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Bank Performance during the Financial Crisis 2007–2010

Ali Mirzaei*

Department of Business, American University of Afghanistan, Afghanistan

Abstract

The recent global financial crisis has negatively affected the performance of most banking sectors around the world. A fundamental question is whether those banks located in more concentrated markets were more vulnerable during the crisis or were those that operated in inefficient markets. This paper analyses the impact of bank market structure and efficiency on the profitability and stability of 6540 banks in 49 emerging and advanced countries during the crisis period 2007–2010. We find that market concentration has a negative impact on bank profitability and stability while controlling other factors. Efficiency, on the other hand, improves both the profitability and stability of individual banks during the crisis. These results suggest that, when facing a negative shock, efficient banks perform better. The policy implication is that enhanced competition would contribute to the efficiency and consequently to the sustainability of the banking sector. This in turn suggests that macroprudential authorities should be wary of and vigilant with respect to the possible negative effects of the recent wave of regulations on bank competition.

Key words: market structure; efficiency; bank performance; financial crisis

JEL classification: D40; G21; L10

1. Introduction

Prior to the credit crisis of 2007, many countries throughout the world had witnessed significant deregulation in the banking sector. Abiad et al. (2010), for example, show that countries in all wealth groups and regions had reformed their financial sectors intensively over the period 1973–2005. The main objective of financial reform policies was to promote a more diversified, efficient and competitive financial system, which is essential for efficient capital allocation. In addition, the impact of globalization and financial integration forced banks to operate closer to the efficient production function. A number of empirical studies have found that the process of deregulation and the forces of intensive competition have indeed resulted efficient banking system. Hence, we expect more efficient banks to be more profitable and stable, as greater efficiency raises asset quality and

*Correspondence to: Department of Business, American University of Afghanistan, Darulaman Road, Kabul, Afghanistan. Email: amirzaei@auaf.edu.af.

thus presumably, more resilience to economic turbulence. Furthermore, intensive competition in the banking sector, which improves efficiency, leads to better screening and monitoring by banks, which consequently improves their credit risk situation. On the other hand, the traditional argument is that more concentration improves the performance of banks and also that a more concentrated market raises the charter value of banks and hence results in a more stable banking system. In this paper, we empirically re-examine the impact of market structure and efficiency on bank performance during the global financial crisis 2007–2010. We examine whether, when the banking sector of a nation faces a systemic crisis, those banks operating in more concentrated markets are more fragile or whether these are simply less efficient banks.

The recent global financial crisis originated in the US and spread throughout the world, causing long-term problems for the banking sector. It has been shown in the literature that financial crises have a significant and even permanent effect on economic growth. Specifically, by destabilizing the financial sector, financial crises affect the performance of the real economy through reducing the availability of credit and increasing uncertainty about future gains, and thus decreasing the level of investment and consumption. A key potential contributor to the performance of non-financial firms is the financial crisis itself, in the form of a negative shock to the much needed supply of external finance. The deep financial crisis has also raised new questions about the relationship between competition and stability. The underlying issue is whether there is a significant trade-off between competition and stability. Although many studies have recently investigated whether more competition increases or decreases risk-taking behavior in the banking sector, they have not yielded a consensus, as both competition-stability and competition-fragility views have been supported (see Uhde and Heimeshoff, 2009). The present paper departs from this debate and ignores the root of the crisis, focusing rather on whether, once a financial crisis occurs, those banks operating in a more concentrated market are more likely to survive the crisis. Or, are efficient banks really more profitable and stable, irrespective of the level of concentration?

There is broad consensus in the literature that a healthy banking system contributes to an efficient allocation of real economic resources across time and space, and an efficient management of wealth and capital accumulation. Profitability and stability are crucial indictors of banking system health. A profitable banking sector is better able to withstand negative shocks and contribute to the stability of the financial system as a whole. Furthermore, the efficiency and stability of the banking system is a crucial concern for monetary and supervisory authorities. An important issue in this respect, which has received little attention in the literature, is how and to what extent a trade-off prevails between efficiency on the one hand and stability on the other. This provides a motivation to contribute to the current debate on the role of bank efficiency in the context of stability.

Traditionally, the assessment of banking performance has been based on the structure-conduct-performance (SCP) paradigm. The SCP postulates that market structure influences the conduct or behavior of firms through, for example, pricing

and investment policies; this in turn influences corporate performance. Bourke (1989), for example, established a positive relationship between market concentration and bank profitability in Europe, North America, and Australia. For European banking markets, Maudos and de Guevara (2004) highlighted a statistically significant positive correlation between concentration and bank interest margins for the period 1993–2000. Furthermore, Demirguc-Kunt and Huizinga (1999) studied the impact of concentration on performance of banks around the world, and Molyneux and Thornton (1992) examined bank performance in Europe. In contrast, however, Smirlock (1985) reports that concentration does not explain bank profit rates for 2,700 state banks operating in the US. Goldberg and Rai (1996) also fail to establish a positive association between concentration and profitability for a sample of large banks located in 11 European countries for the period 1988–1991.

Recent research attempted to explain market structure hypotheses together with the profit-efficiency relationship by specifying x-efficiency and scale-efficiency (Berger, 1995). Such profit-efficiency relationship is classified under the "efficient-structure" (ES) hypothesis (Demsetz, 1973). In fact, the SCP and ES hypotheses take different variables as exogenous: concentration and efficiency, respectively. Claeys and Vander Vennet (2008), among others, investigated the determinants of bank interest margins in the Central and Eastern European countries with the objective to empirically test whether or not the high profit margins of banks are caused by a low degree of efficiency and/or non-competitive market conditions. They found that there is evidence to support the SCP hypothesis, and low operational efficiency is reflected in high bank interest margins in these countries. In Seelanatha (2010), the findings suggest that the performance of banks in Sir Lanka depends on levels of efficiency but not on market power in terms of market share and market concentration. This is contrasted with the findings of the study by Tregenna (2009), who investigated the effects of market structure, bank size, and operational efficiency on the high profit of American banks in the pre-crisis period (1994–2005). The main findings include the weak efficiency effect on profitability, but also a robust and positive concentration-profit relationship.

Regarding bank concentration (or competition)-stability relationship, a large theoretical literature suggests that increased competition leads banks to take on more risky business strategies, providing support for the "competition-fragility" nexus (Smith, 1984; Keeley, 1990; Besanko and Thakor, 1993; Staikouras and Wood, 2000; Repullo, 2004). Smith (1984), for instance, posits a theoretical framework concerning the way in which increased competition for bank deposits increases vulnerabilities in the system. Besanko and Thakor (1993) exemplified the case that, as competition becomes severe; banks choose to adopt a risky portfolio strategy. However, a counter trend has emerged—both at theoretical and empirical levels—which refute the traditional trade-off between market power and bank stability but which bolster the view that competition is beneficial for bank stability—the so-called "competition-stability" view. In a theoretical framework, Caminal and Maututes (2002) argue that banks with intermediate monitoring costs in a monopoly

structure may originate more risky loans, setting the stage for subsequent problems in the system. Perotti and Suarez (2002) illustrate that merger policy contributes to banking stability when the regulatory agency encourages takeovers of failed firms.

In this paper, we reconsider the above theories for the financial crisis period 2007–2010. Our study contributes from several angles to the literature on the relationship between bank performance and risk-taking behavior. Firstly, unlike previous studies that focus mostly on the impact of either bank concentration or efficiency on bank profitability, we include proxies for both and are hence able to disentangle the impact of ES from that SCP. Secondly, again unlike previous studies that concentrate mainly on the impact of bank competition on stability, we study the impact of bank efficiency on stability. This is an important issue, as during the financial crisis, which is a clear case of disequilibrium, we cannot accurately estimate a degree of bank competition, while efficiency does not need to be estimated under equilibrium conditions. It can be expected that during the financial crisis, inefficient banks need to boost returns by lowering their operating standards, such as the monitoring of credit and hence, they may be more vulnerable to the crisis. On the other hand, efficient banks which already operated on the frontier are more profitable even in a crisis and hence are not under pressure to take on more risk, indicating that more efficient banks are more resilient to the global financial crisis. Thirdly, we use data during the financial crisis for almost all advanced and emerging countries whose banking systems may have been influenced significantly in order to test whether, under negative shocks, efficient banks remain stable or rather do those banks that are located in more concentrated markets. Finally, since the financial crisis has an adverse impact on the real economy, identifying those banks that perform better during the crisis (our aim in this study) should help policy makers to adopt such policies that do affect resilient banks but aid less resilient ones.

Our empirical study, with a unique panel dataset of 6540 banks for 49 emerging and advanced countries over the period of the financial crisis 2007–2010, suggests that efficient banks were indeed more resilient, indicating that they were more profitable and hence absorbed the negative shock more effectively. We also find that, although banks that operated in more concentrated (less competitive) markets may be more stable during normal periods, more concentration would not help banks to generate more profits and be more stable during the crisis. These findings suggest that any policies that may significantly reduce or even destroy bank competition during financial turbulence, and which also may affect bank efficiency, should be abandoned.

The rest of the paper is organized as follows. Section 2 describes the models and data used in this study. Empirical results are reported in Section 3. Section 4 concludes.

2. Methodology and Data

2.1 Methodology

Our basic regression model, used to test the impact of market structure and efficiency on bank performance during the financial crisis, has the general form:

$$PERF_{ict} = \alpha_0 + \alpha_1 CONC_{ct} + \alpha_2 EFF_{ict} + \sum \beta_m X_{m,ict} + \sum \gamma_n Y_{n,ct} + \varepsilon_{ict} \ , \qquad (1)$$

where subscripts indicate bank i, country c, and year t. The response variable (PERF) refers to either bank profitability or bank stability, CONC is a proxy for bank concentration, and EFF is a proxy for bank efficiency. The vector control variables X and Y are bank-specific and macroeconomic factors respectively. The signs of the coefficients of the exogenous variables CONC and/or EFF are our main interest.

We include a vector of control variables that are expected to be determinants of bank performance. Following the literature, we include several bank-specific factors as well as contestability and macroeconomics variables to control the potential effects of such variables on bank performance. In particular, we control for bank size (log of total assets), asset growth, capital equity (equity to assets ratio), liquidity (liquid assets to assets ratio), lending (loans to assets ratio), and a diversification index, which is measured as 1-[(net interest income − other operating income)/total income] (see Laeven and Levine, 2007). Contestability variable is banking freedom. Finally, all regressions include GDP growth, inflation, and credit growth (growth of credit provided to private sector) to account for macroeconomic shocks. Table 1 shows variables and their definitions and sources.

Table 1. Definition and Source of Variables

Variable	Definition and Source
(i) Main Variables	
Return on Average Assets (ROAA)	Profit before tax as a percentage of total assets of a bank. Source: BankScope, 2011.
Return on Average Equity (ROAE)*	Profit before tax as a percentage of total equity of a bank. Source: BankScope, 2011.
5-firm Concentration Ratio (CR5)	A country-level indicator of bank concentration, measured by the share of assets of 5 top largest banks in the market, with higher values indicating greater market concentration. Source: BankScope, 2011.
Herfindahl Index (HHI)*	A country-level indicator of bank concentration, measured by the Herfindahl-Hirshman Index of assets, with higher values indicating greater market concentration. Source: BankScope, 2011, and own calculation.
Cost Efficiency Indicator	An x-efficiency score estimated from a translog cost function. Source: BankScope, 2011, and own estimation.
Z-index	The bank-level Z-index, which is measured as return on assets plus capital asset ratio over the volatility of return on assets. Volatilities are taken based on a three-year rolling window. A larger value indicates higher bank stability and less overall bank risk. Source: BankScope, 2011, and own calculation.

Variable	Definition and Source
Non-Performing Loans (NPLs)*	The bank-level ratio of nonperforming loans to total loans; a higher value indicates a riskier loan portfolio. Source: BankScope, 2011.
(ii) Bank-Specific Variables	
Bank Size	The logvalue of total assets. Source: BankScope, 2011.
Asset Growth	The growth of total assets over time. Source: BankScope, 2011, and own calculation.
Capital Equity	Bank equity capital as a percentage of total assets. Source: BankScope, 2011.
Liquidity	A bank-level indicator of liquidity, which is calculated as liquid assets divided by total assets. Source: BankScope, 2011.
Lending	A bank-level indicator of bank lending behavior, which is calculated by total loans divided by total assets. Source: BankScope, 2011.
Diversification Index	A diversification index measured as 1-[(net interest income − other operating income)/total income]. Source: BankScope, 2011, and own calculation.
(iii) Contestability Variable	
Banking Freedom	An indicator that provides an overall measure of openness of the banking sector and the extent to which banks are free to operate their businesses. It ranges from 1 to 9. Higher values signify more freedom. Source: Heritage Foundation.
(iv) Macroeconomics Variables	
GDP Growth	The real annual growth of GDP. Source: World Bank-WDI, 2011.
Inflation	The annual change in the consumer price index. Source: World Bank-WDI, 2011.
Credit Growth	The growth of credit provided to the private sector as a percentage of GDP. Source: World Bank-WDI, 2011.

Note: * used as an alternative indicator.

2.1.1 Measuring Bank Performance

2.1.1.1 Profitability

According to the literature, the main proxy for profitability is the return on average assets (ROAA). It indicates how efficient management is at using its assets to generate earnings. Furthermore, to evaluate robustness, we also employ the return on average equity (ROAE).

2.1.1.2 Stability

Our main indicator of bank stability is the Z-score as a measure of individual bank risk. The Z-score is defined as $Z = (\mu + Cap)/\sigma_{\mu}$, where μ is return as a percentage of average assets, Cap is equity capital as a percentage of assets, and σ_{μ} is the standard deviation of return on assets as a proxy for return volatility. A higher the Z-score implies a lower probability of insolvency risk. The variable Z is a proxy of the probability of a negative shock to profits that forces the bank to default, which

measures how many standard deviations profits must fall below its mean to bankrupt the firm. This variable combines profitability, leverage, and returns volatility into a single measure, and it is an inverse proxy for the firms' probability of failure and an indicator of overall stability at the firm level. Thus a smaller Z (a larger risk exposure) can be associated with narrow returns, larger return volatility, or higher leverage. This is probably due to greater inefficiency, poorer diversification, and lower capitalization. Return volatility is a 3-year rolling window of the standard deviation of return on assets.

And finally, to evaluate robustness, we also use an indicator of bank credit risk, i.e., non-performing loans to total loans (NPLs). Non-performing loans are usually loans made by a bank on which repayments or interest payments are not being made on time. Higher values of NPLs indicate higher risk.

2.1.2 Measuring Cost Efficiency

We measure the average cost efficiency of a country's banking sector using stochastic frontier analysis based on the method developed by Meeusen and van den Broeck (1977), Aigner et al. (1977), and Kumbakhar and Lovel (2000). We use the Battese and Coelli (1995) model that provides estimates of efficiency in a single-step in which firm effects are directly influenced by a number of variables. The estimation of banks' relative efficiency using panel data is performed by estimating a cost function of the general form:

$$LnTC_{it} = f(w_{it}, y_{it}; \beta) + u_{it} + v_{it}, \quad i=1,..., N, \; t=1,...,T, \tag{2}$$

where TC_{it} is the total cost of bank i at time t, w_{it} denotes a vector of values of input prices associated with a suitable functional form, y_{it} is a vector of outputs, β is a vector of unknown scalar parameters to be estimated, u_{it} are the non-negative inefficiency effects in the model which are assumed to be independently (but not identically) distributed, and v_{it} are independent $N(0, \sigma_v^2)$ errors.

The parameters in (2) are estimated using maximum likelihood for each country. The inefficiency score of bank i at time t in each country is defined as $\exp(-\hat{u}_{it})$, where $\hat{u}_{it}$ is the estimated value of u_{it}, taking a value between one and infinity. To make our results comparable, however, we calculate the index of cost efficiency as $1/\exp(u_i)$. Hence, each individual bank in each country has a score between 0 and 1 with values closer to 1 indicating a higher level of efficiency.

Concerning the specification of the efficiency frontier, we follow the intermediate approach, which suggests using deposits as inputs. Thus, following prior studies (e.g., Coccorese and Pellecchia, 2010), we choose one output: total assets (y), and three input prices: cost of deposits (w_1), computed by dividing financial costs (interest paid) by their corresponding liabilities, cost of labor (w_2), calculated by dividing personnel costs by total assets, and cost of physical capital (w_3), calculated as the ratio between expenditures on plant and equipment (other non-interest expenses) and the book value of physical capital (fixed assets). Furthermore, to account for changes in technology over time, we include a trend

variable in the frontier. Finally, the response variable is the bank's total cost, calculated as the sum of interest expenses and non-interest expenses. Thus, the specific form used for the cost function is a standard translog specification, which can be written as:

$$\begin{aligned} \mathrm{In}\left(\mathrm{TC}_{it}\right) = {} & \alpha_0 + \alpha_1 \mathrm{lny}_{it} + \frac{1}{2}\alpha_2 \left(\mathrm{lny}_{it}\right)^2 + \sum_{j=1}^{3} \beta_j \mathrm{lnw}_{j,it} \\ & + \frac{1}{2}\sum_{j=1}^{3}\sum_{k=1}^{3} \beta_{jk} \mathrm{lnw}_{j,it} \mathrm{lnw}_{k,it} + \sum_{j=1}^{3} \gamma_j \mathrm{lny}_{it} \mathrm{lnw}_{j,it} \\ & + \mu_1 \mathrm{Trend} + \frac{1}{2}\mu_2 \mathrm{Trend}^2 + \mu_q \mathrm{Trend.lny}_{it} \\ & + \sum_{j=1}^{3} \mu_{zj} \mathrm{Trend.lnw}_{j,it} + \mathrm{lnu}_{it} + \mathrm{lnv}_{it}. \end{aligned} \tag{3}$$

2.2 Data

We use bank-level data for 49 emerging and advanced economies from BankScope, constituting 6540 banks over the period 2007–2010.[1] The types of banks included are commercial, cooperative, and savings banks. We apply a number of outlier rules to the main variables, where values corresponding to the 1st and 99th percentiles of the distributions of the respective variables are removed. This helps alleviate the problems arising from extreme outliers that affect estimation. We also delete banks for which data on total assets is less than USD 1 million in order to remove very small banks. Our main variables of interest include backward-looking measures of bank risk (Z-score and non-performing loans to total loans) and measures of bank efficiency (cost and profit efficiencies).

Table 2 reports the number of banks and four characteristics of the health of banking sector (i.e., profitability, concentration, efficiency, and stability) in 49 countries. Descriptive statistics of all main variables are in Appendix Table A1.

Figures 1(a) and 1(b) show that bank profitability, measured by return on average assets and return on average equity, decreased sharply during 2007–2010. Figures 2(a) and 2(b) indicate bank stability measured by the Z-score decreased sharply, a finding supported by dramatic increases in bank credit risk, and measured by non-performing loans to total loans increased dramatically. Figures 3(a) and 3(b) show that markets became more concentrated, which is evident both from the 5-firm concentration ratio and the Herfindahl index. Finally, Figures 4(a) and 4(b) shows the trend of bank cost efficiency measured by cost to income ratio and by overheads to total assets. During the crisis period, a dramatic increase in the costs of banking can be observed, suggesting that the recent crisis indeed had negative impact on bank efficiency. Overall, these findings suggest that the impact of the recent financial crisis on bank performance was substantial, which motivated us to examine whether banks operating within a concentrated market were more profitable/stable during the crisis or rather were those in an efficient market.

Table 2. Mean of Competition, Market Structure, Efficiency, and Stability Indicators in 49 Countries

		Bank Performance						
	No. of	Profitability		Concentration		Efficiency	Stability	
Country	Bank	ROAA	ROAE	CR5	HHI	Cost	Z-score	NPL
Argentina	55	1.98	16.47	48.39	941	87.00	3.79	5.11
Australia	22	0.70	12.13	72.46	1795	94.96	10.37	1.26
Austria	238	0.34	5.26	49.43	904	93.70	4.84	4.51
Belgium	37	0.55	8.59	80.88	2316	93.85	4.03	2.87
Brazil	96	1.78	12.76	55.10	1196	76.77	4.38	8.51
Canada	62	0.56	8.58	66.79	1412	86.40	7.46	1.17
Chile	16	0.97	9.69	78.60	3236	85.77	6.13	2.42
China	113	0.95	15.36	62.89	995	78.92	6.92	2.04
Colombia	15	1.77	17.85	66.24	1522	78.79	8.07	3.36
Czech Rep.	20	0.77	13.65	74.84	1477	74.29	6.72	4.44
Denmark	100	0.10	2.72	71.27	3029	85.13	2.16	3.78
Egypt	21	0.89	13.34	60.30	1594	53.98	5.22	11.24
Estonia	6	0.72	12.56	99.59	6296	70.59	1.71	14.76
Finland	11	0.47	6.57	85.55	3461	81.60	4.17	1.12
France	205	0.60	7.64	49.37	751	91.32	8.41	4.60
Germany	1575	0.27	3.97	38.96	490	93.23	12.43	4.41
Greece	18	−0.09	4.58	76.88	1495	94.41	2.01	8.63
Hungary	22	0.38	9.82	68.50	1702	73.08	3.88	7.89
Iceland	8	1.68	16.89	90.14	3446	95.88	1.91	16.35
India	60	1.07	14.48	40.39	857	73.01	10.72	2.61
Indonesia	49	1.70	12.72	57.84	914	68.26	7.57	3.39
Ireland	12	−0.41	8.03	63.48	1883	92.17	4.12	9.82
Israel	10	0.59	9.60	89.28	2075	89.25	3.69	4.34
Italy	576	0.53	5.47	51.34	1144	91.96	4.57	7.32
Japan	580	0.03	2.77	38.88	604	87.96	3.72	7.18
Korea	10	0.62	10.86	47.51	1930	69.46	5.42	1.30
Luxembourg	79	0.61	12.31	37.61	458	91.12	5.46	3.85
Malaysia	27	1.15	13.24	42.07	1031	86.11	9.01	3.75
Mexico	37	0.92	9.04	50.33	1370	76.32	4.06	4.19
Morocco	10	1.15	16.14	67.61	1527	43.50	11.54	4.65
Netherlands	30	0.27	7.94	77.89	1927	93.29	5.59	2.22
New Zealand	9	0.68	14.23	89.99	2164	98.63	9.78	3.30
Norway	127	0.60	7.18	70.31	2513	93.10	5.26	1.34
Peru	14	2.04	20.93	81.11	3026	84.38	8.48	2.16
Philippines	29	1.03	10.38	56.93	993	83.58	5.95	8.91
Poland	38	0.90	10.26	51.52	823	98.49	5.08	6.55
Portugal	27	0.47	6.51	71.62	2019	91.63	3.51	3.96
Russia	907	1.60	9.76	52.45	997	53.71	4.68	3.49
Slovak Rep.	14	0.53	9.00	75.29	1550	73.65	8.06	6.76

		Bank Performance						
	No. of	Profitability		Concentration		Efficiency	Stability	
Country	Bank	ROAA	ROAE	CR5	HHI	Cost	Z-score	NPL
Slovenia	17	0.53	5.91	64.72	1825	81.59	3.16	10.64
South Africa	17	1.99	16.41	58.94	2414	85.79	6.91	5.04
Spain	153	0.50	7.12	60.33	1131	84.02	7.92	3.30
Sweden	76	0.78	6.37	79.72	4101	91.31	2.93	3.12
Switzerland	341	0.48	6.57	74.20	3399	94.59	15.49	2.03
Taiwan	37	0.04	4.23	30.98	611	77.68	2.34	1.59
Thailand	21	0.70	8.98	56.67	930	61.02	6.57	6.37
Turkey	27	2.03	14.15	56.67	1037	77.61	6.37	5.60
UK	120	0.28	6.54	48.48	1090	89.25	4.33	6.58
US	452	0.24	6.17	29.58	618	90.92	5.12	3.34

Notes: For variable notation, see Table 2. The cost efficiencies are taken from a translog cost function. The z-index is the conventional solvency risk using three-year rolling windows for calculating volatility.

Figure 1. Returns on Average Assets and on Average Equity

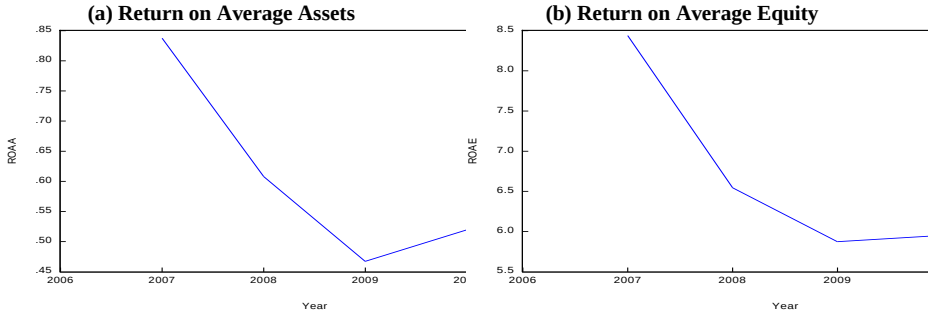


Figure 2. Bank Overall Stability and Credit Risk

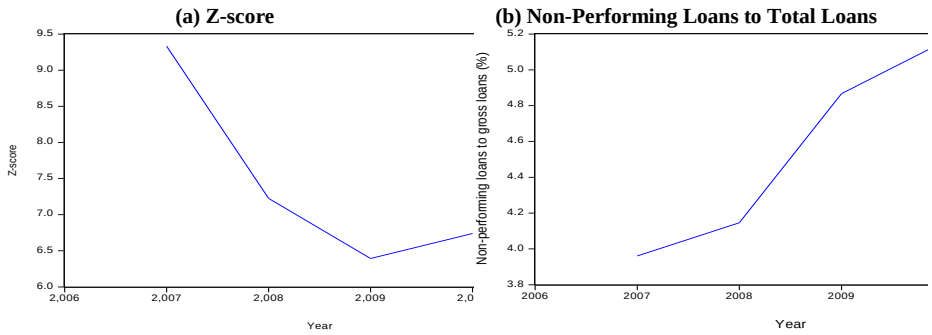


Figure 3. 5-Firm Concentration Ratio and Herfindahl Index

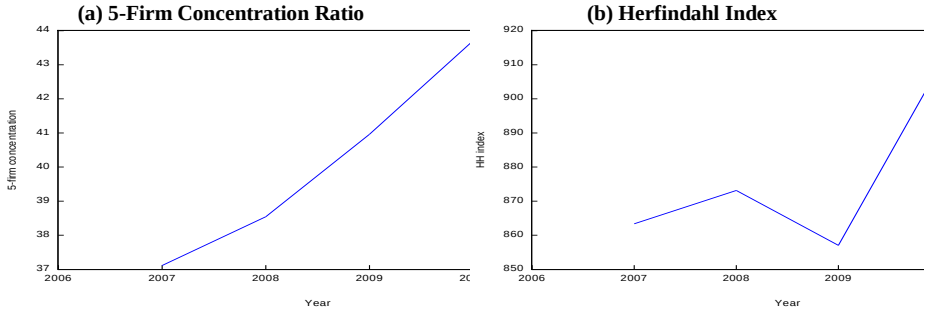
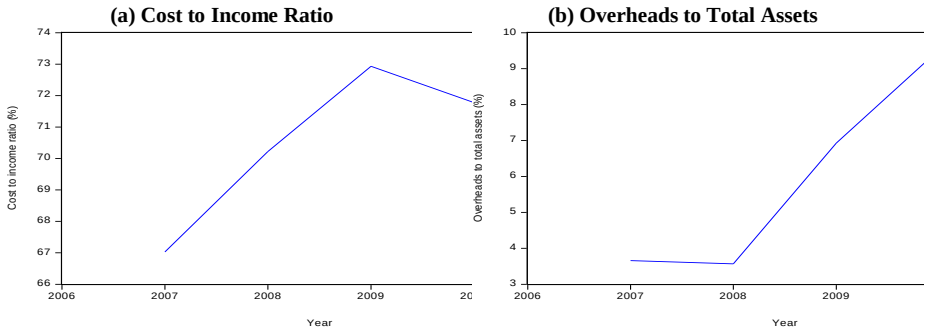


Figure 4. Cost to Income Ratio and Overheads to Total Assets



3. Results

Since both the profitability and stability of a bank may persist over time, and also since bank risk-taking behavior may affect bank competition and hence efficiency, we avoid the endogeniety problems by applying Arellano and Bond's (1991) GMM using lagged values of the response variable and lagged values of the exogenous regressors as instruments. The GMM estimator also accounts for possible correlations between the exogenous variables. The conventional Sargan test shows no strong evidence of over-identifying restrictions. The highly significant coefficient of the lagged response variables also confirms the potential dynamic characteristic of the model.

Table 3 reports the empirical results of the estimation of (1) using ROAA in and ROAE as the response variable in Panels 1 and 2 respectively. We test whether banks located in more concentrated markets are more profitable during the crisis or were those banks which are more efficient. The coefficient of concentration on bank profitability, columns (1) and (4), is negative, while the impact of cost efficiency on profitability, columns (2) and (5), is positive and highly significant. These results support the ES hypothesis and refute the traditional SCP hypothesis.

Table 3. The Impact of Bank Market Structure and Efficiency on Bank Profitability during the Financial Crisis

	Panel 1: ROAA			**Panel 2**: ROAE		
Models	(1)	(2)	(3)	(4)	(5)	(6)
Lag of Response Variable	0.323*** (12.93)	0.318*** (12.25)	0.275*** (9.10)	1.974** (2.15)	2.014*** (3.21)	1.846** (2.00)
Bank Market Structure						
5-firm Conc. Ratio	−0.092*** (−3.37)		−0.001 (−0.96)	−0.004 (−1.15)		−0.005 (−1.36)
Bank Efficiency						
Cost Efficiency		0.131*** (3.46)	0.084* (1.77)		0.036** (2.27)	0.027** (2.04)
Bank-Specific Variables						
Size	−0.033*** (−6.57)	−0.039*** (−6.31)	−0.021** (−2.17)	−0.761*** (−2.77)	−0.616*** (−2.48)	−0.229* (−1.78)
Asset Growth	0.014*** (2.57)	0.005 (1.43)	0.008* (1.72)	0.101 (0.86)	0.130* (1.80)	0.004*** (5.36)
Capital Equity	0.617*** (3.53)	0.641*** (3.77)	0.808*** (4.03)	0.018 (0.29)	0.010 (0.20)	0.135 (1.20)
Liquidity	−0.069* (−1.84)	−0.068* (−1.72)	−0.076* (−1.90)	−0.186** (−2.18)	−0.131** (−2.08)	−0.002 (−1.52)
Lending	0.061 (1.30)	0.077 (1.60)	0.050 (1.45)	0.641*** (3.69)	−0.012 (−0.75)	0.006 (1.53)
Diversification	0.041*** (2.63)	0.037** (2.14)	0.05*** (3.01)	0.837*** (3.38)	0.119** (2.17)	0.206*** (3.34)
Market Contestability						
Banking Freedom	0.021*** (9.95)	0.017*** (6.99)	0.006 (0.83)	0.223 (0.83)	0.001 (0.34)	0.002*** (2.91)
Macroeconomics						
GDP Growth	0.003*** (7.68)	0.002*** (4.19)	0.003*** (6.28)	0.127*** (3.20)	0.114*** (2.64)	0.001*** (3.27)
Inflation	0.001 (0.90)	−0.002 (−0.62)	0.001 (0.90)	0.067 (0.89)	−0.004 (−0.54)	0.001 (1.10)
Credit Growth	0.072*** (2.39)	0.110*** (3.15)	0.080*** (2.78)	0.996* (1.76)	0.751*** (6.42)	0.036*** (6.39)
Sargan Test (p-value)	0.45	0.27	0.19	0.18	0.06	0.05
AR(1) (p-value)	0.00	0.05	0.00	0.07	0.03	0.00
AR(2) (p-value)	0.17	0.33	0.25	0.24	0.36	0.07
Cluster	Bank	Bank	Bank	Bank	Bank	Bank
Number of Countries	49	49	49	49	49	49
Observations	14732	14732	14732	14732	14733	14732

Notes: The response variables are profitability measures ROAA or ROAE. Cost efficiency scores were estimated from a translog cost function. All regressions were estimated using the two-step GMM estimator of Arellano and Bond. T-values are in parentheses. *, **, *** denote significance at 10%, 5%, and 1% levels, respectively. The Sargan test evaluates over-identifying restrictions in GMM dynamic model estimation. AR(1) and AR(2) are Arellano-Bond tests that average auto-covariance in residuals of order 1 and 2, respectively, are 0 (H_0: no autocorrelation). For definitions of other variables, see Table 1. The results are robust when we use the Herfindahl Index instead of the 5-firm concentration ratio.

Note that one could argue that, to verify which theory (the SCP or ES) determines profitability more effectively, both hypotheses must be examined at the same time within a single model. To address this issue, we check the robustness of the results, simultaneously entering into the model both concentration and efficiency indexes, and find similar results; see columns (3) and (6). The negative coefficient of concentration is in line with those studies arguing that the impact of market structure on profitability, while controlling other factors, is negative (e.g., Athanasoglou et al., 2008; Berger, 1995).

Turning to the control variables, we find that most of them have significant impact on bank profitability, indicating the importance of these variables in determining bank performance. Specifically, we find that, although large banks tend to perform poorly compared to medium banks, as evident by the coefficient of size, banks that grow faster perform better. We find that the coefficient of capital equity is positive and highly significant only when ROAA is the response variable. This suggests that financially sound banks perform well in the crisis. Liquidity appears to have negative impact on bank performance, suggesting that while more liquid assets may absorb external shocks better, they reduce bank profitability. We also find that lending is positively but insignificantly related to bank performance. This indicates that traditional activity may not contribute any more to the bank performance, and this is in line with the positive impact of the diversification index on bank performance. Finally, the impact of financial freedom and macroeconomic variables are positive and almost all statistically significant.

Overall, these results suggest that during the financial crisis, banks located in more concentrated markets are more vulnerable or fragile as they are less profitable. On the other hand, efficient banks are more resilient and perform better. The dominance of efficient-structure over structure-conduct-performance also indicates that market deregulation not only improves bank competition and efficiency but also changes the shape of banks in that they are more profitable when facing a systemic crisis.

Next, we examine whether efficient banks, which tend to be more profitable, are also more stable during the crisis or whether there is a trade-off between risk and return. To test this hypothesis, we estimate (1) using bank stability as the response variable. Table 4 presents the regressions results of the Z-score in Panel 1 and the ratio of non-performing loans to total loans (NPLs) in Panel 2. All predictor variables are analogous to the rate-of-return regressions in Table 3. The Z-index is an inverse indicator of bank risk; hence, a positive (negative) sign on the coefficients implies an increase (decrease) in stability, while the converse holds for NPLs.

Table 4. The Impact of Bank Market Structure and Efficiency on Bank Stability during the Financial Crisis

	Panel 1: Z-Score			**Panel 2**: NPLs		
Models	(2)	(1)	(3)	(5)	(4)	(6)
Lag of Response Variable	0.536*** (8.60)	0.472*** (7.46)	0.510*** (8.21)	0.432*** (14.43)	0.401*** (12.11)	0.331*** (6.80)
Bank Market Structure						
5-firm Conc. Ratio	−0.051* (−1.77)		−0.048* (−1.72)	0.109*** (3.73)		0.105** (4.12)
Bank Efficiency						
Cost Efficiency		0.086* (1.86)	0.107** (2.19)		−0.091*** (−3.11)	−0.140*** (−4.16)
Bank-Specific Variables						
Size	0.001 (0.10)	−0.016 (−0.91)	−0.002 (−1.05)	0.011** (2.10)	0.012** (2.14)	0.008*** (3.35)
Asset Growth	0.019** (2.31)	0.007 (1.00)	0.010 (1.61)	0.041* (1.77)	0.042* (1.86)	0.022*** (2.87)
Capital Equity	0.107** (2.19)	0.211*** (2.78)	0.177*** (2.60)	−0.173*** (−3.14)	−0.189*** (−4.34)	−0.597** (−7.65)
Liquidity	−0.001 (−0.03)	0.052** (2.13)	0.011 (1.09)	−0.005 (−0.60)	−0.011 (−1.23)	−0.005 (−0.37)
Lending	0.207*** (4.18)	0.015 (0.81)	0.047 (1.58)	0.118*** (2.92)	0.119*** (2.95)	0.120*** (5.89)
Diversification	0.011* (1.69)	0.010 (1.49)	0.005 (0.69)	−0.075* (−1.75)	−0.067* (−1.69)	−0.093** (−2.19)
Market Contestability						
Banking Freedom	0.003 (0.80)	0.001 (0.55)	0.003 (0.77)	−0.003* (1.74)	−0.004* (−1.83)	0.001 (0.74)
Macroeconomics						
GDP Growth	0.003*** (5.91)	0.002*** (3.55)	0.003*** (3.18)	0.003* (1.70)	0.005** (2.15)	0.002* (1.69)
Inflation	0.006*** (6.19)	0.005*** (4.14)	0.006*** (6.04)	0.005 (1.61)	0.004 (1.51)	0.006 (1.65)
Credit Growth	0.016** (2.47)	0.119*** (3.16)	0.113** (3.17)	0.180 (1.10)	0.135 (0.79)	0.153 (1.09)
Sargan Test (p-value)	0.19	0.09	0.25	0.28	0.20	0.08
AR(1) (p-value)	0.00	0.05	0.00	0.08	0.02	0.00
AR(2) (p-value)	0.13	0.48	0.17	0.12	0.22	0.29
Cluster	Bank	Bank	Bank	Bank	Bank	Bank
Number of Countries	49	49	49	49	49	49
Observations	14732	14733	14732	11277	11277	11277

Notes: The response variables are stability measures Z-score or NPLs. Cost efficiency scores were estimated from a translog cost function. All regressions were estimated using the two-step GMM estimator of Arellano and Bond. T-values are in parentheses. *, **, *** denote significance at 10%, 5%, and 1% levels, respectively. The Sargan test evaluates over-identifying restrictions in GMM dynamic model estimation. AR(1) and AR(2) are Arellano-Bond tests that average auto-covariance in residuals of order 1 and 2, respectively, are 0 (H_0: no autocorrelation). For definitions of other variables, see Table 1. The results are robust when we use the Herfindahl Index instead of the 5-firm concentration ratio.

The Z-score and NPLs are in turn negatively and positively related to market concentration, suggesting that more concentration decreases bank stability. This suggests that concentrated markets pose some risk; concentration may induce incentives for banks to take on more risk, supporting the "concentration-fragility" hypothesis. This finding is in line with that of De Nicolo et al. (2004), who find that banks with more concentration are prone to be vulnerable to systemic failure, for over 100 countries' banks, using an indicator of aggregated Z-index as stability. By contrast, the effect of efficiency on the Z-score is significantly positive and on NPLs is significantly negative, meaning that more efficient banks are more stable.

Turning to control variables, both bank size and asset growth have a negative impact on credit risk, supporting the "too big to fail" view. Not surprisingly, capital equity improves bank stability. Liquidity, on the other hand, has no significant impact on bank stability. Furthermore, while traditional lending activity increases bank credit risk, revenue diversification decreases it. Banking freedom also decreases non-performing loans, but macroeconomic variables exert a greater influence on overall bank stability.

Overall, these results suggest that bank market concentration does not contribute to bank profitability and stability during the crisis. Bank efficiency, on the other hand, not only has positive impact on profitability, but also on bank stability. Thus, we find that more efficient banks are more resilient during the crises.

4. Conclusion

The recent financial crisis has changed the shape of the banking sector in many countries, negatively affecting the performance of banks. In this paper, we have specified an empirical framework for re-investigating bank performance determinants for 6540 banks in 49 emerging and advanced economies during the crisis period 2007–2010, highlighting the role of market structure and efficiency in bank profitability and stability. The empirical results show that during the financial crisis, efficient banks seem to be more profitable and stable, and hence more resilient to negative financial shocks. These results clearly indicate that more competition, rather than concentration, among banks would contribute to the sustainability of the banking sector, raising questions on the arguably excessive use of macroprudential policy and regulations adopted in the wake of the recent financial crisis. Such policies may affect bank competition negatively.

Appendix

Table A1. Summary Statistics

	Mean	Std. Dev.	Min.	Med.	Max.
Variables Used for Estimating Cost Efficiency					
Total Costs (in Million USD)	506	2781	0	29	58744
Total Assets (in Million USD)	17783	90229	0	712	296711
Price of Deposits	0.02	0.01	0.00	0.01	0.30
Price of Labour	0.02	0.02	0.00	0.01	0.24
Price of Capital	15.90	96.39	0.02	0.84	11.26
Price of Assets	7.34	7.50	–6.01	4.84	49.93
Variables Used for Regression					
ROAA	0.61	1.36	–9.91	0.38	9.97
ROAE	6.74	7.96	–19.96	5.00	49.85
Z-Score	7.42	12.20	–20.05	3.41	99.80
NPLs	4.52	4.99	0.01	3.02	49.45
5-firm Conc.	40.08	14.48	25.15	32.71	99.82
HHI Index	857.89	683.20	399.00	630.00	8703.00
Efficiency	84.05	16.85	0.21	90.89	153.86
Size (in Million USD)	16970	1130	0	800	2960000
Asset Growth	0.44	24.48	–0.84	0.08	60.52
Capital Equity (Equity/Total Assets)	0.10	0.09	–0.31	0.08	0.98
Liquidity (Liquid Assets/Total Assets)	0.19	0.16	0.00	0.15	1.00
Lending (Total Loans/ Total Assets)	0.62	0.17	0.00	0.63	0.99
Diversification Index	0.54	0.32	–1.00	0.62	1.00
Banking Freedom	5.87	1.38	3.00	6.00	9.00
GDP Growth	1.17	4.19	–13.90	1.65	14.20
Inflation	3.39	3.82	–4.48	2.29	18.32
Credit Growth	0.28	7.94	–1.00	0.04	88.27

Notes

1. The data are part of the authors' PhD thesis dataset. The main dataset includes bank-level data and macroeconomic variables for 49 emerging and advanced economies over the period 2001–2010. Since the focus of this paper is during the financial crisis, years before the crisis were removed.

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