Economics
The Open-Access, Open-Assessment E-Journal

Discussion Paper
No. 2015-22 | March 26, 2015 | http://www.economics-ejournal.org/economics/discussionpapers/2015-22

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

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Abstract
In this paper, the authors analyze the relationship between banking concentration and financial stability for a sample of 173 developed and developing countries over the period 1980–2011. First, they empirically examined the direct effect of banking concentration on financial stability by using a panel logit model. Second, the authors investigated the indirect effect through which concentration may affect stability. Their findings provide support for the existence of both concentration-stability and concentration-fragility channels. However, the authors report the absence of any direct effect of banking concentration on the occurrence of financial stability in our sample. When considering heterogeneity across countries, their results help 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.

JEL E31 E3 C33 P44
Keywords Banking structure; financial stability; Panel logit; GMM model

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Citation Mohamed Sami Ben Ali, Timoumi Intissar, and Rami Zeitun (2015). Banking Concentration and Financial Stability: Evidence from Developed and Developing Countries. Economics Discussion Papers, No 2015-22, Kiel Institute for the World Economy. http://www.economics-ejournal.org/economics/discussionpapers/2015-22

Received March 8, 2015 **Accepted as Economics Discussion Paper** March 23, 2015 **Published** March 26, 2015

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, affecting both developed countries and developing countries and the socio-economic costs they generate, are the main reasons for this concern. A significant component of this concept 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 institutions such as pension funds, insurance companies and investment funds. In addition, bank deregulation caused significant structural changes that have not come without impact on the fragility of financial systems. Bank fragilities lastingly and profoundly affect societies, as seen in the subprime financial crisis that erupted in 2008.

The idea that emerges highlights the importance of banking concentration and the creation of stronger banks that was seen as a remedy that could promote greater stability of financial systems. A broad movement of mergers and acquisitions has emerged around the world, especially in the United States; these include the purchase of two American investment banks, Bear Stearns and Merrill Lynch, respectively by JP Morgan Chase and Bank of America.

According to the Bank for International Settlement (2001), the world has seen a rapid consolidation of banks during the past several decades, which has caused a decrease in the number of banks and an increase in banks' average size. At the same time, several recent studies show that banking consolidation and changes in the structure of the banking industry significantly affect not only the performance of individual banks but also the stability of the entire banking system (Berger et al. (2007). Due to the particular role that market structure plays in the banking systems, the recent financial literature has become very concerned with discussing the effects of concentration on banking stability (Allen and Gale, 2004; Beck et al., 2006; Boyd and de Nicoló, 2006; Fu and Heffernan, 2009; Koutsomanoli- Filippaki et al., 2009; Fang et al., 2011). However, arguments that emerge in the literature have not all documented the positive effects 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, this subject requires particular attention because the financial situation of banks heavily affects the performance of the real economy (Dell'Ariccia et al. 2008, Kroszner et al. 2007). This paper focuses on the potential effects of banking concentration on financial stability by providing empirical evidence for a set of 173 developed and developing countries. The rest of the paper is organized as follows. Section 2 covers the relevant literature on the banking concentration and financial stability nexus. Section 3 presents the methodology, data description and estimation procedures. In Section 4, we develop our empirical results. Section 4 concludes.

2. BANKING CONCENTRATION AND FINANCIAL STABILITY: A LITERATURE OVERVIEW

The literature on the relationship between the structure of the banking sector and financial stability concerted around two distinct strands with utterly opposite conclusions. They are arranged according to whether they support the idea that banking concentration has a destabilizing effect (concentration-fragility hypothesis) or whether on the contrary it has a stabilizing effect (concentration-stability hypothesis).

Many empirical studies reporting a positive relationship between banking concentration and financial system stability emphasize the return channel as a precursor for financial stability. For example, in their study on a sample of 134 countries over the period 1993 to 2004, Boyd et al. (2006) show that concentrated banks display higher incomes. The same results were confirmed by Uhde and Heimeshoff (2009) for 25 countries in the European Union over the period 1997-2005. In the same line of thought, Berger et al. (2009) highlight the risk channel as favoring the positive relationship between concentration and stability. 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 studied the impact of market power on financial stability highlighting the greater profits of companies having dominant positions (Freixas and Rochet, 2006). Greater profits associated with market power can increase banks' capital and subsequently their ability to absorb shocks in an instable financial framework (Vives, 2010). Banks that are more concentrated are therefore less prone to liquidity or macroeconomic shocks. On another note, Matutes and Vives (2000) support the idea that market power emerging from a concentrated banking market encourages shareholders and managers not to engage in highly risky operations and better customer selection, which strengthens the stability of the financial system. Moreover, banks with market power will limit their risk taking in order to protect the revenue ensuing from that position. Therefore, the probability of a bank run occurring would be lower in a concentrated system (Smith, 1984). In a different line of thought Saez and Shi (2004) explain 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 a slightly different perspective, Chan et al. (1986) and later Hauswald and Marquez (2006) show that increased competition leads to less investment in information search, which contributes to an increase in information asymmetry.

Next to these potential interfering channels between banking concentration and financial stability, the literature highlights other channels, such as the diversification of financing and investment. Diversification, the creation of multiple activities and internationalized banks can promote financial stability, as banks are 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). 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 has a positive and significant impact on financial stability, supporting the theory that more concentrated banking systems with larger and more diversified banks improve the stability of the financial system. The relationship between stability and market structure could also be explained by arguments that emphasize the complexity of the banking system. Allen and Gale (2000) argue that in a concentrated system where only a few large institutions are present, it is easier to monitor larger, but fewer banks with effective action, which consequently reduces the risk of system-wide contagion. The number of banks to control is limited and supervision would be even better despite a likely greater complexity within the major banks.

The literature on the relationship between bank concentration and financial stability also supports the possibility of a negative correlation showing that a concentrated market could have a destabilizing effect on financial stability by making reference to the "*too big to fail*" hypothesis. The implicit or explicit assurance as to rescue in case of bankruptcy encourages risk-taking by banks, which will ultimately increase systemic risk (Mishkin, 1998). Indeed, when concentration is particularly strong, some banks have so much weight and market power that their failure would result in the collapse of the entire financial system. Berger et al. (2009) show the existence of a negative effect of increased market power on the risk of banks' portfolios and confirm the destabilizing concentration thesis. Banks having power market will increase interest rates on loans, which will in turn eliminate the least risky part of the banks' customers. The bank's loan portfolio and the default risk will surge, which will in turn increase the probability of bankruptcy. Thus, the more concentrated the banking system, the more risky the loan portfolio. The study by Boyd et al. (2006) on data from 134 countries over the period 1993-2004 shows that the effect of riskier portfolios dominates despite increased revenues related to the concentration of the banking sector. Market power that comes from banking concentration therefore has a destabilizing effect on the financial system. This situation is even more risky given that the big banks generally seek to minimize the costs of monitoring, which causes 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 shock with a negative impact on financial system stability.

3. METHODOLOGY, DATA AND MODELS

The purpose of this study is to investigate empirically the relationship between bank concentration and financial stability. Note that the theoretical literature on the relationship between banking concentration and financial stability is far from having 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 then look for the existence of an indirect effect.

There is no accurate and definite definition for financial stability. VanHoose.D (2011) lists more than 14 definitions while classifying them into two categories. The first is where the actors are much interconnected, i.e., where the bankruptcy of one institution can cause a general failure of the banking system (systemic crisis). The second category occurs when a shock affects many actors and induces simultaneous failures that destabilize the entire economy.

As stated in Laeven and Valencia (2010), "*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's (2012 and 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 track the profitability of a bank's lending activities (NIM) and profitability as captured by the return on assets (ROA). Banking industry specific variables are captured by market concentration (CONC). Following Bretschger et al. (2012) we introduce per capita GDP (PGDP), GDP growth rate (GDPG) and inflation (INF) as macroeconomic variables in our model. We also include the deposit insurance variable (INS) as an important determinant of the relationship between stability and concentration (Beck et al., 2013). Deposit insurance is a dummy variable that takes a value of one if a country has explicit deposit insurance and a value of zero otherwise. Credible deposit insurance can enhance financial stability by decreasing the likelihood of depositor runs. Conversely, if the capital positions and risk-taking of insured institutions are not supervised carefully, insurers tend to accrue loss exposures that undermine bank stability over the long term. Thus, our model will be as follows:

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

We define basic and extended forms for this model. Following (Bretschger et al., 2012), the basic form of model (1) includes a profitability measure, the interest margin and the concentration variables. In addition to these variables, the first extended form of this first model includes the insurance deposit variables. The second extended form of the first model includes all variables at the same time. In addition to the dichotomous nature of the dependent variable and the systemic financial crisis (SYSC), most empirical studies that focus on modeling this concept (Detragiache and Demirguec –Kunt, 1997; Beck et al, 2006) use the logit and probit models. Following (Bretschger et al., 2012), we estimate in a first step the probability of a systemic financial crisis with a panel logit model. To check the robustness of our empirical results, we estimate the extended model in a panel logit framework.

After investigating the existence of a direct channel through which concentration may affect the probability of a financial crisis occurring, we investigate the existence of an indirect effect by testing two transmission channels of banking concentration on financial stability: the return on assets and the net interest margin channels. The first channel supports the idea that banks in a concentrated banking sector have greater market power and thus have significant revenues that could increase their capacity to absorb negative shocks. The effect of the first channel on the financial system is therefore stabilizing. We use the return on assets (ROA) as a standard measure of profitability. The second channel is the interest rate. The idea 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 these rates. The bank loan portfolio quality is likely to deteriorate, thereby increasing the probability of failure. The effect of the second channel on the financial system is therefore destabilizing. A measure of this channel is based on lending rates.

Following the literature, (Maudos and Fernández de Guevara, 2004; Athanasoglou et al., 2008; et Bretschger et al. (2012), the models that we use to test the two transmission channels (ROA) and (NIM) variables are made using concentration (CONC) as the main exogenous variable. Several studies showed that bank profits tend to be time-persistent (Athanasoglou et al., 2008; Berger et al., 2000; Eichengreen and Gibson, 2001; Goddar et al., 2004). We include the lagged variables in both models. We also include several control variables (Y). In our models, the bank profitability is affected by market concentration (Bourke, 1989).

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

Similarly,

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

Control variables in our models include the macroeconomic variables and the bank-specific variables (Bretschger et al., 2012). Macroeconomic variables include per capita GDP, GDP growth rate and the inflation rate. We expect a positive relationship between per capita GDP and profitability. As bank specific characteristics we include the Cost to Income Ratio (CIR) (Kosmidou et al., 2005; Pasiouras and Kosmidou, 2007; Athanasoglou et al, 2008; and Bretschger et al, 2012). We expect a positive correlation between cost to income and bank profitability.

We estimate Equations (2) and (3) using a one-step GMM model. Note that, in general, a dynamic estimation model, such as GMM, would be the appropriate econometric model (Athanasoglou et al., 2008). Moreover, the one-step GMM estimator outperforms the two-step estimator both in terms of producing smaller bias and a smaller standard deviation of the estimates (Judson and Owe, 1999). The use of a GMM estimator will also account for possible correlations between any of the independent variables.

Before estimating our models according to Arellano & Bond (1991), we run a Sargan test to control for the validity of our lagged variables used as instruments; we also run a Panel Data stationarity test (Kpodar, 2007).

The assumption that concentration has a stabilizing effect suggests a negative correlation of market concentration on the probability of a crisis. This channel implies a positive relationship between concentration and the return on assets and a negative relationship between asset returns and the probability of a crisis. However, the destabilizing effect assumes that concentration increases the likelihood of a systemic crisis. This channel suggests a positive relationship between concentration and the net interest margin on one side and a positive relationship with the probability of a crisis on the other.

To highlight the impact of these channels on the occurrence of a systemic crisis, we use the estimated values of ROA and NIM with other control variables and estimate in a third step 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 is conducted on 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 and robustness of our results. In addition, the choice of this period of 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, they take into account relatively stable periods such as the one from 2003 to 2006. All variables are defined in Table 1.

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	World Bank Survey (Barth et al, 2012)
CIR	Cost Income Ratio	Total costs / total income of all commercial banks	Beck et al (2013)
INF	GDP deflator (annul %)	The ratio of nominal GDP / real GDP	World Development Indicators
PGDP	GDP per capita	The country's GDP / population	World Development Indicators
GDPG	GDP per capita growth	Annual % growth rate of GDP per capita	World Development Indicators

The correlation matrix is presented in Table 2. Most results are consistent with the literature. They show that the probability of a currency crisis occurring is negatively associated with profitability and positively correlated with the net interest margin. Our results show also that instability is negatively impacted by concentration.

To control for any multicolinearity bias, we present the correlation matrix. The results as presented in Table 2 show that return on assets and net interest margin are positively correlated with concentration, which is consistent with theoretical predictions stating that the more concentrated banking sector is more profitable with high interest rates. Profitability is negatively correlated with financial instability. As for the NIM variable, it is positively correlated with the probability of crisis. In addition, the results show a negative correlation between concentration and instability in the financial system.

Table 2. Correlation Matrix

Variables	SYSC	CONC	NIM	ROA	INS	INF	PGDP	GDPG
SYSC	1.0000							
CONC	-0.0695	1.0000						
NIM	0.1564	0.0672	1.0000					
ROA	-0.2600	0.0442	0.2310	1.0000				
INS	-0.2107	-0.2235	-0.1203	-0.1189	1.0000			
INF	-0.0255	0.0499	0.3710	0.0437	-0.0342	1.0000		
PGDP	0.1985	0.0457	-0.5146	-0.1411	0.1574	-0.1419	1.0000	
GDPG	0.1866	-0.0586	0.0473	0.1301	0.0551	-0.0131	-0.1634	1.0000
CIR	0.1474	-0.0763	0.1301	-0.0899	0.1614	0.0459	-0.1098	-0.0309

4. RESULTS AND DISCUSSION

Using a relatively large period in a panel framework may cause the results to be affected by non-stationary data. We performed a stationarity test for all variables in our sample to ensure the validity of our results (Maddala and Wu, 1999). A main advantage of this test is when the sample is an unbalanced panel. Applying this test to our data resulted in the rejection of the null hypothesis of non-stationarity at the 1% significance level.

Estimations of the outcome of the first model in its basic form and of the two extended forms are reported in Table 3.

Table 3. Systemic Crisis – Direct Channel

Regressions	Basic model		Extended model			
	Logit	Probit	Logit	Probit	Logit	Probit
CONC	-0.0064	-0.0036	-0.0041	-0.0022	-0.0080	-0.0029
ROA	-0.6624***	-0.2237***	-0.5976***	-0.2096***	-0.2706***	-0.1310***
NIM	0.0065**	0.0031*	0.0061*	0.0029*	0.0064*	0.0035*
INS			3.2450***	1.5969***	3.0275***	1.4901***
GDPG					-0.0598***	-0.0109*
INF					0.0039	0.0024
Constant	-3.8592***	-2.0462***	-6.3336***	-3.2680***	-5.5101***	-3.1085***
Log likelihood	-329.841	-337.613	-317.133	-323.195	-304.329	-319.061
Wald chi2 (3; 4; 6)	52.68	55.63	56.69	65.30	71.59	77.27
Prob>chi2	0.000	0.000	0.000	0.000	0.000	0.000
rho	0.587	0.517	0.510	0.436	0.477	0.410
chibar2(01)	73.49	80.27	46.51	51.12	43.20	41.78
Prob >= chibar2	0.000	0.000	0.000	0.000	0.000	0.000
Nb. countries	173	173	173	173	173	173
Observations	1770	1770	1713	1713	1680	1680

T-Student coefficients are reported in parentheses. ***, **, and * indicate significance levels at 1, 5, and 10 percent, respectively. The Wald chi2 is used to test the hypothesis that at least one of the predictors' regression coefficients is not equal to zero. The number in the parentheses indicates the degrees of freedom of the Chi-Square distribution used to test the Wald Chi-Square statistic. The null hypothesis is that the regression equation overall is not statistically significant. The Prob >chi2 would lead us to conclude that at least one of the regression coefficients in the model is not equal to zero. Rho can be appreciated as the proportion of the total variance contributed by the panel-level variance component. When rho is zero the panel-level variance component is unimportant. A likelihood ratio test is chibar 2 (01).

These resutls indicate a negative coefficient between banking concentration and the probability of a crisis occurring for all specifications. However, it is not statistically significant. This result suggests that a change in the overall concentration would not have a significant impact on financial stability, all things being equal. These results are in line with the studies by Ruiz-Porras (2007) and Bretschger et al. (2012). It is worth noting the sharp contrast in empirical studies on the effects of banking concentration on financial stability, as the z-score or a dummy variable is used. Most studies using a dummy variable report a positive effect of concentration on stability (Beck et al. 2004; Beck et al. 2007; Laeven and Valentia, 2008) while those using the z-score conclude a negative effect (Boyd et al. 2006; Uhde and Heimeshoff, 2009; Shehzad et al., 2009).

As measured by the rate of return on assets, profitability negatively and significantly influences the probability of a systemic financial crisis. The negative sign of the coefficient in all specifications (-0.6624) supports the idea

that the probability of a crisis decreases with the level of profitability. 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. Berger et al. (2009) found that the overall risks of bankruptcy supported by a bank decreases with the increase in market power. His findings give evidence that banks would have a larger share of capital, thereby increasing their capacity to absorb losses. Previously, Boyd and Runkle, (1993) reported evidence suggesting that concentrated banks subject to economies of scale can reduce costs in information gathering and processing. Their size also allows them to have higher economies of scope by having access to markets that small banks cannot reach (Heggestad, 1977).

Table 4. ROA and NIM Channels

Regressions	System GMM	
	ROA	**NIM**
ROA (t-1)	0.0795 ***	
NIM (t-1)		0.3539***
CONC	0.0366***	0.2538***
GDPG	0.1361***	0.0437**
PGDP	0.0359*	-0.0042
INF	0.1355***	0.0319***
CIR	-0.0009 ***	-0.0002***
Constant	1.85	3.71***
AR(1)	-1.2667	-4.2877
	(0.2053)	(0.1130)
AR(2)	0.3721	-0.7778
	(0.7098)	(0.4367)
Sargan	64.0953	76.7817
	(0.5084)	(0.1505)
Nb. countries	173	173
Observations	1476	1476

T-Student coefficients are reported in parentheses. ***, **, and * indicate significance levels at 1, 5, and 10 percent, respectively. Statistics AR (1) represents the autocorrelation test of order 1. The values in parentheses show that there is no correlation with order 1 error terms. Statistics AR (2) is the autocorrelation test of order 2. They support the hypothesis of autocorrelation of order 2. For the Sargan test, the null hypothesis is that the instruments used are not correlated with the residuals. For the Hansen test of over-identification, the null hypothesis is that the instruments used are not potentially weak.

Our results provide evidence of the positive and significant effect of the net interest margin on financial stability (0.0065). This positive 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 (3.245). This result is in line with Demirguc-Kunt and Kane (2002), Demirguc-Kunt et al. (2008), Beck et al. (2011) and Mitchener and Wheelock (2013). In these studies, the authors show that explicit deposit insurance tends to facilitate the emergence of a crisis. In the same line of thought, Maggie et al. (2014) find that stronger deposit

insurance schemes are associated with greater bank fragility. This result is particularly consistent with the *moral hazard* hypothesis, which indicates that the existence of guarantees on deposits encourages shareholders to acquire maximum debt assets with maximum risk, thereby increasing the risk of instability.

Regarding macroeconomic variables, the inflation rate and the growth rate of GDP per capita are likely to influence the probability of crises occurring. The inflation variable is positively related to the probability of a crisis but not statistically significant. However, the impact of the GDP per capita growth rate on the probability of systemic financial crisis is negative and significantly different from zero in all regressions. This result suggests that the higher the growth rate of GDP per capita, the lower the probability of a crisis. This result is consistent with the findings of Beck et al. (2006) and Allen et al. (2012) that show that higher growth rates lower the probability of a financial crisis.

Estimation outcomes of Equation (2) and (3) using System GMM are displayed in Table 4. They indicate that concentration is significantly and positively correlated with both variables of interest (ROA and NIM) as predicted by theory.
GMM results also indicate a positive and significant relationship between bank concentration and the return on assets (0.0366). As argued in Molyneux and Thornton (1992), this result suggests that a higher level of bank concentration leads to monopoly profits. Boyd et al. (2006) and Srairi (2010) show that banking concentration has a positive and statistically significant impact on profitability, which supports the idea that banks with market power display higher incomes.

Table 5. Systemic Crisis – Indirect Effects

Logit		**Probit**
ROA	-0.4982***	-0.1740***
NIM	0.0004***	0.0002***
DEPINS	4.4539***	2.1589***
GDPG	-0.2050	-0.1072***
GDPD	0.0023***	0.0022
Constant	-7.6038***	-3.7985***
Log likelihood	-329.7742	-335.3782
Wald chi2 (5)	69.38	81.68
Prob>chi2	0.0000	0.0000
rho	0.5856	0.5107
chibar2(01)	56.94	58.46
Prob >= chibar2	0.000	0.000
Nb. countries	173	173
Observations	1770	1770

T-Student are reported in parentheses. ***, **, and * indicate significance levels at 1, 5, and 10 percent, respectively. For the Wald chi2 is used to test the hypothesis that at least one of the predictors' regression coefficient is not equal to zero. The number in the parentheses indicates the degrees of freedom of the Chi-Square distribution used to test the Wald Chi-Square statistic. The null hypothesis is that the regression equation overall is not statistically significant. The Prob >chi2 would lead us to conclude that at least one of the regression coefficients in the model is not equal to zero. For rho can be appreciated as the proportion of the total variance contributed by the panel-level variance component. When rho is zero the panel-level variance component is unimportant. A likelihood ratio test is chibar2(01).

Our results suggest a positive and significant effect of concentration on the net interest margin (0.2538 ***). Our result is consistent with the paradigm stating that concentration increases loan-interest rates. Moreover, higher lending rates tend to eliminate the least risky bank customers who prefer not to borrow at these rates (Beck et al. 2007). The portfolio loan's quality will then deteriorate, which increases the probability of bankruptcy as stated in Bretschger et al. (2012).

Table 6. ROA and NIM Channels – GMM estimates

	Developing countries		**Developed countries**	
Regressions	**ROA**	**NIM**	**ROA**	**NIM**
ROA (t-1)	0.2667 ***		0.3070 ***	
NIM (t-1)		0.1461***		0.1113**
CONC	0.0290***	0.0971	2.7791***	0.0178***
GDPG	0.1397	0.7610***	0.5713***	0.3241**
GDPC	-0.0012***	-0.0012	-0.0007***	-0.0097
GDPD	0.0316***	-0.0562	0.0408	-0.0251
CIR	-0.0191 **	-0.1993***	-0.2952 ***	-.00004***
Constant	10.0791***	17.2251**	6.9905***	3.3067***
AR(1)	-1.5367	-1.7442	-1.1752	-3.5142
	(0.1268)	(0.1811)	(0.2399)	(0.4270)
AR(2)	2.4584	-1.3853	-0.72635	-1.7354
	(0.4136)	(0.1660)	(0.4676)	(0.3647)
Sargan	75.1841	84.2620	54.8531	46.7769
	(0.1473)	(0.1400)	(0.2836)	(0.3152)
Nb. countries	119	119	54	54
Observations	1006	1006	558	560

T-Student coefficients are reported in parentheses. ***, **, and * indicate significance levels at 1, 5, and 10 percent, respectively. The AR(1) is the autocorrelation test of order 1. Coefficients in parenthesis show the absence of order1 autocorrelation of the error term. The coefficients of AR (2) statistics represent the order 2 autocorrelation test. For Sargan test, the null hypothesis is that the instruments used are not correlated with the residuals. For the Hansen test of over-identification, the null hypothesis is that the instruments used are not potentially weak.

The results show also that the GDP per capita growth rate is positive and significant for both channels. This result suggests that economic activity has a positive impact on bank performance because higher economic growth leads to higher consumption and investment and therefore to higher credit and consequently an increase in bank performance (Goddard et al, 2004; Schwaiger and Liebig, 2008). As in Srairi (2010), we also find that inflation is positively and significantly correlated with profitability (0.1355) The effect of inflation on profitability will depend on the degree to which bank income and expenses increase relative to inflation (Revell,

1979). The effect on profits will depend on the accuracy of anticipated inflation. 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) empirically tested this hypothesis and showed that there was a positive relationship between inflation and profitability.

To show the indirect effect of bank concentration on financial stability, we estimated Equation (4). Table 5 summarizes the results. The results show that the coefficients are highly significant and have the expected sign. They support the notion that a higher return on assets is associated with lower crisis probability, whereas higher net interest margins enhance the likelihood of a systemic financial crisis

Table 5 shows a positive and significant relationship between bank concentration and return on assets. Indeed, a high level of concentration in the banking sector could lead to monopoly profits (Molyneux and Thornton, 1992). Boyd et al. (2006), and Heimeshoff Uhde (2009) show that the degree of banking concentration has a positive and statistically significant impact on the ratio of return on assets, which supports the idea that banks with market power have higher incomes. In addition, estimation outcomes display a positive and significant relationship between concentration and net interest margin. This result also shows that larger banks tend to charge high-interest loan rates due to their market power (Boyd and De Nicolo, 2005).

The results show that GDP growth rate is positively significant. This result suggests that an increase in economic activity has a positive impact on bank performance. Indeed, a period of strong growth leads to an increase in consumption and investment, leading to higher credit, thus increasing the performance of banks. This result is supported by the majority of authors who have studied this relationship, namely Goddard et al. (2004) and Schwaiger and Liebig (2008).

The level of economic development can affect a country's susceptibility to financial crises. To check the validity of our initial results across countries, we run a last set of regressions on subsamples depending on their level of development. Therefore, we split our sample into two different subsamples (i.e., developed and developing countries). The first four columns of Table 7 show estimation outcomes of the direct effect that concentration has on financial stability for the basic and extended form of the first model for developing countries. The second four columns of the same table represent the results of estimating the basic and extended models for developed countries in our sample. Consistent with our previous results, the parameters on the channel variables (ROA and NIM) have the expected sign and are highly significant. We find, however, no evidence of a direct effect of banking market concentration on the probability of a financial crisis. We also check the existence of an indirect transmission across subsamples of countries through these two channels separately using the GMM system. A summary of results is presented in the first two columns of Table 6. The concentration coefficient indicates that there is a positive effect of concentration on profitability (ROA); however, the effect of market concentration on the net interest margin (NIM) is not significant. One reason for this may be that the net interest margin is motivated by factors other than market concentration. In developing countries, financial systems are generally underdeveloped. Because of high transaction costs and absence of economies of scale, lending rates may be too high. Therefore, the high net interest margins may occur due to existing deficiencies rather than high market concentration (Bretschger et al. 2012). In addition, this can be explained by the fact that relatively low interest rates in developing countries rate help boost investment. In this regard, Ranciere et al. (2006) and Noy (2004) argue that financial liberalization increases the fragility of the banking system due to the abolition of capping interest rates, credit control and the reduction of barriers to entry for foreign banks.

Therefore, our results give support the stabilizing effect of concentration on financial stability for developing countries. However, the concentration-fragility hypothesis does not hold for these countries. This result suggests that the net interest margin is driven more by factors other than market concentration. Indeed, developing countries suffer from poorly developed banking systems and the net margins of interest may be due to existing inefficiencies rather than to high concentration in the banking market.

Columns 5 to 8 of Table 7 present the results for subsample developed countries. Consistent with our previous results, the parameters on the channel variables have the expected sign and are significant. In addition, we find that concentration of the banking market has no direct effect on the probability of a financial crisis. Moreover, estimation outcomes show that there is a positive effect of concentration on both profitability and net interest

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

5. CONCLUSION

Two main strands of literature exist regarding the relationship between banking concentration and financial stability. They are arranged according to whether they support the idea that banking concentration has a destabilizing effect or a stabilizing 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 notion that additional revenue related to banking concentration can increase banks' capital and subsequently their ability to absorb 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. The quality of banks' loan portfolio is likely to deteriorate and the probability of default becomes higher.

When considering heterogeneity across countries, our results support the stabilizing effect of concentration on financial stability for developing countries. However, the concentration-fragility hypothesis does not hold for these countries. Our results also confirm the existence of both effects regarding concentration: the stabilizing and destabilizing effect of concentration on financial stability.

Table 7. 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	0.0053	0.0009	0.0174	-0.0163	-0.02387	-0.1400	-0.2947	-0.0163				
ROA	-0. 5331***	-0.1827***	-0.3784***	-0.1198***	-0. 16505***	-0.0902***	-0.1415***	-0.0761***	-0.3179***	-0.1577***	-0.2886***	-0.1713***
NIM	0.2359**	0.1017**	0.3775***	0.1577***	0.0004**	0.0002*	0.0005**	0.0002**	0.0095	0.0040	0.0301**	0.0139*
INS			31.2700	0.0359***			4.1191***	2.1343***	0.0617***	0.0359***	2.6051***	1.5922***
GDPG			-0.1617***	-0.1024***			-0.3475***	-0.1850***	-0.1845***	-0.1024***	-1.3375**	-0.4944***
GDPD			0.0329***	0.0083			-0.0014	0.0016	-0.0139	0.0083	-0.0168	-0.0143
Constant	-4.308***	-2.2043***	-33.9192	-4.6854***	-1.6857	-0.8138	-4.9902**	-2.5402**	-8.3071***	-4.6854***	-1.4121***	-1.2669
Log likelihood	-150.563	-155.5651	-129.0352	-137.7063	-176.335	-152.2912	-154.8187	-154.2981	-136.9597	-137.7063	-166.4979	-171.4487
Wald chi2 (3; 4; 6)	29.44	32.74	33.56	45.26	42.62	57.56	47.67	54.87	41.29	45.26	49.16	49.99
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	0.705	0.633	0.642	0.763	0.662	.553	0.677	0.656	0.774	0.7636	0.438	0.4639
chibar2(01)	52.84	54.55	35.62	64.60	37.03	20.22	28.94	31.36	59.76	64.60	9.33	14.88
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	119	119	119	119	54	54	54	54	119	119	54	54
Observations	1241	1241	1209	1209	582	582	582	582	1209	1209	582	582

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. The Wald chi2 test is used to test the hypothesis that at least one of the predictors' regression coefficients is not equal to zero. The number in parentheses indicates the degrees of freedom of the Chi-Square distribution used to test the Wald Chi-Square statistic. The null hypothesis is that the regression equation overall is not statistically significant. The Prob >chi2 would lead us to conclude that at least one of the regression coefficients in the model is not equal to zero. Rho can be appreciated as the proportion of the total variance contributed by the panel-level variance component. When rho is zero the panel-level variance component is unimportant. A likelihood ratio test is chibar 2 (01).

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Appendix A. Sample and Sub-Samples List of 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	