Banking Concentration and Financial Stability
New Evidence from Developed and Developing Countries

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Abstract: In this paper, we analyze the relationship between banking concentration and financial stability for a sample of 173 developed and developing countries over the period 1980-2011. First, we empirically examine the direct effect of banking concentration on financial stability using a panel logit model. Second, we investigate the indirect effect through which concentration may affect stability. Our findings provide support for the existence of both concentration-stability and concentration-fragility channels. However, we report the absence of any direct effect of banking concentration on the occurrence of financial stability in our sample. When considering heterogeneity across countries, our results confirm the stabilizing effect of concentration on financial stability for developing countries. However, the concentration-fragility hypothesis does not hold for these countries. They also confirm the existence of both effects regarding concentration: the stabilizing and destabilizing effect of concentration on financial stability. Further estimations of our models show that concentration has a direct and indirect effect on financial stability during crisis periods. Furthermore, banking concentration has insignificant direct effect on financial stability during the normal period, and a significant indirect effect.

1. INTRODUCTION

In recent decades, financial instability has become a major source of concern worldwide. The proliferation and recurrence of financial crises since the 1980s, which affected both developed and developing countries and the socio-economic costs they generated, are the main reasons for this concern. A significant component of this concern lies in the central role of banks at the heart of countries' growth dynamics.

International banking activity has undergone dramatic changes in terms of banks' structure, status and regulations in a competitive and changing environment. Financial deregulation endorsed the market entry of non-bank financial institutions. In addition, bank deregulation caused significant structural changes that impacted the fragility of financial systems.
The idea that emerges highlights the importance of banking concentration and the creation of stronger banks to have more stable financial systems. As a result, a broad movement of mergers and acquisitions has emerged around the world and banks dramatically decreased in number but increased in size.

Arguments that emerge in the literature have not all documented a positive effect of concentration on financial stability. The empirical literature dealing with this correlation shows two possible connections in the sense that the concentration may promote stability (Beck et al., 2006; Evrensel, 2008), as it can also be a source of instability (Boyd et al., 2006; Uhde and Heimeshoff, 2009 and Shehzad et al., 2009).

Whether banking concentration is a source of stability or, on the contrary, an amplification factor of banking crises, is a subject that requires particular attention since banks' financial situation heavily impacts the real economy (Dell'Ariccia et al., 2008, Kroszner et al., 2007).

This paper discusses the potential effects of banking concentration on financial stability by providing empirical evidence for a set of 173 developed and developing countries. The remaining of the paper is organized as follows. Section 2 covers the relevant literature on the banking concentration and financial stability nexus. Section 3 discusses the methodology, data description and estimation procedures. Section 4 presents the empirical results. Section 4 concludes.

2. LITERATURE OVERVIEW

The literature on the banking sector structure and financial stability nexus concentrated around two distinct strands with utterly opposite conclusions. The first strand supports the idea that banking concentration has a destabilizing effect (concentration-fragility hypothesis) while the second strand provides support for a positive correlation between concentration and financial stability (concentration-stability hypothesis).

Several empirical studies report a positive correlation between banking concentration and the stability of the financial system through the bank profitability channel. Using a sample of 134 countries over the period 1993 to 2004, Boyd et al. (2006) show that concentrated banks display higher profits. The same results were confirmed by Uhde and Heimeshoff (2009) for 25 countries in the European Union over the period 1997-2005. Berger et al. (2009) highlight the risk channel as favoring the positive concentration-stability nexus. They show that the overall bankruptcy risks supported by a bank decreases with the increase of their market power. Indeed, banks will hold a larger capital share, which increases their ability to absorb losses. Other theoretical contributions have considered the impact of market power on financial stability highlighting the greater profits of companies having dominant positions (Freixas and Rochet, 2008). Greater profits associated with market power can increase banks' capital and subsequently their ability to absorb shocks in an instable financial situation (Vives, 2010). Banks that are more concentrated are therefore less prone to liquidity or macroeconomic shocks. Matutes and Vives (2000) show that market power emerging from a concentrated banking market encourages shareholders and managers not to engage in highly risky operations and to better choose their customers , which

strengthens the financial system stability. Therefore, the probability of a bank run occurring would be lower in a concentrated system (Smith, 1984). Similarly, Saez and Shi (2004) argue that in a concentrated system, the number of banks is limited and no entity has an interest in the bankruptcy of others banks because the opportunity costs for bankruptcy is higher for the entire banking system (Northcott, 2004). In addition, a banking system with larger banks could facilitate access to information, mitigate adverse selection problems (Fernandez et al., 2010 and Marquez, 2002) and reduce moral hazard (Freixas and Rochet, 2008).

In addition to these channels between banking concentration and financial stability, the literature highlights other channels, such as the diversification channel. Diversification, the creation of multiple activities and internationalized banks can promote financial stability, as banks become less sensitive to national economic conditions. In addition, mergers and acquisitions, as a dynamic for concentration, can help achieve economies of scale that increase banking diversification (Williamson, 1986, 1987). Numerous studies highlight the important role of diversification in risk reduction, particularly loan portfolio diversification. Stever (2007), for example, argues that small banks are more risky because they have fewer opportunities for diversification, which may cause higher profit volatility. Beck et al. (2007) show that it is mainly through diversification that concentration improves the financial stability.

The stability-market structure nexus could also be explained by arguments that emphasize the complexity of the banking system. Allen and Gale (2000) argue that in a concentrated banking system where only a few large institutions are present, it become easier to supervise them, which consequently reduces the hazard. Add more explanation here.

The second strand n the literature dealing with the concentration-financial stability nexus supports the possibility of a negative correlation-- showing that a concentrated market could have a destabilizing effect on financial stability by referring to the "*too big to fail*" thesis. The implicit or explicit assurance of being rescued in case of bankruptcy encourages risk-taking by banks, which will ultimately increase systemic risk (Mishkin, 1998). Berger et al. (2009) show the existence of a negative impact of higher concentration on banks' portfolios and confirm the destabilizing concentration thesis. Banks having power in the market will increase interest rates on loans, which will in turn eliminate the least risky part of the banks' customers. A bank's default risk will surge, which will induce more bankruptcies. Thus, the more concentrated the banking system is, the more risky the loan portfolio. A study by Boyd et al. (2006) using data from 134 countries over the period 1993-2004 shows that the effect of riskier portfolios dominates despite the existence of high revenues related to the banking concentration and market power giving rise to a destabilizing impact on the financial system. This situation is even more risky given that the big banks generally seek to minimize the costs of monitoring, pushing them to concentrate their lending in a single industry to achieve economies of scale in information gathering. Loan portfolio diversification will therefore decrease and banks will become much more sensitive to shocks with a negative impact on financial system stability. More explanation is needed here.

3. METHODOLOGY, DATA AND MODELS

This study empirically examines the nature of the correlation between bank concentration and financial stability. It is worth noting that the literature has not reached a consensus on the nature of this relationship. Most of the empirical studies seek to establish the existence of a direct effect of bank concentration on financial stability without recognizing the importance of a potential indirect effect. In this study, we first assess the existence of a direct effect. We also examine the existence of an indirect effect.

We consider a broad definition of financial instability by considering it when a crisis erupts in a given country. Laeven and Valencia (2010) argue that "*Crises are given by a simple binary variable that equals one if a country i at time t experience a financial crisis, and zero otherwise*." Empirically, Laeven and Valencia (2012, 2010) approach considers that systemic crises are actual and not potential. Specifically, the occurrence of a systemic banking crisis (SYSC) is a binary variable based on bank-specific, industry-specific and a list of macroeconomic control variables (X). Bank specific variables are represented by the net interest margin used to assess the profitability of a bank's lending activities (NIM). We also use another profitability measure as captured by the return on assets (ROA). The Banking industry specific variable is captured by market concentration (CONC). Following Bretschger et al. (2012) the study uses per capita GDP (PGDP), GDP growth

rate (GDPG) and inflation (INF) as macroeconomic variables. Also, the binary deposit insurance variable (INS) is included as an important variable driving the concentration-stability nexus depending if the country has or not a deposit insurance (Beck et al., 2013). Thus, our model will be as follows:

$$SYSC_{it} = \alpha_0 + \alpha_1 CONC + \alpha_2 ROA + \alpha_3 NIM + \alpha_4 X + \varepsilon it \quad (1)$$

Following Bretschger et al. (2012), the basic form of the model is introduced in Equation (1). It includes a profitability measure (ROA), the net interest margin (NIM) and the concentration variables (CONC). Moreover, the extended form of the model includes CONC, ROA, NIM, insurance deposit variables (INS), GDPG and INF. Our dependent variable (SYSC) is dichotomous and will be estimated using qualitative models (Probit and Logit).

After investigating the existence of a direct channel through which concentration may affect the likelihood of financial instability, we investigate the existence of an indirect effect by testing two transmission channels. The first channel uses return on assets (ROA) and supports the argument that a concentrated banking system has greater market power and thus has significant revenues that could increase banks capacity to absorb negative shocks. The effect of the first channel on the financial system is therefore stabilizing. The second channel uses the net interest margin. The argument is that large concentrated banks display higher interest rates, which are likely to eliminate the least risky of the customers who prefer not to borrow at higher rates. The bank loan portfolio quality is likely to deteriorate, thereby increasing the occurrence of crises. The impact of the second channel on the financial system is therefore destabilizing.

As in Bourke (1989), Molyneux and Thornton (1992), Athanasoglou et al. (2008), and Bretschger et al. (2012), among others, we define the two models representing our two transmission channels:

$$ROA_{it} = \beta_0 + \beta_1 ROA_{it-1} + \beta_2 CONC + \beta_3 Y + \varepsilon_{it} \quad (2)$$

$$NIM_{it} = \delta_0 + \delta_1 NIM_{it-1} + \delta_2 CONC + \delta_3 Y + \varepsilon_{it} \quad (3)$$

where Y is a set of macroeconomic and bank-specific variables. Per capita GDP, GDP growth rate and the inflation rate are the macroeconomic variables. The cost to income ratio (CIR) is included to control for bank specific characteristics (Bretschger et al., 2012).

The assumption that concentration has a stabilizing effect suggests a negative correlation between banking concentration and financial instability. Therefore, we expect a positive correlation between ROA and concentration and a negative correlation between asset returns and financial instability. As for the destabilizing channel, we expect a positive relationship between concentration and the net interest margin on one side and a positive relationship with the probability of a crisis occurrence on the other.

To highlight the effect of these channels on financial stability, we use the estimated values of ROA and NIM with other control variables and estimate the following model in a logit framework (Bretschger et al., 2012).

$$SYSC_{it} = \alpha_0 + \alpha_1 \widehat{ROA} + \alpha_2 \widehat{NIM} + \alpha_3 X + \varepsilon it \quad (4)$$

As presented in Appendix A, the study considers a sample of 173 developed and developing countries over a period of 32 years (1980-2011). This relatively large amount of data will improve the accuracy of our estimations. In addition, the period of the study allows us to consider two major systemic crises that have particularly affected banking institutions around the world: the Asian crisis (1997) and the subprime crisis (2008). In addition, it takes into account relatively stable periods such as the one from 2003 to 2006. All variables are summarized in Table 1.

Equations (2) and (3) are estimated using the Generalized Method of Moments (GMM) system. We run a Sargan test to examine the validity of instruments. Also, to test for the second autocorrelation of the residuals, the Arellano-Bond test is used (Arellano and Bond, 1991). Also, a stationary test is performed for all variables in our sample to ensure the validity of our results since we have a large period in a panel framework that may affect our results by non-stationary data (Maddala and Wu, 1999).

Table 1. Definitions of Variables and Sources

Variable	Proxy	Definition	Source
SYSC	Systemic crisis	Dummy variable (0,1)	Laeven an Valencia (2012)
ROA	Return On Assets	Net income/total assets	Beck et al. (2013)
NIM	Net Interest Margin	Net interest income / total earnings assets	Beck et al. (2013)
CONC	Concentration	Assets held by the three largest banks in each country	Beck et al. (2013)
INS	Deposit Insurance	A dummy variable that takes a value of one if the country has deposit insurance, and zero otherwise	(Barth et al., 2012)
CIR	Cost Income Ratio	Total costs /total income of all commercial banks	Beck et a.l (2013)
INF	GDP deflator (annul %)	The ratio of nominal GDP / real GDP	World Development Indicators
PGDP	Per capita GDP	The country's GDP / population	World Development Indicators
GDPG	Per capita GDP growth	Annual % growth rate of per capita GDP.	World Development Indicators

4. Results and Discussion

Table in Appendix B provides the descriptive statistics for the full sample (developing and developed countries). The average concentration ratio for developed countries is slightly higher (0.77 compared to 0.71).

The correlation matrix presented in Table 2 shows that the return on assets and the net interest margin are positively correlated with concentration, which is consistent with theoretical predictions, stating that higher banking concentration is consistent with higher profits stemming from high interest rates. Profitability is negatively correlated with financial instability. The NIM is positively correlated with the probability of crisis. Results also report a negative relationship between concentration and the financial system instability.

Table 2. Pairwise Correlation Matrix

Variables	SYSC	CONC	NIM	ROA	INS	INF	PGDP	GDPG
SYSC	1.0000							
CONC	-0.0801	1.0000						
NIM	0.1518	0.0515	1.0000					
ROA	-0.2618	0.0520	0.2314	1.0000				
INS	-0.2123	-0.2397	-0.1181	-0.1271	1.0000			
INF	-0.0251	0.0442	0.3678	0.0452	-0.0371	1.0000		
PGDP	0.1896	0.0545	-0.5120	-0.1365	0.1503	-0.1423	1.0000	
GDPG	0.1760	-0.0455	0.0423	0.1245	0.0430	-0.0021	-0.1495	1.0000
CIR	0.1512	-0.1075	0.1313	-0.0968	0.1769	0.0427	-0.1071	-0.0495

Table 3 reports the results for the basic and the extended model for the full sample. The results indicate a negative but insignificant relationship between banking concentration and financial instability in all models. This result suggests that a change in the overall concentration would not have a significant impact on financial instability, all other things being equal. This finding is in line with the earlier studies including Ruiz-Porras (2007) and Bretschger et al. (2012), among others. It is worth noting in this regard that results stemming from empirical studies dealing with the effects of banking concentration on financial stability report different findings depending if a z-score or a dummy variable is used. Studies using dummy variable report a positive relationship of concentration on instability (Laeven and Valentia, 2008, among others), while studies using the z-score find a negative relationship between concentration and instability (Boyd et al., 2006; Shehzad et al., 2009, among others).

Table 3. Systemic Crisis – Direct Channel for The Full Sample

Regressions	Basic model		Extended model			
	Logit	Probit	Logit	Probit	Logit	Probit
CONC	-0.0024	-0.0037	-0.0057	-0.0009	-0.0046	-0.0084
ROA	-0.0114***	-0.1468***	-0.1002***	-1.2505***	-0.4466***	-0.1172***
NIM	0.0676**	0.0214**	0.0004*	0.0165*	0.0022*	0.0082*
INS			1.0639***	3.6400***	1.0024***	2.8653***
GDPG					-0.0532***	-0.0044*
INF					0.0003	0.0006
Constant	-2.2471***	-3.9892***	-1.3016***	-3.5790***	-2.2705***	-4.1729***
Log likelihood	-370.224	-355.998	-317.976	-368.660	-337.010	-349.820
Wald chi2 (3; 4; 6)	44.75	26.20	31.68	62.45	51.22	44.55
Prob>chi2	0.000	0.000	0.000	0.000	0.000	0.000
rho	0.5474	0.5212	0.5662	0.4942	0.3667	0.4812
chibar2(01)	81.40	90.21	56.00	62.58	65.30	51.93
Prob>= chibar2	0.000	0.000	0.000	0.000	0.000	0.000
Nb. Countries	156	156	156	156	156	156
Observations	1660	1660	1660	1660	1608	1608

T-Student coefficients are reported in parentheses. ***, **, and * indicate significance levels at 1, 5, and 10 percent, respectively.

The profitability measured by ROA negatively and significantly influences the probability of a systemic financial crisis. The negative sign of the coefficient in all models supports the argument that the occurrence of a crisis decreases with the level of profitability. This implies that the higher the return on assets, the lower the risk of financial instability. A bank's ability to generate sufficient and sustainable profitability increases its continuity in the market. In this regard, Berger et al. (2009) found that the overall risks of bankruptcy supported by a bank decreases with the increase in market power. Their findings provide evidence that banks having a larger share of capital increase their capacity to absorb losses. Banks with large size tend to have higher economies of scope by having access to markets while small banks cannot afford it (Heggestad, 1977).

Our results regarding the NIM provide evidence for the positive and significant effect of the net interest margin on financial instability. This positive and significant relationship is due to the destabilizing effect of excessive risk-taking by banks. Higher interest rates attract risky borrowers, which will increase the likelihood of bank failures and equally reduce financial system stability.

The regression coefficient obtained for the deposit insurance variable (INS) is significantly positive. This result is in line with Mitchener and Wheelock (2013) who show that deposit insurance increases the occurrence of a crisis. In the same line of thought, Maggie et al. (2014) find that higher deposit insurance lead to higher bankruptcy. This result is particularly in line with the *moral hazard* assumption, which indicates that the existence of guarantees on deposits encourages shareholders to acquire maximum debt assets with maximum risk, which increase the risk of instability.

For macroeconomic variables, inflation is positively but not statistically significant related to the probability of crisis occurrence. However, the impact of the GDP per capita growth rate on financial instability is negative and highly significant in all regressions. This result suggests that higher economic growth lower the probability of financial instability (Beck et al., 2006; Allen et al., 2012).

Estimation results of Equations (2) and (3) using System GMM are displayed in Table 4. The results show a positive and significant correlation between concentration and ROA on one hand and with the NIM on the other. This finding is consistent with previous studies including Bourke (1989), Molyneux and Thornton (1992), Athanasoglou et al. (2008), and Bretschger et al. (2012), among others. This result suggests that a higher level of bank concentration leads to monopoly profits as argued by Molyneux and Thornton (1992). This result is also confirmed by Boyd et al. (2006) and Srairi (2010) who show that banking concentration and profitability are positively correlated arguing that banks having higher marker power display higher profits .

Estimations outcomes suggest that concentration and the net interest margin are positively and significantly correlated. This finding supported by the idea stating that concentration increases loan-interest rates and higher lending rates tend to eliminate the least risky bank customers who prefer not to borrow at these rates (Beck et al., 2007).

Table 4. ROA and NIM Channels Using GMM System

Regressions	**ROA**	**NIM**
ROA (t-1)	0.0625 ***	
NIM (t-1)		0.4520***
CONC	0.0166***	0.3002***
GDPG	0.0321***	0.0379**
PGDP	0.0368*	-0.0143
INF	0.0565***	0.0196***
CIR	-0.0001 ***	-0.0002***
Constant	1.53	3.13***
AR(1)	-1.2917	-5.0883
	(0.3062)	(0.1068)
AR(2)	0.3721	-0.7003
	(0.7098)	(0.4367)
Sargan	56.9175	83.7258
	(0.6001)	(0.2109)
Nb. countries	156	156
Observations	1206	1206

T-Student coefficients are reported in parentheses. ***, **, and * indicate significance levels at 1, 5, and 10 percent, respectively.

As a result, the portfolio loan's quality will deteriorate, which increases the probability of bankruptcy (Bretschger et al., 2012).

The results also show that the GDP per capita growth rate is positive and significant in both models (ROA and NIM). This result suggests that economic activity positively impacts bank performance since higher economic growth leads to higher consumption and investment, and therefore to higher credit that consequently increases banks' performance (Goddard et al., 2004; Schwaiger and Liebig, 2008). Consistent with Srairi (2010), profitability is found to be positively and significantly correlated with inflation. The effect of inflation on profitability will depend on the degree to which bank income and expenses increase relative to inflation (Revell, 1979). Moreover, the effect of inflation on profits will depend on the accuracy of anticipated inflation. For example, better inflation anticipation allows the bank to raise the interest rates of its loans in advance. In this case, revenues will increase faster than operating costs, allowing the bank to record higher profits (Athanasoglou et al., 2008).

To show the indirect effect of bank concentration on financial stability, we estimated Equation (4). The results presented in Table 5 reports that high return on assets is associated with lower financial instability. However, higher net interest margins increases the likelihood of a crisis.

Our results also show that the coefficient of GDP growth rate is negative and significant using the profit model. This result suggests that an increase in economic activity positively impacts bank performance and thereby decreases the probability of crisis occurrence. This result suggests that higher economic growth is consistent with an increase in consumption and investment, which would lead to higher credits demand, and by the same time an increase of banks' performance (Goddard et al., 2004; Schwaiger and Liebig, 2008)..

Table 5. Systemic Crisis – Indirect Effects

	Logit	**Probit**
ROA	-0.0997***	-0.1065***
NIM	0.0034***	0.0021***
INS	3.1459**	2.1589***
GDPG	-0.1160	-0.1247***
INF	0.0035***	0.0028
Constant	-6.5137***	-4.6813***
Log likelihood	-332.6654	-330.9521
Wald chi2 (5)	70.12	80.73
Prob>chi2	0.0000	0.0000
rho	0.5067	0.5009
chibar2(01)	56.34	59.01
Prob>= chibar2	0.000	0.000
Nb. Countries	156	156
Observations	1606	1606

T-Student are reported in parentheses. ***, **, and * indicate significance levels at 1, 5, and 10 percent, respectively.

The level of economic development might affect the predisposition of a country to financial instability. To check the validity of our initial results across countries, we run a set of regressions by subsamples depending of their level of development (developed and developing countries). Table 6 provides the results of the direct and indirect effects of concentration on financial stability for the basic and extended models for both subsamples. Results show that the coefficients of the return on assets and net interest margin have the anticipated effect on financial instability in both developed and developing countries. However, we report no evidence of a direct effect of banking concentration on financial instability in both developed and developing countries (coefficients are not significant).

Table 7. ROA and NIM Channels – GMM Estimates

	Developing countries		**Developed countries**	
Regressions	**ROA**	**NIM**	**ROA**	**NIM**
ROA (t-1)	0.2050 ***		0.310 2***	
NIM (t-1)		0.1103***		0.1075**
CONC	0.1893***	0.1164	0. 9138***	0.1973***
GDPG	0.1810	0.9567***	0.3150***	0.4321**
PGDP	-0.0102***	-0.0104	-0.0009***	-0.0102
INF	0.0115***	-0.0821	0.0601	-0.0120
CIR	-0.0184 **	-0.1870***	-0.2083 ***	-.0001***
Constant	9.0112***	13.0061**	7.1505***	5.3562***
AR(1)	-2.5012	-1.1032	-3.1026	-2.5952
	(0.1650)	(0.1251)	(0.9830)	(0.1427)
AR(2)	2.4811	-0.9573	-0.5861	-1.0135
	(0.3750)	(0.1832)	(0.6081)	(0.3749)
Sargan	68.1164	85.2083	60.6701	51.7018
	(0.2510)	(0.1183)	(0.1483)	(0.4208)
Nb. countries	115	115	41	41
Observations	980	980	466	466

T-Student coefficients are reported in parentheses. ***, **, and * indicate significance levels at 1, 5, and 10 percent, respectively.

Furthermore, we examine the existence of an indirect transmission channels across the two subsamples (developed and developing countries) using the system GMM (Table 7). The results show robust support to suggest the existence of a positive and significant effect of concentration on profitability (ROA) in both developed and developing countries. However, contrary to developed countries, we report no significant correlation between banking concentration and the interest margin (NIM) in developing countries. This result suggests that the net interest margin is driven by other factors in developing countries. Financial systems in developing countries are generally less developed. Because of high transaction costs and absence of economies of scale, lending rates may be too high. Therefore, high net interest margins may occur due to existing deficiencies rather than high market concentration (Bretschger et al., 2012). Interestingly, the estimated coefficient of concentration in developed countries (0.914) is higher compared to developing countries (0.189), reflecting the economic importance of concentration on banks profitability ROA in developed countries. Furthermore, GDPG is found to have a positive and significant impact on banks performance in developed countries, while GDPG has a positive but insignificant impact in developing countries.

Table 8. ROA and NIM Channels – GMM Estimates

	1980→1995		1996→2006		2007→2011	
Regressions	**ROA**	**NIM**	**ROA**	**NIM**	**ROA**	**NIM**
ROA (t-1)	0.3010 ***		0.4125***		0.2458***	
NIM (t-1)		0.1006***		0.2108**		0.1146**
CONC	0.1243**	0.5429	1. 1023***	1.0061***	0.8240***	0.2462***
GDPG	0.4721**	0.8462*	0.3351***	0.3250**	0.2580***	0.3427**
PGDP	-0.0082***	-0.0117	-0.0011***	-0.5431	-0.0011***	-0.0102
INF	0.0241***	-0.0905	0.5106	0.5132	0.0871	-0.0116
CIR	-0.0112 **	-0.2013***	-0.0824***	-0.4201***	-0.2591***	-0.0014***
Constant	8.4120***	10.1132**	9.1823***	8.0215***	8.5512***	6.6072***
AR(1)	-1.8020	-1.1589	-2.2651	-1.9041	-4.0013	-3.1957
	(0.6580)	(0.2590)	(0.5022)	(0.5481)	(0.5621)	(0.5623)
AR(2)	2.3497	-0.8510	-0.1687	-2.5420	-0.1572	-1.2160
	(0.6213)	(0.2146)	(0.5127)	(0.7420)	(0.6124)	(0.7128)
Sargan	82.0124	80.2143	65.5427	58.1249	63.8162	65.5471
	(0.1302)	(0.1276)	(0.1350)	(0.5701)	(0.1820)	(0.2716)
Nb. countries	156	156	156	156	156	156
Observations	1120	1120	842	842	656	656

T-Student coefficients are reported in parentheses. ***, **, and * indicate significance levels at 1, 5, and 10 percent, respectively.

To sum up, our results provide support to the suggestion that concentration have a stabilizing impact on financial stability for developing countries. However, the concentration-fragility hypothesis does not hold for these countries. Moreover, concentration is found to be positively impacting profitability and net interest margin

as well. Our results also support both hypotheses regarding concentration: the stabilizing and destabilizing effect of concentration on financial stability.

To further develop our estimations and analyze the robustness of our results, we split our period of study into three sub-periods. This decomposition is based on the occurrence or the absence of international crisis during these sub-periods that could impact banking stability. The first period is from 1980 to 1985 where no major international crises have been recorded. The second sub period is from 1996 to 2006. Two main crises have been recorded during the second period: the Asian financial crisis in 1996-97 and the Russian financial crisis that impacted and spread worldwide. The third sub period is from 2007 to 2011, during which the subprime financial crisis erupted in the United States and that had major repercussions worldwide.

The estimation results are presented in Tables 8 and 9. The concentration coefficient for the first sub period 1980-1985 is not significant showing the absence of any direct effect of bank concentration on financial stability. However, we report a stabilizing indirect effect since concentration has a positive and significant effect on ROA and therefore on bank stability in the sense that more profitability induces less financial instability.

As for the second sub period, our results show that the coefficient of concentration is negative and significant which suggests the existence of a direct and indirect effect of concentration on financial instability. Concentration has a positive effect on Profitability and this later is negatively correlated to crisis occurrence. Therefore there is an indirect effect of concentration on stability as shown in Table 9. Furthermore, for the sub period 2007-2011, the results show also a negative and significant effect of concentration on financial instability. This implies that more concentration decreases financial instability.

5. CONCLUSION

Two main strands of literature exist regarding the relationship between banking concentration and financial stability. The first strand highlights the effect of the return on assets as a stabilizing. The second strand highlights the effect of net interest margin as a destabilizing effect.

In our study, we focused on the relationship between banking concentration and financial stability by exploring both the direct and indirect channels. The results show that concentration does not directly affect the stability of the financial system. However, concentration has a positive impact on financial stability through the profitability channel and a negative impact through the interest rate channel. This supports the evidence that additional revenues related to banking concentration can increase banks' capital and subsequently their ability to absorb negative shocks during financial crises. Our results also confirm that bank concentration has a destabilizing effect on financial stability. Banks that are more concentrated charge higher interest rates, which will eliminate the least risky part of the customers who prefer not to borrow at these rates.

When considering development levels across countries, our results support the stabilizing effect of concentration on financial stability for developing countries. However, the destabilizing effect does not hold for these countries.

Further estimations of our models show that the concentration has a direct and indirect effect on financial stability during crisis. Nevertheless, concentration has insignificant direct effect on financial stability during the normal period (1980-1995), even though it has a significant indirect effect. The findings of this study are consistent using different models and after inclusion of different control variables.

The findings of this study are important for policymakers in both developed and developing countries. They show that increasing financial market concentration tends to decrease financial instability during financial crisis periods, even though it has no significant impact during normal periods. However, considering the concentration alone may not provide a strong support for the effect of financial market concentration on financial stability, as other factors could affect the occurrence of crises. The finding also may help policymakers to pressure the concentrated financial institutions not to increase the net interest margin during financial crises as it may

increase the probability of financial crisis. Furthermore, policymakers need to monitor concentration and competition in the banking system.

Table 6. Systemic Crisis – Direct and Indirect Effects

	Direct Effect								Indirect Effects			
	Developing Countries				Developed Countries				Developing Countries		Developed Countries	
	Basic Model		Extended Model		Basic Model		Extended Model					
Regressions	Logit	Probit	Logit	Probit	Logit	Probit	Logit	Probit	Logit	Probit	Probit	Logit
CONC	0.0082	0.0091	0.0110	-0.1102	-0.0135	-0.1501	-0.2017	-0.0124				
ROA	-0. 5006***	-0.1165***	-0.3412***	-0.1286***	-0. 1158***	-0.0812***	-0.1126***	-0.0681***	-0.6240***	-0.1761***	-0.2586***	-0.1803***
NIM	0.3709**	0.1327**	0.3123***	0.1378***	0.0210**	0.0013*	0.0154**	0.0101**	0.0146	0.0182	0.0125**	0.0113*
INS			1. 0027	0.0450***			1.1191***	1.9354***	0.1386***	0.0561***	1.6892***	1.4761***
GDPG			-0.1162***	-0.1207***			-0.3546***	-0.1913***	-0.1021***	-0.1134***	-1.7387**	-0.4720***
inf			0.0302***	0.0136			-0.0123	0.1028	-0.0423	0.0127	-0.0258	-0.0121
Constant	-2.3195***	-3.0412***	-3.9181	-2.9680***	-3.6819	-1.8864	-4.0021**	-3.5410**	-3.1117***	-3.6132***	-2.4014***	-2.6816
Log likelihood	-121.365	-136.501	-130.512	-138.780	-141.261	-157.212	-150.189	-146.086	-138.927	-140.061	-157.470	-163.884
Wald chi2 (3; 4; 6)	30.41	33.42	41.83	55.20	50.66	47.59	49.35	58.76	44.27	65.55	50.93	50.30
Prob>chi2	0.000	0.000	0.000	0.0000	0.000	0.000	0.0000	0.0000	0.000	0.000	0.000	0.000
rho	0.701	0.691	0.638	0.715	0.679	0.496	0.714	0.634	0.719	0.726	0.511	0.501
chibar2(01)	53.41	56.80	45.02	55.19	28.57	26.10	31.78	32.54	65.39	60.82	16.44	19.25
Prob>= chibar2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000
Nb. countries	115	115	115	115	41	41	41	41	115	115	41	41
Observations	908	908	869	869	452	452	452	452	869	869	452	452

T-Student coefficients are reported in parentheses. ***, **, and * indicate significance levels at 1, 5, and 10 percent, respectively. ROA and NIM are the GMM estimated values for the indirect effects..

Table 9. Systemic Crisis – Direct and Indirect Effects

	Direct Effect						Indirect Effect					
	1980→1995		1996→2006		2007→2011		1980→1995		1996→2006		2007→2011	
Regressions	**Logit**	**Probit**	**Logit**	**Probit**	**Logit**	**Probit**	**Logit**	**Probit**	**Logit**	**Probit**	**Logit**	**Probit**
CONC	0.0110	-0.0062	-0.0074**	-0.0037**	-0.1316*	-0.1054**						
ROA	-0.2393***	-0.1191***	-0.0423***	-0.1064***	-0.0712***	-0.0422***	-0.0061***	-0.0975***	-0.1167**	-0.0981***	-0.1564**	-0.0270**
NIM	0.1335***	0.0856***	0.0308**	0.0207**	0.0239**	0.0139**	0.2836**	0.5212*	0.2663*	0.3099*	0.0177**	0.0055**
INS	0. 9421	0.0943***	2.4238*	1.2447***	1.6787***	1.6571***	1.0027	0.0543***	2.1700**	1.0417*	1.2655***	1.0469***
GDPG	-0.1942***	-0.0112***	-0.0099**	-0.0267***	-0.0822***	-0.0460***	-0.1162***	-0.1438**	-0.5846***	-0.1913***	-0.3819***	-0.6849***
INF	0.0202***	0.0559	-0.0151	0.0057	-0.0364	0.1689	0.0234***	0.0137**	-0.0241*	0.1578**	-0.0135	0.1028
Constant	-0.8976	-0.5381***	-6.9972	-3.5621	-43.7441	-21.1250*	-0.9129	-1.6044*	-8.6281	-4.4226*	-26.2902	-13.0997
Log likelihood	-548.010	-545.927	-124.685	-123.714	-117.761	-117.994	-533.366	-531.221	-117.802	-116.987	-125.328	-124.700
Wald chi2 (5,6)	26.34	27.55	15.13	15.16	27.60	28.17	28.01	29.26	21.18	23.66	23.03	26.38
Prob>chi2	0.0001	0.0000	0.0000	0.0000	0.2688	0.2258	0.000	0.0000	0.0007	0.0006	0.0008	0.0002
rho	0.429	0.407	0.691	0.664	0..858	0.859	0.3913	0.3731	0.684	0.693	0.786	0.770
chibar2(01)	99.57	102.04	40.74	41.94	117.34	118.42	84.62	88.20	34.78	33.52	93.99	88.11
Prob>= chibar2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nb. countries	156	156	156	156	156	156	156	156	156	156	156	156
Observations	1564	1564	1004	1004	624	624	1687	1687	1117	1117	734	734

T-Student coefficients are reported in parentheses. ***, **, and * indicate significance levels at 1, 5, and 10 percent, respectively. ROA and NIM are the GMM estimated values for the indirect effects.

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Appendix A. Sample and Sub-Samples List of Countries (173 Countries)

DEVELOPED COUNTRIES		DEVELOPING COUNTRIES		
Andorra	San Marino	Afghanistan	Grenada	Paraguay
Aruba	Saudi Arabia	Albania	Guatemala	Peru
Australia	Singapore	Algeria	Guinea	Philippines
Austria	Slovak Republic	Angola	Guyana	Romania
Bahamas	Slovenia	Antigua and Barbuda	Haiti	Russia
Bahrain	Spain	Argentina	Honduras	Rwanda
Barbados	St. Kitts and Nevis	Armenia	India	Samoa
Belgium	Sweden	Azerbaijan	Indonesia	Senegal
Bermuda	Switzerland	Bangladesh	Iraq	Serbia
Brunei Darussalam	Trinidad and Tobago	Belarus	Jamaica	Sierra Leone
Canada	United Arab Emirates	Belize	Jordan	South Africa
Croatia	United Kingdom	Benin	Kazakhstan	Sri Lanka
Cyprus	United States	Bhutan	Kenya	St. Lucia
Czech Republic		Bolivia	Kyrgyz Republic	Sudan
Denmark		Bosnia and Herzegovina	Latvia	Suriname
Equatorial Guinea		Botswana	Lebanon	Swaziland
Estonia		Brazil	Lesotho	Syrian
Finland		Bulgaria	Libya	Tajikistan
France		Burkina Faso	Lithuania	Tanzania
Germany		Burundi	Macedonia. FYR	Thailand
Greece		Cambodia	Madagascar	Togo
Hong Kong		Cameroon	Malawi	Tonga
Hungary		Chad	Malaysia	Tunisia
Iceland		Chile	Mali	Turkey
Ireland		China	Mauritania	Turkmenistan
Israel		Colombia	Mauritius	Tuvalu
Italy		Congo. Dem. Rep.	Mexico	Uganda
Japan		Costa Rica	Micronesia	Ukraine
Korea		Cote d'Ivoire	Moldova	Uruguay
Kuwait		Cuba	Mongolia	Uzbekistan
Luxembourg		Djibouti	Montenegro	Vanuatu
Macao		Dominica	Morocco	Venezuela. RB
Malta		Dominican Republic	Mozambique	Vietnam
Monaco		Ecuador	Myanmar	West Bank and Gaza
Netherlands		Egypt. Arab Rep.	Namibia	Yemen. Rep.
New Zealand		El Salvador	Nepal	Zambia
Norway		Ethiopia	Nicaragua	Zimbabwe
Oman		Gabon	Niger	
Poland		Gambia. The	Nigeria	
Portugal		Georgia	Pakistan	
Qatar		Ghana	Panama	

Appendix B. Descriptive Statistics

Full Sample					
Variable	**Observation**	**Mean**	**Std. dev.**	**Min**	**Max**
SYSC	4993	0.086	0.28	0	1
ROA	1982	1.348	3.41	-109.49	21.119
NIM	1977	4.904	3.347	0.006	39.237
CONC	2025	0.723	19.846	0.213	1
PGDP	4545	10588	16577	111	158803
GDPG	4596	3.399	5.681	-50.248	88.957
INF	4574	53	594	-27	26762
INS	4993	0.589	0.491	0	1
CIR	2135	56.873	16.084	1.53	226.316
Developing Countries					
Variable	**Observation**	**Mean**	**Std. dev.**	**Min**	**Max**
SYSC	3681	0.092	0.29	0	1
ROA	1458	1.573	2.554	-51.412	21.119
NIM	1455	5.844	3.367	0.006	39.237
CONC	1487	0.708	0.203	0.213	1
PGDP	3327	4194	8707	111	81947
GDPG	3373	3.437	6.129	-50.248	88.957
INF	3351	70.429	693.148	-27.631	26762
INS	3681	0.565	0.495	0	1
CIR	1573	58.13	15.589	6.651	226.316
Developed Countries					
Variable	**Observation**	**Mean**	**Std. dev.**	**Min**	**Max**
SYSC	1312	0.067	0.251	0	1
ROA	524	0.722	5.033	-109.49	7.598
NIM	522	2.284	1.234	0.124	8.922
CONC	538	0.765	0.175	0.269	1
PGDP	1218	28053	20044	4270	158803
GDPG	1223	3.295	4.205	-20.615	33.99
INF	1223	6.231	17.004	-25.699	390.679
INS	1312	0.658	0.474	0	1
CIR	562	53.356	16.918	1.53	126.016