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SCHOOL OF BUSINESS ADMINISTRATION WORKING PAPER SERIES

SBAWPS: 01-01/2015

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Working Paper 01-01/2015

School of Business Administration
Working Paper Series (SBA WPS)

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ABSTRACT

This article investigates whether the recent financial crisis has had any adverse impact on bank competition for 24 emerging and 25 advanced countries with large and small-size banks over the sample period 2001-2010. The H-statistic advocated by Panzar and Rosse (1987) is employed as the measure of competition. We find that the adverse effect of the financial crisis on bank competition seems to be trivial and on the contrary, competition is marginally boosted during the crisis period. This applies to both types of economies, irrespective of bank size. This suggests that currently ongoing policies to avert further crises in the banking sector have not exerted so great an adverse effect on competition. In the individual countries' study, the recent global financial crisis, however, led to a significant decline in competition in some countries.

Keywords: Bank competition; Bank concentration; Financial crisis; Emerging banking system

JEL classification: G01, D4, G21, L1 **1.**

1. INTRODUCTION

The recent financial crisis triggered by the US subprime market in 2007 resulted in a banking crisis, spreading to financial markets in many developed countries. In particular, the US and European banking sectors have been hit hard by the crisis, where many banks incurred large losses, and either directly or indirectly the intervention of governments and central banks was the only way to defend against the crisis. It is argued that the crisis has overridden competition policy concerns with state aid and public commitments in the EU and US, and increased market power resulting from mergers among banks (Sun 2011). Mergers have contributed to a weak competitive environment and increased concentration within and across countries. It is also claimed that the public aid programs distorted competition and created an uneven playing field in terms of the cost of capital. There is even a naïve view that banking has been blown away by the massive public intervention involving considerable competitive distortion. This may have involved requiring restructuring and reviewing the prudential policies in the banking system, and such a shift is likely to change the landscape of the banking system in its structure. This is in evidence in the transition period of the new currency of the Euro, where euro-area countries faced a significant decline in bank competition, due to the increase in concentration and bank size in the post-euro period under the EU rules (Bikker and Spierdijk, 2008). A financial crisis poses a host of questions about the relationship between competition and stability and competition policy and regulation in banking. The degree of banking competition has always been a subject of some controversy, and given this financial crisis, this is a more relevant issue now than earlier and of vital importance for welfare-related public policy towards market structure and conduct in the banking system (Shaffer 2004).

This paper examines the impact of the recent financial crisis on the degree of bank competition together with market structure for 24 emerging countries and 25 advanced countries by breaking up national banking sectors by size over the period 2001–2010. We

employ the H-statistic developed by Panzar and Rosse (1987) which has been widely used to measure competition in the banking system. The key objective of this paper is to investigate whether the crisis and the subsequent policy measures undertaken have had any adverse impact on competition in the banking sector. We also address the issue of whether bank size or the type of economy matters in the resultant effects of the crisis. This is an important issue in the conduct of sustainable policy strategy in the banking system.

According to the existing studies, several competition indicators are found which can be classified in two major categories: those that use *the traditional structural measures* of competition and those that fall within the so-called 'new empirical industrial organization' models (*the non-structural approach*). The traditional measures use concentration indexes under the structure–conduct–performance (SCP) hypothesis (Berger, 1995). Under this paradigm, the concentration index (either n-firm concentration ratios or Herfindahl index), net income to total assets or the number of institutions per inhabitant are used as an indicator of industry market structure. In this context, more concentration is an adverse signal of lower competition. However, the theory of contestability criticises the SCP hypothesis suggesting that regardless of the level of concentration an industry can reach competitive outcomes, if the industry is contestable (Baumol et al., 1982). It assumes that ease of competitive entry and the existence of potential short-term entrants can restrain market power. The competitive pressure that incumbent firms confront in a contestable market, where there is no restriction on entry, leads the industry to be more competitive.

The recent studies have suggested the limitations of the use of measurement of market structure to proxy the degree of competition (Claessens and Leaven, 2004 and Carbo et al, 2009, among others). The shortcomings of the traditional SCP hypothesis, have led many empirical studies to follow a new course within the non-structural indicators. One of the non-structural indicators of competition used to assess competitive behaviour in financial services

is based on the Panzar and Rosse (1982 and 1987). They propose the so-called H-statistics which is the sum of the estimated elasticities of revenues to factor prices. The first applicant was Shaffer (1982) who applied the Panzar and Rosse methodology to a cross-section of banking firms in New York in 1979, and found that competitive conduct of banks cannot be characterized as monopolistic or perfectly competitive in the long-run equilibrium, but as monopolistic competition. Following Shaffer, numerous studies have applied the Panzar and Rosse model empirically in the Euro zone both in cross-country or single-country studies. In this paper, we use the Panzar and Rosse H-statistic as a measure of competition together with some concentration indicators.

The US subprime crisis was transmitted quickly around the world, triggering the global recession. It is argued that the developed economies were infected more deeply than emerging economies. This is due to the fact that the emerging markets were insulated from adverse shocks from the rest of the world.[1] However, Dooley and Hutchison (2009), who analysed the spillover effect of the US subprime crisis on emerging financial markets find that the emerging markets were also infected by the deteriorating situation of the US financial system, in particular, after the Lehman crisis. See also the recent study of the spillover effect of the crises in Wang and Moore (2012).We conduct the study by distinguishing between emerging and advanced countries[2]. Note, also, that the behaviour of banks may differ according to their size. For example, the presence of a few relatively large banks, is more likely to display a 'too big to fail' problem by which large banks increase their risk exposure anticipating the

[1] This is either because immature financial markets do not have an adequate mechanism for shocks to be transmitted into the market in the short run, or because emerging markets have undertaken financial reforms, for example, by increasing prudential policies in the banking sector, reducing government debts and restricting or strictly controlling foreign borrowings (Dooley and Hutchison 2009).

[2] For example, Staikouras and Koutsomanoli-Fillipaki (2006) study the competition and concentration in 25 advanced and emerging European countries over the period 1998-2002. They find that advanced European economies operate in a more competitive environment than of emerging European economies.

unwillingness of the regulator to let the bank default in the event of an insolvency problem (Hughes and Mester 1998). In this instance, intensive competitive behaviour may be observed more among large banks[3].

Competition conditions are measured in terms of interest, organic and total income. The organic income includes interest and fee income and the total income includes interest income, fee income and capital gains/losses. Differentiating the different types of income is considered to be highly relevant, in particular, during the period of crisis, market conditions may have altered and the focus may have shifted away from interest earnings towards fees and other incomes.

The only study that investigates the impact of the recent financial crisis on the degree of bank competition is the work conducted by Sun (2011). Using data for the euro area, the U.S. and U.K. over the period 1995-2009, the author argues that the impact is heterogeneous across countries, and finds that the impact of such a crisis is significant in several countries, leading to a decline in competition. When Sun (2011) examines the difference in banking competition between small and large banks, it is found that there is no strong pattern. However, for some countries like the U.S. and the U.K., small banks seems to compete more intensively whilst larger banks in countries such as France, Italy and Spain tend to be more competitive.

[3]With respect to the degree of bank competition for different size-classes, several studies can be found in the literature. For example, using data for France, Germany, Italy and the US over the period 1992-1996, De Bandt and Davis (2000) compared the degree of bank competition in the EU and US by assessing competition separately for large and small banks. They find that, compared to the US, the behaviour of large banks in other countries was not fully competitive, and the level of competition for small banks appears to be even lower. Furthermore, by dividing banks into three size-classes, Staikouras and Koutsomanoli-Fillipaki (2006) find that while for total revenue larger banks earn income in a less competitive environment than their counterpart's small banks, the opposite is the case for interest income. Yildirim and Philippatos (2007a) examine the evolution of competitive condition in 14 Central and Eastern European transition countries' banking sectors. It is found that small banks in transition countries are operating in a relatively less competitive environment compared with large banks. See also Bikker and Haaf (2002) and Gischer and Stiele (2009).

We find some distinguished difference in the degree of competition between emerging and advanced economies, and also between different bank sizes. In terms of any changes in banking competitiveness after the crisis, we find that the adverse effect of the financial crisis on bank competition is trivial, and on the contrary, competition is marginally boosted during the crisis period for both types of economies and irrespective of bank size. It seems that bank competition remains to be robust during the financial crisis, hence there is little concern within the current prudential policies to defend against the crisis in terms of bank competition. Note, however, that the investigation of individual countries suggests that some countries exhibit a significant decline in competition.

This paper is organized in the following manner. Section 2 discusses the empirical model and methodology to estimate the competition indicator. Section 3 presents data and Section 4 reports the degree of concentration and profitability, and Section 5 is for empirical results of competition. Section 6presents several robustness tests and Section 7 concludes.

2. METHODOLOGY

Appropriately assessing the degree of competition in the financial markets remains an open issue. It can be classified into two major categories: One is the traditional measures, which use concentration indexes under the structure–conduct–performance or the efficient structure hypothesis (Berger 1995). The other is the non-structural indicators, which include the estimation of the mark-up test of Bresnahan (Shaffer 1989 and 1993, Shaffer and Disalvo 1994), the Panzar and Rosse test (Nathan and Neave 1989 and Molyneux et al. 1994) or instruments derived from Monti–Klein-type banking competition models, such as the estimation of Lerner indexes (Fernández de Guevara 2004 and 2007). Although these methods have been individually applied to various markets, researchers have recently attempted to empirically examine whether different approaches yield similar results (e.g. Carbo et al. 2009).

One of the non-structural indicators of competition used to assess competitive behavior in financial services is advocated by Panzar and Rosse (1982 and 1987). This methodology is based on reduced form revenue functions using firm-level data. It investigates the market power (H-statistic) measured by the extent to which changes in factor prices are reflected in revenues. Panzar and Rosse show that this statistic can reflect the structure and conduct of the market to which the firm belongs. The Panzar and Rosse (1987) model has been extensively used in the literature as a direct measure of the competitive conduct of the banking sector (e.g. Molyneux et al. 1994, Bikker and Haaf 2002, Claessens and Laeven 2004). See Table A1 in Appendix where we document these studies. In this paper, we use Panzar and Rosse H-statistic as our main competition indicator, though we employ an alternative measure of competition in the robustness test. The Panzar and Rosse model has several advantages over other competition indicators: its simplicity and transparency and also no assumption required about market structure. It is derived by estimating a single-equation model that is the reduced form from profit-maximizing conditions.

The Panzar and Rosse model for estimating the degree of competition relies on the premise that each bank will employ a different pricing strategy in response to a change in input costs, depending on the market structure in which this bank operates. Panzar and Rosse define a measure of competition, the H-statistics, which represents the percentage change of the equilibrium revenue resulting from a percentage increase in the price of all factors used by the firm as follows:

$$H = \sum_{m=1}^{l} \frac{\partial R_i^*}{\partial z_{mi}} \cdot \frac{z_{mi}}{R_i^*}$$

where H is a measure of competition and computed as the sum of the elasticities of the reduced-form revenue function with respect to factor prices. An asterisk $(*)$ represents equilibrium

values,R is total revenue, z is input factor price$m$, and l is number of inputs. The H-statistic discriminates between competitive, monopolistically competitive and monopolistic markets.

Following Claessens and Laeven (2004), Staikouras and Koutsomanoli-Fillipaki (2006) and Goddard and Wilson (2009), the H-statistic for each panel dataset is derived using the following specification of the reduced-form price equation with size and period dummies:

$$\begin{aligned} Ln(P_{itc}) = {} & h_0 + h_1 Ln\left(z_{F,itc}\right) + h_2 Ln\left(z_{L,itc}\right) + h_3 Ln\left(z_{K,itc}\right) + h_4 Ln\left(TA_{itc)}\right) \\ & + h_5 Ln(ETA_{itc}) + h_6 Ln\left(LTA_{itc)}\right) + h_7 Ln\left(LLPTA_{itc)}\right) + Dum_{crisis} \\ & * \left[h'_0 + h'_1 Ln\left(z_{F,itc}\right) + h'_2 Ln\left(z_{L,itc}\right) + h'_3 Ln\left(z_{K,itc}\right) + h'_4 Ln\left(TA_{itc)}\right)\right. \\ & \left. + h'_5 Ln(ETA_{itc}) + h'_6 Ln\left(LTA_{itc)}\right) + h'_7 Ln\left(LLPTA_{itc)}\right)\right] + Dum_{large} \\ & * \left[h''_0 + h''_1 Ln\left(z_{F,itc}\right) + h''_2 Ln\left(z_{L,itc}\right) + h''_3 Ln\left(z_{K,itc}\right) + h''_4 Ln\left(TA_{itc)}\right)\right. \\ & \left. + h''_5 Ln(ETA_{itc}) + h''_6 Ln\left(LTA_{itc)}\right) + h''_7 Ln\left(LLPTA_{itc)}\right)\right] + \varepsilon_{itc} \end{aligned} \quad (1)$$

where the Ln and subscripts i, t and c denote natural logarithms, bank i, year t and country c, respectively. h_0 is a constant, h_1 to h_7 are coefficients and ε is a stochastic error term. Following Molyneux et al. (1994) and Claessens and Laeven (2004) and many others,P is the ratio of interest revenue (or organic income or total income) to total assets[4] (proxy output price of loans, organic assets or total assets). Since the share of non-interest income (including fee-based services and off-balance sheet activities) has recently increased significantly, following Staikouras and Koutsomanoli-Fillipaki (2006), we use three different dependent variables: i) the ratio of interest income to total assets as the core banking business, ii) the ratio of organic income to total assets where organic income equals the interest income plus fee and commission income, and iii) the total income (operating and non-operating) to total assets.

[4] We follow the specification of the dependent variable of Molyneux et al. (1994) as well as Bikker and Haaf (2002).

z_F is the ratio of interest expenses to total deposits (proxy for input price of funds),$z_L$is the ratio of personnel expenses to total assets (proxy for input price of labour[5]), and $z_K$is the ratio of other operating and administrative expenses to total fixed asset (proxy for input price of equipment and fixed capital). In order to compare the competition levels before and after the 2007 financial crisis for different bank size classifications, we introduce two dummies: Dum_{crisis} takes 1 for period of the financial crisis (2007-2010), 0 otherwise. Also, Dum_{size} takes 1 for large-size, 0 otherwise.

As in previous studies, we also include several control variables to capture the potential effects of bank size, bank capital levels, lending levels and bank risk. Specifically, TA is total asset as a scaling factor, ETA is the ratio of equity to total assets as a proxy of equity capital levels(Yildirim and Philippatos, 2007b; Yeyati and Micco, 2007; Coccorese, 2004), LTA is the ratio of net loans to total assets as a proxy of lending ratio (De Bandt and Davis, 2000; Bikker and Groeneveld, 2000; Bikker and Haaf, 2002b; Yildirim and Philippatos, 2007b; Yeyati and Micco, 2007; Gelos and Roldos, 2004 and Coccorese, 2004), and $LLPTA$ is loan loss provision to total assets as a proxy for bank risk (Hondroyiannis et al., 1999; Bikker and Haaf, 2002; Hempell, 2002). We expect i) a positive effect of size (TA) for the purpose of economies of scale,ii) a positive coefficient for ETA because more equity implies less leverage, and hence more interest income although it is also claimed that capital requirement increases loan portfolio risk, iii) a positive sign for LTA as more loans typically reflect more potential interest rate income, and iv) a negative sign for $LLPTA$ as higher non-performing loans reduced revenue.

The H-statictic is given by the sum of the elasticities of the interest (or organic or total) income with respect to the three input prices i.e. $\mathrm{h}_1 + \mathrm{h}_2 + \mathrm{h}_3$. The Panzer and Rosse H

[5] Due to lack of data on total employees, we do not express the unit cost of labour in terms of total employees but in terms of total assets. However, empirical studies reveal that results of these two variables are quite close to each other.

statistic ranges between $-\infty$ and 1, and is interpreted as follows: H<0[6] indicates a monopoly where an increase in input prices will increase marginal costs, reduce equilibrium output and subsequently reduce revenues; H=1 indicates perfect competition or the monopolistic market which is perfectly contestable, an increase in input prices raises both marginal and average costs without altering the optimal output of a bank; and 0<H<1 indicates monopolistic competition where potential entry leads to contestable market equilibrium, and income increases less than proportionally to input prices. Thus, higher values of H indicate intensive competition.

According to our specification in Eq. (1) the degree of bank competition before and during crisis for different size-category is computed as in Table 1.

[Table 1 about here]

A critical feature of the Panzer and Rosse model is that the tests must be undertaken under the long-run equilibrium. Following Nathan and Neave (1989), Molyneux et al. (1996), Yildirim and Philippatos (2007b), Bikker and Haaf (2002), and Drakos and Konstantinou (2003), we test for equilibrium. The equilibrium can be tested by computing Eq. (1) using return on assets or return on equity as the dependent variable, and thus, the following representative equation for long-run equilibrium is estimated for each country:

$$\begin{aligned} Ln(ROAA_{itc}) = {} & e_0 + e_1 Ln(z_{F,itc}) + e_2 Ln(z_{L,itc}) + e_3 Ln(z_{K,itc}) + e_4 Ln(TA_{itc)}) \\ & + e_5 Ln(ETA_{itc}) + e_6 Ln(LTA_{itc)}) + e_7 Ln(LLPTA_{itc)}) + Dum_{crisis} \\ & * \left[e'_0 + e'_1 Ln(z_{F,itc}) + e'_2 Ln(z_{L,itc}) + e'_3 Ln(z_{K,itc}) + e'_4 Ln(TA_{itc)}) \right. \\ & \left. + e'_5 Ln(ETA_{itc}) + e'_6 Ln(LTA_{itc)}) + e'_7 Ln(LLPTA_{itc)})\right] + Dum_{large} \\ & * \left[e''_0 + e''_1 Ln(z_{F,itc}) + e''_2 Ln(z_{L,itc}) + e''_3 Ln(z_{K,itc}) + e''_4 Ln(TA_{itc)}) \right. \\ & \left. + e''_5 Ln(ETA_{itc}) + e''_6 Ln(LTA_{itc)}) + e''_7 Ln(LLPTA_{itc)})\right] \\ & + \varepsilon_{itc} \qquad (2) \end{aligned}$$

[6] $H < 0$ is also consistent with short-run conjectural variations oligopoly (see Shaffer, 1983)

where ROAA is before-tax return on average assets. The independent variables are as defined in Eq. (1). We define the equilibrium E-statistic as in Table 1,for example, the E-statistics for small-size banks before crisis is as$E = e_1 + e_2 + e_3$. In equilibrium, input prices should not affect return on total assets, hence $E = 0$ would prove equilibrium.When the market is in disequilibrium, returns are correlated to input prices, and hence, the E-statistic is significantly different from zero (Molyneux et al., 1996). A value of $E < 0$ would show non-equilibrium, however, if the sample is not in long-run equilibrium, it is true that $H < 0$ no longer proves monopoly, but it remains true that $H > 0$ disproves monopoly or conjectural variation short-run oligopoly (Shaffer, 1985, 2004).We test whether$E = 0$, using an F-test. If not rejected, the market is assumed to be in equilibrium. The tests suggest that for most cases this condition is not violated. The results are not reported here, but are available from the authors upon request. For the cases that the null hypothesis is rejected, we replace ROAA by return on average equity (ROAE) and found the evidence of market equilibrium.

3. DATA

We select 24 emerging countries based on Standard and Poor's classification and 25 OECD advanced countries. We use bank-level data from BankScope constituting 5867 banks (including 1220 banks from emerging economies and 4647 banks from advanced economies) over the period 2001-2010. 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. In order to ensure that each bank is included only once in the dataset, we use unconsolidated statements when available and consolidated statements when the

unconsolidated ones were not available. Merged banks are considered as separate entities before the merger and as one entity afterwards.

In order to capture the possibly different nature of competition for banks of different sizes, following Staikouras and Koutsomanoli-Fillipaki (2006) we divide banks into two size-classes. The threshold differentiating between small-sized and large-size banks is set at $5 billion. A bank is classified as large if it has total assets above $5 billion (according to the size of their balance sheet), and small if it has total assets below $5 billion. Table A2 in Appendix presents the number of banks for individual countries and also for each year. Note that the average number of banks in emerging economies is smaller than that for advanced economies, and also while the number of banks in emerging economies has increased over the sample period, it has almost remained constant in the case of advanced economies. Table 2 shows the distribution of banks in terms of size classification both before and during the financial crisis periods. It is noteworthy that the average size (measured by total assets) of small and large banks in emerging economies is significantly smaller than that observed for advanced economies. Most banks are classified as small, representing 79-85% of all banks, and the large bank sample is relatively small, representing only around 15-20%, either located in emerging or in advanced economies.

[Table 2 and Table 3 about here]

In Appendix Table A3 we present some descriptive statistics of the variables concerned, which show that variables are, in general, greater for small banks. Table 3 shows the correlation matrix for the major variables used in the regressions. A high correlation is found between both price of fund and price of labour versus dependent variables, reflecting the robust relationship.

In general, there appears to be a relatively low correlation amongst independent variables, hence concern of multicollinearity is likely to be minimal.

4. Concentration, profitability and revenues

As a first step to assessing the degree of bank competition, we look at the key traditional indicators of concentration, i.e. the share of assets of the 5 largest banks (CR5) and the Herfindahl-Hirschman index (HHI) together with the return on average assets (ROAA) and the return on average equity (ROAE). The 5-firm concentration (CR5) is computed by the market share of the five largest banks in the country. The HHI is a standard measure of consolidation in any industry and it is defined as the sum of squared assets market share of all the banks in the market. The HHI takes an upper value of 10,000 in the case of monopolist banks with a 100% share of the market; the index approaches zero in the case of a large number of banks with very small market shares for individual banks.

[Table 4 and 5 about here]

Table 4 shows some indicators for market structure. ROAA indicate that small banks are more profitable than large banks (except in the case of advanced economies before the crisis period), whereas ROAE appears to favour the large banks. This reflects the lower holding of equity in many large banks. The average results suggest that higher returns and a more concentrated banking system are observed in emerging banks as compared with advanced banks. By comparing the before- and during- crisis periods, there is a sharp fall in returns observed for advanced economies, reflecting the detrimental effect of the crisis on their profitability. This is contrasted with emerging banks that show an increase in ROAA and a marginal fall in ROAE. The concentration indicators also tend to show a different result between emerging and advanced banks; the former witnesses a fall of CR5 and HHI, whereas

the latter observes a modest increase in these indicators. This appears to reflect more mergers and acquisitions undertaken within the advanced banking system.

For individual countries, Table 5 presents these indicators for years 2001 and 2010. In order to examine the evolution of market structure over time, we also calculate the percentage change of these indicators (*%*) and difference between 2001 and2010. The average results are similar to Table 4 (see the last row of each economy). In general, compared to advanced economies, the banking sector in emerging economies becomes less concentrated but more profitable during 2001-2010. While the average 5-firm concentration ratio (CR5) in emerging countries is reduced by nearly 3%, in advanced economies it increased by 4.7%. This trend is supported by the average HHI where it declined by approximately 15% in emerging economies, but rose by around 11% in advanced economies. The average ROAA increases by 0.25% in emerging banking markets, whilst it reduced by -0.03% in advanced economies. Based on these results one might argue that the traditional Structure Conduct Performance (SCP) hypothesis may not be supported by these data, as there is an opposite movement between concentration indicators and profitability.

There is significant heterogeneity across countries. In emerging markets, many countries show a decline in concentration, yet Brazil, Colombia and Hungary have a relatively large increase in CR5, and Argentina, Brazil and India experience a large increase in HHI after the crisis. In advanced markets, a sharp increase in concentration is observed in the Netherlands and the U.S.A, when it is measured by CR5, and in Belgium and Denmark when measured by HHI. A change in the profitability measured by ROAA reveals that banks in Brazil, Chile, Estonia and Hungary in emerging markets and Ireland in advanced economies suffer from a sharp fallover the period, possibly they may have been severely affected by the crisis. This is contrasted with countries such as Argentina, Peru, South Africa andTurkey, which enjoyed a substantial increase in profitability.

[Figures 1 and 2 about here]

In order to assess the evolution of revenues over time, we present Figures 1 and 2 that show the three types of income (the ratio of interest, organic or total income to assets) over the period 2001-2010. Apart from Figure 1a, revenues tend to show an upward trend till around 2008, and a downward trend after the financial crisis. This demonstrates the adverse effect of the crisis on banks' revenues. An interesting observation is that there is time lag of the effect on emerging banks, where the fall of revenue only started in 2009 (see Figure 1b), whereas it began in 2007 and 2008 in advanced markets (see Figure 2a and 2b). Such an impact appears to be absent for the small banks in emerging markets in Figure 1a; constant levels of revenues are observed for interest and organic incomes throughout the sample period, and there is a sharp and rapid rise in total income after 2008. The latter implies a dramatic increase of capital gains amongst this group of banks. One can debate whether small emerging banks are insulated from the crisis.

In sum, we find that i) while banking sectors in emerging economies became less concentrated over the period 2001-2010, their counterparts in advanced economies tended to be more concentrated, ii) profitability in emerging banking markets increased over the sample period, however, the reverse is true for advanced markets, and iii) there is a shift in the trend of interest, organic and total incomes after recent financial crisis.

Such evolution or shift of market structure, profitability and revenues over the sample period warrants an investigation of bank competition. The next question that arises is the extent to which competitive conditions have been affected by such banking characteristics and the environment. According to the traditional SCP hypothesis, there is a direct link between market concentration and the degree of competition. However, recent studies by Claessens and Leaven (2004) and Carbo et al. (2009) have cast doubt on this view. Furthermore, in the case of a

contestable market with no barriers to entry, even in highly concentrated markets, banks would still be competitive as they are unable to impose their market power. Also, factors such as globalization, hosting more foreign banks, deregulation, merger and acquisitions, are likely to foster (or hamper) competition. Therefore, the next section moves beyond the descriptive approach conducted so far, to a new Industrial Organisation approach by estimating the degree of bank competition.

5. EMPIRICAL RESULTS OF COMPETITION

We present estimation of Eq. (1) as derived from a panel data set analysis, using fixed effects and ordinary least square (OLS) estimators.

5.1. Fixed effects results

As stated by Goddard and Wilson (2009) the standard procedure for estimation of the H-statistics involves the application of the fixed effects regression to panel data for individual firms. The regression models are, hence, estimated using the fixed effects estimator in order to control for unobserved heterogeneity. Our choice of the fixed effects over the random effects estimators is also confirmed by the Hausman test. A modified Wald statistics is estimated to test for group-wise heteroscedasticity in the residuals. Moreover, Table A4 in the Appendix presents two tests for the mean values and heteroscedasticity. In Panel A, we perform a t-test on the equality of means of dependent variables for the classified groups with the three types of incomes, and in Panel B, we have used Levene's robust test statistic for the equality of variance of residuals amongst these groups. As can be seen, the all mean equality test has been rejected. Also, nearly all group-wise heteroscedasticity in the residuals show the rejection of the null hypothesis of homoscedasticity. White's robust standard error is applied to correct for heteroscedasticity.

[Table 6 about here]

Table 6 reports pooled regression results for the 24 emerging (Panel A) and the 25 advanced economies (Panel B)[7]. The results indicate that for both emerging and advanced economies, all of the coefficients of the prices of fund, labour and capital are positive and statistically highly significant. This is consistent with the findings of previous studies (i.e. Yeyati and Micco 2007, Gelos and Roldos 2004, Coccorese 2004and Casu and Girardone 2006 among others). Overall, judging from the magnitude of the coefficients amongst these prices, the price of labour contributes the most to the explanation of bank revenue, followed by the price of funds. In any case, the effect of the price of capital on the overall elasticity appears to be minimal.

As far as the control variables are concerned, the impact of bank size measured by total assets on revenue is negative and statistically significant, indicating that smaller banks are in a position to earn more profit. The ratio of equity to total assets always has positive and significant sign in emerging economies, but in advanced economies it is only significant when total revenue is specified as the dependent variable. The ratio of loans to total assets always has the expected positive and significant sign for both economies, regardless of the type of dependent variables (i.e. higher fractions of loans on the total assets generate greater interest, organic and total incomes). Interestingly, the ratio of loan loss provisions to total loans is also positive and statistically significant at the 1% level for both economies in all types of revenues. This implies that banks are potentially able to raise more revenues as they simply increase their total loans, irrespective of the quality of these loans. This is also found in Staikouras and Koutsomanoli-Fillipaki (2006).

[7] The regressions show relatively a good fit of the models for this type of study.

Based on the above results, we computed the H-statistic, the measure of competition (Recall Table 1 for the derivation). The results are reported also in Table 6. By conducting the Wald test, both hypotheses of monopoly (H=0) and perfect competition (H=1) are rejected. H-statistic satisfies that 0<H<1 and that all banks under investigation operate under monopolistic competition.

The result indicates that the banking sector in emerging economies operates in a more competitive environment than that in advanced economies in all respects. Note also that the H-statistics for large banks are greater than those for small banks for all cases. This may be due to the fact that smaller banks, operating in local markets, face less competitive pressure and hence they may be able to impose their market power. A similar pattern of results is found in Bikker and Haaf (2002). In terms of the alternative periods, we find that the degree of bank competition in emerging markets has risen during the crisis period for both small and large banks in all income equations. Such an increase has also been observed in advanced markets with the exception of the interest income equation that shows a decline during the crisis period. A fall in H-statistics in interest income may imply that interest revenue is earned under conditions of lower competition among advanced banks, i.e. banks may no longer compete in lending after the crisis. This is quite plausible given the fact that many major banks had to suspend reckless lending practices in the developed economies. However, the shift in the level of competition should be small, as the change in H-statistics is marginal in all cases.

5.2. OLS results

[Table 7 about here]

As a robustness test we also present the results using OLS technique in Table 7. In terms of the sign and statistical significance of the factor prices and bank specific control variables,

we find a similar pattern as in the model for fixed effects. We also find that the contribution of input price of labour is generally greater than other input prices. In respect of the degree of bank competition, again a similar result is found: large banks are more competitive than their small counterparts, and emerging markets are, in general, more competitive than advanced markets. However, we find slightly higher magnitude of H-statistic compared to that observed based on fixed effects.

When focusing on the degree of bank competition before and during the financial crisis period, the OLS appears to confirm the result of fixed effects for advanced economies, where an increase in competition is observed in organic and total incomes. For the emerging economies, a consistent result is only found in total income regression, not for other incomes. The H-statistic increases after the crisis as in the fixed effect, but falls with the interest and organic income equations. This implies that the capital gain revenues are obtained in an environment with a higher degree of competition in the emerging banking sector in the post crisis period.

5.3 Fixed effect results with individual countries

[Table 8 and 9 about here]

We also run regressions of Eq. (1) country by country to measure the degree of bank competition across individual countries with the fixed effect[8]. The H-statistic used as the indicator of competition of the banking system is the average of the H-statistic estimated using

[8]Due to limited observations, we removed the following countries from the sample: Chile, Egypt, Estonia, Mexico and Morocco for emerging economies, and Belgium, Finland, Ireland, Korea and New Zealand for advanced economies.

three different dependent variables, i.e. interest income, organic income and total income. Tables 8 and 9 report the results for emerging and advanced countries, respectively.

In general, large banks are more competitive than small banks. We find that Hungary and Poland in Table 8 and Austria, Denmark, Japan and Sweden in Table 9 show a relatively high degree of competition difference between large and small banks. Small banks in some countries have been shown to be more competitive than large banks in such countries as Taiwan and Portugal. When the comparison between pre- and post-crisis periods is made in the last column, the average difference indicates that, for emerging countries, the Czech Republic, Hungary, Peru, Poland and Slovakia have seen a relatively large fall in competition, whereas Columbia and Malaysia have reported a large increase. For advanced economies, Austria, Luxembourg and Portugal seem to be negatively affected by the crisis with a relatively large decline in competition, whereas banks in Iceland have increased their competitiveness in the post-crisis period. The overall results of the H-statistic with 0.022 and 0.005 for the respective economies (in the last row of Table 8 and 9) suggest that the impact of the recent financial crisis on bank competition seems to be negligible.

5.4 Bank-based and market-based difference in competition

Competition may differ according to whether countries are under bank-based or market-based financial systems. Hence, we divide our sample countries into two groups: the bank-based countries if the ratio of credit provided by the banking sector to market capitalization is greater than cross-country average, and the market-based countries if the ratio is smaller than the cross-country average. The cross-country average of this ratio is 2.185. According to this classification, 17 countries out of 48 (removing Taiwan as there is missing information for this country) are bank-based and 31 countries are market-based. Being consistent with the literature, countries such as Japan, Italy and Germany are bank-based, while the US and the

UK are market-based[9]. The average H-statistic for bank-based and market-based countries before and during the period of financial crisis is presented in Table 10.

[Table 10 about here]

The key findings are as follows: i) bank-based countries in both economies have a more competitive banking sector than market-based countries, regardless of bank size or the period under consideration,ii)small banks are less competitive than large banks, and the differences are larger for bank-based countries,iii) banks in both bank-based and market-based emerging countries are more competitive than their counterparts in advanced economies. In terms of the difference before and during the crisis periods, there is a marginal increase in competition in the post-crisis period in all cases.

6. ROBUSTNESS TESTS

[Table 11 about here]

In this section, we present several robustness tests to verify our main result that the adverse effect of the financial crisis on bank competition is trivial. Firstly, the previous researchers have used three empirical versions of Panzar and Rosse H-statistics: i) the revenue equation with bank size as a control variable, where (interest) gross total revenue is the dependent variable (e.g. Molyneux et al. 1994 and Carbo et al. 2009), ii) the price equation without controlling for bank size, where price of total assets or loans is the dependent variable (e.g. Staikouras and Koutsomanoli-Fillipaki 2006) andiii) the price equation controlling for bank

[9] The detail of the countries in each group is available upon request from the authors.

size (e.g. Claessens and Laeven 2004; and Schaeck et al. 2009). So far, we have only reported the third version due to its better empirical performance especially for individual countries. As robustness tests, we also estimate the first two versions to examine whether our previous results hold[10].Model 1 and 2 in Table 11 present the results for these alternative two versions, respectively. As can be seen, in both economies the degree of bank competition in large-size banks is greater overall than that for small-size banks. We also tend to find an increase in banking competition during the financial crisis (except for a marginal fall observed in interest and organic incomes for advanced economies). These results appear to support the original results in Table 6.

Secondly, we re-estimate Eq. (1)in four ways without specifying dummy variables, instead, we separate the samples between small and large-size banks and also split the periods, before and during the financial crisis:

$$Ln(P_{itc}) = h_0 + h_1 Ln(z_{F,itc}) + h_2 Ln(z_{L,itc}) + h_3 Ln(z_{K,itc}) + h_4 Ln(TA_{itc)}) + h_5 Ln(ETA_{itc}) + h_6 Ln(LTA_{itc)}) + h_7 Ln(LLPTA_{itc)}) \quad (3)$$

Model 3 in Table 11 presents the results. Being consistent with the original results, it is clearly shown that small-banks are less competitive than large-banks, and bank competition has increased during the financial crisis.

The third test is for the initial year of the crisis. One might argue that the data for 2007 may have not yet picked up the impact of the crisis, which did not hit many of the banks until 2008 (after Lehman Brothers' bankruptcy in September 2008). We re-estimate Eq. (1) with

[10] To clarify, in the original price model in Eq. (1), the revenue is scaled by the total assets, and also the variable of total assets is specified, and we refer to it as fully scaled. However, in the first version of the revenue equation, the revenue is not scaled by the total assets, and in the second version of the price equation, the variables of total assets (bank size) are not specified. Hence, we refer to both models as partially unscaled. Intuitively, controlling for scale makes apparent sense because larger firms earn more revenue. However, Bikker et al. (2012) theoretically and empirically argue that only an unscaled revenue equation version of H-statistics may yield a valid measure of competition.

dummy crisis 2008 where it takes value 1 for the period 2008-2010, and 0 otherwise. The results are presented in Model 4. The crucial evidence is that there is no presence of decline in competition, except for the interest income equation in advanced economies, again verifying our original result in Table 6.

Fourthly, it is argued that not all countries have experienced the financial crisis. Recently, Laeven and Valencia (2012) have documented the following countries that suffered from the systemic banking crises: Austria, Belgium, Denmark, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Portugal, Russia, Slovenia, Spain, Sweden, Switzerland, the UK and the USA. Thus, as a robustness test we re-estimated Eq. (1) only for these countries, excluding other countries. See Model 5 in Table 11.Evidence reveals that even for these countries the degree of bank competition has marginally increased during the financial crisis. This implies that the banking crisis does not necessarily correspond to a measure of bank competition.

The last issue is that so far we have used one non-structural indicator of bank competition, i.e. the Panzar and Rosse H-statistic. To examine whether other competition indicators yield similar results, we utilise the Lerner index[11]. We compute it as $Lerner\ (i) =$

[11]To estimate the Lerner index we follow the literature by using the conventional translog cost function (e.g. Maudos and Fernandez de Guevara, 2007). Specifically, we choose two outputs: total loans (L) and total deposits (D) and three input prices: cost of loanable funds (w_1) computed by dividing financial costs (interest paid) by their corresponding liabilities, cost of labour (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, in order to take account of changes in technology over time, we include trend variables (Trend) in the frontier. The dependent variable (C) is the bank's total cost calculated as the summation of operating and financial costs (i.e. interest and non-interest expenses). Thus, the specific form used for the cost function is the translog specification, which can be written as:

$$ln(C_{it}) = \alpha_0 + \alpha_L lnL_{it} + \alpha_D lnD_{it} + \frac{1}{2}\alpha_{LL}(lnL_{it})^2 + \frac{1}{2}\alpha_{DD}(lnD_{it})^2 + \alpha_{LD} lnL_{it} lnD_{it}$$
$$+ \sum_{j=1}^{3} \beta_j lnw_{j,it} + \frac{1}{2}\sum_{j=1}^{3}\sum_{k=1}^{3} \beta_{jk}\, lnw_{j,it} lnw_{k,it} + \sum_{j=1}^{3}\ _{jL} lnw_{j,it} lnL_{it} + \sum_{j=1}^{3}\ _{jk} lnw_{j,it} lnD_{it}$$
$$+ \mu_1 Trend + \frac{1}{2}\mu_2 Trend^2 + \mu_L Trend.\, lnL_{it} + \mu_D Trend.\, lnD_{it} + \sum_{j=1}^{3} \mu_{wj} Trend.\, lnw_{j,it}$$
$$+ lnu_{it} + lnv_{it}$$

$\left(\frac{P(i)-MC(i)}{P(i)}\right)$, where i denote loans, deposits or total assets, P is price and MC is marginal cost. We define the price of loans as the total interest income on loans divided by total loans, the price of deposits as the total interest expenses divided by total deposits, and the price of total assets as total income divided by total assets. The results are found in Model 6, Table 11. Note that by definition, as opposed to the H-statistics, a decrease (increase) in the index implies an increase (decrease) in competition. An increased competition is observed in Assets and Loans equations in emerging economies. For advanced economies, the results are mixed between small and large banks, yet large banks tend to increase their competitiveness during the financial crisis when estimated with Assets and Deposits equations.

7. CONCLUSION

This article investigates whether the recent financial crisis had any impact on bank competition for 24 emerging and 25 advanced countries with large and small size banks over the sample period 2001-2010.Our results suggest that a majority of banks continue to operate under conditions of monopolistic competition. We find distinguishing features in competition between different bank sizes and also between emerging and advanced economies, namely, large banks and emerging banks are more competitive than their respective counterparts. However, we find that the banks' size does not seem to matter in terms of the impact of the financial crisis, as both large and small banks move in the same direction.

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where $i = 1, 2, \dots, N$ and $t = 1,2, \dots, T$ denote bank and time, respectively. Note that by symmetry of the Hessian in the translog function we have$\beta_{jk} = \beta_{kj}$, where $k \neq j$. In order to correspond to a well-behaved production technology, the cost function needs to be linearly homogeneous, non-decreasing and concave in factor prices, and non-decreasing in output. Thus we impose the symmetry restriction. Then the marginal costs for loan and deposits are taken from $\text{MC (Loan)}_{it} = \frac{\partial C_{it}}{\partial L_{it}}$ and $\text{MC (Deposit)}_{it} = \frac{\partial C_{it}}{\partial D_{it}}$, respectively. Finally, by aggregating outputs into one category i.e. total assets we also estimate marginal costs for asset.

We have observed some shift in the market structure during the crisis periods, where a noticeable fall in profitability is observed in advanced economies with an increased concentration, and the reverse results are found for emerging economies. However, competition seems to be less affected during the crisis period. The competitiveness measured by the fixed effect result is supported by the OLS for the advanced economies and partially for the emerging economies. We find that the adverse effect of the financial crisis on bank competition is trivial and, on the contrary, competition is marginally boosted during the crisis period. This applies to both types of economies, irrespective of bank size. The market-based and bank-based competition analysis also indicates that there is little marked difference in the degree of competition in the post-crisis period. The robustness tests are also supportive to the initial results. This suggests that currently ongoing policy to avert further crisis in the banking sector has not exerted much of an adverse effect on competition. However, it should be noted that there are some countries where competition has been significantly disrupted by the recent financial crisis.

APPENDIX

Table A1: Empirical studies based on the Panzar and Rosse H-statistics

Authors	Period	Countries considered	Results
Liu et al. (2012)	1998- 2008	Indonesia, Malaysia, Philippines, Vietnam	Monopolistic competition
Brissimis and Delis (2011)	1999- 2006	20 transition countries	Monopolistic competition
Delis (2010)	1999- 2006	22 Central and Eastern European countries	Monopolistic competition
Turk- Ariss (2009)	2000- 2006	12 Middle East and North African countries	Monopolistic competition in most countries
Coccorese (2009)	1988- 2005	Italy	Monopolistic competition
Goddard and Wilson (2009)	2001- 2007	Canada, France, Germany, Italy, Japan, UK, US	Monopolistic competition
Schaek et al. (2009)	1980- 2003	38 countries	Monopolistic competition
Park (2009)	1992- 2004	Korea	Monopolistic competition
Bikker and Spierdijk (2008)	1986- 2004	101countries over the world	Monopolistic competition – with varying degree across countries
Matthews et al. (2007)	1980- 2004	UK	Monopolistic competition
Levy Yeyati and Micco (2007)	1993- 2002	8 Latin American countries	Monopolistic competition
Yildirim and Philippatos (2007)	1993- 2000	14 Central and Eastern European countries	Monopolistic competition except for FYR of Macedonia and Slovak Rep.
Al- Muharrami et al. (2006)	1993- 2002	6 Arab countries	Monopolistic competition
Casu and Girardone (2006)	1997- 2003	15 EU countries	Monopolistic competition except two countries
Goddard and Wilson (2006)	1998- 2004	25 countries	Monopolistic competition
Laeven (2006)	1994- 2004	7 East Asian countries	Monopolistic competition
Staikouras and Koutsomanoli-Fillipaki (2006)	1998- 2002	25 EU advanced countries and emerging economies	Monopolistic competition
Yuan (2006)	1996- 2000	China	Monopolistic competition
Buchs and Mathisen (2005)	1998- 2003	Ghana	Monopolistic competition
Mamatzakis et al. (2005)	1998- 2002	7 South Eastern European	Monopolistic competition
Jiang et al. (2004)	1992- 2002	Hong Kong	Perfect competition
Boutillier et al. (2004)	1993- 2000	Germany, France, Italy, Spain	Monopolistic competition
Gelos and Roldos (2004)	1994- 1999	8 Latin America and Eastern European countries	Monopolistic competition except Argentina and Hungary
Coccorese (2004)	1997- 1999	Italy	Monopolistic competition
Claessens and Laeven (2004)	1994- 2001	50 countries	Monopolistic competition
Shaffer (2004)	Mar1984- Jun 1994	US (4 banks, quarterly)	Monopolistic competition
Drakos and Konstantinou (2003)	1992- 2000	10 Central and Eastern European countries	Monopolistic competition – (monopoly for Latvia)
Levy Yeyati & Micco (2003)	1993- 2002	8 Latin American countries	Monopolistic competition
Belaisch (2003)	1997- 2000	Brazil	Oligopoly
Bikker and Haaf (2002b)	1988- 1998	23 Advanced economies	Monopolistic competition
Hempell (2002)	1993- 1998	Germany	Monopolistic competition
Coccorese (2002)	1988- 1996	Italy	Monopolistic competition (perfect competition in 1992/1994)
Bikker and Groeneveld (2000)	1989- 1996	15 EU countries	Monopolistic competition
Barajas et al. (2000)	1985- 1998	Colombia	Monopolistic competition
De Bandt and Davis (2000)	1992- 1996	France, Germany and Italy	Monopolistic competition in large banks and small banks in Italy, monopoly in France and Germany's small banks
Rime (1999)	1987- 1994	Switzerland	Monopolistic competition
Hondroyiannis et al. (1999)	1993- 1995	Greece	Monopolistic competition
Molyneux et al. (1996)	1986- 1988	Japan	Monopoly in 1986 and Monopolistic competition in 1988
Vesala (1995)	1985- 1992	Finland	Monopolistic competition during the period 1985- 88/1991- 92 and perfect competition during 1989- 90
Molyneux et al. (1994)	1986- 1989	France, Germany, Italy, Spain, UK	Monopolistic competition but monopoly for Italy during the period 1987- 89
Nathan and Neave (1989)	1982- 1984	Canada	Monopolistic competition during the period 1983- 84 and perfect competition in 1982
Gelfand and Spiller (1987)	1977- 1980	Uruguay	Monopolistic competition
Shaffer (1982)	1979	US (New York)	Monopolistic competition

Source: Liu et al. (2012), Bikker et al. (2012) and own investigation.

Table A2: Number of banks in the sample, by country (Panel A) and by year (Panel B) – (emerging vs. advanced economies). Number of observation is based on the available data for total assets.

Panel A: by country-averages over 2001-2010

	No. of banks	*No of observation per bank type* All	Small	Large		No. of banks	*No of observation per bank type* All	Small	Large
Emerging economies					*Advanced economies*				
Argentina	60	595	545	50	Australia	15	149	62	87
Brazil	105	1049	868	181	Austria	226	2255	2066	189
Chile	9	84	58	26	Belgium	42	412	314	98
China	81	809	453	356	Canada	57	570	399	171
Colombia	17	168	137	31	Denmark	83	827	755	72
Czech Rep.	21	202	144	58	Finland	8	72	36	36
Egypt	22	219	167	52	France	197	1967	1110	857
Estonia	6	52	44	8	Germany	1551	15505	14580	925
Hungary	23	225	170	55	Greece	14	135	64	71
India	59	581	346	235	Iceland	11	102	87	15
Indonesia	50	491	422	69	Ireland	10	97	24	73
Malaysia	26	257	111	146	Israel	11	110	48	62
Mexico	31	303	219	84	Italy	377	3765	3306	459
Morocco	7	65	18	47	Japan	631	6306	4504	1802
Peru	14	136	104	32	Korea	13	121	30	91
Philippines	23	226	185	41	Luxembourg	77	764	491	273
Poland	31	303	210	93	Netherlands	25	244	125	119
Russia	523	5221	5078	143	New Zealand	5	50	16	34
Slovak Rep.	14	134	101	33	Norway	85	847	769	78
Slovenia	15	143	124	19	Portugal	19	182	104	78
South Africa	13	124	96	28	Spain	108	1080	641	439
Taiwan	33	330	60	270	Sweden	83	824	789	35
Thailand	20	192	74	118	Switzerland	342	3414	3269	145
Turkey	20	194	112	82	UK	105	1042	738	304
					US	556	5554	3863	1691
Total	*1220*	*12103*	*9846*	*2257*		*4647*	*46394*	*38190*	*8204*
In%		100	81	19			100	82	18

Panel B: by year

	No. of banks	*No of observation per bank type* All	Small	Large		No. of banks	*No of observation per bank type* All	Small	Large
Emerging economies					*Advanced economies*				
2001	67	665	557	108	2001	434	4332	3829	503
2002	70	696	586	110	2002	414	4131	3619	512
2003	71	702	571	131	2003	397	3970	3402	568
2004	76	753	584	169	2004	404	4037	3315	722
2005	120	1195	998	197	2005	522	5217	4337	880
2006	144	1434	1209	225	2006	522	5217	4252	965
2007	169	1679	1389	290	2007	515	5122	4096	1026
2008	175	1732	1407	325	2008	504	5024	3993	1031
2009	170	1676	1337	339	2009	491	4907	3870	1037
2010	158	1571	1208	363	2010	444	4437	3477	960
total	*1220*	*12103*	*9846*	*2257*	*total*	*4647*	*46394*	*38190*	*8204*

Table A3: Descriptive statistics.
This table provides descriptive statistics on: (1) total assets (TA) (expressed in million USD), (2) loan to assets (LTA), (3) equity to assets (ETA), (4) interest revenue to assets (IR/A), (5) organic revenue (interest plus fee and commission revenue) to assets (OR/A), (6) total revenue to assets (TR/A), (7) interest expenses to assets (z(F)), (8) personnel expenses to assets (z(L)), (9) other operating expenses to assets (z(K)), and (10) loan loss provisions to assets (LLPTA), for each of emerging and advanced economies before (2001-2006) and during (2007-2010) financial crisis for small and large size banks. All variables except TA are in percentage. Standard errors are given under mean values. Further descriptive statistics by country can be provided upon requested. Source: BankScope database and own estimations.

		before crisis (2001-2006)				during crisis (2007-2010)			
		emerging economics		advanced economies		emerging economics		advanced economies	
		small	large	small	large	small	large	small	large
TA	Mean	790	95495	936	143743	656	121210	1062	180935
	St. Dev.	1081	99144	1079	173574	1098	169597	1137	234564
LTA	Mean	49.14	52.03	59.37	57.36	52.15	54.51	59.81	58.02
	St. Dev.	21.06	12.21	20.75	13.97	21.19	10.85	20.70	14.83
ETA	Mean	18.87	6.76	9.34	6.45	20.50	7.93	9.88	6.48
	St. Dev.	17.47	3.61	11.06	3.00	16.26	2.89	10.79	4.52
IR/A	Mean	7.87	4.38	3.62	2.51	8.05	4.65	3.35	2.85
	St. Dev.	7.25	1.81	11.04	1.08	5.60	1.82	1.48	1.20
OR/A	Mean	9.73	5.24	4.37	3.04	9.75	5.49	4.25	3.38
	St. Dev.	8.66	2.22	3.15	1.20	6.71	2.13	3.61	1.34
TR/A	Mean	11.63	5.79	4.89	3.35	24.28	6.18	4.62	3.67
	St. Dev.	10.28	2.44	15.07	1.34	31.36	3.66	5.30	1.52
z(F)	Mean	3.73	2.75	1.19	1.04	2.92	2.44	0.95	1.03
	St. Dev.	3.99	1.51	15.37	0.94	2.37	1.22	1.02	0.79
z(L)	Mean	2.77	1.25	1.61	0.97	3.43	1.03	1.52	0.83
	St. Dev.	3.34	0.87	3.18	0.39	3.10	0.45	2.78	0.37
z(K)	Mean	3.84	1.49	1.66	1.07	15.03	1.42	1.37	0.91
	St. Dev.	5.86	0.90	24.54	0.84	29.79	2.73	4.19	0.68
LLPTA	Mean	1.02	0.65	0.50	0.37	0.93	0.75	0.48	0.59
	St. Dev.	3.61	0.52	2.32	0.50	3.65	0.63	1.23	1.49

Table A4: Group-wise mean values and heteroscedasticity tests.

The table reports a conventional t-test (Panel A) to test on the equality of means of dependent variables for different groups. Also, it reports the Levene's robust test statistics (W0 in Panel B) for the equality of variance between the groups (group-wise heteroscedasticity in the residuals of Eq. (1) for different dependent variables). Source: BankScope database and own estimations. *, **, and *** indicate 10%, 5% and 1% significance levels, respectively.

Panel A: mean values tests				
	pair-waise	interest income	organic income	total income
Before crisis (2001-2006)				
emerging	small vs. large	t-value=9.08***	12.75***	17.21***
advanced	small vs. large	29.24***	30.56***	28.56***
emerging vs. advanced	small vs. small	45.65***	52.50***	67.82***
	large vs. large	19.17***	20.42***	23.25***
During crisis (2007-2010)				
emerging	small vs. large	16.01***	19.37***	33.19***
advanced	small vs. large	19.41***	20.21***	17.58***
emerging vs. advanced	small vs. small	68.09***	71.91***	112.57***
	large vs. large	21.11***	23.32***	24.64***
Comapre before and post crisis				
emerging	small vs. small	-7.06***	-5.59***	-25.64***
	large vs. large	-2.27**	-2.54**	-1.71*
advanced	small vs. small	6.55***	5.10***	6.02***
	large vs. large	-3.93***	-5.95***	-5.87***
Panel B: heteroskedasticity tests				
	pair-waise	interest income	organic income	total income
Before crisis (2001-2006)				
emerging	small vs. large	W0=15.07***	11.46***	3.27*
advanced	small vs. large	103.68***	105.96***	58.98***
emerging vs. advanced	small vs. small	1236.12***	1345.81***	951.01***
	large vs. large	51.07***	55.88***	78.70***
During crisis (2007-2010)				
emerging	small vs. large	0.396	0.420	0.090
advanced	small vs. large	51.70***	85.01***	63.28***
emerging vs. advanced	small vs. small	179.39***	316.77***	194.96***
	large vs. large	4.33**	10.45***	5.59***
Comapre before and post crisis				
emerging	small vs. small	45.36***	33.94***	33.19***
	large vs. large	0.070	3.45*	5.42**
advanced	small vs. small	338.80***	283.58***	172.88***
	large vs. large	18.04***	26.51***	34.74***

ACKNOWLEDGEMENTS

This is a revised version of the paper presented at the International Conference on the Global Financial Crisis: European Financial Markets and Institution, April 2013, Southampton, UK. The authors are grateful to participants of this conference for their helpful comments and suggestions. The usual disclaimer applies.

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Table 1: the degree of bank competition before and during financial crisis

	Before crisis (2001-2006)		During crisis (2007-2010)	
	small	large	small	large
	Dum_crisi=0	Dum_crisi=0	Dum_crisi=1	Dum_crisi=1
	Dum_large=0	Dum_large=1	Dum_large=0	Dum_large=1
H-statistics	H=h(1)+h(2)+h(3)	H=h(1)+h(2)+h(3) + h(1)"+h(2)"+h(3)"	H=h(1)+h(2)+h(3) + h(1)'+h(2)'+h(3)'	H=h(1)+h(2)+h(3) + h(1)'+h(2)'+h(3)' + h(1)"+h(2)"+h(3)"

Table 2: Distribution of banks in terms of bank size before and during crisis

	before crisis: 2001-2006		during crisis: 2007-2010	
	average size (USD million)	% of banks	average size (USD million)	% of banks
Emerging economies				
small-size	790	83	656	80
large-size	33,000	17	51,000	20
Advanced economies				
small-size	936	85	1,062	79
large-size	58,800	15	88,000	21

The threshold for the size is set at $5 billion.

Table 3: Correlation matrix between major variables.

This table reports the correlation matrix between major variables for all observations including all countries in the sample for 2001-2010. *, ** and *** are significant at 10%, 5% and 1% levels, respectively. Organic income is interest income plus fees and commissions income. Price of fund is the ratio of interest expenses to total deposits, price of labour is the ratio of personnel expenses to total assets, and price of capital is the ratio of other operating and administrative expenses to total fixed assets.

	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1)log(organic income/asset)	0.838***								
(2)log(total income/asset)	0.738***	0.883***							
(3) log(price of fund)	0.608***	0.531***	0.443***						
(4) log(price of labour)	0.390***	0.585***	0.620***	0.067***					
(5) log(price of capital)	0.141***	0.260***	0.429***	0.091***	0.075***				
(6) log(total assets)	-0.288***	-0.347***	-0.391***	-0.108***	-0.437***	-0.088***			
(7) log(equity/total asset)	0.248***	0.402***	0.503***	0.047***	0.449***	0.317***	-0.396***		
(8) log(loan/asset)	0.452***	0.191***	0.066***	0.169***	-0.001	-0.205***	0.042***	-0.144***	
(9) log(loan-loss prov./loan)	0.233***	0.322***	0.350***	0.073***	0.288***	0.095***	-0.150***	0.154***	-0.278***

(0): log(interest income/asset)

Table 4: Bank market structure.
This table compares bank market structure for emerging and advanced economies for different size-classes before and during financial crisis. For market structure we select two characteristics: profitability and concentration. These indicators are return on average assets (ROAA), return on average equity (ROAE), 5-firm concentration ratio (CR5) and Herfindahl-Hirschman index (HHI). CR5 and HHI are based on total assets and the same for both small and large-size banks.

	Market structure			
	Profitability indicators		Concentration indicators	
	ROAA	ROAE	CR5	HHI
	Panel A: before crisis: 2001-2006			
i-emerging economies				
small-size	1.44	11.41	61.07	1856
Large-size	1.06	14.66	61.07	1856
average	**1.25**	**13.04**	**61.07**	**1856**
ii-advanced economies				
small-size	0.51	6.57	34.06	811
Large-size	0.65	9.67	34.06	811
average	**0.58**	**8.12**	**34.06**	**811**
	Panel B: during crisis: 2007-2010			
i-emerging economies				
small-size	1.49	10.22	55.00	1156
Large-size	1.14	14.77	55.00	1156
average	**1.32**	**12.50**	**55.00**	**1156**
ii-advanced economies				
small-size	0.35	4.87	37.86	834
Large-size	0.31	6.66	37.86	834
average	**0.33**	**5.77**	**37.86**	**834**

Table 5: Market structure of banking sector in emerging and advanced economies over 2001-2010.

This table reports concentration and profitability in each of the 24 emerging and 25 advanced economies for the years 2001 and 2010. '*CR5*.' indicates the share of market share of 5 largest banks in each market. '*HHI*' indicates the sum of square of market share of all banks in each market. '*ROAA*' indicates the return on average assets as a proxy of profitability. *'%Δ'* indicates the percentage change from 2001 to 2010. Diff: difference between 2001 and 2010. Sources: BankScope and authors' calculation.

	CR5			HHI			ROAA		
	2001	2010	%Δ	2001	2010	%Δ	2001	2010	Diff
Emerging economies									
Argentina	48.96	54.09	10.48	733	1141	55.66	0.07	2.68	2.61
Brazil	45.82	58.05	26.69	773	1243	60.80	2.81	1.56	-1.25
Chile	97.47	73.80	-24.28	3531	1442	-59.16	2.48	1.26	-1.22
China	80.71	65.66	-18.65	3321	916	-72.42	0.49	1.02	0.53
Colombia	49.22	68.41	38.99	1108	1476	33.21	1.20	1.21	0.02
Czech Rep.	79.95	86.38	8.04	1952	1557	-20.24	0.74	0.61	-0.13
Egypt	65.23	69.59	6.68	1613	1764	9.36	0.74	1.00	0.26
Estonia	92.71	99.34	7.15	5706	6680	17.07	0.83	-0.43	-1.26
Hungary	64.37	84.43	31.16	1515	1848	21.98	1.51	-0.82	-2.34
India	35.13	39.34	11.98	537	825	53.63	0.30	0.95	0.64
Indonesia	69.86	61.53	-11.92	1376	940	-31.69	1.32	1.75	0.43
Malaysia	39.65	45.44	14.60	994	1038	4.43	0.93	1.08	0.15
Mexico	61.58	54.56	-11.40	1997	1299	-34.95	0.75	0.85	0.10
Morocco	93.63	71.91	-23.20	3006	1715	-42.95	0.74	1.17	0.44
Peru	82.29	86.39	4.98	2838	2985	5.18	0.06	2.03	1.98
Philippines	91.31	57.82	-36.68	9771	1005	-89.71	0.65	1.42	0.77
Poland	55.67	56.75	1.94	894	829	-7.27	1.02	0.89	-0.13
Russia	69.20	60.27	-12.90	2817	1134	-59.74	1.66	1.21	-0.45
Slovak Rep.	80.98	80.63	-0.43	2044	1535	-24.90	0.16	0.68	0.51
Slovenia	80.48	64.09	-20.37	2451	1653	-32.56	1.21	0.13	-1.08
South Africa	79.65	58.73	-26.26	4095	2467	-39.76	-0.04	1.33	1.37
Taiwan	49.18	32.27	-34.38	930	646	-30.54	-0.22	0.48	0.70
Thailand	58.74	62.15	5.81	1037	919	-11.38	0.48	1.09	0.61
Turkey	75.04	61.54	-17.99	2439	1054	-56.79	-1.22	1.59	2.81
average emerging	*68.62*	*64.72*	*-2.91*	*2395*	*1588*	*-14.70*	*0.78*	*1.03*	0.25
Advanced economies									
Australia	68.90	76.09	10.44	1796	1957	8.96	0.04	0.70	0.66
Austria	70.42	53.91	-23.45	2516	944	-62.48	0.49	0.23	-0.26
Belgium	80.04	84.84	6.00	614	1881	206.35	0.92	0.62	-0.30
Canada	76.24	73.83	-3.16	1464	1408	-3.83	0.47	0.43	-0.05
Denmark	81.55	72.74	-10.80	482	2998	521.99	0.97	0.00	-0.97
Finland	99.04	91.48	-7.63	9990	4399	-55.97	-1.15	0.38	1.52
France	45.51	56.78	24.76	1025	816	-20.39	0.63	0.62	0.00
Germany	47.24	42.81	-9.38	894	528	-40.94	0.23	0.32	0.09
Greece	89.87	78.31	-12.86	8478	1530	-81.95	-3.38	-1.00	2.37
Iceland	93.65	99.48	6.23	4843	3332	-31.20	0.66	1.89	1.23
Ireland	52.59	72.12	37.14	4565	1858	-59.30	0.58	-2.01	-2.60
Israel	84.88	95.50	12.51	2069	2047	-1.06	0.38	0.53	0.15
Italy	52.34	57.87	10.57	841	1193	41.85	0.04	0.22	0.18
Japan	39.70	39.29	-1.03	459	580	26.36	-0.19	0.13	0.32
Korea	52.73	53.44	1.35	2083	1203	-42.25	-0.05	0.52	0.57
Luxembourg	38.55	43.40	12.58	603	554	-8.13	0.59	0.65	0.06
Netherlands	53.20	82.08	54.29	1618	2243	38.63	1.00	0.48	-0.52
New Zealand	98.40	90.32	-8.21	10000	2187	-78.13	1.23	0.30	-0.92
Norway	91.04	68.58	-24.67	5216	2402	-53.95	0.78	0.79	0.01
Portugal	98.48	78.77	-20.01	4236	2014	-52.46	0.46	0.30	-0.16
Spain	65.56	69.75	6.39	1565	1456	-6.96	-0.32	0.24	0.56
Sweden	77.74	79.77	2.61	5111	3927	-23.17	1.08	0.78	-0.31
Switzerland	69.38	74.71	7.68	6256	3056	-51.15	0.87	0.19	-0.67
United Kingdom	59.04	47.18	-20.09	2370	1049	-55.74	0.84	-0.02	-0.86
United States	19.62	32.61	66.21	271	673	148.34	1.16	0.27	-0.89
average advanced	*68.23*	*68.63*	*4.70*	*3175*	*1849*	*10.54*	*0.33*	*0.30*	-0.03

Table 6: Results with fixed effect (small vs. large size, before crisis vs. during crisis, and emerging vs. advanced economies).

The table reports the results arising from the estimation of the regression model (1). The dependent variable is the logarithm of total interest revenue, organic income and total income, all scaled by total assets. Variables$z(F)$, $z(L)$ and $z(K)$ are the unit prices of three inputs: $(z(F))$ interest expenses to total deposits, $(z(L))$ the ratio of personnel expenses to total assets, and $(z(K))$ the ratio of other operating and administrative expenses to fixed assets. Bank specific factors included in the model are bank size (total assets), the ratio of equity to total assets, the ratio of loans to total assets, and the ratio of loan loss provision to loans. Two dummies included are as follows: D_1 takes value 1 if years are 2007-2010 (during crisis), 0 otherwise; D_2 takes value 1 if bank is classified as large-size (total assets greater than 5 billion USD). The t-values were calculated using White's (1980) correction for heteroscedasticity. *, **, and *** indicate 10%, 5% and 1% significance levels, respectively. The H-statistic is equal to the sum of the elasticities of interest (or organic or total) revenue with respect to three input prices (see Table 1). The Wald test is used to test the H = 0 and H = 1 hypotheses and follows an F-distribution.

	Panel A: emerging economies			**Panel B:** advanced economies		
dependent var.	Interest income	Organic income	Total income	Interest income	Organic income	Total income
independent var.						
ln *z(F)*	0.184 (10.96)***	0.174 (10.96)***	0.193 (9.07)***	0.198 (30.20)***	0.150 (28.86)***	0.141 (26.17)***
ln *z(L)*	0.200 (9.52)***	0.217 (8.90)***	0.223 (9.01)***	0.151 (8.72)***	0.272 (11.76)***	0.275 (12.46)***
ln *z(K)*	0.044 (4.77)***	0.051 (5.75)***	0.119 (9.08)***	0.022 (3.86)***	0.017 (2.41)**	0.023 (3.22)***
ln(total assets)	-0.085 (-6.01)***	-0.070 (-5.21)***	-0.040 (-2.44)**	-0.122 (-15.09)***	-0.115 (-12.49)***	-0.082 (-9.04)***
ln(equity/assets)	0.090 (2.81)***	0.089 (2.77)***	0.142 (3.93)***	-0.023 (-1.56)	0.010 (0.76)	0.129 (6.17)***
ln(loans/assets)	0.329 (4.48)***	0.258 (3.42)***	0.149 (2.05)**	0.263 (9.42)***	0.190 (7.53)***	0.146 (6.01)***
ln(prov./loan)	0.049 (6.72)***	0.047 (6.65)***	0.044 (5.14)***	0.017 (7.55)***	0.016 (9.19)***	0.026 (14.54)***
D1*ln *z(F)*	0.034 (2.59)***	0.027 (2.13)**	0.013 (0.90)	0.018 (3.23)***	0.020 (4.41)***	0.017 (3.82)***
D1*ln *z(L)*	0.006 (0.38)	0.006 (0.37)	0.011 (0.73)	-0.025 (-3.26)***	-0.021 (-2.39)**	-0.002 (-0.25)
D1*ln *z(K)*	-0.011 (-1.45)	-0.012 (-1.53)	-0.004 (-0.47)	-0.001 (-0.09)	0.002 (0.28)	0.005 (0.93)
D1*ln(total assets)	0.011 (2.19)**	0.007 (1.39)	0.005 (0.73)	0.003 (2.03)**	0.003 (2.31)**	0.003 (2.14)**
D1*ln(equity/assets)	-0.006 (-0.29)	-0.008 (-0.35)	0.016 (0.65)	0.041 (5.66)***	0.031 (5.03)***	0.027 (3.65)***
D1*ln(loans/assets)	-0.037 (-0.84)	-0.096 (-2.02)**	-0.047 (-1.33)	-0.050 (-3.76)***	-0.056 (-4.34)***	-0.034 (-3.05)***
D1*ln(prov./loan)	-0.001 (-0.18)	-0.002 (-0.32)	-0.004 (-0.48)	-0.002 (-0.72)	-0.003 (-1.09)	-0.010 (-3.57)***
D2*ln *z(F)*	-0.012 (-0.65)	-0.021 (-1.20)	-0.039 (-1.97)**	0.098 (6.43)***	0.085 (6.31)***	0.074 (5.79)***
D2*ln *z(L)*	0.105 (2.49)**	0.140 (3.06)***	0.123 (3.08)***	0.038 (1.42)	0.013 (0.45)	0.013 (0.49)
D2*ln *z(K)*	-0.007 (-0.42)	-0.004 (-0.28)	-0.018 (-0.84)	0.008 (0.68)	0.000 (0.01)	-0.000 (-0.03)
D2*ln(total assets)	0.035 (2.63)***	0.041 (3.30)***	0.035 (3.09)***	0.039 (4.27)***	0.023 (2.76)***	0.009 (1.14)
D2*ln(equity/assets)	0.006 (0.13)	0.016 (0.38)	0.025 (0.52)	0.004 (0.15)	-0.010 (-0.43)	-0.057 (-2.18)**
D2*ln(loans/assets)	0.016 (0.23)	0.035 (0.48)	0.006 (0.07)	-0.063 (-2.01)**	-0.029 (-1.04)	-0.027 (-1.16)
D2*ln(prov./loan)	0.013 (1.35)	0.004 (0.43)	0.006 (0.48)	0.002 (0.30)	-0.007 (-1.51)	-0.016 (-3.09)***
constant	0.498 (2.85)***	0.485 (2.99)***	0.374 (2.04)**	0.084 (0.67)	0.532 (4.40)***	0.486 (4.32)***
Husman test (χ2)	268.64***	225.98***	170.65***	2025.28***	1759.46***	1748.84***
No. of obs.	5347	5325	5339	23278	23099	23269
R-square	0.60	0.68	0.72	0.47	0.43	0.48
Degree of bank competition						
i-Before crisis						
small-size	0.429 (15.78)***	0.442 (16.41)***	0.535 (15.78)***	0.371 (18.73)***	0.439 (19.74)***	0.439 (20.01)***
large_size	0.514 (9.79)***	0.556 (10.25)***	0.602 (11.07)***	0.514 (15.05)***	0.536 (16.00)***	0.527 (16.12)***
ii-During crisis						
small-size	0.457 (15.87)***	0.463 (17.17)***	0.554 (17.44)***	0.364 (18.03)***	0.440 (16.27)***	0.459 (17.15)***
large_size	0.542 (9.94)***	0.577 (10.01)***	0.621 (10.82)***	0.507 (15.40)***	0.538 (15.94)***	0.547 (16.27)***
Test of monopoly H=0						
i-Before crisis						
small-size	Reject***	Reject***	Reject***	Reject***	Reject***	Reject***
large_size	Reject***	Reject***	Reject***	Reject***	Reject***	Reject***
ii-During crisis						
small-size	Reject***	Reject***	Reject***	Reject***	Reject***	Reject***
large_size	Reject***	Reject***	Reject***	Reject***	Reject***	Reject***
Test of perfect competition H=1						
i-Before crisis						
small-size	Reject***	Reject***	Reject***	Reject***	Reject***	Reject***
large_size	Reject***	Reject***	Reject***	Reject***	Reject***	Reject***
ii-During crisis						
small-size	Reject***	Reject***	Reject***	Reject***	Reject***	Reject***
large_size	Reject***	Reject***	Reject***	Reject***	Reject***	Reject***

Table 7: Results by OLS (small vs. large size, before crisis vs. during crisis, and emerging vs. advanced economies).

The table reports the results arising from the estimation of the regression model (1). The dependent variable is the logarithm of total interest revenue, organic income and total income, all scaled by total assets. Variables$z(F)$, $z(L)$ and $z(K)$ are the unit prices of three inputs: $(z(F))$ interest expenses to total deposits, $(z(L))$ the ratio of personnel expenses to total assets, and $(z(K))$ the ratio of other operating and administrative expenses to fixed assets. Bank specific factors included in the model are bank size (total assets), the ratio of equity to total assets, the ratio of loans to total assets, and the ratio of loan loss provision to loans. Two dummies included are as follows: D_1 takes value 1 if years are 2007-2010 (during crisis), 0 otherwise; D_2 takes value 1 if bank is classified as large-size (total assets greater than 5 billion USD). The t-values were calculated using White's (1980) correction for heteroscedasticity. *, **, and *** indicate 10%, 5% and 1% significance levels, respectively. The H-statistic is equal to the sum of the elasticities of interest (or organic or total) revenue with respect to three input prices (see Table 1). The Wald test is used to test the H = 0 and H = 1 hypotheses and follows an F-distribution.

	Panel A: emerging economies			**Panel B:** advanced economies		
dependent var.	Interest income	Organic income	Total income	Interest income	Organic income	Total income
Independent var.						
ln *z(F)*	0.263 (17.38)***	0.239 (17.09)***	0.227 (16.47)***	0.220 (48.00)***	0.193 (50.20)***	0.189 (48.51)***
ln *z(L)*	0.205 (11.03)***	0.278 (14.12)***	0.249 (18.09)***	0.156 (22.32)***	0.333 (48.65)***	0.349 (50.67)***
ln *z(K)*	0.105 (11.30)***	0.098 (11.64)***	0.113 (13.92)***	0.025 (7.24)***	0.061 (19.98)***	0.071 (19.32)***
ln(total assets)	-0.017 (-3.04)***	-0.036 (-6.75)***	-0.044 (-8.58)***	-0.014 (-9.98)***	0.001 (0.69)	0.005 (3.87)***
ln(equity/assets)	0.116 (5.25)***	0.103 (4.79)***	0.171 (8.70)***	0.047 (8.61)***	0.105 (22.43)***	0.136 (24.92)***
ln(loans/assets)	0.467 (8.99)***	0.319 (7.73)***	0.158 (4.26)***	0.241 (15.86)***	0.043 (2.91)***	0.031 (2.62)***
ln(prov./loan)	0.089 (9.83)***	0.087 (10.50)***	0.089 (10.87)***	0.059 (21.09)***	0.027 (11.37)***	0.031 (12.00)***
D1*ln *z(F)*	-0.010 (-0.56)	-0.002 (-0.11)	-0.004 (-0.24)	-0.017 (-2.63)***	-0.004 (-0.76)	-0.009 (-1.79)*
D1*ln *z(L)*	-0.034 (-1.49)	-0.011 (-0.43)	0.050 (2.33)**	0.002 (0.24)	0.028 (2.95)***	0.042 (4.36)***
D1*ln *z(K)*	-0.070 (-6.42)***	-0.071 (-7.13)***	-0.027 (-2.62)**	0.001 (0.26)	0.001 (0.19)	0.002 (0.44)
D1*ln(total assets)	-0.005 (-0.83)	-0.007 (-1.07)	0.006 (0.98)	0.004 (2.11)**	0.007 (4.19)***	0.006 (3.37)***
D1*ln(equity/assets)	0.024 (0.90)	-0.017 (-0.67)	-0.016 (-0.68)	0.056 (6.99)***	0.018 (2.59)***	0.010 (1.22)
D1*ln(loans/assets)	0.014 (0.20)	-0.156 (-2.80)***	-0.143 (-3.56)***	0.052 (2.12)**	0.007 (0.31)	0.008 (0.53)
D1*ln(prov./loan)	0.017 (1.62)	0.020 (2.12)**	0.008 (0.85)	-0.002 (-0.50)	-0.002 (-0.62)	-0.005 (-1.24)
D2*ln *z(F)*	-0.038 (-2.30)**	-0.053 (-3.25)***	-0.032 (-2.10)**	0.086 (9.17)***	0.078 (9.70)***	0.073 (9.48)***
D2*ln *z(L)*	0.030 (1.11)	0.035 (1.20)	0.048 (1.68)	-0.119 (-9.02)***	-0.186 (-13.95)***	-0.191 (-15.02)***
D2*ln *z(K)*	0.036 (2.76)***	0.054 (4.15)***	0.005 (0.35)	0.005 (0.82)	0.000 (0.05)	0.005 (0.78)
D2*ln(total assets)	0.010 (1.58)	0.030 (4.67)***	0.026 (4.32)***	-0.014 (-3.70)***	-0.026 (-7.88)***	-0.019 (-6.11)***
D2*ln(equity/assets)	0.073 (2.48)**	0.148 (4.85)***	0.119 (3.97)***	-0.037 (-2.30)**	-0.019 (-1.37)	0.023 (1.75)*
D2*ln(loans/assets)	-0.183 (-2.83)***	0.052 (0.73)	0.045 (0.84)	0.012 (0.37)	0.119 (4.35)***	0.048 (3.20)***
D2*ln(prov./loan)	0.018 (1.60)	0.016 (1.36)	-0.011 (-1.02)	0.016 (2.57)***	0.022 (3.95)***	0.030 (5.84)***
constant	0.281 (5.67)***	0.789 (17.60)***	0.962 (22.67)***	-0.854 (-24.86)***	-0.311 (-10.58)***	-0.157 (-5.00)***
No. of obs.	5347	5325	5339	23278	23099	23269
R-square	0.69	0.72	0.74	0.65	0.71	0.70
H-statistics: Degree of bank competition						
i-Before crisis						
small-size	0.573 (23.86)***	0.615 (27.06)***	0.588 (31.52)***	0.401 (49.93)***	0.587 (80.01)***	0.609 (81.04)***
large_size	0.602 (22.21)***	0.652 (23.82)***	0.610 (23.42)***	0.373 (22.85)***	0.479 (31.55)***	0.497 (35.42)***
ii-During crisis						
small-size	0.459 (20.90)***	0.531 (26.14)***	0.608 (31.40)***	0.388 (37.31)***	0.612 (67.74)***	0.644 (68.91)***
large_size	0.488 (18.38)***	0.568 (21.42)***	0.629 (23.41)***	0.360 (23.23)***	0.504 (34.23)***	0.532 (38.42)***
Test of monopoly H=0						
i-Before crisis						
small-size	Reject***	Reject***	Reject***	Reject***	Reject***	Reject***
large_size	Reject***	Reject***	Reject***	Reject***	Reject***	Reject***
ii-During crisis						
small-size	Reject***	Reject***	Reject***	Reject***	Reject***	Reject***
large_size	Reject***	Reject***	Reject***	Reject***	Reject***	Reject***
Test of perfect competition H=1						
i-Before crisis						
small-size	Reject***	Reject***	Reject***	Reject***	Reject***	Reject***
large_size	Reject***	Reject***	Reject***	Reject***	Reject***	Reject***
ii-During crisis						
small-size	Reject***	Reject***	Reject***	Reject***	Reject***	Reject***
large_size	Reject***	Reject***	Reject***	Reject***	Reject***	Reject***

Table 8: Degree of bank competition (H-statistics) in emerging economies before and during crisis for different bank sizes- by country.

The table displays the estimated average H-statistics of three reduced-form bank revenue equation of the regression model (1) for emerging economies, using least square dummy variables (Fixed Effects) regressions. One is estimated using interest revenue over total assets as dependent variable, the other one using organic revenue (interest income plus fee and commission income) over total assets, and the last one using total income over total assets. The sample covers years 2001-2010. The pre crisis period is from 2001-2006; post crisis is from 2007-2010. The standard errors were calculated using White's (1980) correction for heteroscedasticity. *, **, and *** indicate 10%, 5% and 1% significance levels, respectively.

		Before crisis (2001-2006)				During crisis (2007-2010)				Comapre before and post crisis
		small		large		small		large		Average of small and large
	Obs.	H-sts.	S.E	H-sts.	S.E	H-sts.	S.E	H-sts.	S.E	ΔH-sts.
Argentina	253	0.549***	0.125	0.671***	0.179	0.488***	0.081	0.610***	0.157	-0.061
Brazil	526	0.411***	0.047	0.405***	0.043	0.478***	0.033	0.473***	0.048	0.068
China	269	0.621***	0.088	0.681***	0.055	0.645***	0.086	0.705***	0.051	0.024
Colombia	49	0.409	0.382	0.439	0.424	0.604*	0.309	0.634***	0.178	0.195
Czech Rep.	76	0.292**	0.128	0.575***	0.155	0.041	0.166	0.324**	0.142	-0.251
Hungary	60	0.114	0.179	0.589***	0.103	-0.161	0.188	0.314***	0.102	-0.275
India	439	0.279***	0.037	0.540***	0.084	0.252***	0.041	0.543***	0.053	-0.028
Indonesia	118	0.487***	0.099	0.291	0.205	0.635***	0.071	0.439**	0.189	0.148
Malaysia	73	0.294**	0.119	0.104	0.090	0.557***	0.034	0.366***	0.068	0.263
Peru	84	0.531***	0.075	0.733***	0.086	0.148	0.100	0.350***	0.092	-0.383
Philippines	123	0.815***	0.047	0.646***	0.154	0.852***	0.056	0.683***	0.130	0.037
Poland	140	0.702***	0.070	1.030***	0.051	0.484***	0.096	0.813***	0.072	-0.218
Russia	2385	0.414***	0.026	0.684***	0.140	0.469***	0.021	0.739***	0.133	0.055
Slovak Rep.	59	0.876***	0.247	0.839***	0.251	0.681***	0.135	0.643***	0.183	-0.195
Slovenia	104	0.480***	0.052	0.814***	0.101	0.103	0.102	0.438***	0.115	-0.377
South Africa	62	0.445***	0.083	0.846***	0.092	0.367***	0.102	0.767***	0.082	-0.078
Taiwan	124	1.194***	0.228	0.726***	0.152	1.363***	0.241	0.895***	0.061	0.169
Thailand	155	0.247**	0.108	0.480***	0.075	0.136	0.106	0.369***	0.075	-0.111
Turkey	123	0.695***	0.100	0.668***	0.085	0.522***	0.123	0.495***	0.090	-0.173
Emerging	***5337***	***0.469******	***0.029***	***0.557******	***0.053***	***0.491******	***0.029***	***0.580******	***0.057***	***0.022***

Table 9: Degree of bank competition (H-statistics) in advanced economies before and during crisis for different bank sizes- by country.

The table displays the estimated average H-statistics of three reduced-form bank revenue equation of the regression model (1) for advanced economies, using least square dummy variables (Fixed Effects) regressions. One is estimated using interest revenue over total assets as dependent variable, the other one using organic revenue (interest income plus fee and commission income) over total assets, and the last one using total income over total assets. The sample covers years 2001-2010. The pre crisis period is from 2001-2010; post crisis is from 2007-2010. The standard errors were calculated using White's (1980) correction for heteroscedasticity. *, **, and *** indicate 10%, 5% and 1% significance levels, respectively.

		Before crisis (2001-2006)				During crisis (2007-2010)				Comapre before and post crisis
		small		large		small		large		Average of small and large
	Obs.	H-sts.	S.E	H-sts.	S.E	H-sts.	S.E	H-sts.	S.E	ΔH-sts.
Australia	86	0.888***	0.128	0.822***	0.047	0.750***	0.125	0.685***	0.038	-0.138
Austria	111	0.004	0.179	0.693***	0.066	-0.221	0.215	0.469***	0.102	-0.225
Canada	278	0.456***	0.071	0.400***	0.136	0.446***	0.103	0.315	0.257	-0.010
Denmark	272	0.460***	0.116	0.929***	0.152	0.403***	0.086	0.871***	0.087	-0.057
France	1006	0.461***	0.038	0.428***	0.051	0.539***	0.046	0.505***	0.053	0.077
Germany	13382	0.339***	0.016	0.388***	0.034	0.343***	0.022	0.393***	0.034	0.004
Greece	95	0.560***	0.093	0.423**	0.176	0.633***	0.090	0.495***	0.139	0.073
Iceland	93	0.100	0.183	0.317	0.388	0.494*	0.271	0.312	0.403	0.394
Israel	90	0.138	0.143	0.411***	0.102	0.102	0.168	0.275**	0.122	-0.036
Italy	2502	0.655***	0.041	0.712***	0.054	0.667***	0.044	0.725***	0.054	0.013
Japan	475	0.265**	0.105	0.942***	0.021	0.192*	0.102	0.870***	0.029	-0.073
Luxembourg	273	0.568***	0.077	0.694***	0.086	0.271***	0.072	0.397***	0.100	-0.297
Netherlands	70	0.574***	0.156	0.645***	0.085	0.639***	0.101	0.710***	0.132	0.065
Norway	605	0.530***	0.035	0.570***	0.046	0.652***	0.041	0.692***	0.048	0.122
Portugal	102	0.891***	0.044	0.521***	0.076	0.700***	0.071	0.329***	0.100	-0.191
Spain	447	0.470***	0.081	0.434***	0.071	0.553***	0.083	0.516***	0.073	0.083
Sweden	516	0.273***	0.043	0.999***	0.079	0.256***	0.046	0.981***	0.089	-0.017
Switzerland	1897	0.496***	0.034	0.446***	0.100	0.518***	0.033	0.467***	0.097	0.022
UK	147	0.738***	0.090	0.778***	0.073	0.663***	0.067	0.704***	0.075	-0.075
US	424	0.445***	0.020	0.677***	0.030	0.446***	0.039	0.617***	0.024	0.001
Advanced	***23215***	***0.416******	***0.012***	***0.526******	***0.019***	***0.421******	***0.014***	***0.531******	***0.019***	***0.005***

Table 10: Degree of bank competition (H-statistics) in bank- and market-based countries before and during financial crisis-(emerging vs. advanced economies)

The table displays the estimated average H-statistics of three reduced-form bank revenue equation of the regression model (1) for bank- and market-based countries in emerging and advanced economies, using least square dummy variables (Fixed Effects) regressions. One is estimated using interest revenue over total assets as dependent variable, the other one using organic revenue (interest income plus fee and commission income) over total assets, and the last one using total income over total assets. The sample covers years 2001-2010. The pre crisis period is from 2001-2010; post crisis is from 2007-2010. The threshold for large banks is 5 billion USD for total assets. We classify a country as bask-based if the ratio of credit provided by banking sector to total market-capitalization is greater than the cross-country average and market-based otherwise. The standard errors were calculated using White's (1980) correction for heteroscedasticity. *, **, and *** indicate 10%, 5% and 1% significance levels, respectively.

		Before crisis (2001-2006)				During crisis (2007-2010)				Comapre before and post crisis
		small		large		small		large		Average of small and large
	Obs.	H-sts.	S.E	H-sts.	S.E	H-sts.	S.E	H-sts.	S.E	ΔH-sts.
Emerging economies										
bank-based	729	0.586***	0.042	0.795***	0.055	0.602***	0.048	0.811***	0.052	0.016
market-based	4618	0.460***	0.019	0.484***	0.031	0.479***	0.017	0.503***	0.030	0.019
Advanced economies										
bank-based	16281	0.433***	0.015	0.562***	0.027	0.434***	0.019	0.563***	0.027	0.001
market-based	6997	0.419***	0.021	0.480***	0.029	0.438***	0.023	0.500***	0.029	0.019

Table 11: Robustness test

	Panel A: emerging economies			**Panel B:** advanced economies		
	Interest income	Organic income	Total income	Interest income	Organic income	Total income
Model 1: Revenue equation without scale						
i-Before crisis						
small-size	0.420 (t=13.55)***	0.394 (14.34)***	0.489 (14.63)***	0.364 (15.20)***	0.376 (15.53)***	0.383 (15.89)***
large_size	0.526 (15.09)***	0.447 (9.84)***	0.491 (11.14)***	0.510 (10.11)***	0.492 (13.35)***	0.491 (13.61)***
ii-During crisis						
small-size	0.431 (9.93)***	0.396 (14.78)***	0.486 (16.02)***	0.358 (14.99)***	0.373 (12.59)***	0.397 (13.69)***
large_size	0.544 (10.14)***	0.448 (9.39)***	0.488 (10.66)***	0.501 (13.01)***	0.488 (13.26)***	0.505 (13.78)***
Model 2: Price equation withought scale						
i-Before crisis						
small-size	0.465 (17.45)***	0.473 (17.85)***	0.552 (17.42)***	0.454 (23.79)***	0.516 (26.52)***	0.495 (25.78)***
large_size	0.535 (10.44)***	0.572 (10.78)***	0.611 (11.50)***	0.551 (16.44)***	0.571 (17.42)***	0.551 (17.49)***
ii-During crisis						
small-size	0.485 (17.02)***	0.487 (17.91)***	0.568 (18.74)***	0.449 (23.01)***	0.519 (23.44)***	0.516 (22.80)***
large_size	0.555 (10.44)***	0.578 (10.40)***	0.627 (11.12)***	0.546 (17.04)***	0.574 (18.04)***	0.573 (17.98)***
Model 3: Conventional H-statistics (without dummies)						
i-Before crisis						
small-size	0.375 (8.32)***	0.346 (7.40)***	0.459 (6.73)***	0.340 (12.48)***	0.388 (15.25)***	0.386 (11.97)***
large_size	0.655 (5.32)***	0.680 (6.23)***	0.686 (5.80)***	0.649 (10.95)***	0.587 (8.19)***	0.620 (10.50)***
ii-During crisis						
small-size	0.474 (10.20)***	0.502 (9.96)***	0.586 (10.75)***	0.407 (8.26)***	0.434 (9.52)***	0.471 (10.48)***
large_size	0.735 (11.55)***	0.760 (9.35)***	0.852 (8.21)***	0.652 (13.41)***	0.663 (12.92)***	0.678 (9.20)***
Model 4: Crisis 2008						
i-Before crisis						
small-size	0.481 (10.73)***	0.485 (8.04)***	0.553 (14.08)***	0.396 (8.19)***	0.456 (14.57)***	0.451 (8.94)***
large_size	0.554 (11.69)***	0.595 (10.22)***	0.617 (12.43)***	0.536 (13.14)***	0.559 (12.30)***	0.540 (10.13)***
ii-During crisis						
small-size	0.504 (9.32)***	0.491 (9.96)***	0.561 (9.93)***	0.389 (10.78)***	0.459 (9.07)***	0.466 (9.19)***
large_size	0.577 (12.34)***	0.601 (10.46)***	0.625 (10.11)***	0.530 (14.15)***	0.561 (11.25)***	0.555 (14.73)***

Model 5: Countries experienced recent crisis (Leaven and Valencia 2012)

	Interest income	Organic income	Total income
i-Before crisis			
small-size	0.371 (21.35)***	0.403 (21.13)***	0.463 (20.23)***
large_size	0.511 (15.30)***	0.513 (15.36)***	0.539 (14.90)***
ii-During crisis			
small-size	0.375 (21.86)***	0.418 (19.73)***	0.495 (20.41)***
large_size	0.516 (16.15)***	0.528 (16.32)***	0.571 (15.91)***

Model 6: Lener index

	Panel A: emerging economies			**Panel B:** advanced economies		
	Assets	Loans	Deposits	Assets	Loans	Deposits
i-Before crisis						
small-size	0.339 (sd=0.194)	0.225 (0.137)	-0.088 (0.818)	0.232 (0.113)	0.162 (0.090)	-0.178 (0.615)
large_size	0.354 (0.174)	0.148 (0.101)	0.222 (0.983)	0.256 (0.118)	0.161 (0.113)	-0.191 (0.712)
ii-During crisis						
small-size	0.288 (0.186)	0.200 (0.127)	-0.037 (0.833)	0.250 (0.122)	0.153 (0.120)	-0.177 (0.674)
large_size	0.388 (0.158)	0.142 (0.100)	0.303 (0.815)	0.249 (0.156)	0.175 (0.114)	-0.211 (0.599)

The t-values are in parenthesis for Models 1-5. *, **, and *** indicate 10%, 5% and 1% significance levels, respectively. The standard deviations are in parenthesis for Model 6.

Figures 1: Bank revenues in emerging economies with small and large size banks

Fig. 1-a: The trend of income to toal assets for small-size banks over 2001-2010 (emerging economies)

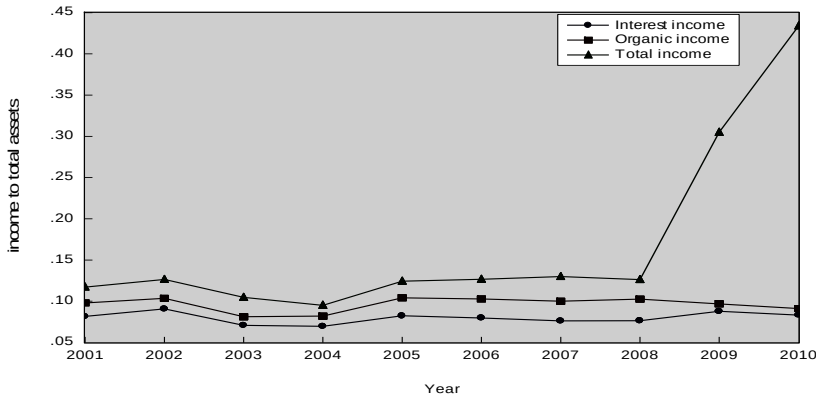
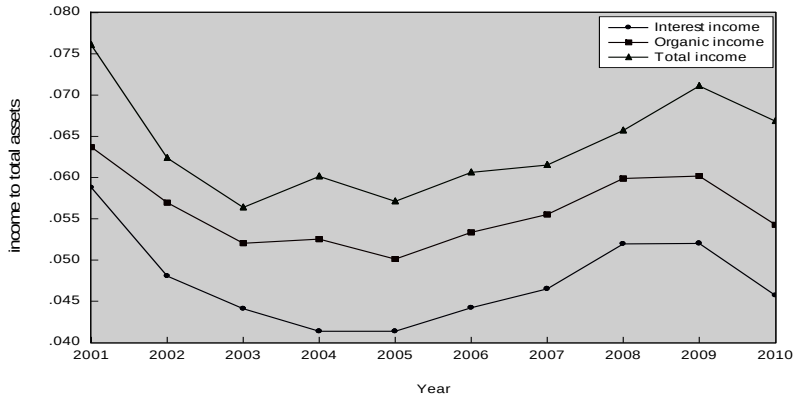


Fig. 1-b: the trend of income to total assets for large-size banks over 2001-2010 (emerging economies)



Figures 2: Bank revenues in advanced economies with small and large size banks

Fig. 2-a: The trend of income to total assets for small-size banks over 2001-2010 (advanced economies)

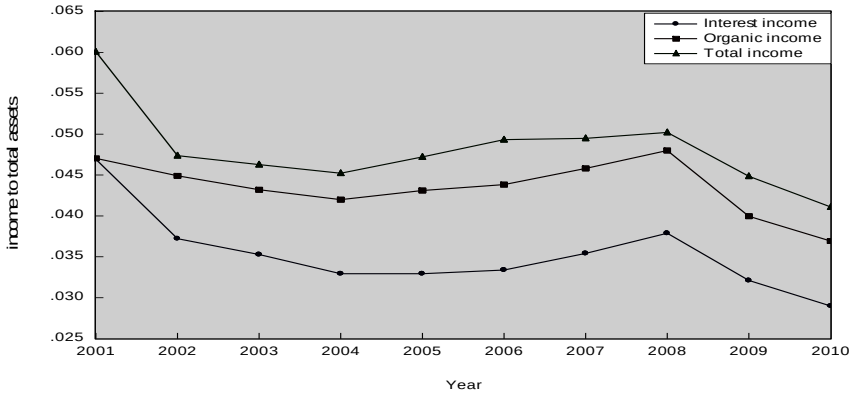


Fig. 2-b: The trend of income to total assets for large-size banks over 2001-2010 (advanced economies)