & Middle Income Countries).

3.3 Robustness Checks

In this section, we perform robustness checks. All analyses in this section control for country-specific unobservables.

3.3.1 Adding Controls

Table 5 shows that our results are robust to additional controls. In addition to controlling for developments in legal systems and institutions and the rate-of-change effects of banking concentration, in Table 5 we control for different components of financial risk that a country may experience. As in the case of the previous long run specification, we control for Net International Liquidity as Months of Import Cover (totalreserve) and the Current Account as a Percentage of Exports of Goods and Services (catoexp) along with the share of foreign-owed banks as a percent of total banks (frgnbnkshare).

In columns (1)-(3) of Table 5, we depict the results from the full sample. To begin, column (1) only adds the Current Account as a Percentage of Exports of Goods and Services to the set of controls, while column (2) only adds the Net International Liquidity as Months of Import Cover. However, column (3) adds both variables the share of foreign-owed banks as a percent of total banks (frgnbnkshare) to the set of controls. Similar to the results of the full sample results in column (2) of Table 4, we see that whether or not we control for components of financial risk and foreign-owed bank share, greater financial openness is not robustly related to credit market activity in the banking sector. The level of banking concentration also enters insignificantly. Column (2) shows weak dependence of the association between banking concentration and credit market activity on financial openness. Further, columns (1)-(3) of Table 5 show that the components of financial risk and foreign-owed bank share are not important in promoting credit market activity.

Columns (4)-(6) of Table 5 look at high income economies within the sample. Here, we see a contrast to the full sample. In particular, financial openness is negatively associated with credit market activity in advanced countries. Further, a highly concentrated banking system in advanced economies is robustly associated with reduced credit to the private sector by deposit money banks. Moreover, the relation between banking concentration and credit market activity is significantly reduced as advanced countries become more financially open. In addition, concentration growth is robustly correlated with lower credit market activity.

In columns (7)-(9) of Table 5, we see the results for the developing economies in the sample.[21] Again, we see that the association of banking concentration with credit market activity is similar to the results in column (6) in Table 4. In particular, a more concentrated banking system is not robustly associated with credit market activity in the banking sector. Moreover, financial openness enters significantly at the 10% level in only one specification (column (8)), whereas

[21] We further explore the robustness of our results for developing countries by considering other measures of concentration and financial openness. For alternative measures of concentration, we consider the 5-bank concentration ratio and the Lerner index. Our results are unaltered using these measures. For financial openness, we consider a *de facto* measure of the degree of openness developed by Lane and Milesi-Ferretti (2007). Our findings, once again, are essentially the same. Further details can be made available upon request.

Table 5: Private Credit to GDP by Banks, Banking Concentration and Financial Openness: Adding Controls

	Dependent variable:								
	Credit/GDP by Banks								
	Full			HIC			LIC		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
initialka_open	23.013	25.167	22.338	-51.223**	-53.352*	-64.043**	13.966	16.216*	13.273
	(17.715)	(18.341)	(18.025)	(26.041)	(27.485)	(31.649)	(9.149)	(9.747)	(8.918)
initialcr	-0.257	-0.269	-0.266	-1.698***	-1.719***	-1.853***	-0.063	-0.066	-0.061
	(0.172)	(0.183)	(0.182)	(0.435)	(0.413)	(0.477)	(0.079)	(0.080)	(0.072)
initialcr:initialka_open	-0.265	-0.282*	-0.245	0.974**	0.995**	1.171**	-0.119	-0.141	-0.092
	(0.165)	(0.167)	(0.166)	(0.457)	(0.446)	(0.520)	(0.116)	(0.117)	(0.118)
log(initialM1stock)	3.967**	4.384***	3.855**	11.284*	12.249**	12.034	3.210**	3.614**	3.084*
	(1.555)	(1.610)	(1.714)	(5.817)	(5.713)	(7.401)	(1.536)	(1.539)	(1.686)
log(initialrgdppc)	8.136	4.638	7.973	-5.014	-7.554	-7.491	11.670*	8.432	11.284*
	(7.646)	(8.967)	(7.932)	(26.236)	(20.618)	(29.010)	(6.432)	(6.985)	(6.397)
grrgdppercap	-1.100***	-1.263***	-1.072***	-2.581***	-2.574***	-2.385**	-0.159	-0.317	-0.151
	(0.411)	(0.418)	(0.413)	(0.867)	(0.818)	(0.948)	(0.328)	(0.351)	(0.329)
M1growth	34.343	36.056	35.309	-8.378	-9.052	-13.373	-12.680	-11.264	-13.994
	(43.005)	(43.911)	(45.276)	(78.785)	(78.532)	(80.565)	(31.343)	(32.660)	(33.944)
tradeopen	13.658*	10.813	15.735*	15.332	16.037	14.836	12.148**	9.437*	16.648***
	(7.723)	(7.565)	(8.896)	(16.091)	(16.812)	(17.052)	(4.826)	(5.054)	(5.206)
corrupt	2.570	2.436	2.478	1.407	1.453	1.128	1.473	1.278	1.013
	(2.587)	(2.678)	(2.651)	(5.518)	(5.539)	(5.516)	(2.261)	(2.482)	(2.225)
laworder	-0.036	-0.314	0.146	2.037	2.286	2.662	-0.567	-0.651	-0.259
	(2.754)	(2.765)	(2.957)	(6.205)	(7.026)	(7.532)	(3.233)	(3.132)	(3.488)
bq	-4.576	-4.386	-4.332	9.932	9.957	7.962	-4.350	-4.281	-4.582
	(5.583)	(5.619)	(5.870)	(8.523)	(8.333)	(8.162)	(3.686)	(3.835)	(3.727)
grconcentration	-159.735**	-171.430**	-155.235**	-370.257***	-372.777***	-359.113***	-29.681	-35.377	-12.859
	(70.544)	(74.283)	(74.289)	(107.262)	(105.602)	(112.951)	(31.792)	(33.046)	(32.549)
catoexp	-0.073		-0.088	-0.012		0.004	-0.065**		-0.083**
	(0.046)		(0.059)	(0.186)		(0.190)	(0.030)		(0.037)
totalreserve		0.183	0.243		-0.209	-0.199		0.159	0.331
		(0.364)	(0.375)		(0.549)	(0.553)		(0.480)	(0.477)
frgnbnkshare			0.048			0.253			0.076
			(0.160)			(0.333)			(0.149)
Constant	-55.459	-26.126	-57.458	47.716	62.658	66.094	-95.629**	-72.349	-99.246**
	(66.936)	(78.010)	(69.722)	(215.573)	(178.295)	(229.412)	(42.396)	(45.672)	(40.821)
Observations	298	288	267	102	102	97	196	186	170
Country-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 (within)	0.403	0.397	0.406	0.570	0.571	0.574	0.553	0.540	0.572
R^2 (overall)	0.255	0.126	0.243	0.063	0.055	0.246	0.182	0.141	0.174

The dependent variable is credit to GDP ratio by banks. The dependent and explanatory variables are averaged over 5-year periods covering 1998–2017 (except when stated otherwise). "Initial" refers to the year before the respective 5-year period. Standard errors are robust to heteroskedasticity. *p<0.1; **p<0.05; ***p<0.01.

it enters insignificantly in column (7) and (9). In addition, the relationship between banking concentration and credit market activity in developing countries is independent of financial openness and vice versa. Interestingly, columns (7) and (9) of Table 5 show that a reduction in the current account-to-export ratio is important in improving credit market activity. However, concentration growth is not important for credit market activity in developing countries.

3.3.2 Changes in the Dependent Variable

We now look at other measures of financial development. Again, we highlight the fact that the rise of shadow banks has been an important feature in the credit market. As a result, commercial banks are not the only source of credit market activity. Hence, we look at domestic credit to the private sector (relative to GDP). Columns (1)-(3) of Table 6 shows that our main results are largely unaffected when using this as our dependent variable.

Finally, in order to take into consideration the time variation of credit market activity in the banking system over the past decades, we include time fixed effects. The results are reported in columns (4)-(6) of Table 6. The regressions show that adding time fixed effects do not alter our main results.

3.4 On the diverging dependence of the relationship between credit market activity and banking concentration on financial openness

An interesting result from our previous analysis is that the relationship between credit market activity and banking concentration is weakened as financial openness increases in advanced countries, but is strengthened as financial openness increases in developing countries. We provide two reasons for this divergence, each of which is discussed below.

3.4.1 Public External Debt

We observe from our analysis in Figure 4 that if developing countries are relatively closed, then the association of banking concentration with credit market activity does not depend on financial openness. One argument for this is that if developing countries are relatively closed, then amount of external debt would be smaller and relatively large domestic banks would have some degree of influence on the interest rate on government bonds. To exert this influence, domestic banks can hold back on devoting resources to holding both private and public debt by holding more reserves. In particular, banks issue loans so that the marginal returns are the same across both private and public debt markets.

However, the role of external debt in relatively open developing countries could be key to this divergence. In particular, if developing countries are relatively more open, they tend to borrow more from other countries. Since greater financial openness makes it easier for the government to issue bonds to holders in other countries, domestic banks would not perceive that they have much of an impact on the interest rates on government bonds. As a result, the incentives to withhold funding to the public debt market would be weaker since local domestic banks would

Table 6: Additional robustness checks on the dependent variable.

	Dependent variable:					
	Priv. Sector			Banks (Time FE)		
	Full	HIC	LIC	Full	HIC	LIC
	(1)	(2)	(3)	(4)	(5)	(6)
initialka_open	30.081	-33.857	18.421*	23.381	-63.511***	14.169
	(18.911)	(24.845)	(10.723)	(18.109)	(20.573)	(9.393)
initialcr	-0.232	-1.577***	0.005	-0.304*	-1.975***	-0.084
	(0.207)	(0.375)	(0.070)	(0.178)	(0.284)	(0.078)
initialcr:initialka_open	-0.404**	0.764*	-0.240**	-0.280*	1.322***	-0.124
	(0.189)	(0.418)	(0.122)	(0.164)	(0.301)	(0.110)
log(initialM1stock)	3.459**	8.943**	3.343***	-0.433	-2.369	3.182
	(1.496)	(4.348)	(1.213)	(3.271)	(4.796)	(2.474)
log(initialrgdppc)	15.209**	6.472	13.846**	-2.114	-15.062	6.632
	(6.988)	(17.537)	(6.908)	(9.143)	(23.964)	(6.845)
grrgdppercap	-1.354***	-2.449***	-0.131	-1.557***	-4.068***	-0.283
	(0.461)	(0.838)	(0.458)	(0.537)	(0.760)	(0.350)
M1growth	33.848	-0.266	-4.129	-0.134	-78.926	-10.168
	(45.134)	(71.809)	(30.056)	(49.748)	(68.740)	(34.489)
tradeopen	13.618	14.595	14.051***	6.505	5.235	10.646**
	(8.297)	(17.969)	(4.586)	(8.032)	(16.656)	(5.089)
corrupt	2.425	-0.427	2.279	1.480	-6.270	1.879
	(2.968)	(5.348)	(2.274)	(2.792)	(3.907)	(2.461)
laworder	-3.372	-4.321	-3.428	0.190	15.780***	-0.664
	(2.623)	(6.507)	(2.414)	(2.860)	(5.999)	(3.128)
bq	-5.318	16.321**	-6.044	-4.563	1.628	-6.460**
	(7.723)	(7.842)	(5.113)	(5.714)	(6.386)	(3.153)
grconcentration	-191.232***	-393.799***	-56.479**	-159.886**	-288.511***	-41.527
	(70.110)	(95.597)	(28.666)	(70.032)	(63.137)	(32.477)
Constant	-90.135	-29.863	-103.614**	99.630	312.674*	-48.059
	(66.725)	(159.407)	(45.653)	(90.909)	(267.812)	(54.333)
Observations	277	103	174	301	104	197
Country-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2 (within)	0.416	0.600	0.534	0.257	0.587	0.272
R^2 (overall)	0.331	0.305	0.126	0.055	2.2×10^{-6}	0.116

In columns (1)-(3), the dependent variable is private credit to GDP ratio. In columns (4)-(6), the dependent variable is private credit to GDP ratio by banks and we include time fixed effects. The dependent and explanatory variables are averaged over 5-year periods covering 1998–2017 (except when stated otherwise). "Initial" refers to the year before the respective 5-year period. Standard errors are robust to heteroskedasticity. All regressions control for country-fixed effects. *Note:* *p<0.1; **p<0.05; ***p<0.01.

not have much market power in the market for debt which is held across countries in the global financial system. This, in turn, means that banks would lend less to the local credit market. Therefore, a rise in banking concentration reduces domestic lending as developing countries become more open.

In contrast, governments in advanced countries have less reliance on foreign lenders since they tend to experience capital outflows as shown by Reinhardt et al. (2013). Consequently, the role of public external debt is less of an issue in advanced economies. Moreover, as advanced economies become more financially open, residents can obtain funding from foreign sources, thus weakening the negative correlation between concentration in the banking sector and credit market activity.

We investigate this hypothesis by looking at how the relationship between banking concentration and credit market activity depends on financial openness and public external debt in developing economies. To do this, we add public external debt stocks as a percentage of GDP (initialppg) as an interaction term to banking concentration and financial openness. It includes long-term debt obligations of public debtors to nonresidents that is repayable in currency, goods or services.[22] As a robustness check, we replace public external debt with initial total external debt (initialext). This is the sum of public and private external debt obligations, whether it be long-term debt, short-term debt, or the use of IMF credit.

Table 7 reports the empirical results for the role of external debt in determining of credit market activity. Column (1) shows results using public external debt in the absence of controlling for country-specific unobservables while column (2) controls for country-fixed effects. We see that in the absence of fixed effects, we get results that are more consistent with the results for advanced countries. In particular, a more concentrated banking system by itself is associated with lower credit market activity, but as financial openness increases, the correlation between credit market activity and concentration is weakened (assuming no external debt). From column (1), we also observe that for developing countries that are financially open, there is weak evidence that the correlation between banking concentration and credit market activity is strengthened as public debt obligations to foreigners increase.

Yet, in column (2), which controls for country-fixed effects, we see that a more concentrated banking system is not robustly related to bank lending, neither does it depend on financial openness nor public external debt. Due to the large number of additional variables (and therefore, more parameters to be estimated – more than twice the number of the high income sample), it is more difficult to obtain results that are statistically significant at conventional levels in the developing country sample. Nonetheless, our results are such that our hypothesis is at least partially consistent with the evidence for advanced countries.

In columns (3) and (4), we replace public external debt with total external debt. Our results are consistent with those from column (1) and (2). In particular, column (3) shows that in the absence of country specific unobservables, the correlation between banking concentration and credit market activity is weakened as developing countries become more financially open

[22]See World Bank Development Indicators for more details.

Table 7: Private Credit to GDP by Banks, Banking Concentration and Financial Openness in Developing Economies: The Role of External Debt

	Dependent variable:			
	Credit/GDP by Banks Low & Middle Income Countries			
	(1)	(2)	(3)	(4)
initialka_open	-33.656	11.869	-50.827*	13.353
	(24.658)	(10.987)	(30.021)	(12.443)
initialcr	-0.600***	-0.085	-0.660***	-0.026
	(0.151)	(0.093)	(0.183)	(0.093)
initialpub_debt	-0.885	-0.269		
	(0.663)	(0.245)		
initialext_debt			-0.505	0.037
			(0.404)	(0.155)
log(initialM1stock)	0.873	3.434**	0.895	3.751**
	(0.864)	(1.722)	(0.853)	(1.664)
log(initialrgdppc)	4.159***	14.784*	4.713***	15.115**
	(1.588)	(8.002)	(1.719)	(7.680)
grrgdppercap	1.214	0.185	1.184	0.252
	(1.171)	(0.410)	(1.105)	(0.382)
M1growth	-185.447***	-21.173	-190.769***	-24.650
	(56.081)	(40.238)	(55.403)	(38.631)
tradeopen	21.167***	7.853	18.086**	6.696
	(7.826)	(6.937)	(7.399)	(6.548)
corrupt	-3.741	0.940	-4.403*	0.485
	(2.525)	(2.561)	(2.447)	(2.417)
laworder	3.912*	-0.219	4.480*	-0.013
	(2.122)	(3.359)	(2.295)	(3.126)
bq	6.285**	-5.348	6.049**	-3.514
	(2.469)	(4.548)	(2.419)	(4.123)
grconcentration	-50.708	-25.809	-55.173	-29.222
	(46.145)	(31.105)	(45.795)	(29.928)
initialcr:initialka_open	0.544**	-0.117	0.741**	-0.141
	(0.246)	(0.130)	(0.327)	(0.149)
initialcr:initialpub_debt	0.010	0.003		
	(0.007)	(0.003)		
initialka_open:initialpub_debt	1.393	0.298		
	(0.890)	(0.304)		
initialcr:initialka_open:initialpub_debt	-0.015*	-0.003		
	(0.009)	(0.004)		
initialcr:initialext_debt			0.006	0.0001
			(0.004)	(0.002)
initialka_open:initialext_debt			1.020*	0.112
			(0.543)	(0.193)
initialcr:initialka_open:initialext_debt			-0.011*	-0.001
			(0.006)	(0.002)
Observations	186	186	186	186
Country Fixed Effects	No	Yes	No	Yes
R^2 (within)		0.570		0.594
R^2 (overall)	0.414	0.171	0.430	0.197

The dependent variable is private credit to GDP ratio by banks. The dependent and explanatory variables are averaged over 5-year periods covering 1998–2017 (except when stated otherwise).“Initial” refers to the year before the respective 5-year period. Standard errors are robust to heteroskedasticity. *Note:* *p<0.1; **p<0.05; ***p<0.01.

while having no external debt. However, the correlation between banking concentration and domestic lending is strengthened in open economies as they issue more debt internationally.

3.4.2 Home Bias

Another reason for this divergence could be the role of home bias in financial markets in developing economies. In this case, domestic investors may choose to hold a large fraction (sometimes all) of their portfolio in domestic securities, despite the benefits of holding securities in world markets. Even though there is some financial integration, global risk sharing is limited by various restrictions that both domestic and foreign investors face when financial markets are not fully integrated (Lau et al., 2010). One such restriction is that borrowers in developing countries may not have much information about borrowing from institutions from other countries. Another restriction could be that lenders in other countries may be reluctant to lend to borrowers in developing countries. From this perspective, the impact of home bias in developing countries may be a lot higher than in advanced countries. In fact, Lau et al. (2010) have shown that home bias tends to be higher in developing countries than in advanced economies. Therefore, a rise in banking concentration in the presence of home bias can reduce credit market activity even as developing countries become more financially open.

To investigate this hypothesis, we consider how the relationship between banking concentration and credit market activity depends on financial openness and home bias in developing economies. As a result, we add initial home bias (initiallnhbna) as an interaction term to banking concentration and financial openness. In order to get a proxy for home bias, we follow Lau et al. (2010) by dividing the portion of domestic investors' holdings in their local equity markets by the country's world-market capitalization weight and taking natural logs.[23,24] The data for constructing this proxy are from the World Bank Development Indicators and the Coordinated Portfolio Investment Survey (CPIS) obtained from the IMF database.

The empirical results are reported in Table 8. Column (1) shows results using home bias in the absence of controlling for country-specific unobservables while column (2) controls for country-fixed effects. We see that in column (1), the association of a more concentrated banking system with bank lending is not robust, neither does it depend on financial openness nor home bias. This lack of significance may be because the holdings of domestic investors vary across countries and may even depend on some characteristics that are specific to each country.

However, in column (2), which controls for country-fixed effects, we see results that are more consistent with those for advanced countries. In particular, a more concentrated banking system by itself is robustly associated with reduced credit market activity, but as financial openness increases, the correlation between credit market activity and concentration is weakened (assuming no home bias). When controlling for country-specific unobservables, column (2) also reveals that for developing countries that are financially open, there is strong evidence that the relationship between banking concentration and credit market activity is strengthened

[23] See Lau et al. (2010) and the appendix in this manuscript for more details.

[24] In our calculation, the proxy for home bias contained some negative values so that the natural log could not be calculated. Only two observations fell into this category. Those values were dropped from the sample.

Table 8: Private Credit to GDP by Banks, Banking Concentration and Financial Openness in Developing Economies: The Role of Home Bias

	Dependent variable:	
	Credit/GDP by Banks Low & Middle Income Countries	
	(1)	(2)
initialka_open	1,312.506	-3,868.259***
	(1,120.037)	(1,248.036)
initialcr	-3.671	-21.282**
	(5.573)	(9.554)
initiallnhbna	-7.141	-87.248*
	(4.575)	(48.072)
log(initialM1stock)	0.830	-2.357
	(1.663)	(5.971)
log(initialrgdppc)	11.259**	42.213***
	(4.950)	(13.328)
grrgdppercap	4.576	-0.797
	(3.550)	(1.156)
M1growth	-360.155**	-19.470
	(148.453)	(87.401)
tradeopen	34.770***	4.917
	(11.673)	(11.340)
corrupt	-9.969	2.698
	(6.341)	(3.253)
laworder	6.455	-9.458**
	(4.397)	(4.707)
bq	0.019	-8.882
	(7.521)	(18.785)
grconcentration	-94.948	-1.422
	(93.155)	(29.275)
initialcr:initialka_open	-21.946	71.084***
	(18.918)	(24.016)
initialcr:initiallnhbna	0.258	1.570**
	(0.413)	(0.714)
initialka_open:initiallnhbna	-95.440	284.650***
	(83.020)	(92.219)
initialcr:initialka_open:initiallnhbna	1.633	-5.234***
	(1.398)	(1.768)
Observations	60	60
Country-Fixed Effects	No	Yes
R^2 (within)		0.754
R^2 (overall)	0.550	0.028

The dependent variable is private credit to GDP ratio by banks. The dependent and explanatory variables are averaged over 5-year periods covering 1998–2017 (except when stated otherwise)."Initial" refers to the year before the respective 5-year period. Standard errors are robust to heteroskedasticity. *Note:* *p<0.1; **p<0.05; ***p<0.01.

as domestic investors increase their holdings of domestic equities instead of diversifying their portfolio by holding more foreign equities. Thus, controlling for country-fixed effects strongly supports our hypothesis and shows results that are consistent with the evidence for advanced countries.

4 Conclusion

Over the past twenty-five years or so, there have been strides across countries to remove restrictions on capital flows. Within the same time frame, there have also been significant changes in the market structure of the banking system across countries. Taking note of the marked differences in the level of financial development across countries, we investigate how the level of financial development in the banking sector depends on both the degree of capital account openness and the degree of concentration of the banking system across countries at different stages of economic development. We generally find that, when controlling for a number of determinants of credit market activity, financial openness is associated with credit market activity, particularly in countries with concentrated banking systems.

Our findings also show that banking concentration is a significant issue for the development of the banking system in advanced economies. In particular, for high income economies that are financially closed (for example, Luxembourg, Macao, and the Bahamas), a rise in banking concentration is robustly associated with a reduction in the development of the banking system. However, as high income economies reduce government interference into the cross-border flow of private capital, the negative association of a more concentrated banking system with credit market activity is significantly reduced. Therefore, if an advanced nation is intent on improving credit access to the private sector while remaining financially closed, the level of banking concentration within such an economy must be reduced. Otherwise, relaxing capital account restrictions can soften the blow of increased concentration on credit market activity.

For low and middle income countries, a less concentrated banking system does is not robustly associated with the development of the banking sector in the long-run. This is particularly true for developing countries with strict account restrictions (for example, Serbia, Sudan, Malawi). However, our results show that if developing economies are sufficiently open, a rise in banking concentration can significantly reduce bank lending.

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Appendix A: Data and Sample

Table 9: List of Variables

Variable	Description
Domestic credit to private sector (% of GDP) (credprivsect)	Domestic credit to private sector refers to financial resources provided to the private sector by financial corporations, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment. For some countries these claims include credit to public enterprises. The financial corporations include monetary authorities and deposit money banks, as well as other financial corporations where data are available (including corporations that do not accept transferable deposits but do incur such liabilities as time and savings deposits). Examples of other financial corporations are finance and leasing companies, money lenders, insurance corporations, pension funds, and foreign exchange companies. Source: International Monetary Fund, International Financial Statistics and data files, and World Bank and OECD GDP estimates.
Domestic credit to private sector by banks (% of GDP) (credbanks)	Domestic credit to private sector by banks refers to financial resources provided to the private sector by other depository corporations (deposit taking corporations except central banks), such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment. For some countries these claims include credit to public enterprises. Source: International Monetary Fund, International Financial Statistics and data files, and World Bank and OECD GDP estimates.

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Table 9: List of Variables – *Continued from previous page*

Variable	Description
Initial Bank Concentration (initialcr)	Assets of three largest banks as a share of assets of all commercial banks. It is updated to 2017 and was obtained from Beck et al. (2010). Source: Bankscope and Orbis Bank Focus databases.
Index of initial capital account openness (initialka_open)	The Chinn-Ito index is an index measuring a country's degree of capital account openness. Initially introduced by Chinn and Ito (2006), it is based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER).
Initial M1 stock of money (initialM1stock)	Total stock of money in the domestic currency. Source: International Financial Statistics.
Initial Real GDP per capita (initialrgdppc)	Real GDP per capita is measured in constant 2010 US dollars. Source: World bank Development Indicators.
Real GDP per capita growth (grrgdppercap)	The annual growth rate in real GDP per capita. Source: World bank Development Indicators.
M1 growth (M1growth)	The growth rate in the M1 stock of money. This was calculated by the authors by taking logged differences.
Trade Openness (tradeopen)	This is calculated as the sum of imports and exports of goods and services divided by GDP. All variables used to calculate trade openness are from the World Bank national accounts data, and OECD National Accounts data files.

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Table 9: List of Variables – *Continued from previous page*

Variable	Description
Corrupt (corrupt)	This is an assessment of corruption within the political system as part of the composite index measuring political risk of countries put together by the International Country Risk Guide (ICRG).
Law and Order (laworder)	To assess the "Law" element, the strength and impartiality of the legal system are considered, while the "Order" element is an assessment of popular observance of the law. It is part of the composite index measuring political risk of countries put together by the International Country Risk Guide (ICRG).
Bureaucracy Quality (bq)	The institutional strength and quality of the bureaucracy is also part of the composite index measuring political risk of countries put together by the International Country Risk Guide (ICRG).
Concentration Growth (grconcentration)	The growth rate of banking concentration, calculated by the authors by taking logged differences.
Current Account to Exports of Goods and Services (%) (catoexp)	The balance of the current account of the balance of payments for a given year, converted into US dollars at the average exchange rate for that year, is expressed as a percentage of the sum of the estimated total exports of goods and services for that year, converted into US dollars at the average exchange rate for that year. It is part of the composite index measuring financial risk of countries put together by the International Country Risk Guide (ICRG).

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Table 9: List of Variables – *Continued from previous page*

Variable	Description
Total reserves in months of imports (totalreserve)	The total estimated official reserves for a given year, converted into US dollars at the average exchange rate for that year, including official holdings of gold, converted into US dollars at the free market price for the period, but excluding the use of IMF credits and the foreign liabilities of the monetary authorities, is divided by the average monthly merchandise import cost, converted into US dollars at the average exchange rate for the period. This provides a comparative liquidity risk ratio that indicates how many months of imports can be financed with reserves and is part of the composite index measuring financial risk of countries put together by the International Country Risk Guide (ICRG).
Initial Public External Debt (% of GDP) (initialppg)	Public and publicly guaranteed debt comprises long-term external obligations of public debtors, including the national government, Public Corporations, State Owned Enterprises, Development Banks and Other Mixed Enterprises, political subdivisions (or an agency of either), autonomous public bodies, and external obligations of private debtors that are guaranteed for repayment by a public entity. Source: World bank Development Indicators.

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Table 9: List of Variables – *Continued from previous page*

Variable	Description
Initial Total External Debt (% of GDP) (initialext)	Total external debt is debt owed to non-residents repayable in currency, goods, or services. It is the sum of public, publicly guaranteed, and private non-guaranteed long-term debt, short-term debt, and use of IMF credit. Source: World bank Development Indicators.
Initial Home Bias (initiallnhbna)	Following Lau et al. (2010), we calculate a home-bias proxy by taking the difference between the country's total market capitalization and the value of foreigners' holdings in domestic equities, and divide it by the country's world-market capitalization weight which is calculated by dividing the market capitalization of a country by the world market capitalization. We then express this result in natural logs. Data on market capitalization is from the World bank Development Indicators. On the other hand, data on foreign holdings of domestic equities are from the Derived Portfolio Investment Liabilities: Equity and Investment Fund Shares section of the Coordinated Portfolio Investment Survey (CPIS) and obtained from the IMF website.

Table 10: List of Countries

Country	Code	Is High Income? Yes = 1
Afghanistan	AFG	0
Albania	ALB	0
Algeria	DZA	0
Angola	AGO	0
Antigua and Barbuda	ATG	1
Argentina	ARG	1
Armenia	ARM	0

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Table 10: List of Countries – *Continued from previous page*

Country	Code	Is High Income? Yes = 1
Australia	AUS	1
Austria	AUT	1
Azerbaijan	AZE	0
Bahamas, The	BHS	1
Bahrain	BHR	1
Bangladesh	BGD	0
Belarus	BLR	0
Belize	BLZ	0
Benin	BEN	0
Bhutan	BTN	0
Bolivia	BOL	0
Bosnia and Herzegovina	BIH	0
Botswana	BWA	0
Brazil	BRA	0
Bulgaria	BGR	0
Burkina Faso	BFA	0
Burundi	BDI	0
Cabo Verde	CPV	0
Cambodia	KHM	0
Cameroon	CMR	0
Canada	CAN	1
Chad	TCD	0
Chile	CHL	1
China	CHN	0
Colombia	COL	0
Congo, Dem. Rep.	COD	0
Congo, Rep.	COG	0
Costa Rica	CRI	0
Croatia	HRV	1
Cyprus	CYP	1
Czech Republic	CZE	1
Côte d'Ivoire	CIV	0
Denmark	DNK	1
Djibouti	DJI	0
Dominican Republic	DOM	0
Egypt, Arab Rep.	EGY	0
El Salvador	SLV	0

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Table 10: List of Countries – *Continued from previous page*

Country	Code	Is High Income? Yes = 1
Estonia	EST	1
Eswatini	SWZ	0
Ethiopia	ETH	0
France	FRA	1
Gabon	GAB	0
Gambia, The	GMB	0
Ghana	GHA	0
Guatemala	GTM	0
Guyana	GUY	0
Haiti	HTI	0
Honduras	HND	0
Hong Kong SAR, China	HKG	1
Hungary	HUN	1
Iceland	ISL	1
India	IND	0
Indonesia	IDN	0
Iraq	IRQ	0
Ireland	IRL	1
Israel	ISR	1
Jamaica	JAM	0
Japan	JPN	1
Jordan	JOR	0
Kazakhstan	KAZ	0
Kenya	KEN	0
Korea, Rep.	KOR	1
Kuwait	KWT	1
Kyrgyz Republic	KGZ	0
Latvia	LVA	1
Lebanon	LBN	0
Lesotho	LSO	0
Libya	LBY	0
Lithuania	LTU	1
Luxembourg	LUX	1
Macao SAR, China	MAC	1
Malawi	MWI	0
Malaysia	MYS	0
Mali	MLI	0

Continued on following page

Table 10: List of Countries – *Continued from previous page*

Country	Code	Is High Income? Yes = 1
Malta	MLT	1
Mauritius	MUS	0
Mexico	MEX	0
Moldova	MDA	0
Mongolia	MNG	0
Morocco	MAR	0
Mozambique	MOZ	0
Namibia	NAM	0
Nepal	NPL	0
New Zealand	NZL	1
Nicaragua	NIC	0
Niger	NER	0
Nigeria	NGA	0
North Macedonia	MKD	0
Norway	NOR	1
Oman	OMN	1
Pakistan	PAK	0
Paraguay	PRY	0
Poland	POL	1
Portugal	PRT	1
Qatar	QAT	1
Romania	ROU	0
Russian Federation	RUS	0
Rwanda	RWA	0
Samoa	WSM	0
Saudi Arabia	SAU	1
Senegal	SEN	0
Serbia	SRB	0
Seychelles	SYC	1
Sierra Leone	SLE	0
Singapore	SGP	1
Slovak Republic	SVK	1
Slovenia	SVN	1
South Africa	ZAF	0
South Sudan	SSD	0
Spain	ESP	1
Sri Lanka	LKA	0

Continued on following page

Table 10: List of Countries – *Continued from previous page*

Country	Code	Is High Income? Yes = 1
St. Lucia	LCA	0
Sudan	SDN	0
Suriname	SUR	0
Sweden	SWE	1
Switzerland	CHE	1
Tajikistan	TJK	0
Tanzania	TZA	0
Thailand	THA	0
Togo	TGO	0
Turkey	TUR	0
Uganda	UGA	0
Ukraine	UKR	0
United Arab Emirates	ARE	1
United Kingdom	GBR	1
United States	USA	1
Uruguay	URY	1
Venezuela, RB	VEN	0
Zambia	ZMB	0

136 countries in total. 45 countries are classified as high income countries.

Appendix B: Testing Endogeneity

This section describes the procedure of Lewbel (2012) to construct instruments when no external instruments are available, or, alternatively, used to supplement external instruments to improve the efficiency of IV estimators. To identify these instruments, there must be a vector of exogenous variables, denoted by Z, and the errors must be heteroskedatic. The elements of Z can be discrete or continuous, and Z can be a vector or a scalar. Some or all of the elements of Z can also be elements of the control variables. In our model, we use GDP per capita averaged over non-overlapping 5-year periods as our vector Z. We denote this measure by $GDP_{i,t}$. With the initial level of bank concentration, $CR_{i,t-1}$, being the dependent variable in this exercise, shifts in the averaged per capita GDP in the current period will not be associated with the initial level of bank concentration.[25] Thus, we use the first of the two-stage procedure proposed by Lewbel (2012) to construct instruments. In the first stage, initial bank concentration and its interaction with the measure of initial financial openness are regressed on all of the control variables (including external instruments) and the vectors of residuals are stored. The residuals are then used to create instruments if we observe heteroskedasticity in

[25]Recall that the initial level of bank concentration represents values for the years preceding each 5-year average.

the first-stage regressions. A Breusch-Pagan test (Breusch and Pagan, 1979) is used to test for heteroskedasticity.

Assuming that Z and the squared residuals from the first stage regression are correlated, the valid instruments are calculated as $(Z-\bar{Z})\epsilon$, where $\bar{Z}$ is the mean of Z and ϵ is the residuals from the first stage regression. From here, we use the instruments to test if bank concentration and its interaction is endogenous, and we find that they are not.

We now describe our results for the full sample for the initial level of bank concentration and its interaction with initial financial openness.[26] From the first stage regression, the Breusch-Pagan test confirms heteroskedasticity, rejecting the null hypothesis of homoskedasticity with Chi square test statistic of 72.03 and a p-value of 0.000. For the second condition, the correlation between Z and ϵ^2 should be non-zero. We find that this correlation is 0.08. Thus, we proceed to use the method of Lewbel (2012) to create instruments.

Once the instruments are created, we use the standard two-step procedure to test if the initial level of bank concentration and its interaction with initial financial openness are endogenous. The results suggests that both are not.

Appendix C: Summary Statistics and Correlations

Table 11: Summary Statistics

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
credprivsect	483	52.806	46.865	0.604	17.378	73.256	233.313
credbanks	530	47.826	42.306	0.557	16.116	66.036	233.194
initialcr	477	68.668	21.013	0.000	53.245	85.596	100.000
initialka_open	542	0.506	0.376	0.000	0.166	1.000	1.000
log(initialM1stock)	413	11.536	3.121	4.560	9.299	13.500	20.551
log(initialrgdppc)	534	8.468	1.524	5.298	7.234	9.643	11.626
grrgdppercap	538	2.460	2.942	−13.385	0.789	3.804	20.277
M1growth	474	0.064	0.068	−0.079	0.037	0.074	1.163
tradeopen	528	0.891	0.564	0.196	0.552	1.052	4.038
corrupt	520	0.362	1.373	−2.000	−1.000	2.000	2.000
laworder	444	3.770	1.309	1.000	2.724	5.000	6.000
bq	448	2.189	1.105	0.000	1.239	3.000	4.000
grconcentration	513	−0.004	0.021	−0.089	−0.012	0.004	0.117
totalreserve	489	5.164	5.287	0.019	2.462	5.799	48.002

"Initial" refers to the year before the respective 5-year period.

[26] Results are analogous to those of the split samples of high- and low-middle income countries.

Table 12: Summary Statistics Across Countries

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
credprivsect	136	52.573	44.273	1.289	19.103	71.020	193.102
credbanks	136	47.788	40.303	1.235	17.518	64.688	193.025
initialcr	134	70.543	17.532	28.189	57.179	84.537	100.000
initialka_open	136	0.507	0.349	0	0.2	0.9	1
log(initialM1stock)	136	11.536	0.000	11.536	11.536	11.536	11.536
log(initialrgdppc)	136	8.468	0.000	8.468	8.468	8.468	8.468
grrgdppercap	136	2.443	1.941	−6.730	1.299	3.615	8.504
M1growth	132	0.063	0.037	0.013	0.044	0.069	0.330
tradeopen	135	0.899	0.561	0.249	0.568	1.065	3.661
corrupt	132	0.340	1.311	−2.000	−1.000	1.712	2.000
laworder	111	3.770	1.275	1.034	2.736	4.883	6.000
bq	112	2.189	1.100	0.000	1.255	3.000	4.000
grconcentration	135	−0.004	0.009	−0.033	−0.009	0.002	0.027
totalreserve	127	5.193	4.971	0.027	2.723	5.842	37.447

"Initial" refers to the year before the respective 5-year period.

Table 13: Summary Statistics Across Time

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
credprivsect	4	52.241	6.453	44.377	48.335	56.992	58.414
credbanks	4	47.686	7.286	39.160	42.887	53.394	54.396
initialcr	4	68.755	1.994	66.071	68.268	69.514	70.893
initialka_open	4	0.506	0.040	0.453	0.491	0.528	0.547
log(initialM1stock)	4	11.536	0.000	11.536	11.536	11.536	11.536
log(initialrgdppc)	4	8.468	0.000	8.468	8.468	8.468	8.468
grrgdppercap	4	2.463	1.146	1.755	1.826	2.601	4.170
M1growth	4	0.065	0.017	0.049	0.051	0.078	0.080
tradeopen	4	0.890	0.049	0.817	0.882	0.919	0.922
corrupt	4	0.363	0.107	0.208	0.331	0.434	0.438
laworder	4	3.770	0.142	3.627	3.687	3.830	3.959
bq	4	2.189	0.018	2.168	2.179	2.200	2.208
grconcentration	4	−0.003	0.004	−0.007	−0.007	−0.0003	0.0005
totalreserve	4	5.136	0.734	4.188	4.745	5.678	5.784

"Initial" refers to the year before the respective 5-year period.

Table 14: Pairwise correlations

	credbanks	initialcr	initialka_open	initialM1stock	initialrgdppc	grrgdppercap	M1growth	tradeopen	corrupt	laworder	bq	grconcentration	totalreserve
credbanks	1												
initialcr	-0.086*	1											
initialka_open	0.433***	-0.027	1										
initialM1stock	0.152***	-0.365***	0.067	1									
initialrgdppc	0.683***	-0.129***	0.493***	0.078	1								
grrgdppercap	-0.132***	-0.014	-0.136***	-0.055	-0.207***	1							
M1growth	-0.214***	0.005	-0.165***	-0.2***	-0.166***	0.193***	1						
tradeopen	0.31***	0.147***	0.146***	-0.245***	0.337***	0.055	-0.033	1					
corrupt	0.444***	-0.041	0.953***	0.062	0.548***	-0.113***	-0.155***	0.228***	1				
laworder	0.613***	0.064	0.37***	-0.065	0.623***	-0.012	-0.048	0.285***	0.407***	1			
bq	0.702***	-0.095*	0.462***	0.147***	0.764***	-0.109**	-0.188***	0.27***	0.507***	0.628***	1		
grconcentration	0.126***	-0.337***	0.107**	0.079	0.192***	-0.111**	-0.145***	0.042	0.116**	0.089*	0.155***	1	
totalreserve	-0.044	-0.08*	-0.109**	0.213***	0.021	0.061	-0.044	-0.116**	-0.092**	-0.056	-0.126**	0.004	1

"Initial" refers to the year before the respective 5-year period. *Note:* *p<0.1; **p<0.05; ***p<0.01.

Table 15: Summary Statistics - High Income Countries

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
credprivsect	165	90.817	50.702	11.222	50.752	123.993	233.313
credbanks	171	85.033	46.636	10.937	50.533	116.775	233.194
initialcr	172	67.739	19.838	0.000	53.342	83.971	100.000
initialka_open	179	0.772	0.330	0.000	0.699	1.000	1.000
log(initialM1stock)	133	11.755	3.322	5.491	9.440	13.655	20.144
log(initialrgdppc)	179	10.164	0.673	8.677	9.633	10.701	11.626
grrgdppercap	180	1.887	2.829	−5.366	0.136	3.184	12.189
M1growth	142	0.047	0.033	−0.064	0.026	0.064	0.187
tradeopen	180	1.128	0.781	0.196	0.650	1.330	4.038
corrupt	171	1.435	0.961	−2.000	1.000	2.000	2.000
laworder	164	4.962	0.826	2.000	4.500	5.529	6.000
bq	168	3.240	0.725	2.000	3.000	4.000	4.000
grconcentration	176	0.002	0.020	−0.089	−0.006	0.008	0.117
totalreserve	172	4.314	4.416	0.019	1.678	5.417	32.026

"Initial" refers to the year before the respective 5-year period.

Table 16: Summary Statistics Across High Income Countries

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
credprivsect	45	90.642	46.826	15.274	54.243	116.596	193.102
credbanks	45	84.213	42.543	14.828	52.144	113.443	193.025
initialcr	45	68.173	17.502	28.189	54.832	80.912	100.000
initialka_open	45	0.772	0.290	0.000	0.630	1.000	1.000
log(initialM1stock)	45	11.755	0.000	11.755	11.755	11.755	11.755
log(initialrgdppc)	45	10.164	0.000	10.164	10.164	10.164	10.164
grrgdppercap	45	1.887	1.527	−2.046	0.991	2.645	5.319
M1growth	42	0.048	0.018	0.013	0.036	0.058	0.101
tradeopen	45	1.128	0.766	0.264	0.690	1.300	3.661
corrupt	43	1.433	0.855	−2.000	1.050	2.000	2.000
laworder	41	4.962	0.792	2.598	4.729	5.504	6.000
bq	42	3.240	0.726	2.000	3.000	4.000	4.000
grconcentration	45	0.002	0.007	−0.025	−0.001	0.005	0.027
totalreserve	44	4.277	3.816	0.027	1.968	5.269	20.750

"Initial" refers to the year before the respective 5-year period.

Table 17: Summary Statistics - High Income Countries Across Time

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
credprivsect	4	90.327	9.271	78.583	85.395	96.465	99.660
credbanks	4	84.615	9.398	72.854	79.632	90.519	94.535
initialcr	4	67.749	2.453	64.280	67.311	68.765	70.062
initialka_open	4	0.772	0.060	0.696	0.739	0.816	0.827
log(initialM1stock)	4	11.755	0.000	11.755	11.755	11.755	11.755
log(initialrgdppc)	4	10.164	0.000	10.164	10.164	10.164	10.164
grrgdppercap	4	1.887	1.481	0.120	1.266	2.474	3.723
M1growth	4	0.047	0.010	0.036	0.043	0.049	0.061
tradeopen	4	1.128	0.111	0.985	1.071	1.206	1.231
corrupt	4	1.436	0.178	1.172	1.416	1.524	1.562
laworder	4	4.962	0.115	4.861	4.905	4.988	5.127
bq	4	3.240	0.018	3.226	3.228	3.246	3.265
grconcentration	4	0.002	0.008	−0.006	−0.001	0.003	0.012
totalreserve	4	4.304	0.482	3.870	3.906	4.661	4.820

"Initial" refers to the year before the respective 5-year period.

Table 18: Pairwise correlations - High Income Countries

	credbanks	initialcr	initialka_open	log(initialM1stock)	log(initialrgdppc)	grrgdppercap	M1growth	tradeopen	corrupt	laworder	bq	grconcentration	totalreserve
credbanks	1												
initialcr	0.152*	1											
initialka_open	0.241***	0.146*	1										
initialM1stock	0.223**	-0.411***	0.208**	1									
initialrgdppc	0.505***	0.144*	0.17**	0.204**	1								
grrgdppercap	-0.144*	-0.008	-0.149**	0.021	-0.337***	1							
M1growth	-0.189**	-0.12	-0.082	-0.139	-0.208**	0.392***	1						
tradeopen	0.13*	0.176**	-0.092	-0.226***	0.092	0.132*	0.042	1					
corrupt	0.268***	0.102	0.892***	0.213**	0.314***	-0.024	-0.012	0.127*	1				
laworder	0.483***	0.204***	0.179**	0.092	0.651***	-0.084	-0.189**	0.1	0.279***	1			
bq	0.532***	-0.016	0.017	0.324***	0.573***	0.026	-0.23***	0.026	0.109	0.57***	1		
grconcentration	-0.062	-0.395***	-0.089	0.133	-0.063	0.049	0.018	-0.018	-0.103	-0.067	-0.034	1	
totalreserve	-0.128	-0.084	-0.116	0.266***	-0.052	0.015	0.057	-0.136*	-0.09	-0.15*	-0.227***	0.01	1

"Initial" refers to the year before the respective 5-year period. *Note:* *p<0.1; **p<0.05; ***p<0.01.

Table 19: Summary Statistics - Low Income Countries

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
credprivsect	318	33.084	29.450	0.604	13.227	43.103	147.802
credbanks	359	30.104	25.214	0.557	12.454	40.262	147.647
initialcr	305	69.192	21.661	0.000	52.869	87.100	100.000
initialka_open	363	0.375	0.324	0.000	0.166	0.699	1.000
log(initialM1stock)	280	11.432	3.021	4.560	9.287	13.458	20.551
log(initialrgdppc)	355	7.613	1.042	5.298	6.736	8.465	9.598
grrgdppercap	358	2.748	2.960	−13.385	1.016	4.086	20.277
M1growth	332	0.072	0.078	−0.079	0.043	0.081	1.163
tradeopen	348	0.768	0.351	0.212	0.506	0.973	2.852
corrupt	349	−0.163	1.231	−2.000	−1.000	1.000	2.000
laworder	280	3.071	0.998	1.000	2.229	4.000	6.000
bq	280	1.559	0.760	0.000	1.000	2.000	3.000
grconcentration	337	−0.006	0.021	−0.080	−0.017	0.002	0.093
totalreserve	317	5.625	5.657	0.188	3.064	6.000	48.002

"Initial" refers to the year before the respective 5-year period.

Table 20: Summary Statistics Across Low Income Countries

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
credprivsect	91	33.748	28.022	1.289	15.725	45.163	139.223
credbanks	91	29.776	23.670	1.235	13.495	39.362	123.376
initialcr	89	71.742	17.523	33.374	58.446	86.445	100.000
initialka_open	91	0.376	0.299	0	0.2	0.7	1
log(initialM1stock)	91	11.432	0.000	11.432	11.432	11.432	11.432
log(initialrgdppc)	91	7.613	0.000	7.613	7.613	7.613	7.613
grrgdppercap	91	2.717	2.069	−6.730	1.508	3.918	8.504
M1growth	90	0.071	0.041	0.029	0.050	0.081	0.330
tradeopen	90	0.785	0.379	0.249	0.522	0.978	2.852
corrupt	89	−0.188	1.159	−2.000	−1.000	0.850	2.000
laworder	70	3.071	0.942	1.034	2.248	3.833	5.329
bq	70	1.559	0.747	0.000	1.000	2.000	3.000
grconcentration	90	−0.006	0.009	−0.033	−0.012	−0.0002	0.020
totalreserve	83	5.678	5.446	0.691	3.262	6.108	37.447

"Initial" refers to the year before the respective 5-year period.

Table 21: Summary Statistics - Low Income Countries Across Time

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
credprivsect	4	32.401	6.708	25.202	27.956	36.479	40.332
credbanks	4	30.064	6.048	24.228	25.623	33.761	37.390
initialcr	4	69.530	3.292	64.946	68.310	71.615	72.383
initialka_open	4	0.375	0.032	0.331	0.368	0.388	0.409
log(initialM1stock)	4	11.432	0.000	11.432	11.432	11.432	11.432
log(initialrgdppc)	4	7.613	0.000	7.613	7.613	7.613	7.613
grrgdppercap	4	2.751	1.128	1.949	2.054	3.028	4.396
M1growth	4	0.073	0.023	0.050	0.056	0.088	0.099
tradeopen	4	0.767	0.032	0.727	0.751	0.787	0.801
corrupt	4	−0.163	0.084	−0.257	−0.221	−0.096	−0.085
laworder	4	3.071	0.159	2.905	2.973	3.151	3.275
bq	4	1.559	0.035	1.526	1.531	1.585	1.596
grconcentration	4	−0.006	0.004	−0.010	−0.009	−0.005	−0.001
totalreserve	4	5.584	0.899	4.369	5.198	6.163	6.415

"Initial" refers to the year before the respective 5-year period.

Table 22: Pairwise correlations - Low Income Countries

	credbanks	initialcr	initialka_open	initialM1stock	initialrgdppc	grrgdppercap	M1growth	tradeopen	corrupt	laworder	bq	grconcentration	totalreserve
credbanks	1												
initialcr	-0.304***	1											
initialka_open	0.165***	-0.096*	1										
initialM1stock	0.077	-0.341***	-0.031	1									
initialrgdppc	0.454***	-0.272***	0.192***	0.014	1								
grrgdppercap	0.039	-0.026	-0.045	-0.085	-0.087	1							
M1growth	-0.169***	0.041	-0.113**	-0.217***	-0.046	0.151***	1						
tradeopen	0.248***	0.182***	0.093*	-0.342***	0.259***	0.095*	0	1					
corrupt	0.136**	-0.086	0.951***	-0.046	0.195***	-0.033	-0.099*	0.091*	1				
laworder	0.211***	0.061	-0.036	-0.219***	-0.004	0.226***	0.138**	0.133**	-0.025	1			
bq	0.436***	-0.182***	0.23***	0.09	0.383***	-0.012	-0.074	0.124**	0.232***	0.081	1		
grconcentration	0.098*	-0.307***	0.075	0.037	0.12**	-0.154***	-0.156***	-0.018	0.071	-0.05	0.07	1	
totalreserve	0.151***	-0.078	-0.04	0.201***	0.252***	0.054	-0.071	-0.06	-0.02	0.136**	0.064	0.033	1

"Initial" refers to the year before the respective 5-year period. *Note:* *p<0.1; **p<0.05; ***p<0.01.