Banking Competition and Stability: Evidence from Inter-Continental Markets

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In this paper partial adjustment process to Panzar and Rosse's (1987) H-Statistics is introduced. The basic aim is to estimate the speed at which the EU, US, and ANZ banking markets adjust to their long-run equilibrium levels. Normally, banking markets adjust towards long-run equilibrium in a non-instantaneous manner. Moreover, while estimating the market structure, the speed of adjustment process is taken into account. We introduced an empirical model based on Nerlove's (1956) partial adjustment model to capture the speed of convergence of transition in the EU, US and ANZ banking market. Empirical results suggest that the transition and speed of adjustment towards long-run equilibrium varies from market to market depending on the profit deviation from average market profits.

JEL Classifications: L11, N20

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Business performance is, always considered a dependent variable for the competition that exists in any respective market. The same is true for global banking industry. Competition in global banking industry plays a crucial role for the economic and financial stability of any economy and is considered an important factor for quality improvement of existing financial services/ products besides the introduction of new ones. Cecchetti (1999) identified that the effective implementation of countries' monetary policy is dependent on the overall performance efficiency of the banking industry. Guzman (2000) further recognized that countries' economic development is directly linked with well-developed financial markets. Therefore, absence of efficient banking system shall be a cause of unstable financial and economic status of a country.

Competition also compels the market players to adopt optimization, that is, minimization of product prices without any compromise on the quality. Around the globe, banking industry also caters to the requirements of large number of small and medium enterprises (SMEs). Optimization is in the best interest of these stakeholders due to their limited affordability. Inefficient players are knocked out of market automatically due to failure to adopt optimization.

Concentration (market power) is also significant as it makes the banking industry more stable. There exists a complicated relationship between efficiency and concentration. Relationship between efficiency and concentration in highly competitive banking sector and less competitive banking sector shows different behavior as confirmed by several empirical studies (Beck Demirgüç-Kunt, & Levine, 2000; Collender & Shaffer, 2003; Jayaratne & Strahan, 1996). Highly competitive banking industry is more efficient than less competitive banking industry, thus, is a reason for high economic growth. Strong relationship is also confirmed between banking structure and economic growth (Berger Demirgüç-Kunt, Levine, & Haubrich, 2004; Bikker & Haaf, 2002; Goddard & Wilson, 2009; Prasad & Ghosh, 2007). Therefore, the relationship between efficiency and concentration needs thorough investigation as little literature regarding combined optimization of concentration and efficiency is available. Moreover, there had been a little discussion about the speed at which the banking industry adjusts itself towards long run equilibrium.

Financial stability is another important issue. Various empirical studies also discussed the high cost of financial instability. Hoggarth, Reis, and Saporta (2002) found that the average fiscal costs of banking resolution across countries is 16% of GDP. For developed countries it is 12%, whereas for emerging countries it is as high as 17.5%.

LITERATURE REVIEW

Inter-Continental Banking Markets: – A Brief Overview

US banking industry. Both the federal and state governments regulate banking in the US. Top five banks in the US in 2015 were JP Morgan, Goldman Sachs, Morgan Stanley, Bank of America and Citi Bank; and had taken 33.5% of the global investment banking fee pool. US banks, as a whole, account for 49% of total investment-banking fees which was 43% in 2009 (MacLannahan & Noonan, 2015).

US institutions initially suffered from the global financial crisis of 2007-08. US banking resumed its financial growth when the US Treasury did a strong stress test for its main banks in 2009. It forced the banks to remedy any capital shortfalls. The early and strong recapitalization, mainly through equity issues, helped US banks to resume their role as provider of credit to the economy (Schoenmaker & Peek, 2014). As a result, of all these measures, US banking industry was able to enlarge its share again from a low of 22% in 2009 to 31% in 2015. Currently US banks benefited from a more favorable macroeconomic environment, with most of the improvement in US bank profits is linked to declining loan loss provisions (European Central Bank, 2015).

EU Banking Industry. European Banking Authority and European Central Bank regulate banking in the EU. Top five banks of EU worldwide are Deutsche Bank, Barclays, Credit Suisse, HSBC and UBS (MacLannahan & Noonan, 2015). In context of market capitalization, top banks of Eurozone are HSBC Holdings, Banco Santander, Lloyds Banking Group, BNP Paribas and UBS (BanksDaily.com, 2015).

Before the start of the financial crisis in 2007, European banks accounted for nearly half of the aggregated market capitalization of 25 largest institutions worldwide. This share has fallen to currently only 17.5% after the financial crisis. In 2012-13, European banks on average report poor profitability and shrinking business activities including a pull-back from overseas markets. Moreover, these banks restructured their operations and were "rewarded" with low share prices (Schildbach & Wenzel, 2013). European banks were also distracted by a consistent regulatory changes, business restructurings, and political pressure to cut back in investment banking (Schäfer & Sakoui, 2013).

ANZ Banking Industry. Australia has four large domestic banks (the "four pillars") that are dominating the entire industry; Australia and New Zealand Bank (ANZ), Commonwealth Bank of Australia (CBA), National Australia Bank (NAB), and Westpac Banking Corporation (WBC). Each has AA rating by S&P with only nine of the top 100 banks globally enjoying a rating of AA or higher (Alexander, 2010). These four banks control almost 80% of the banking sector's total assets along with one-third market share in funds management and financial advice (Williams, 2014). These four "Big Banks" are declared among the "World's 50 Safest Banks" in 2015 (Global Finance, 2015). Australian major banks reported strong financial results for year 2014-15. Notwithstanding the record profits, increased regulatory capital requirements exerted pressure on the industry. Due to this pressure return on equity continued to decline as compared to the profits (KPMG, 2015a, 2015b).

NZ banking industry is dominated by four large subsidiaries of Australian banks. New Zealand's five major banks are Westpac, ASB Bank, ANZ New Zealand, BNZ and Kiwibank which have continued to show growth in 2015 financial years on the back of good lending growth. Besides, these banks are smoothly ahead of the regulatory requirements regarding capital ratios (PricewaterhouseCoopers New Zealand, 2015). According to IMF, any distress in one of the four banks could have significant repercussions for the entire New Zealand financial system and, in turn, the country's real economy (Vaughan, 2013).

Biggest competitors of US banking market is European banking market, which now US banking industry has left behind. US banks have turned out to be more worthy as compared to their European counterpart over the past few years alone as the DJ US Banks Index has climbed by almost 80%, nearly twice as much as its European counterpart (MacLannahan & Noonan, 2015). Moreover, U.S. banks' return on equity is lower than before the crisis, but at 12% is still almost three times higher than in Europe, according to consulting firm EY. (Davies & Slater, 2015). The ANZ Banking sector did not experience the sorts of problems that affected the US or EU banking systems. Despite tight lending standards, which had a significant effect on some businesses, ANZ banking system was largely able to maintain the confidence of depositors and creditors.

Banking Competition

Research literature regarding banking competition is ever increasing. A positive relationship between banking competition and access to banking services exists for the reason that increased banking competition leads to better service quality and efficiency, innovative products, enhanced money supply and low financial intermediation cost (Besanko & Thakor, 1992). Low cost financial intermediation helps in lowering the cost of capital that ultimately leads to increased growth rates. However the issue of hold-up cost also arises in highly concentrated markets (Boot & Thakor 2000; Petersen & Rajan, 1995). High competitive environment and greater access too are efficient ways to cater problem of hold-up cost.

Improved technology and better information may offset the negative effects of low access to lending in case of high market power of banking institutions. However, Hauswald and Marguez (2003) witnessed some other complications. They argued that competition is partly endogenous to the banks' investment in technology and information enhancement tools. Other studies show ambiguous results regarding the relationship between stability, access, competition and technology in the banking industry (Dell' Ariccia & Marquez, 2004). Another study by Dell' Ariccia, Igan and Laeven (2009) showed that although competitive markets give more access to financial services but weaken the lending standards.

Bikker and Haaf (2002) studied competition level of 23 OECD countries during the period 1988-1998. All banks are sub-sampled based on their size. The results suggested monopolistic competition and large banks face stronger competition as compared to small banks. These results are also supported by the study of De Bandit and Davis (2000). Bikker and Groeneveld (1998) conducted another study on sample of European countries for the period 1989–1996. The results of this study suggested steady competition during this period. Weighted average approach is used in measuring competition among banks included in the sample. These weights are determined by calculating the share of each bank in the total assets of the banking market. Both of the above said studies introduced logistic time curve model into the existing PR framework. Their study focus was on finding the relationship between competition and market structure for the purpose of validation of SCP (Structure-Conduct-Performance) paradigm. Their results are in line with the conventional theory that market concentration weakens the competition.

Claessens, Klingebiel and Laeven (2004) carried out a detailed banking competition analysis using H-statistics for 50 developed and developing countries for the period 1994-2001. Their results suggested that monopolistic competition is the best description of market structure in most of the countries. Furthermore, by regressing the H-statistics on country specific characteristics, the researchers tried to establish relationship between variables that shape the market structure.

Gischer and Stiele (2005) adopted the Panzar-Rosse approach to assess the competitive conditions for German savings banks (Sparkassen) for the years 1993 – 2002. Using disaggregated annual data of more than 400 credit institutions, the empirical results indicated monopolistic competition and the cases of monopoly and perfect competition are strongly rejected. It also appeared that the savings banks have found a niche by lending to small and mid-size enterprises, as well as to private customers, wherein competitive pressure was rather modest. Small banks seem to enjoy even more market power. Furthermore, researchers found no significant evidence for a better performance of larger banks in their sample.

Weill (2004) tried to establish a relationship between banking competition and efficiency. He used a sample of 12 EU countries. He used SFA (Stochastic Frontier Approach) for estimating of banking efficiency levels. With this approach he found a negative relationship between competition and efficiency. Casu and Girardone (2006) used H-statistics for measuring banking competition for the sample of 15 EU countries and measured banking efficiency using the non-parametric approach DEA (Data Envelopment Analysis). Their results showed no relationship between banking and efficiency. A study by Staikouras and Koutsomanoli- Fillipaki (2006) suggestsed that larger banks face more competition as compared to small banks. The researchers also found an evidence of greater competition among banks operating in countries, which are new members of EU as compared to former member countries' banks. Lloyd-Williams, Molyneux and Thornton (1994) carried out a study on banking competition using PR methodology for the period 1986-1989. Their sample includes banks of France, Germany, Italy, Spain and UK and results stated that most of these banking markets are facing monopolistic competition.

Allen and Gale (2004) discussed relationship between stability and competition. Concentration-stability view says "a concentrated banking system with few large institutions is more stable because the banks are more profitable, better

Table 1. ***H-Statistics***

Estimated H	Competitive Environment
$H = 1$	Perfect competition
$0 < H < 1$	Monopolistic competition free entry (Chamberlinian equilibrium)
$H \leq 0$	Monopoly equilibrium

diversified, and easy to monitor so they can resist shocks", whereas Concentration-fragility view states that "the concentration reduces competition, increases market power and political influence of financial conglomerates, thus destabilizes financial systems as banks become too big to discipline and use their influence to shape banking regulations and policies" (Mishkin, 1999. p. 680).

PR Model

Panzar and Rosse banking competition model (hereinafter called PR model) is popular among the researchers interested in measuring the competition level of banking industry. Panzar and Rosse (1977, 1982, 1987) provided an excellent framework for assessing degrees of competition in the banking industry. The model uses cross-sectional data to assess the competitive behavior of banks based on the comparative static properties of reduced form revenue equations. It explains revenues from input prices, among other factors. More specifically, the sum of elasticity of the reduced form revenues with respect to factor prices is estimated. This sum is given the symbol H and is formally known as the H-statistic. Market power of banks is measured by the extent to which changes in factor prices (unit cost) are reflected in revenue earned.

The Panzar-Rosse test had been widely applied to assess competitive conduct, often in specifications controlling for firm scale or using a price equation. Bikker, Shaffer, and Spierdijk (2012) discussed that neither a price equation nor a scaled revenue function yields a valid measure for competitive conduct. Moreover, even an un-scaled revenue function generally requires additional information about costs and market equilibrium to infer the degree of competition. Their theoretical findings are confirmed by an empirical analysis of competition in banking, using a sample containing more than 100,000 bank-year observations on more than 17,000 banks in 63 countries during the years 1994 to 2004.

H-statistics ranging between 0 – 1 can be interpreted (see Table 1.)

Specifically in banking literature PR Model is used as a tool for measuring market power. The null hypothesis is that the firm is a monopolist and it can be rejected if $H > 0$. This H-statistic is based on the assumption that the transition between two equilibrium points $R^e \rightarrow R^s$ is instantaneous.

Appendix A illustrates the complete derivation of PR model.

OBJECTIVE AND CONTRIBUTION OF THE PAPER

This article contributes to the existing literature by introducing a dynamic adjustment process to the PR model. Different types of banks are considered, for example, large vs. small, foreign vs. domestic after incorporating the adjustment factor to the PR model. Moreover, we have studied the effect of non-instantaneous adjustment on the index H.

This article will also elaborate the relationship between competition in banking sector and its stability. We have captured the financial stability through speed of adjustment towards equilibrium.

Our point of view is that the markets that have higher rate of adjustment towards equilibrium are more stable and there is less opportunities to make abnormal profits, which ultimately reduces the chance of involvement in high risk activities.

The objective of the current study is two-fold. First, to develop a dynamic model that addresses the issue of biasness in revenue equation. To make the system dynamic and to introduce the partial adjustment factor into the traditional PR model, partial adjustment model of Nerlove (1956) is used. We believe that markets adjust towards long-run equilibrium in a non-instantaneous manner and the speed of this adjustment process should be taken into account while estimating the market structure. The reason of considering the speed of adjustment is that, in state of dis-equilibrium every market behaves differently, some markets adjust themselves quickly where some takes more time to go back to equilibrium. The adjustment speed of each market depends on the attractiveness of the market. We used deviated profits from average market profits as a proxy for market attractiveness. Amel and Liang (1990) stated that the market profits play an important role in defining the speed of adjustment towards equilibrium market structure. They argued that the rate of adjustment towards long run equilibrium is greater in markets that experience extremely high or low profits compared to those markets where profits are average. The reason of quick adjustment in markets with abnormal profitability is that there exists a positive and significant relationship between high profits and new entrants (Geroski, Masson, & Shaanan, 1987). Secondly, the paper inspects the competition levels within different bank sizes (large and small). The data set used in the study has certain advantages on previously carried out studies. We used panel data just for banking markets that allow us to observe differences in the market structure purely for banking markets. For estimation of PR model, data was adjusted for bank mergers, which means that we treated the banks before merger as separate entities and after the merger as a single bank. This adjustment helps us to identify banks' structural changes before and after mergers.

DATA DESCRIPTION

For empirical test, unbalanced data (Bank Scope: 1990-2014) from 10 European Union (EU) countries (UK, Austria, Finland, France, Germany, Greece, Italy, Netherlands, Portugal, and Spain), United States (US), and Australia/ New Zealand (ANZ), is used. Furthermore, we sub-sampled countries in our dataset based on continent to which they belong.

Table 2. ***Profit Deviations***

Countries	Profit deviation
Australia	1.22
Austria	6.00
Finland	10.33
France	15.43
Germany	6.56
Greece	1.00
Italy	11.24
Netherlands	15.66
New Zealand	1.05
Portugal	7.01
Spain	9.11
UK	9.09
USA	1.11

EU represents European continent, the US represents North American continent, and ANZ represents the continent of Australia. In a nutshell, it will provide an overall picture of banking markets of three continents. We also sub-sampled our data set in order to study the competitive environment within different types of banks separated by size.

RESEARCH METHODOLOGY

We are interested in estimating the speed of adjustment towards long-run equilibrium by means of abnormal market profits. We used DP (deviated profits), which is the squared deviation of market net interest income-to-assets from the un-weighted sample average of markets net interest income-to-assets over the defined estimation period. The intuition behind using DP as an explanatory factor in determining the speed of adjustment is that markets deviate from their normal profits during periods of disequilibrium and adjust back to normal profit levels once they reach the equilibrium position. We can interpret it as a speed of adjustment towards equilibrium; for example, highly competitive markets take less time to adjust to equilibrium compared to markets that are less competitive. Therefore, we expect to obtain $\lambda < 1$ for less competitive markets and λ close to 1 for highly competitive markets.

THE EMPIRICAL MODEL

H-Statistics

We have estimated the H-statistic using the three different versions of revenue equation.

$$\ln(II_{i,t}) = \alpha + \beta_1 \ln(W_{1,i,t}) + \beta_2 \ln(W_{2,i,t}) + \beta_3 \ln(W_{3,i,t}) + \gamma_1 \ln(Y_{1,i,t}) + \gamma_2 \ln(Y_{2,i,t}) + \varepsilon_{i,t} \quad (13)$$

$$\ln(II_{i,t}) = \alpha + \beta_1 \ln(W_{1,i,t}) + \beta_2 \ln(W_{2,i,t}) + \beta_3 \ln(W_{3,i,t}) + \gamma_1 \ln(Y_{1,i,t}) + \gamma_2 \ln(Y_{2,i,t}) + \gamma_3 \ln(Y_{3,i,t}) + \varepsilon_{i,t} \quad (14)$$

$$\ln(\frac{TR_{i,t}}{TA_{i,t}}) = \alpha + \beta_1 \ln(W_{1,i,t}) + \beta_2 \ln(W_{2,i,t}) + \beta_3 \ln(W_{3,i,t}) + \gamma_1 \ln(Y_{1,i,t}) + \gamma_2 \ln(Y_{2,i,t}) + \gamma_3 \ln(Y_{3,i,t}) + \varepsilon_{i,t} \quad (15)$$

Un-scaled revenue equation 13 excludes total assets as dependent variable. Scaled revenue equation 14 includes total assets as the independent variable and the traditional revenue equation 15 includes total assets as dependent variable and using dependent variable 1n (*Interest Income / total* assets). In first and second version of the revenue the dependent variable is $\ln(II_{i,t})$ where $II_{i,t}$ revenue, is defined using interest income. Where *i* = bank *i, t* = year *t*, $\frac{TR}{TA}$ is ratio of total *interest income / total assets* (proxy for output price of loans). We used three factor inputs: $W_{1,i,t}$ is the ratio of total interest expenses to total deposits (proxy for input price of deposits); $W_{2,i,t}$ is the ratio of personnel expense over total assets (proxy for labor cost); $W_{3,i,t}$ is the ratio of other operating expenses over total assets (proxy for input price and other fixed capital); $Y_{1,i,t}$ is the ratio of equity over total assets; $Y_{2,i,t}$ is the ratio of net loans to total assets; and $Y_{3,i,t}$ is the total assets. $Y_{1,i,t}$, $Y_{2,i,t}$ and $Y_{3,i,t}$ is used as the control variable for bank-specific effect.

In PR model, the H-statistic is defined as the sum of factor price elasticity so from the above stated reduced-form revenue equation the H-statistic can be derived as:

$$H = \beta_1 + \beta_2 + \beta_3 \quad (16)$$

Partial Adjustment Model

The partial adjustment model was given by Nerlove (1956), which is based on the accelerator model of economic theory. The model can be illustrated as follows:

Let $R_{i,t}$ be economically relevant and observable variable, which adjust to some desired but unobservable level $R^*_{i,t}$ as shown below:

$$R_{i,t} - R_{i,t-1} = \lambda(R^*_{i,t} - R_{i,t-1}) \quad (17)$$

Where $R_{i,t}$ = variable value at time *t*, $R_{i,t-1}$ variable value at t – 1, $R^*_{i,t}$ is the desired value of a particular variable, λ the speed of adjustment coefficient.

Equation 17 defines the phenomena that the current level of variable $R_{i,t}$ will move only partially from the previous position $R_{i,t-1}$ to the desired level $R^*_{i,t}$. Where $\lambda(R^*_{i,t} - R_{i,t-1})$ will be the amount of adjustment between time t and $t - 1$ and λ is interpreted as an adjustment coefficient, which characterizes the fact that there are limitations to the rate of adjustment of R_{it} due to abnormal profits. The coefficient may assume values between 0 and 1. The smaller the value of λ the greater the adjustment lags and vice versa. For example, when λ equals to 1, adjustment of the target variable is instantaneous.

Thus, the partial adjustment model states that when bank/firms observe a deviation in its profit from market profits, banks adjust their profit levels in the future. In this way, the markets move non-instantaneously from the state of in-equilibrium to equilibrium. We are interested in knowing the fact that how different speeds of profit adjustment affects the market structure. We assume that the time taken by markets to adjust their profits back to equilibrium levels can be interpreted in terms of competitive environment, that is, fast or instantaneous adjustment takes place in highly competitive environment λ closer to 1 and slow or non-instantaneous adjustment takes place in less competitive environment $\lambda < 1$.

We setup the following model to study the dynamics of banking competition. Using the partial adjustment model, the PR revenue equation can be written as:

$$R_{it} = R_{i,t-1} + \lambda(R^*_{it} - R_{i,t-1}) = (1-\lambda)R_{i,t-1} + \lambda R^*_{it} \tag{18}$$

In the above equation we have two latent variables namely $R^*_{i,t}$ and λ. Thus we infer these two variables through variables that are directly observable.

$R^*_{i,t}$ is the revenue equation in long-run equilibrium and defined as a function of factor input prices W and bank specific variables Y.

$$\begin{aligned} R^*_{it} &= \beta_1 ln(W_{1,i,t}) + \beta_2 ln(W_{2,i,t}) + \beta_2 ln(W_{3,it}) + \\ &\gamma_1 ln(Y_{1,it}) + \gamma_2 ln(Y_{2,it}) + \gamma_3 ln(Y_{3,it}) + \varepsilon_{it} \end{aligned} \tag{19}$$

We have used the all three variants of revenue equation in our dynamic model[1]. λ is defined it as the function of deviated profits and we can write it in linear form as follow:

$$\lambda = \gamma_1 + \gamma_2 DP_{i,t} \tag{20}$$

The speed of adjustment is the function of firm deviated profits from normal market profits and we define the deviated profits as squared deviation of market net interest income to total assets from the sample average of market net interest income to total assets.

$$DP_{i,t} = \left(\frac{NetInterestIncome_{i,t}}{Total\text{Assets}_{i,t}} - \overline{\frac{NetInterestIncome_{i,t}}{Total\text{Assets}_{i,t}}} \right)^2 \tag{21}$$

The interesting fact behind equation 21 for speed of adjustment is that the λ value is directly proportional to the deviated profits, which makes it a convex function. Alternatively, we can say if the deviated profits will be high or market is in state of dis-equilibrium, the speed of adjustment will also be high. The speed of adjustment coefficient is affected by high values of deviated profits as consistency in profit deviation from normal market profits makes the market more attractive and fringe extension. As a result, market quickly moves back to equilibrium state. On the other hand, if deviated profits will be low the λ value would also be low as small deviations make the market less attractive and fringe contraction.

Another reason behind using the squared deviation of market profits from normal profits is that if we use the revenues $R_{i,t}$ and simple market profits into a single regression it causes a severe multi co-linearity issue. Eq. 18 can be written as follow:

$$R_{i,t} = \left(1-\gamma_1-\gamma_2 DP_{i,t}\right)R_{i,t-1} + \left(\gamma_1+\gamma_2 DP_{i,t}\right)\left\{\begin{array}{l}\beta_1 ln\left(W_{1,i,t}\right)+\beta_2 ln\left(W_{2,i,t}\right)+\\ \beta_3 ln\left(W_{3,i,t}\right)+\gamma_1 ln\left(Y_{1,i,t}\right)+\gamma_2 ln\left(Y_{2,i,t}\right)+\gamma_3 ln\left(Y_{3,i,t}\right)+\varepsilon_{i,t}\end{array}\right\} \quad (22)$$

Equation 22 is a dynamic revenue equation that also considers the effect of speed of adjustment on PR revenue equation. We can interpret it as if the deviated profits will be high the more effect will λ have on the factor input prices coefficients. Where on the other hand if deviated profits will be zero or markets are in equilibrium then λ will not affect the factor input prices coefficients. Equation 22 also tells us that if DP are significantly above zero then γ_2 will play its role in correcting the biased revenue equation. If DP will be zero or markets are in equilibrium then only the γ_1 coefficient (constant) will be considered.

RESULTS

Nature of Competition

The competition level in EU banking industry falls under monopolistic competition as all countries have H-statistic $0 < H < 1$. We have rejected the null that the $H < 1$ or $H < 0$ with 95% confidence interval. Italy, Portugal, and Spain have the highest H-statistics 0.77, 0.75, 0.73 respectively. Alternatively, we can say that countries with 0 < H-statistics < 1 values are having a monopolistic market structure. Germany and Netherlands have the least competitive banking industry. The average H-statistic of EU banking industry is 0.62. Thus, our results are coherent with the results of previous available literature that monopolistic competition prevails in EU countries.

US banking industry have H-statistics 0.47 that suggests that monopolistic competition exists in US but the competition level is more aggressive as compared to EU countries.

Results from ANZ Banking market signal a monopolistic competition with H-statistics 0.13 and 0.72 respectively. Because of higher H-statistics, we can comment that banks in New Zealand are operating in close to perfect competition market as compared to Australia.

Size of Banks

Our results summaries the fact that size of bank does play a significant role in its operational activities, which ultimately affects the market competition in banking sector as a whole. However, we can conclude that small banks compete more aggressively than large banks as the small banks have average H-statistic 0.660 and large banks have an average H-statistic 0.585.

In EU banking industry, large banks in Spain and UK have the highest H-statistics, 0.83 and 0.76 respectively, suggesting monopolistic competition. On the other hand, large banks in Italy and Germany have more competitive environment as they have lowest H-statistics 0.39 and 0.44 respectively. Small banks in Spain and UK have monopolistic competition environment with H-statistic 0.88 and 0.798 respectively.

Larger banks in ANZ are both working in monopolistic environment with H statistics 0.61 and 0.81 respectively. But higher H-statistics in case of New Zealand suggests higher competition as compared to Australia. However, small banks in Australia and New Zealand represents monopolistic competition, with H-statistics 0.74 and 0.94 respectively, but competition level is more aggressive as compared to large banks.

All results are reported in appendix B. The results from FE and GMM estimation are reported in Appendix C and D respectively.

Speed of Adjustment

The speed of adjustment towards the long-run equilibrium is measured by $(\gamma_1 + \gamma_2 DP_{i,t})$. The significance of γ_1 and γ_2 suggests that the rate of adjustment varies significantly across markets. Table A.3 shows that λ value remained between zero and one for all the countries. We developed

Table 3. *Inter-Continental Comparison*

	Large banks		Small banks		Overall	
	λ	H-statistic	λ	H-statistic	λ	H-statistic
ANZ	0.21	0.62	0.70	0.91	0.44	0.39
EU	0.59	0.59	0.77	0.68	0.49	0.66
US	0.54	0.44	0.89	0.50	0.51	0.41
Average	0.40	0.57	0.78	0.69	0.51	0.50

a relationship between speed of adjustment and market competition environment by assuming that the time taken by markets to adjust their profits back to equilibrium levels can be interpreted in terms of competitive environment, that is, fast/instantaneous adjustment takes place in highly competitive environment λ closer to 1 and slow/non-instantaneous adjustment takes place in less competitive environment $\lambda < 1$.

Our results for rate of adjustment among small and large banks are consistent with the work of Freixas and Ma, (2014) and further strengthen the fact that financial stability is better when competition level is high and it drops with the competitors in the market.

In EU banking market, the highest speed of adjustment is observed in Portugal's and Greece's banking industry with λ of 0.903 and 0.790 respectively and competitive environment in these countries are monopolistic. France and Germany have the lowest λ of 0.22 and 0.38 respectively. The average speed of adjustment in EU countries and US is not significantly different with λ equal to 0.585 and 0.520 respectively. The λ coefficient for small and large banks states that the speed of adjustment in small banks is greater than that of large banks. The average speed of adjustment in small and large banks is 0.78 and 0.54 respectively.

Australia and New Zealand banking markets have λ value 0.33 and 0.69 respectively and both are facing monopolistic competition. New Zealand's has a higher λ value, which indicates the banking markets with higher H-statistics (representing markets competition close to perfect competition) also have higher speed of adjustment. Such results are in line with our hypothesis that markets with perfect competitions adjust themselves towards equilibrium more quickly as compared to markets with less competition.

Inter-Continental Comparison

Our intercontinental comparison shows that banking markets in all three continents (Australian, European, and American continent) are working under monopolistic competition environment, with no significant difference in H-statistics. Same is the case with speed of adjustment in which λ values are almost similar for all observed continents. This result shows that the banking markets are following the same pace around the world and no region could be marked as an outlier. Furthermore, this can be interpreted as that we are not seeing any abnormalities or banking industry bubbles creating in any observed region. Our results also show that the speed of adjustment is dependent on competition level in banking sector irrespective of geographic region or economic condition of a country. This point further strengthens the fact that the banking sector is more stable under competitive conditions rather than monopoly.

CONCLUDING REMARKS

Our paper examines the implications for the estimation of the Panzar and Rosse H-statistic of departures from assumed product market equilibrium conditions. Results from our model have two notable findings. First, our results show enough evidence of non-instantaneous adjustment of markets, as the value of λ coefficient for all studied markets remain between zero and one. Secondly, our results depict a relationship between the rate of market adjustment to long run equilibrium and its competition level. Monopolistic competition with little variation in all three continents concludes that the competition levels are not significantly different.

In practice, the assumption of static equilibrium framework of Panzar and Rosse H-Statistics is not valid, as the markets do not adjust themselves in an instantaneous manner. Speed of adjustment towards equilibrium might be less than instantaneous, and markets might be out of equilibrium either occasionally, or frequently or always.

Furthermore, this paper also covers the interest of policy makers. Our findings and results highlighted the facts that:

- Profit deviation in banking sector plays an important role in adjusting the market towards equilibrium. Markets where banks are too big to fail, they remain out of equilibrium for a long time, which means that individual banks that have large number of competitors are less likely to take part in high risk activities as they are concerned about their existence in the market.
- Only markets with abnormal profits experience quick adjustment so market competition does affect the stability of banking sector.
- In contrast, the difficulty of measuring the efficiency costs of concentration may suggest that competition policy warrants a lower priority. In fact, the uncertainty about the costs of concentration together with the perceived (negative) trade-off between competition and financial stability may actually encourage policymakers to favor concentration at the expense of competition policy. This subordination of competition policy to financial stability may be unwise for a number of reasons, however. Firstly, the extent to which there is a negative trade-off between competition and financial stability may be questioned. The costs of financial crises are undoubtedly high, but it does not follow that it is necessary to reduce competition to avoid those costs. Secondly, the wide range of estimates of the efficiency costs from concentration is at least consistent with a high efficiency gain from greater competition. Thirdly, the costs of financial crises occur infrequently, perhaps every decade or few decades, whereas the inefficiency cost concentrations are born continuously.

In view of the foregoing, it is recommended that:

- Central banks must monitor the profit deviation in banking sector as it plays a significant role in keeping markets near equilibrium.
- Monetary policy should be implemented effectively to increase the overall performance of the banking sector.
- Banks, whether small or large, should focus on optimization to remain financially stable and competitive in the market.
- Given the large and visible costs of financial instability, it should be natural for policymakers to make the avoidance of financial crises a high priority.

In the nutshell, our study concluded that studying the competition levels and rate of adjustment towards long-run equilibrium provides an insight to the role of competition in banking sector's equilibrium level, which further can be interpreted as a sign of financial stability. Furthermore, our results show that competition affects the rate of adjustment around the globe in a similar fashion irrespective of the country's economic and political condition.

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APPENDIX A

Theoretical Framework of PR Model

Let $R = R(k,z)$ where k a vector of decision variables is and firm revenues are affected by k, where the vector z represents a set of variables that depends on the market structure treated so z can be written as $z = (y,a)$ where vector y represents the output level. Furthermore we also assume that the firms' cost also depends directly or indirectly on y. Then firms cost function can be written as $C = C(y,w,t)$ where w is a vector of factor input prices, t is a vector of exogenous variables that shifts the firms cost function. The vector z and t can shift the firm's revenue and cost functions respectively but we cannot assume that these two vectors have common components. We denote the optimal level of output as Y^* so the reduced form revenue function of the firm can be written as follow:

$$R^* = R^*(z,w,t) \tag{1}$$

Where the firms profit function can be written as:

$$\pi(y,z,w,t) = R - C \tag{2}$$

From here we can define the starting point of equilibrium R^e and the steady point equilibrium as R^s. In a similar way we can write Y^e and Y^s where

$$Y^e = \text{argmax}_y \{\pi(y,z,w,t)\} \tag{3}$$

And

$$Y^s = \text{argmax} \{\pi(y,z,(1+h)w,t)\} \tag{4}$$

with scalar $h > 0$

Furthermore we can assume that

$$R^e = R(y^e, z) = R^*(z,w,t) \tag{5}$$

And

$$R^s = R(y^s, z) = R^*(z,(1+h)w,t) \tag{6}$$

Then by definition we write

$$R^s = C(y^s,(1+h)w,t) \geq R^e - C(y^e,(1+h)w,t) \tag{7}$$

As C is homogenous in w so we can write the above inequality as

$$R^s - (1+h)C(y^s,w,t) \geq R^e - (1+h)C(y^e,w,t) \tag{8}$$

Similarly,

$$R^e - C(y^e,w,t) \geq R^s - C(y^s,w,t) \tag{9}$$

–Multiplying both sides of (9) by $1+h$ and adding result to (8) yields

$$-h(R^s - R^e) \geq 0 \tag{10}$$

–By dividing both sides of (10) by $-h^2$, we get,

$$(R^s - R^e) / h \leq 0 \tag{11}$$

The theorem 1 stated that the sum of elasticity's of factor prices w of reduced form revenue equation must be non-positive (Rosse & Panzar, 1987). So H-statistic can be mathematically defined as:

$$H = \sum \partial_w R^* \frac{w_i}{R^*} \leq 0 \tag{12}$$

Appendix B. ***Un-scaled Revenue Equation with Lambda Coefficient***

Countries	Large banks				Small banks				Overall			
	λ	H-statistic	Competition Environment	SE	λ	H-statistic	Competition Environment	SE	λ	H-statistic	Competition Environment	SE
Australia	0.31	0.61***	*MC*	*0.042*	0.46	0.74***	*MC*	*0.043*	0.33	0.13***	*MC*	*0.21*
Austria	0.47	0.54***	*MC*	*0.042*	0.831	0.661***	*MC*	*0.043*	0.68	0.707***	*MC*	*0.01*
Finland	0.73	0.72***	*MC*	*0.037*	0.57	0.71***	*MP*	*0.01*	0.49	0.73***	*MC*	*0.05*
France	0.36	0.63***	*MC*	*0.11*	0.93	0.55***	*MP*	*0.0783*	0.22	0.66***	*MC*	*0.71*
Germany	0.61	0.44***	*MC*	*0.081*	0.71	0.58***	*MP*	*0.0133*	0.38	0.28***	*MC*	*0.076*
Greece	0.13	0.51***	*MC*	*0.0724*	0.76	0.739***	*MP*	*0.076*	0.79	0.61***	*MC*	*0.093*
Italy	0.55	0.39***	*MP*	*0.034*	0.83	0.448***	*MP*	*0.0382*	0.69	0.77***	*MC*	*0.01*
Netherlands	0.84	0.47***	*MP*	*0.019*	0.72	0.49***	*MP*	*0.033*	0.75	0.54***	*MC*	*0.03*
New Zealand	0.20	0.81***	*MC*	*0.47*	0.87	0.94***	*PC*	*0.38*	0.69	0.72***	*MC*	*0.18*
Portugal	0.63	0.52***	*MP*	*0.016*	0.93	0.75***	*MP*	*0.013*	0.903	0.75***	MC	0.013
Spain	0.81	0.83***	*MP*	*0.08*	0.804	0.88***	*MP*	*0.0076*	0.4	0.73***	*MC*	*0.23*
UK	0.47	0.76***	*MP*	*0.003*	0.78	0.798***	*MP*	*0.0405*	0.55	0.68***	*MC*	*0.05*
USA	0.44	0.46***	*MP*	*0.089*	0.94	0.49***	*MP*	*0.0503*	0.52	0.47***	*MC*	0.19
Average	0.5490	0.581			0.7865	0.6606			**0.5853**	**0.6457**	***MC***	

Key: MC = Monopolistic competition, MP = Monopoly Competition, PC = Perfect competition

Notes: This table reports estimated values of λ (lambda), H and corresponding standard errors S.E. obtained by partial adjustment model for un-scaled revenue equation (excludes total assets $Y_{3,i,t}$ from control variables) (Bikker et al., 2008).

$\ln(II_{i,t})=\alpha_0+\beta_1\ln(W_{1,i,t})+\beta_2\ln(W_{2,i,t})+\beta_3\ln(W_{3,i,t})+\ddot{}_1\ln(Y_{1,i,t})+\ddot{}_2\ln(Y_{2,i,t})+\varepsilon_{i,t}$.

*** Refers to hypothesis testing at a (5% significance level) indicates the acceptance of 0<H<1 (monopolistic competition).

Appendix C: ***FE Estimation with Scaled and Un-scaled Revenue Equation***

	Scaled revenue equation						Un-scaled revenue equation					
Countries	**Large banks**		**Small banks**		**Overall**		**Large banks**		**Small banks**		**Overall**	
	H-statistic	**S.E**	**H-statistic**	**S.E**	**H-statistic**	**S.E**	**H-statistic**	**S.E**	**H-statistic**	**S.E**	**H-statistic**	**S.E**
Australia	0.17	*0.07*	0.54***	*0.07*	0.07	*0.04*	0.25***	*0.06*	0.46***	*0.07*	0.11	*0.04*
Austria	0.44	*0.127*	0.54***	*0.1*	0.56***	*0.031*	0.54***	*0.1*	0.61***	*0.2*	0.55***	*0.02*
Finland	0.74	*0.15*	0.72***	*0.1*	0.76***	*0.104*	0.73***	*0.13*	0.79***	*0.08*	0.69***	*0.08*
France	0.51	*0.12*	0.69***	*0.031*	0.39***	*0.02*	0.61***	*0.09*	0.68***	*0.02*	0.49***	*0.02*
Germany	0.4	*0.01*	0.58***	*0.01*	0.58***	*0.01*	0.445***	*0.09*	0.51***	*0.002*	0.55***	*0.008*
Greece	0.43	*0.01*	0.92***	*0.066*	0.92***	0.05	0.48***	*0.09*	0.73***	*0.05*	0.64***	*0.04*
Italy	0.47	*0.04*	0.81***	*0.01*	0.74***	*0.012*	0.576***	*0.04*	0.66***	*0.01*	0.71***	*0.015*
Netherlands	0.25	*0.09*	0.89***	*0.11*	0.59***	*0.09*	0.35***	*0.081*	0.46***	*0.102*	0.52***	*0.08*
New Zealand	0.82	*0.35*	0.53***	*0.21*	0.26***	*0.18*	-0.12***	*0.33*	0.85***	*0.12*	0.20***	0.04
Portugal	0.63	*0.245*	0.75***	*0.07*	0.43***	*0.07*	0.51***	*0.164*	0.73***	*0.06*	0.48***	*0.06*
Spain	0.61	*0.17*	0.73***	*0.02*	0.58***	*0.02*	0.68***	*0.14*	0.54***	*0.02*	0.54***	*0.02*
UK	0.56	*0.07*	0.79***	*0.04*	0.52***	*0.04*	0.60***	*0.07*	0.59***	*0.04*	0.59***	*0.04*
USA	0.41	*0.15*	0.62***	*0.0031*	0.61***	*0.003*	0.51***	*0.13*	0.57***	*0.003*	0.56***	*0.003*
Average	0.4954		0.7309		0.6072		0.5483		0.6245		0.5745	

Notes: This table reports estimated values of H and corresponding standard errors S.E. obtained by fixed effect estimation for traditional scaled and un-scaled revenue equation for large and small banks

$\ln(II_{i,t}/TA)=\alpha_0+\beta_1\ln(W_{1,i,t})+\beta_2\ln(W_{2,i,t})+\beta_3\ln(W_{3,i,t})+\text{¨}_1\ln(Y_{1,i,t})+\text{¨}_2\ln(Y_{2,i,t})+\varepsilon_{i,t}$. (excludes total assets $Y_{3,i,t}$ from control variables) (Bikker et al. 2008).

$\ln(II_{i,t}/TA)=\alpha_0+\beta_1\ln(W_{1,i,t})+\beta_2\ln(W_{2,i,t})+\beta_3\ln(W_{3,i,t})+\text{¨}_1\ln(Y_{1,i,t})+\text{¨}_2\ln(Y_{2,i,t})+\text{¨}_3\ln(Y_{3,i,t})+\varepsilon_{i,t}$.

Where $II_{i,t}/TA$ is revenue, defined using interest income/total assets.

*** Refers to hypothesis testing at a (5% significance level) indicates the acceptance of 0<H<1 (monopolistic competition).

Appendix D: ***GMM Results for Scaled and Un-scaled Revenue Equation***

	Scaled revenue equation		Unscaled revenue equation	
Countries	**H-statistic**	**S.E**	**H-statistic**	**S.E**
Australia	0.79***	*0.09*	1.19***	*0.12*
Austria	0.62***	*0.0043*	0.61***	*0.096*
Finland	0.89***	*0.26*	0.87***	*0.048*
France	0.75***	*0.004*	0.74***	*0.038*
Germany	0.55***	*0.294*	0.69***	*0.043*
Greece	1.33***	*0.03*	0.13***	*0.12*
Italy	0.66***	*0.112*	0.92***	*0.096*
Netherlands	0.63***	*0.053*	0.71***	*0.077*
New Zealand	0.84***	*0.26*	0.87***	*0.048*
Portugal	0.49***	*0.222*	0.55***	*0.053*
Spain	0.75***	*0.043*	0.59***	*0.107*
UK	0.56***	*0.03*	0.55***	*0.266*
USA	0.68***	*0.04*	0.59***	*0.068*
Average	0.729		0.634	

Notes: This table reports estimated values of H and corresponding standard errors S.E. obtained by (Arellano bond dynamic panel) GMM estimation for scaled and un-scaled revenue equation for large and small banks. The approach was used by Goddard and Wilson (2009)
$\ln(II_{i,t})=\alpha_0+\beta_1\ln(W_{1,i,t})+\beta_2\ln(W_{2,i,t})+\beta_3\ln(W_{3,i,t})+\ddot{}_1\ln(Y_{1,i,t})+\ddot{}_2\ln(Y_{2,i,t})+\varepsilon_{i,t}$. (excludes total assets $Y_{3,i,t}$ from control variables) (Bikker et al. 2008).
$\ln(II_{i,t})=\alpha_0+\beta_1\ln(W_{1,i,t})+\beta_2\ln(W_{2,i,t})+\beta_3\ln(W_{3,i,t})+\ddot{}_1\ln(Y_{1,i,t})+\ddot{}_2\ln(Y_{2,i,t})+\ddot{}_3\ln(Y_{3,i,t})+\varepsilon_{i,t}$.
Where $II_{i,t}$ is revenue, defined using interest income.
*** Refers to hypothesis testing at a (5% significance level) indicates the acceptance of $0<H<1$ (monopolistic competition).

Appendix E: ***Correlation Matrix for All the Variables***

	R1	**W1**	**W2**	**W3**	**Y1**	**Y2**	**Y3**	**DP**	**Interest**
R1	1.0000								
W1	0.4998	1.0000							
W2	0.1315	(0.2229)	1.0000						
W3	0.1215	(0.1607)	0.6865	1.0000					
Y1	(0.0298)	0.2357	(0.1479)	(0.1556)	1.0000				
Y2	0.1597	(0.1883)	0.2099	0.1773	(0.7470)	1.0000			
Y3	(0.0257)	(0.0599)	(0.0583)	0.0067	(0.7389)	0.5293	1.0000		
DP	0.1071	0.0400	0.0320	0.0970	0.0337	(0.0275)	(0.0241)	1.0000	
Interest	0.0978	0.3641	(0.2998)	(0.2142)	0.3582	(0.2829)	0.3021	0.0315	1.0000