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The ‘Competition–Stability Nexus’: Is Efficiency an Appropriate Channel?

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Abstract

This research investigates whether ‘efficiency’ is an appropriate channel through which competition affects stability in the Islamic and conventional banking sectors. We employ three dominant hypotheses in the banking literature to establish this relationship: the ‘competition–efficiency’ hypothesis, the ‘efficiency–stability’ hypothesis and the ‘competition–stability’ hypothesis. Our dataset comprises 324 banks from 13 countries for the years 2000 to 2012 where both banking systems co-existed. Our findings suggest that market power increases efficiency and stability significantly for both banking systems. However, although efficiency has a significant impact on stability in conventional banks; it does not have any significant impact on Islamic banks. Thus, our results lend support to the traditional view of the competition–fragility hypothesis, while they cast doubt on the findings of whether ‘efficiency’ is an appropriate channel to significantly modulate the linkage between competition and stability.

JEL Classification: G21; G21; L11

Keywords: Competition; Efficiency; Stability; GMM; Lerner Index; Distance-to-default

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1. Introduction

Managing credit risk in financial institutions has always been a core issue for regulators, policy makers and practitioners, especially since the onset of the financial crisis. One of the driving forces of financial instability is excessive competition in the financial market (Dima et al., 2014). The competition–stability nexus has received special attention since the onset of the financial crisis. In fact, volumes of studies have been produced which investigate the relationship between competition and stability, ranging from single country studies to cross- country studies (Anginer et al., 2014; Ariss, 2010b; Berger et al., 2009). Two dominant hypotheses are available in the banking literature with regards to relationships between competition and stability. These hypotheses are often referred to as the competition–fragility hypotheses and the competition–stability hypotheses. The former argues that market power (as opposed to competition) increases stability, since banks with greater market power have the ability to reduce the asymmetric information problem, and have higher quality screening and monitoring methods to select credit worthy borrowers, as well as the ability to charge higher interest rates (Besanko and Thakor, 1993; Keeley, 1990; Petersen and Rajan, 1995). However, this conventional idea is challenged by recent studies which conclude that competition increases stability, since more competition helps banks to be more innovative and more efficient and eventually increases their stability (Boyd and De Nicolo, 2005; Caminal and Matutes, 2002; Dima et al., 2014; Nicoló et al., 2006). Both views enjoy theoretical and empirical support and hence no conclusive findings are available to date.

While there is ample literature on the effects of competition on stability for different economies and regions, studies that investigate the ‘transmission mechanism’ through which competition affects stability are scarce. Studying the transmission mechanism between competition and stability is especially important for policy makers in the design of a bank's stability-enhancing policy. Existing competition–stability theories indicate that 'efficiency' could be one of the transmission mechanisms through which competition affects stability (Dima, Dincă, and Spulbăr, 2014). We argue that if competition increases, and in order to survive in the more competitive market banks will diversify, introducing new and innovative products and services and reducing their cost, efficiency will increase. Thus, efficiency can positively affect stability (Schaeck and Cihák, 2014).

The alternative view could be that when market power increases, banks will pay lower interest rates, save on the cost of screening and monitoring by engaging in 'relationship-type' banking, which may increase the efficiency of banking and also have a positive impact on stability. Whether market power or competition has the more substantial impact on stability in the banking system, the role of efficiency as a channel mechanism is relatively unknown to the policy makers. Our research attempts to contribute to the literature by combining these two strands of literature through incorporating efficiency as a channel mechanism.

In order to investigate whether efficiency plays a vital role as a channel between competition and stability, we apply the three dominant hypotheses in the banking literature. The first hypothesis describes the relationship between competition and efficiency, the second investigates the relationship between efficiency and stability, and the third looks at how competition affects stability. The first competition–efficiency hypothesis argues that in a non-competitive environment, managers have the ability to extract a higher rent and are not challenged to improve the quality of service, thus lowering the efficiency of firms. According to this hypothesis, competition increases the efficiency of firms. The efficiency–stability hypothesis argues that efficient banks have better screening and monitoring mechanisms for the borrowers, helping to lower the default probability of the banks. Furthermore, efficient allocation of resources also helps to increase the stability of banks. Finally, the competition–stability hypothesis argues that competition makes a firm more innovative and forces banks to have better credit risk management, which makes banks more stable. Combining the findings from these three hypotheses would help to establish whether efficiency is an appropriate channel through which to transmit competition into stability. We postulate that if competition increases efficiency (accepting the first hypothesis) and efficiency increases stability (accepting the second hypothesis) and also that competition increases stability (accepting the third hypothesis), then it can be established that competition enhances stability through the efficiency mechanism. Alternatively, if market power influences positively affect the level of efficiency, and efficiency positively affects stability, we conclude that market power increases efficiency, and efficiency is translated into stability.

Existing empirical studies examine each of these three hypotheses individually in different studies. For example, Berger (1995); Färe, Grosskopf, Maudos, and Tortosa-Ausina (2015) and Chortareas, Garza-Garcia, and Girardone (2011) investigate the competition and efficiency hypothesis; Koutsomanoli-Filippaki and Mamatzakis (2009); Saeed and Izzeldin (2014) and Koetter and Porath (2007) investigate the efficiency–stability hypothesis; and Anginer et al. (2014); Fiordelisi and Mare (2014); Fungáčová and Weill (2013) investigate the competition–stability hypothesis. However, to the best of our knowledge, the transmission mechanism between competition and stability has not been studied in the literature by combining all three hypotheses in a single study.

Our paper is closely related to two other studies that investigate the transmission mechanism between competition and stability in the banking sector. First, Schaeck and Cihák (2014) investigate the transmission mechanism between competition and stability by using a sample of European banks for the year 1995–2005. Using the Boone (2008) indicator as a proxy of competition and the Z-score as a proxy of stability, they identify that competition affects stability through efficiency. Without explicitly measuring efficiency, here they argue that the Boone indicator is a function of efficiency, thus a negative relationship between the Boone indicator (the higher the Boone indicator, the lower the competition) and the Z-score would indicate that competition increases stability through the efficiency mechanism. The other study that investigates the transmission mechanism between competition and stability is that of Dima et al. (2014). Using macro-economic data from 63 developed and developing economies, they conclude that large and efficient banks are able to benefit from sector concentration and capital market development. They use the Lerner index as a measure of competition and the Z-score as a measure of stability to test the relationship between competition and stability.

However, neither of these studies considers efficiency exclusively in their analysis, and hence results from these studies have been difficult to interpret and also difficult to draw conclusions from regarding the role of efficiency as a transmission mechanism between competition and stability. Our research aims to advance the literature by combining the three hypotheses and to provide comprehensive evidence with regards to the transmission mechanism between competition and stability.

Investigating the competition–efficiency–stability nexus in the context of Islamic and conventional banks is interesting during a time when, for the last two decades, Islamic banking has been experiencing unprecedented growth. Although enjoying strong growth, Islamic banks face fierce competition from their counterpart conventional banks in most of the economies in which they operate. Therefore, the sustainability of Islamic banks in the long run is a concern for the regulators. Furthermore, conventional banks are well established and have a long history compared to Islamic banks, and thus may have more expertise and know-how than Islamic banks, thus making them more efficient. However, there is no clear empirical evidence on the impact of competition on stability comparing these two banking sectors, and also no study is available on the role of efficiency on stability. Thus our study provides a timely contribution to the regulators with regards to the competition–efficiency–stability nexus for both banking systems.

Our study contributes to the literature in three ways. First, we investigate the inter-temporal relationships among competition, efficiency and stability by linking them with each other using three dominant hypotheses, which the first study of this nature in the banking literature. Applying these three hypotheses to investigate the relationships among these three variables helps to clearly identify the transmission mechanism between competition and stability. Second, this is the first study that examines the competition–efficiency–stability nexus in the context of Islamic and conventional banks by using a large dataset that comprises 324 banks from 13 countries for the years 2000–2012. Third, we use a variety of estimation techniques such as the generalised method of moments (GMM) method, which is robust in dealing with the endogenity issue; the Tobit model, which is preferable when the dependent variable lies between zero and one, and also the ‘distance-to-default’ model as a proxy for credit risk in sensitivity analysis, which is a robust proxy for credit risk.

On a preview of results, our study rejects the competition–efficiency hypothesis, *partially* accepts the efficiency–stability hypothesis and rejects the competition–stability hypothesis for both banking systems. We find that, first, market power significantly increases the efficiency for both banking sectors, however in a higher magnitude for Islamic banks, thus we reject the competition–efficiency hypothesis. Second, efficiency significantly positively affects the stability for conventional banks but has no significant impact on stability in Islamic banks. Third, market power increases the stability for both banking sectors. Combining the findings from these three hypotheses, we can conclude that market power significantly increases the stability of banking systems; however, our results cast doubt on 'efficiency' as a transmission channel between competition and stability, since we find that efficiency has significant impact on stability in conventional banks but not in Islamic banks. We postulate that, with a greater market power, Islamic banks have the ability to pay less interest (profit) to the depositors and save this cost, thus gaining greater cost efficiency, however, because of lack of experience and skills, Islamic banks are not able to translate this efficiency into stability, as reflected in our results.

Our results have a number of policy implications. Among others, this research indicates that market power is an important driving force of stability for those countries where dual-banking systems exist. Regulators should limit that competition among those countries. Furthermore, we do not find any significant difference between conventional and Islamic banks with regards to the effect of competition on stability, but we do with regards to the impact of efficiency on stability. Islamic banks need mechanisms and expertise to turn the level of efficiency into stability.

This chapter is structured as follows. Section 2 reviews the literature exploring the possible relationships among competition–efficiency–stability. Section 3 discusses the methodology, Section 4 discusses the descriptive statistics of the variables, Section 5 discusses the empirical results and Section 6 concludes the paper.

2. Hypothesis Development

Since this research aims to establish the link between competition–efficiency–stability, we first analyse the relationships between competition and efficiency, efficiency and stability, and competition and stability.

2.1. Competition–Efficiency Hypothesis

During the last three decades, the competition–efficiency hypothesis has been one of the most widely investigated hypotheses in industrial organization literature. Vast amounts of literature have examined this hypothesis in the banking industry, since competition is one of the vital factors in the financial sector. Maudos and de Guevara (2007) mention three hypotheses to describe the relationship between competition and efficiency. These are the 'structure–conduct–performance hypothesis' 'efficient–structure' hypothesis and 'relative market power' hypotheses. Another hypothesis, namely the 'quiet life hypothesis' is a special case of the relative market power (RMP) hypothesis which is used widely in the banking sector. We describe all four hypotheses respectively, with empirical evidence that is applied mostly in the banking sector.

The first hypothesis, 'structure–conduct–performance' (S–C–P), states that higher concentration or more market power brings higher profit for the firm (Bain, 1956). The term 'structure' refers to the number of firms in the industry (banks in the financial industry), the term 'conduct' refers to the behaviour of the banks in the markets and 'performance' refers to the quantity and quality of products and services provided by the banks in the industry. This hypothesis assumes that a high entry barrier for a new entrant in the banking sector will lead to a highly concentrated market structure. This high concentration structure will produce low-cost collusions between the firms in the industry, and that collusion enables banks to translate it into higher profit. This hypothesis also asserts that the concentration is inversely related to competition. Furthermore, a positive relationship exists between market structure and firm performance. This hypothesis could be supported if concentration has a positive significant impact on performance, irrespective of the efficiency of the firm (Lloyd-Williams, Molyneux, and Thornton, 1994).

As opposed to the S–C–P hypothesis, the efficient structure hypothesis provides an alternative explanation with regards to a positive relationship between concentration and profitability. According to this hypothesis, the direct relationship between market concentration and profitability is spurious. The additional factor which affects the performance of the banking industry, other than concentration, is efficiency (Demsetz, 1973). This hypothesis argues that higher profitability is not necessarily because of higher concentration; it might be the result of higher efficiency of individual firms. Firms with higher efficiency enjoy higher profits through X-efficiency or scale efficiency and obtain more market share, and thus, banking systems become more concentrated.

The third hypothesis that describes the relationship between competition and efficiency is the ‘relative market hypothesis’, proposed by Shepherd (1983). According to this hypothesis, market share could be the proxy of market power since it accommodates the efficiency and product differentiation as well as the market power of banks. Finally, the ‘quiet life hypothesis’ – a special case of relative market power hypothesis – postulates that when market power increases, managers may pursue an objective other than profit maximization, and banks have less incentive to reduce the cost, thus enjoy a quiet life (Hicks, 1935). According to this hypothesis, the higher the market power, the lower the effort of managers to maximize managerial efficiency. Therefore a negative correlation exists between market power and efficiency. Acceptance of the quiet life hypothesis would indicate that competition increases efficiency.

Empirical evidence with regards to the competition–efficiency nexus in the banking industry varies greatly among the studies due to various methodologies used to measure competition and efficiency, different economies and different time periods used in the studies. A number of methods have been used to measure competition, such as the concentration ratio, the Panzar and Rosse (1987) model, the Lerner (1934) index and the Boone (2008) indicator. On the other hand, both parametric approaches, such as the stochastic frontier analysis (SFA), and non-parametric approaches, such as data envelopment analysis (DEA), have been used to measure the efficiency of banks.

One of the pioneer studies by Berger (1995) investigates four hypotheses regarding the competition–efficiency nexus by using a number of datasets and a number of techniques to provide robust empirical findings regarding these hypotheses. These hypotheses are the traditional structure–conduct–performance hypothesis, the relative market power hypothesis, and two versions of the efficient structure hypothesis. The author finds limited support for the efficient market structure hypothesis, especially for X-efficiency and the relative market power hypothesis, and does not find any support for traditional structure–conduct–performance hypothesis and the scale efficiency hypothesis. All of these hypotheses have been tested with profitability as measured by ROE.

Recently, Chortareas et al. (2011) conducted a very similar study by using data from nine Latin American countries for the period 1997–2005. Similar to the previous study, they also investigate all four hypotheses by using bank level data for a sample of over 2,500 observations. Their findings support the efficient market hypothesis and reject both the S–C–P hypothesis and the RMP hypothesis. Market power is measured by the Herfindahl-Hirschman Index (HHI), efficiency is measured by using data envelopment analysis, and profitability is measured by ROE. They find a negative and significant association between market power and profitability.

Recent studies have focused more on investigating the direct relationship between competition and efficiency that is consistent with the quiet life hypothesis. Studies that investigate the impact of competition on efficiency find both positive and negative associations between competition and efficiency, and therefore findings remain inconclusive. For example, Andrieş and Căpraru (2014) investigate the relationship between competition and efficiency in the European banking industry for the period 2004–2010. Using the Granger causality approach, they find that competition increases efficiency for all groups of countries except the non-euro zone. In this study, competition is measured by H-statistics, and efficiency – cost and profit – is measured by the SFA method. Another study by Delis and Tsionas (2009) also shows that market power is negatively significantly correlated with efficiency, indicating that higher market power lowers efficiency. Contrary to other studies, this study estimates the market power of banks by using the local maximum likelihood (LML) method that overcomes the problem of other proxy of competition, such as the Lerner index faces.

Conversely, a number of studies find support for the market power–efficiency nexus. Weill (2004) investigates the relationship between competition and efficiency in banking on a sample of 12 EU countries during the period 1994–1999. Contrary to traditional views, the author provides evidence of a negative relationship between competition and efficiency. Casu and Girardone (2009) provide empirical evidence to reject the quiet life hypothesis, stating that competition negatively Granger–causes efficiency (measured by the Lerner index). In this study, they investigate the competition–efficiency hypothesis for five EU countries for the period 2000–2005. Cost efficiency is measured using both parametric and non-parametric ways, and competition is measured by the Lerner index. Maudos and de Guevara (2007) investigate the relationship between market power and efficiency, considering the welfare loss in the economy for EU countries between 1993 and 2002. This study rejects the quiet life hypothesis, indicating that market power is positively correlated with cost efficiency. Competition is measured by the Lerner index and efficiency is calculated using the SFA method. The authors state a number of reasons with regards to this positive relationship between market power and efficiency. While most of the studies were conducted on developed countries, a study by Ariss (2010b) conducted on developing countries shows that market power is negatively correlated with cost efficiency, however, it shows a positive correlation with profit efficiency.

Having put the discussion above in context, Färe et al. (2015) provide comprehensive results in regards to the competition–efficiency relationship. Using the non-parametric regression technique to investigate the relationship between competition and efficiency, they argue that the relationship between competition and efficiency varies according to the level of market power, the type of efficiency and the type of banking form. Cost efficiency, allocative efficiency and technical efficiency have different types of relationships with market power (measured by the Lerner index). Also, the results vary greatly between savings banks and commercial banks. Finally, they conclude that the relationship between competition and efficiency is not linear. Based on the above discussion, we develop the following hypotheses to be tested as follows:

$H1_n$: Competition significantly increases efficiency

$H1_a$: Market power significantly increases efficiency.

2.2. Efficiency–Stability Hypothesis

According to this hypothesis, greater efficiency will translate into enhanced stability, since the bank will have a better asset quality and that will reduce the likelihood of default (Schaeck and Cihák, 2014). Berger and DeYoung (1997) develop four hypotheses to describe the relationship between efficiency and default risk, which are: the 'bad luck hypothesis', the 'bad management hypothesis', the 'skimping hypothesis' and the 'moral hazard hypothesis'. They argue that banks which have a higher credit risk are to be located far from the best practice frontier (Berger and Humphrey, 1992; Wheelock and Wilson, 1995). Furthermore, poor management is unable to control the cost and fails to improve the stability of banks, thus increasing the credit risk. Moreover, inefficient management systems can incur more cost to screen and monitor the performance of borrowers, as well as to seize the collateral of borrowers in times of financial distress, which eventually increases the cost to banks and leads to higher credit risk. Chen (2007) finds that competition increases the efficiency of the screening and monitoring ability of banks, which has a positive impact on stability.

Empirical evidence also tends to suggest that failed banks, or high credit risk banks, have very low cost efficiency (Berger and DeYoung, 1997; Kwan and Eisenbeis, 1995). Using the Granger causality test, Berger and DeYoung (1997) find an inter-temporal relationship between efficiency and loan quality, and that it runs in both directions. These findings support both the bad luck hypothesis and the bad management hypothesis. Koetter and Porath (2007) analyse the relationship between efficiency and default risk for German banks for the period 1993–2004. According to their findings, an increase in efficiency reduces the probability of default and also increases profits. Supporting the efficiency structure hypothesis, they conclude that policy makers should encourage efficiency enhancing mechanisms such as competition and innovation. They argue that these efficiency enhancing mechanisms will not have any immediate adverse effect on risk and profitability for the banking sector.

Koutsomanoli-Filippaki and Mamatzakis (2009) investigate similar hypotheses as Berger and DeYoung (1997) for European Union (EU) countries over the period 1998–2006. Three alternative measures of efficiency, namely productive, cost and profit efficiency are used as a measure of performance, and Merton's distance-to-default model is used as a proxy of credit risk. Using the panel vector auto regressive (PVAR) method, they find that risk causes inefficiency in most of the cases, and in some cases reverse causality is also found with EU banking systems. They provide evidence to support both the bad management hypothesis and the moral hazard hypothesis.

The only study which investigates the relationship between efficiency and stability by comparing conventional and Islamic banks is by Saeed and Izzeldin (2014). Similar to the previous study mentioned, this study also uses the PVAR framework to identify the causality/reverse causality between efficiency and default risk. According to their findings, a decrease in default risk is associated with a lower efficiency level for conventional banks, and causality from profit efficiency to default risk is inversely related for all categories except Islamic banks. There is a trade-off between efficiency and default risk for conventional banks only.

Based on the foregoing discussion, we develop the following hypotheses to be tested:

$H2_n$: Efficiency significantly increases stability

$H2_a$: Efficiency significantly decreases stability.

2.3. Competition–Stability Hypothesis

The competition–stability nexus is a widely investigated research area in the banking literature. Competition is considered as a double-edged sword in the banking industry, as healthy competition is required for bringing stability, while excess competition may have a severe impact on the banking industry. Both views: competition–fragility and competition–stability enjoy theoretical and empirical support in the literature. The competition–fragility view argues that banks with greater market power have better screening and monitoring ability to distinguish the credit-worthy borrowers, helping to lower the default risk of the banks (Besanko and Thakor, 1993; Petersen and Rajan, 1995). Furthermore, excessive competition may erode the charter value of the banks and force banks to diversify their portfolio into riskier businesses, hence, increase the default risk. On the other hand, recent literature challenges this paradigm by arguing that excessive market power may induce the banks to take additional risk, or they may suffer from the moral hazard problem since incumbent banks receive subsidies under the ‘too-big-to-fail’ policy, which, indeed, increases the default risk for banks (Boyd and De Nicolo, 2005; Caminal and Matutes, 2002).

As stated earlier, empirical evidence also provides mixed results with regards to the relationship between competition and stability. Keeley (1990) finds that an increase in competition caused the charter value of banks to decline, which in turn led to an increase in default risk. In another study, Fungáčová and Weill (2013) find evidence for the competition–fragility hypothesis, using quarterly data from 2001–2007 from the Russian banking sector, concluding that market power, as measured by the Lerner index, was negatively associated with bank failure. Elsewhere, Roman (2012) investigates the role of competition during a period of financial crisis in the US banking sector over the period 1986–2010. Using the Lerner index as a measure of competition, he finds that competition led to less financial stability, thus supporting the competition–fragility view.

Some empirical evidence also exists supporting the competition–stability hypothesis. According to this hypothesis, more competition (or typically less concentration) increases banking sector stability. For instance, Nicoló et al. (2006) examine the competition–stability hypothesis using two different datasets, one cross-sectional data on US banks, and the other, bank-year data from 134 non-industrial countries. Consistent with their theoretical findings (Boyd et al, 2005), they provide empirical evidence that the probability of bank failure is positively and significantly correlated with concentration. In another single country study, Yaldiz and Bazzana (2010) provide evidence supporting the competition–stability hypothesis for the Turkish banking sector:

$H3_n$: Competition significantly increases stability

$H3_a$: Market power significantly increases stability.

2.4. Competition–Efficiency–Stability Nexus

The only two studies that investigate the competition–efficiency–stability nexus by arguing that competition increases (decreases) stability through the efficiency mechanism are by Schaeck and Cihák (2014) and Dima et al. (2014). Schaeck and Cihák (2014) provide evidence that competition enhances stability, and efficiency is the conduit through which competition enhances stability. Using data from 3,325 banks from EU countries over the period 1995–2005, they investigate the nexus between competition and efficiency, and efficiency and stability. The Boone indicator is used to measure competition, and financial stability is measured by using the Z-score. In this research, the Boone indicator is assumed to gauge the effect of efficiency and therefore a positive relationship between competition and stability is explained, as competition affects stability through efficiency. Dima et al. (2014) argue that banks' soundness, the structural characteristics and efficiency of the banking sector, along with the development of capital markets, formulates a financial nexus. For an international set of banks, they find that efficiency significantly modulates the linkages between concentration and soundness. Moreover, they provide evidence that development in capital markets helps to increase the stability of the banking sector. Similar to the previous study, this research also does not measure efficiency nor does it test whether efficiency is a direct mechanism that translates competition into stability or fragility.

3. Methodology

3.1. Data

First, we begin with the countries from the Organization of Islamic Cooperation (OIC) that have both conventional and Islamic banks. The initial screening results in 21 countries that fit the criteria. Second, because of the lack of availability and inconsistency in the data of the required variables, we remove another eight countries, and the final sample becomes thirteen countries that have both Islamic and conventional banks. From these sample countries, we select those banks that have been observed for at least three consecutive years. This results in 254 conventional and 70 Islamic banks and the number of observations are 1,995 and 358 for conventional and Islamic banks respectively. To remove the outlier, we winsorize all the variables at the 1% and 99% level. Data have been collected from a number of sources. Bank specific variables are collected from Bankscope, and macro-economic variables are collected from the World Bank database and the Heritage Foundation. Bank-specific missing data were collected manually from annual reports.

3.2. Variable Descriptions

To investigate whether efficiency is an appropriate channel through which competition affects stability, we test the three hypotheses developed in Section 2 by estimating following equations:

Efficiency= f(Competition, Bank Controls, Macro Controls) (1)

Stability= f(Efficiency, Bank Controls, Macro Controls) (2)

Stability= f(Competition, Bank Controls, Macro Controls) (3)

In the following sections, we describe the variables used in the regression.

3.3. Competition Measures

Generally, the empirical approaches to measuring bank competition can be divided into two groups: traditional and new industrial organization (NIO) methods. The traditional approach is based on the structure–conduct–performance, which assumes that banks in more concentrated markets are more profitable than those in a competitive environment. Thus bank competition can be proxied by structural measures of market concentration such as the HHI or the market of the n-largest banks in the system (Fungáčová and Weill, 2013). However, empirical studies suggest that concentration is generally a poor measure of bank competition (Bikker and Haaf, 2002). The alternative approach to measuring competition is called the NIO method, which measures the market power (opposite to competition) directly instead of taking a proxy. The two very popular measures of competition based on the NIO method are the Panzar-Rosse model and the Lerner index. In this study, we adopt the Lerner index as the main measure of competition. Among all the different measures, the Lerner index is the only measure that can be computed at bank level which suits our requirements. Furthermore, the Lerner index is a more accurate measure of market power than the standard concentration measures (Jiménez et al., 2013).

Simply, the higher the score of the Lerner index, the lower the competition. Our calculation of the Lerner index is mainly based on the stochastic frontier estimation approach proposed by Kumbhakar et al. (2012) and Coccorese (2014). This estimation technique has an advantage over other more conventional methods, as argued by Kumbhakar et al. (2012). To start with, there could be an optimization error by the firm in minimizing total costs. In addition, mark-ups calculated using the Lerner procedure should theoretically be non-negative; in practice, the conventional approach generates many non-negative observations (Coccorese, 2014). Measuring the Learner index using stochastic frontier techniques overcomes these problems.

In brief, the Lerner index measures the ability of a firm to set a price above marginal cost. In other words, it directly measures the market power of an individual firm. Mathematically, we express this as follows:

$$Lerner_{it} = P_{it-} - MC_{it} / P_{it} \qquad (4)$$

where P_{it} and MC_{it} are the price and marginal cost of the output of the bank i in year t. We calculate the price of output using the ratio of total revenues to total assets following Fungáčová and Weill (2013) and Fiordelisi and Mare (2014). In line with recent studies, we estimate marginal cost using a translog cost function comprising one output, Q_{it} (loans) and three input prices, W_{hit} (h = deposits, labor and capital), as follows:

$$LnTC_{it} = \alpha_0 + \alpha_1 \ln Q_{it} + \sum_{h=1}^{3} \alpha_h \ln W_{hit} + \frac{1}{2}\alpha_{QQ} (\ln Q_{it})^2 + \frac{1}{2}\sum_{h=1}^{3}\sum_{k=1}^{3} \alpha_{hk} \ln W_{hit} \ln W_{kit} + \sum_{h=1}^{3} \alpha_{Qh} \ln Q_{it} \ln W_{hit} + \alpha_E \ln E_{it} + \frac{1}{2}\alpha_{EE} (\ln E_{it})^2 + \sum_{h=1}^{3} \alpha_{Eh} \ln E_{it} \ln W_{hit} + \alpha_{EQ} \ln E_{it} \ln Q_{it} + \alpha_T T + \alpha_{TT} T^2 + \sum_{h=1}^{3} \alpha_{Th} T \ln W_{hit} + \alpha_{TQ} T \ln Q_{it} + \varepsilon_{it} \tag{5}$$

where E is each bank's total equity, T is a time trend that captures technological change and ε is the error term. Total equity (E) in this model accounts for the possible use of capital as a source of loan funding. This is in line with the intermediation approach to bank behaviour where deposits are an intermediate input for producing loans. To impose the symmetry condition and linear homogeneity restrictions, we divide the total cost and the prices of all inputs by the price of labour. As a result, the translog cost function becomes:

$$LnTC_{it} / W_{3it} = \alpha_0 + \alpha_1 \ln Q_{it} + \sum_{h=1}^{3} \alpha_h (\ln W_{hit} / W_{3it}) + \frac{1}{2}\alpha_{QQ} (\ln Q_{it})^2 + \frac{1}{2}\sum_{h=1}^{3}\sum_{k=1}^{3} \alpha_{hk} (\ln W_{hit} / W_{3it})(\ln W_{kit} / W_{3it}) + \sum_{h=1}^{3} \alpha_{Qh} \ln Q_{it} (\ln W_{hit} / W_{3it}) + \alpha_E \ln E_{it} + \frac{1}{2}\alpha_{EE} (\ln E_{it})^2 + \sum_{h=1}^{3} \alpha_{Eh} \ln E_{it} (\ln W_{hit} / W_{3it}) + \alpha_{EQ} \ln E_{it} \ln Q_{it} + \alpha_T T + \alpha_{TT} T^2 + \sum_{h=1}^{3} \alpha_{Th} T (\ln W_{hit} / W_{3it}) + \alpha_{TQ} T \ln Q_{it} + \varepsilon_{it} \tag{6}$$

In this equation, the error term ε_{it} is a two-component error term $\varepsilon_{it} = \upsilon_{it} + \nu_{it}$ where ν_{it} is a two-sided error term representing noise, and υ_{it} is a one-sided disturbance term representing inefficiency. We estimate this equation using maximum likelihood techniques. From Equation 3, we calculate *MC* as follows:

$$MC_{it} = \frac{TC_{it}}{Q_{it}}[\widehat{\alpha}_1 + \widehat{\alpha}_2 \ln Q + \sum_{h=1}^{3} \widehat{\delta}_j \ln W_{hit} \tag{7}$$

Once the marginal cost is estimated and the price of output computed, we can calculate the Lerner index for each bank by replacing these two values in Equation 4.

3.4. Efficiency Measures

A voluminous body of literature investigates the level of efficiency in the banking sectors. There are two dominant ways of measuring efficiency, namely parametric and non-parametric methods. Researchers usually measure productive, cost and profit efficiency by using both parametric and non-parametric methods. Each technique has its own advantages and limitations. Stochastic frontier analysis (SFA) is one of the very popular parametric ways of measuring efficiency. Following some recent studies on banking efficiency (Ariss, 2010b; Saeed and Izzeldin, 2014), we employ the SFA method developed by Aigner, Lovell, and Schmidt (1977) and Meeusen and Van den Broeck (1977). One of the main attractions of using SFA over the other methods is the possibility it offers for a richer specification, especially if the data type is panel and if it is a cross-country analysis (Hjalmarsson, Kumbhakar, and Heshmati, 1996). Furthermore, it has the ability to disentangle the inefficiency term from the residual.

Simply, this methodology computes the inefficiency of a bank if the bank incurs higher cost than a best-practice bank’s cost to produce the same quantity of output. A bank can be more inefficient than its best practice peer in three ways. Either the bank is wasting some of its inputs (technical efficiency) or it is using the wrong combination of inputs to produce outputs (allocative efficiency) or it could be both. For the sake of simplicity in our analysis, we consider only cost efficiency.

In a perfect competitive market where cost minimization is the primary objective, banks require input quantities (X) at a given price (W) to produce outputs (Q) so that the total cost (TC) is optimal. The model assumes that the total cost deviates from the optimal cost by a random disturbance, and inefficiency forms part of the error term. Thus, the error term consists of two components which are ν and υ respectively. ν is a two-sided component that represents the random disturbance in the model, and υ is a one-sided variable that captures inefficiency relative to the frontier. Both ν and υ are independently distributed. Following Mohanty, Lin, and Lin (2013), we specify the following equation that accounts for heteroscedasticity and permits the single step estimation of the parameters of the cost function as follows:

$$TC_{it}= f(W_{it}, Q_{it}\ E_{it})+ \nu_{it}+\upsilon_{it} \tag{8}$$

and

$$\upsilon_{it} = g(z_{it}; \alpha)+ \varepsilon_{it} \tag{9}$$

Where TC_{it} denotes observed total cost for the bank *I* at year *t*, W_{it} is a vector of input prices, Q_{it} is a vector of outputs of the firm. E_{it} is a vector of fixed netputs and Z_{it} is a vector of control variables. ν_{it} is random fluctuations and is assumed to follow a symmetric normal distribution, and υ_{it} is the firm's inefficiency and is assumed to follow an asymmetric, usually a truncated normal or a half-normal distribution. To empirically implement the cost frontier, we opt for:

$$LnTC_{it} = \alpha_0 + \alpha_1 \ln Q_{it} + \sum_{h=1}^{3} \alpha_h \ln W_{hit} + \frac{1}{2}\alpha_{QQ}(\ln Q_{it})^2 + \frac{1}{2}\sum_{h=1}^{3}\sum_{k=1}^{3}\alpha_{hk} \ln W_{hit} \ln W_{kit} +$$
$$\sum_{h=1}^{3}\alpha_{Qh} \ln Q_{it} \ln W_{hit} + \alpha_E \ln E_{it} + \frac{1}{2}\alpha_{EE}(\ln E_{it})^2 +$$
$$\sum_{h=1}^{3}\alpha_{Eh} \ln E_{it} \ln W_{hit} + \alpha_{EQ} \ln E_{it} \ln Q_{it} + \alpha_T T + \alpha_{TT} T^2 + \sum_{h=1}^{3}\alpha_{Th} T \ln W_{hit} + \alpha_{TQ} T \ln Q_{it} + \nu_{it} + \upsilon_{it} \quad (10)$$

There is a considerable amount of debate in prior literature regarding the definition of cost, outputs and inputs in banking. A number of approaches have been proposed in the literature, such as the production, the intermediation, the asset, the value-added and the user-cost approach to estimate efficiency. Since the main function of banks is to channel funds from depositors to borrowers, the role of banks is mainly intermediary. Hence an intermediation approach is used to select the input and output of the above model. Consistent with the intermediation approach, total cost (TC) is calculated as the sum of interest and non-interest expense. We have selected three output variables and three input prices. Output variables encompass total loans (Q_1), other earning assets (Q_2) and off balance sheet items (Q_3). The input prices are price of labour (W_1), price of capital (W_2) and price of fund (W_3). Price of labour (W_1) is obtained by dividing the total personnel expense by the number of total assets, price of capital (W_2) is the ratio between non-interest expense and total fixed assets, and price of fund (W_3) is the ratio between interest expense and total deposits. To impose the homogeneity restriction, we divide the total cost, total outputs and all input prices by one of the input prices, which is price of fund (W_3). We also include equity capital as a netput to control for differences in risk preference. Since we are measuring efficiency for multiple countries, it is important to control for country heterogeneity. Accordingly, we include country dummies, GDP growth and inflation to control for heterogeneity. Year dummies are also included to control for a time fixed effect. Finally, the translog cost function to estimate cost efficiency is as follows:

$$LnTC_{it} / W_{3it} = \alpha_0 + \alpha_1 \ln Q_{it} + \sum_{h=1}^{3} \alpha_h (\ln W_{hit} / W_{3it}) + \frac{1}{2}\alpha_{QQ} (\ln Q_{it})^2$$ (11)

$$+ \frac{1}{2}\sum_{h=1}^{3}\sum_{k=1}^{3} \alpha_{hk} (\ln W_{hit} / W_{3it})(\ln W_{kit} / W_{3it}) +$$

$$\sum_{h=1}^{3} \alpha_{Qh} \ln Q_{it} (\ln W_{hit} / W_{3it}) + \alpha_E \ln E_{it} + \frac{1}{2}\alpha_{EE} (\ln E_{it})^2 +$$

$$\sum_{h=1}^{3} \alpha_{Eh} \ln E_{it} (\ln W_{hit} / W_{3it}) + \alpha_{EQ} \ln E_{it} \ln Q_{it} + \alpha_T T + \alpha_{TT} T^2$$

$$+ \sum_{h=1}^{3} \alpha_{Th} T (\ln W_{hit} / W_{3it}) + \alpha_{TQ} T \ln Q_{it} + \nu_{it} + \upsilon_{it}$$

The maximum likelihood estimation technique has been used to estimate the equation stochastic frontier Equation 11. Given the specifications of the translog stochastic frontier cost function in Equation 11, the cost efficiency level of individual bank would be calculated as:

Cost efficiency$_{it} \approx \exp(-\upsilon_{it})$

3.5. Financial Stability Measurement

Based on prior research (Ahmad and Ariff, 2007; Berger and DeYoung, 1997; Das and Ghosh, 2007; Fiordelisi, Marques-Ibanez, and Molyneux, 2011; Jiménez, Lopez, and Salas, 2010), we use the non-performing loan ratio as a proxy of financial stability. NPL ratio is measured by the total amount of impaired loan to the net amount of loan. A high NPL ratio indicates the higher probability of a bank's insolvency. One of the advantages of using the NPL ratio as a measurement of financial stability is that it is a direct measurement of a bank's solvency and it is subject to managerial discretion.

3.6. Control Variables

We also introduce a set of control variables that are bank-specific and macro-specific. For bank-specific control variables, we consider the logarithm of total asset (size), equity to asset ratio (ETA), growth of total asset (GTA) and liquidity as measured by ratio of bank deposits to customer deposits. For macro-specific control variables, we incorporate stock market capitalization (SMC), bank concentration (CON), the economic freedom index (EFI), the financial freedom index (FFI), the real gross domestic product growth rate (GDP) and governance (GOV) score. Definitions of the variables, along with the source of data, have been presented in Table 1.

[INSERT TABLE 1 HERE]

3.7. Estimation techniques

Before we estimate Equations 1, 2 and 3, we check the stationary of the variables. As previous literature argues, dependent variable NPL ratio (in Equation 1 and 3) and efficiency (in Equation 2) may follow a unit root process, hinting at a possible co-integrating relationship with other explanatory variables, including our variables of interest (Athanasoglou, Brissimis, and Delis, 2008; Louzis, Vouldis, and Metaxas, 2012). In order to check the stationary of the variables, we run a Fisher-type panel unit root test for all the variables included in the model. Maddala and Wu (1999) suggest using the Fisher test, as this test is based on combining the p-values of the test-statistic for a unit root in each bank. Furthermore, this test performs better than other panel unit tests, as it can be applied for an unbalanced panel dataset that fits with our requirements. The null hypothesis of this test is that all panels contain a unit root process, and the alternative hypothesis is that at least one panel is stationary. The result of the panel unit root test indicates that all variables used in the model are stationary. The results of the unit root test for all the variables are presented in Table 2.

[INSERT TABLE 2 HERE]

Since the data set is panel and the equation model is static at this stage, we begin our primary analysis by estimating Equations 1–3 by using a panel estimation technique. Of the various available panel estimation techniques for the static model, both the random effect and fixed effect model are frequently used in the literature (Sufian, 2011). Hence, we estimate Equation 1–3 by using both the random effect and the fixed effect model. The result of the Hausman test indicates that the fixed model is better than the random effect model (results not reported here).

As argued in the literature, panel data models such as RE, FE or pooled OLS may have biased and inconsistent results due to possible correlations between the unobserved cross and time-specific effects and the regressors (Baltagi, 2008). Furthermore, the literature suggests that the NPL ratio, cost efficiency and competition are endogenous variables, and, finally, like other bank specific variables, NPL and efficiency also show a tendency to persist over time (Jiménez and Saurina, 2004; Louzis et al., 2012). Therefore, we adopt a dynamic specification of the models by including a lagged dependent variable among the regressors, which would also result in correlation between the regressors and the error term. To overcome both the auto-correlation and the endogenity problems, we employ dynamic panel data estimation techniques, namely the GMM estimator proposed by Arellano and Bond (1991).

A general dynamic model specification is as follows:

$$y_{it} = c + \delta y_{it-1} + \beta(L)X_{it} + \varepsilon_{it} \quad i = 1, \ldots, N;\ t = 1, \ldots, T \qquad \varepsilon_{it} = \nu_i + \upsilon_{it} \tag{12}$$

where subscript i denotes the number of the cross sectional and t denotes the time dimension of the panel sample, y is the dependent variable (NPL or efficiency), y_{it-1} is the lagged dependent variable, X_{it} is the k×1 vector of explanatory variables including the variable of interest other than the y_{it-1}, ε_{it} is the disturbance with ν_i the observed bank-specific effect and υ_{it} the idiosyncratic error. Here, the assumption is that ε_{it} follows a one-way error component model

where $\nu_i \sim$ IID(0, $\sigma 2\nu$,) and independent of $\upsilon_{it} \sim$ IID(0, $\sigma 2\upsilon$). δ indicates the speed of adjustment to equilibrium. As Athanasoglou et al. (2008) argue, a value of δ between 0 and 1 indicates that NPL/efficiency persists and they return to their level. A value of δ close to 0 means that the industry is highly competitive, and a value of theta close to 1 indicates a less competitive level in the industry.

While in the literature both the two-step system GMM and the difference GMM are widely applied, we estimate the equation based on the two-step system GMM, since it provides more reliable results when the variables are close to a random walk (Roodman, 2009). The system GMM estimator uses the levels equation to obtain a system of two equations: one differenced and one in levels. This allows the introduction of more instruments and can improve efficiency. Furthermore, for unbalanced panel data, system GMM is preferable to difference GMM (Roodman, 2009). We apply the Windmeijer (2005) finite-sample correction to the reported standard errors in system GMM, since standard errors obtained from the two-step system GMM are severely downward biased. Specifying Windmeijer corrected standard errors also produces variance-covariance estimates that are robust to heteroscedasticity.

Consistency of GMM estimation heavily depends on two important conditions: validity of instruments used in the moment conditions and the assumption of serial independence of the residuals. In order to check the over-identification of valid instruments used in the regression, we use the Hansen specification test (as proposed by Arellano and Bond, 1991; Blundell and Bond, 1998). Under the null hypothesis of valid moment conditions, the Hansen test statistics are asymptotically distributed as chi-square. Furthermore, we check the no second-order autocorrelation using the method proposed by Arellano and Bond (1991).

Based on the above discussion we rearrange our regression equation as follows:

$$\text{Efficiency} = C + \delta\ \text{Efficiency}_{t-1} + \beta_1\ \text{Competition} + \Sigma\ \beta_2\ X_{it}^{l} + \varepsilon_{it} \quad (13)$$

$$\text{Financial Stability} = C + \delta\ \text{Financial Stability}_{t-1} + \beta_1\ \text{Efficiency} + \Sigma\ \beta_2\ X_{it}^{l} + \varepsilon_{it} \quad (14)$$

$$\text{Financial Stability} = C + \delta\ \text{Financial Stability}_{t-1} + \beta_1\ \text{Competition} + \Sigma\ \beta_2\ X_{it}^{l} + \varepsilon_{it} \quad (15)$$

Where C is constant, efficiency represents the cost efficiency measured by SFA, competition is measured by the Lerner index, and financial stability is measured by the NPL ratio. X_{it}^{l} are the explanatory variables and ε_{it} is the error term.

4. Summary Statistics

4.1. Competition by Country

Descriptive statistics of competition by country are presented in Table 3. We begin our analysis by investigating the competitiveness of the banking industry among sample countries. As noted earlier, the higher the score of the Lerner index, the higher the market power is. In general, Islamic banks in Bahrain, Egypt, Jordan, Qatar, Saudi Arabia and Turkey have statistically significantly higher market power than their counterpart conventional banks in the same economy. On the other hand, Islamic banks in Bangladesh, Indonesia and the UAE have significantly lower market power than conventional banks, while Kuwait, Malaysia, Pakistan and Yemen do not show any significant difference between Islamic and conventional banks in terms of market power. Furthermore, among the sample countries, the banking industry in Bahrain is the least competitive banking sector compared to other sample countries, whereas the Egyptian banking industry is the most competitive. Overall, Islamic banks have significantly higher market power than conventional banks. Our results are consistent with the findings of Ariss (2010a) and Neila Boulila Taktak, Hamza, and Kachtouli (2014), who also find that Islamic banks have significantly higher market power than conventional banks.

[INSERT TABLE 3 HERE]

4.2. Efficiency by Country

Efficiency analysis by country is presented in Table 4. According to this table, Islamic banks in Bahrain, Bangladesh, Egypt, Indonesia, Kuwait, Malaysia and Saudi Arabia have significantly lower cost efficiency than that of conventional banks in the same economy. Conversely, Islamic banks in Jordan, Qatar, Turkey, the UAE and Yemen have significantly higher cost efficiency scores than conventional banks. In general, it can be concluded that Islamic banks are less cost efficient than conventional banks in most of the sample countries. A comparison of cost efficiency among the sample countries reveals that most of the countries have almost similar efficiency scores, and the mean efficiency score lies between 0.69 and 0.73 among the sample countries. Overall, cost efficiency is significantly higher for conventional banks than Islamic banks. This result is in line with studies by Saeed and Izzeldin (2014) and Kamarudin, Nordin, Muhammad, and Hamid (2014).

[INSERT TABLE 4 HERE]

4.3. NPL by Country

Similar to the Lerner index and efficiency score, the NPL ratio also varies from country to country significantly. From Table 5, we observe that Islamic banks in Bahrain, Jordan and Kuwait have a significantly higher NPL ratio than that of conventional banks in the same countries. On the other hand, Islamic banks in Malaysia, Pakistan, Qatar and Yemen have significantly lower credit risk than conventional banks in the same economies. Moreover, Yemen has the highest NPL ratio and Saudi Arabia has the lowest NPL ratio among the sample countries. The overall NPL ratio is significantly lower for conventional banks than for Islamic banks. The result is consistent with Čihák and Hesse (2010); Beck et al. (2013) and Abedifar et al. (2013).

[INSERT TABLE 5 HERE]

4.4. Summary Statistics

Summary statistics of all dependent and independent variables are presented in Table 6. Credit risk proxy – the NPL ratio – has an average of 9.23% for all sample banks, ranging from 0.1% to 61.6% with a standard deviation of 12.7. Comparing conventional banks and Islamic banks, we find that the NPL ratio is higher for conventional banks (9.36%) than for Islamic banks (8.67%). The proxy for market power – the Lerner index – has an average score of 0.17, and varies between 0 and 0.95, with a standard deviation of 0.15. Average Lerner index scores are 0.24 and 0.15 for Islamic and conventional banks respectively, indicating that Islamic banks have significantly higher market power than conventional banks. The average cost efficiency score for our sample countries lies between 0 and 0.93, with an average of 0.71 and a standard deviation of 0.09. It appears from Table 6 that Islamic banks are less cost efficient than conventional banks, as average cost efficiency scores are 0.72 and 0.71 for conventional and Islamic banks respectively. Among the explanatory variables, the average total assets for the full sample are $879 million, and the size of the Islamic banks' assets is significantly lower than the conventional banks. The equity to asset ratio (ETA) has an average score of 15.06% ranging from -77.21% to 100%, with a standard deviation of 15.89. The equity to asset ratio is significantly higher for Islamic banks than conventional banks, with an average of 21.5% for the former and 12.5% for the latter. The average growth of total assets is 24.39% for all banks, while it is 20.8% for conventional banks and 33.94% for Islamic banks, indicating that the growth of Islamic banks is significantly higher than conventional banks. There is no significant difference in terms of liquidity between conventional and Islamic banks, as the average liquidity level is 36.25% and 36.57% for conventional banks and Islamic banks respectively. Among the macro-economic variables, stock market capitalization to GDP has an average value of 40.63%, ranging from 0% to 224.86%, the average bank concentration ratio is 69.21, and the average Economic Freedom index is 55.23. The Financial Freedom index score lies between 0 and 90, with an average of 39.13 among the sample countries. The average GDP growth rate is 5.00%, with a standard deviation of 0.03. A great variation in the inflation rate is observed, ranging between -0.1% and 55%, with an average of 7%. The average governance score is -0.43, with a standard deviation of 0.58.

[INSERT TABLE 6 HERE]

4.5. Correlation Matrix

The correlation matrix is presented in Table 7. Most of the variables exhibit statistically significant correlations. No variables are highly correlated, thus our models are free from the multicollinearity problem. The NPL has a negative significant correlation with all the variables except the equity to asset ratio and inflation. The relationship between Lerner and cost efficiency is significant and positive. Lerner has a significant relationship with all the variables except growth of total assets (GTA). Cost efficiency shows a statistically significant relationship with a number of bank-specific and macro-specific variables.

[INSERT TABLE 7 HERE]

5. Empirical Results

In the following sections, we provide the empirical evidence of the three hypotheses that we developed in Section 2.

5.1. Competition–Efficiency Hypothesis

Empirical results based on the two-step system GMM estimation method are presented in Table 8. Column (1)–(3) represents all banks, (4)–(6) for conventional banks and (7)–(9) for Islamic banks. We begin with the validity tests of the model. The overall fitness of the model is satisfactory, as the Wald test rejects the null hypothesis in all our regressions. To test the presence of dynamic characteristics in the model, we investigate the coefficient and level of significance of the lag dependent variable. In all regressions, the lag dependent variable – cost efficiency – is significantly correlated with the dependent variable, and the coefficient value remains stable in all regressions, which justifies the usage of the dynamic model. Furthermore, we check auto-correlation at first order and second order. In all our regression results, we reject the null hypothesis of no auto correlation existing at first order; however, we cannot reject the null hypothesis of no autocorrelation at second order. The results of Hansen's over-identification test indicate that instruments are properly identified.

Turning to our main regression results, it appears that the Lerner index has a positive and significant relationship with cost efficiency in both Islamic and conventional banks. This implies that a higher market power increases the efficiency for both Islamic and conventional banks. Our findings are in line with those studies (Casu and Girardone, 2009; Fu and Heffernan, 2009; Koetter and Porath, 2007; Maudos and de Guevara, 2007) that reject the quiet life hypothesis, and are in contrast to studies by Ariss (2010b) and Delis and Tsionas (2009), who accept the quiet life hypothesis. Interestingly, the positive significant relationship between efficiency and competition is consistent for both Islamic and conventional banks. However, the magnitude of coefficient differs significantly between Islamic and conventional banks. The effect of market power on cost efficiency is significantly higher for Islamic banks (0.08) than for conventional banks (0.02), implying that Islamic banks with greater market power are more cost efficient than conventional banks. A number of reasons could be behind this. First, as discussed earlier, Islamic banks have greater market power than conventional banks. An increase in market power gives the opportunity to Islamic banks to pay a lower interest rate to the depositors. Since, in number, Islamic banks are very few compared to conventional banks in most of the sample countries, Islamic banks with a greater market power have the ability to pay lower profit (interest) to the borrowers, thus saving the cost. Second, Islamic banks operate business in a close relationship with the customers, where screening and monitoring costs are less than conventional banks. This could be another cause for greater efficiency in Islamic banks when market power increases.

[INSERT TABLE 8 HERE]

Among the control variables, size has a positive and significant relationship with cost efficiency in the full sample as well as in conventional banks. However, it shows a negative significant relationship with efficiency in the Islamic banks sample, indicating that when Islamic banks get bigger, efficiency decreases. The equity to asset ratio also has a positive and significant relationship with efficiency in conventional banks but does not show any significant relationship in Islamic banks. The growth of the total asset ratio has a negative relationship in both Islamic and conventional banks but does not appear to be significant. Similarly, the liquidity ratio has a positive but not significant relationship with efficiency.

With respect to macro-economic variables, stock market capitalization to GDP has a negative relationship with cost efficiency in conventional banks but a positive relationship in Islamic banks. While bank concentration shows a positive relationship with efficiency in conventional banks but shows a negative relationship with Islamic banks, in either case, it is not a significant determinant of cost efficiency. The Economic Freedom index has no significant impact on the efficiency. The GDP growth rate is negatively significant for both Islamic and conventional banks. The good governance score has a positive association with efficiency but does not appear to be significant in either of the banking systems.

5.2. Efficiency–Stability

In this section we investigate the impact of cost efficiency on credit risk, based on the two-step system GMM estimation method as presented in Table 9. The results of the Wald test indicate the overall validity of the model, the independence of the second-order correlation meets the first criteria for GMM estimation and the rejection of the null hypothesis of Hansen's test across the model indicates that instruments are not over identified. The highly significant coefficient of the lagged NPL ratio variable confirms the dynamic character of the model specification. The estimated persistence of NPL ratio is positive for both Islamic and conventional banks, and the level of persistence is higher for Islamic banks than conventional banks, as the mean value of theta (persistence) is 0.631 and 0.824 for conventional banks and Islamic banks respectively. Our variable of interest – cost efficiency – has a significant negative impact on the NPL ratio in the full sample and conventional banks only. However, cost efficiency does not show any significant impact on the reduction of the NPL ratio in Islamic banks, although the relationship is negative. Our findings are consistent with the findings of Berger and DeYoung (1997) and Koetter and Porath (2007), who find that an increase in efficiency reduces the default probability of banks. However, it contradicts the findings of Koutsomanoli-Filippaki and Mamatzakis (2009). Our results are also partially consistent with those of Saeed and Izzeldin (2014) regarding the insignificant impact of cost efficiency on the reduction of default probability in Islamic banks. However, Saeed and Izzeldin (2014) find cost efficiency increases default risk for conventional banks, whereas our results support an inverse relationship between cost efficiency and the NPL ratio for conventional banks. A plausible explanation could be that the operational history of Islamic banks is of much shorter duration than that of conventional banks, and thus lack of experience makes them unable to turn efficiency into stability.

Among the bank-specific control variables, the equity to asset ratio has a significant negative impact on the NPL ratio for the full sample and conventional banks. The growth of total assets has a significant negative impact on the NPL ratio, indicating that an increase in total assets lowers the NPL ratio. This could be because of diversification strategy, when a bank diversifies its asset portfolio to a different sector. The liquidity ratio appears to be significant for both banking systems, however, positively in the case of conventional banks and negatively for Islamic banks. Among the macro-economic control variables, an increase in GDP lowers the NPL ratio for both banking systems, which is expected, as per conventional theory.

[INSERT TABLE 9 HERE]

5.3. Competition–Stability

This section presents the impact of competition on stability for both conventional and Islamic banks (Table 10). The results of the Wald test indicate that the overall fitness of the model is appropriate. The rejection of the null hypothesis of Hansen's test and the independence of the second-order correlation provide the validity of results obtained from the GMM estimation technique. Similar to the previously reported result in Table 9, the NPL is a highly persistent variable, which justifies the usage of the dynamic panel data estimation method.

With respect to the impact of market power on the NPL ratio, we find that the Lerner index has a negative and significant impact on the NPL ratio in both banking systems. The Lerner index is significant at 10%, with the NPL ratio in conventional banks at 10% and at 1% in Islamic banks. This indicates that market power is a highly significant determinant of stability for both banking systems. The negative significant relationship between the Lerner index and the NPL ratio lends support to the competition–fragility hypothesis. Our findings are similar to other findings (Ariss, 2010b; Fungáčová and Weill, 2013; Roman, 2012) however; they contradict the findings of Nicoló et al. (2006) and Schaeck et al. (2009).

Regarding the negative relationship between the Lerner index and the NPL ratio, it can be reasonably assumed that, since Islamic banks have greater market power compared to conventional banks, they have the ability to charge higher profit (interest) from borrowers, which helps them to be more stable. Also, a portion of Islamic banks' asset portfolio consists of a profit and loss sharing (PLS) agreement scheme where Islamic banks have the ability to share the loss with the partner, and, because of greater market power, Islamic banks may exercise this right, which may increase the stability of Islamic banks.

As for other control variables, the growth of total assets has a significant negative impact on the NPL ratio for both banking systems, supporting the diversification hypothesis; the equity to asset ratio shows a negative significant relationship with NPL in conventional banks but a positive significant relationship with the NPL ratio in Islamic banks. Liquidity appears to be positively significant for conventional banks but negatively significant for Islamic banks. GDP has a negative significant impact on the NPL ratio, as discussed earlier.

[INSERT TABLE 10 HERE]

5.4. Competition–Efficiency–Stability Nexus

Combining the findings from all three hypotheses, we find that market power increases cost efficiency for both Islamic and conventional banks, however, the degree of magnitude is significantly higher for Islamic banks, implying that Islamic banks that have greater market power are more capable of being more cost efficient than their counterpart conventional banks. The results of the second hypothesis indicate that cost efficiency significantly decreases the NPL ratio for conventional banks, while it does not appear to be significant for Islamic banks. The third hypothesis indicates that market power significantly lowers the credit risk in both banking systems. In summary, we can argue that Islamic banks have greater market power and are more cost efficient than conventional banks, however, Islamic banks fail to convert efficiency into stability. As Islamic banks have greater market power, they have the ability to charge the borrower a higher profit rate and pay a lower profit rate to the depositor, which increases profit margins and helps to increase stability. However, because of lack of experience in the banking industry, Islamic banks are not able to turn this efficiency into stability. Since Islamic banks are growing both in terms of number and asset size, it is important to be more efficient to survive in the long term. In summary, our results reject the competition–efficiency hypothesis, support the efficiency–stability hypothesis and reject the competition–stability hypothesis. This leads us to conclude that market power significantly increases stability, while we cast doubt on whether efficiency is an appropriate transmission mechanism that translates market power into stability; at least, it is not applicable to Islamic banks.

5.5. Sensitivity Analysis

Change in proxy of stability

We run a range of sensitivity check on the baseline model of Equation 1, 2 and 3. First, we employ a new proxy of credit risk that is Merton's distance-to-default (DD). DD is a market-based credit risk measurement technique that is assumed to perform better as a measurement of credit risk than other credit risk proxies such as the NPL ratio or Z-score (Agarwal and Taffler, 2008; Harada, Ito, and Takahashi, 2010). One of the advantages of using distance-to-default as a proxy of credit risk is that it is a forward-looking credit risk measurement system that incorporates future expectations and equity volatility of banks. According to this model, a bank defaults when the market value of assets falls below the book value of liabilities. To calculate the distance-to-default score, we subtract the face value of a firm's debt from the market value of the assets and divide the difference by the estimated volatility of the firm. A fundamental limitation of this measurement is that it can be used only for banks that are listed on the stock exchange, since it requires stock price information. Therefore, it significantly reduces the sample size in our analysis. In this research, we find only nine economies that have listed Islamic and conventional banks. The total number of observations is 258 and 864 for Islamic and conventional banks respectively. We examine the efficiency–stability and competition–stability hypotheses using a DD score as a proxy of stability. We use the fixed effect model to estimate the baseline Equation 2 and 3.

Regression results regarding efficiency–stability and competition–stability are reported in Table 11 and 12. Results from Table 11 indicate that efficiency significantly improves the efficiency in all banks and conventional banks, but has very little impact on the stability of Islamic banks. On other hand, results from Table 12 provide support to the competition–instability/fragility hypothesis, as the Lerner index has a significant positive impact on the DD score. Again, both the level of significance and the magnitude of value of the co-efficient are higher in Islamic banks, indicating that Islamic banks gain more stability compared to conventional banks when market power increases.

[INSERT TABLE 11 HERE]

[INSERT TABLE 12 HERE]

Employing instrumental variable Tobit regression

To further check the robustness of our main empirical findings, we employ the instrumental variable (IV) Tobit regression. The IV Tobit regression is suitable when the value of the dependent variable lies between zero and 1. Since all our variables of interest, competition, efficiency and stability are endogenous, we exploit the opportunity to use the IV Tobit regression. As for the instrument of the variables, we use the lag value of probable endogenous variables. The results of the IV Tobit regression for the competition–efficiency hypothesis, the efficiency–stability hypothesis and the stability–efficiency hypothesis are presented in Tables 13, 14, and 15 respectively.

The results obtained from these three hypotheses greatly support our main empirical findings. From Table 13, we find that market power significantly increases the level of efficiency for both banking systems at 1% significant level for almost all of our models, indicating that greater market power increases efficiency. The results of efficiency–stability (Table 14) indicate that efficiency is significantly lower than the NPL ratio for the full sample and conventional banks. Similar to our main empirical findings, efficiency does not appear to be a significant determinant of default risk for Islamic banks when both bank-specific and macro-economic conditions are controlled. The results reported in Table 15 reject the competition–stability hypothesis for both banking systems, indicating that an increase in market power lowers the default risk significantly in both banking systems. In summary, our findings suggest that market power significantly increases the stability of both banking systems. Further, we find that market power increases efficiency for both banking systems, and Islamic banks are unable to channel efficiency into stability, whereas conventional banks are capable of transmitting efficiency into stability.

[INSERT TABLE 13 HERE]

[INSERT TABLE 14 HERE]

[INSERT TABLE 15 HERE]

6. Conclusion

Since the onset of the financial crisis, literature in the banking sector has intensely focused on the role of competition in stability. Traditionally, it is assumed that competition plays a vital role in the instability of the banking sector, since excess competition may lower the margin, banks may lose the charter value and thus become vulnerable to a financial crisis. However, recent literature challenges this view and provides both theoretical and empirical evidence in support of the competition–stability view. As for the reason, this strand of literature argues that greater competition increases the efficiency in services, helps to bring diversified and innovative financial products and access to financial services. While banking literature generally focuses on the relationship between competition and stability, very little attention has been given to the transmission mechanism between competition and stability.

In this paper we investigate the role of competition on stability and whether 'efficiency' is an appropriate transmission mechanism that translates competition into stability. To study this competition–efficiency–stability nexus, we set three very dominant hypotheses in the banking literature, namely the competition–efficiency hypothesis, the efficiency–stability hypothesis and the competition–stability hypothesis. We test these three hypotheses on the data from 13 economies where both conventional and Islamic banks co-existed for the time period between 2000 and 2012. The Lerner index has been used as a proxy for competition, efficiency is calculated using the SFA method and the NPL ratio has been used as a proxy for credit risk. We apply the two-step system GMM estimation technique to test our three hypotheses and control both the bank-specific and macro-specific factor that could have an effect on the variable of the interest. To check the sensitivity of the results, we use Merton's distance-to-default (DD) as a proxy of credit risk and employ IV Tobit regression as an alternative to the GMM estimation technique.

Our results provide robust support to the competition–fragility hypothesis for both banking systems, as market power is negatively significant with the NPL ratio. However, when we investigate whether efficiency is an appropriate transmission mechanism between market power and stability, we find that market power significantly increases efficiency for both banking systems, though in higher magnitude for Islamic banks; however, efficiency does not significantly contribute in reducing the credit risk in Islamic banks, while efficiency has a significant impact on increasing stability for conventional banks. We postulate that, because of greater market power, Islamic banks have the opportunity to pay less profit (deposit), thus gain higher efficiency; on the other hand, because of lack of experience and resource limitation, Islamic banks are unable to turn this level of efficiency into stability. From these findings, we can conclude that efficiency is an appropriate transmission mechanism for conventional banks but not for Islamic banks, since efficiency does not have an impact on stability in Islamic banks.

The findings from our study have important policy implications. First, our results indicate that market power increases stability for both banking systems, which gives an indication that the level of competition in these economies should be regulated. Second, Islamic banks are not as efficient as conventional banks, and, more importantly, Islamic banks are not able to transfer the level of efficiency into stability. Policy makers and Islamic bank practitioners should emphasize increasing the level of efficiency of Islamic banks and should be equipped to take advantage of turning the level of efficiency into stability. Third, a uniform competition policy can govern both banking systems in those economies, since the impact of competition on stability remains the same for both Islamic and conventional banks.

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Table 1: Variable Definitions and Data Sources.

Variable	Definition	Source
Part A: LI components		
Total revenue	Interest + other operating income	Bankscope
Total cost	Interest + personnel + other operating expenses	Bankscope
Total output	Loans+ other earning asset	Bankscope
Price of deposits	Interest expense/ total deposit	Bankscope
Price of labour	Personnel expense/total assets	Bankscope
Price of capital	Other operating expense/ total fixed assets	Bankscope
Equity	Total equity	Bankscope
Part B: Cost efficiency component		
Total cost (TC)	Interest + personnel + other operating expenses	Bankscope
Total loan (Q_1)	Gross loans	Bankscope
Other earning assets (Q_2)	Other earning assets	Bankscope
Off balance sheet items (Q_3)	Off balance sheet items	Bankscope
Price of labour (W_1)	Personnel expense/total assets	Bankscope
Price of capital (W_2)	Non-interest expense/total fixed asset	Bankscope
Price of fund (W_3)	Interest expense/ total deposit	Bankscope
Equity (E)	Total equity	Bankscope
GDP growth rate	Growth rate of nominal GDP	World Bank Database
Inflation (INF)	Change in CPI	World Bank Database
Part C: Credit risk measurement		
Nonperforming loans (NPL)	Net impaired loans/gross loans	BankScope
Part D: Control variables for regression		
Bank-specific variables		
Total asset (LTA)	Natural logarithm of total assets	Bankscope
Growth of total asset (GTA)	Change in total assets	Bankscope
Equity to asset (ETA)	Gross equity/ total assets	Bankscope
Liquidity (LIQ)	Bank deposit/customer deposit	Bankscope
Macroeconomic variables		
Stock market capitalization (SMC)	Total value of all listed shares in a stock market as a percentage of GDP.	World Development Indicators
Concentration (CON)	% share of assets of three-largest banks	World Development Indicators
Economic Freedom Index(EFI)	Measures the independence of economic decision of an individual	Heritage Foundation
Financial Freedom Index (FFI)	Measures the banking independence ranges between 0 (no freedom) to 100(maximum	Heritage Foundation

Variable	Definition	Source
	freedom)	
GDP	Growth rate of nominal GDP	World Bank
Governance (GOV)	Mean of measures in Kaufmann et.al (2010)	Worldwide Governance Indicators

Table 2:Unit Root Test

	Statistics (t value)			
Variable	**Inverse chisquared(p)**	**Inverse normal (z)**	**Inverse logit(L)**	**Modified inv. chisquared(Pm)**
NPL	2073.48	–8.21	–22.68	–39.25
Lerner	1465.31	–9.52	–14.01	19.96
Efficiency	2547.00	–18.18	–31.59	47.80
LTA	2534.41	0.44	–12.88	39.25
ETA	3423.39	–17.22	–35.26	60.39
GTA	4415.49	–37.26	–56.22	86.02
LIQ	1722.37	–10.25	–18.65	30.15
SMC	1630.84	–17.74	–19.71	19.58
CON	2121.33	–5.82	–15.36	30.25
GDP	1830.93	–12.54	–16.98	22.52
GOV	1395.65	–0.52	–2.56	12.16
EFI	1216.99	–5.42	–9.04	11.06
FFI	4143.18	–32.67	–53.38	85.15

Table 3: Lerner by Country

	All banks						Conventional banks					Islamic banks					
Country	N	Mean	SD	MIN	MAX	Rank	N	Mean	SD	MIN	MAX	N	Mean	SD	MIN	MAX	t stat
Bahrain	182	0.45	0.22	0.07	0.95	1	106	0.39	0.20	0.07	0.84	76	0.54	0.23	0.08	0.95	–4.86***
Bangladesh	360	0.24	0.01	0.02	0.11	3	293	0.25	0.01	0.02	0.11	67	0.23	0.01	0.03	0.07	1.38*
Egypt	88	0.12	0.07	0.02	0.5	13	77	0.11	0.07	0.02	0.50	11	0.15	0.06	0.06	0.23	–1.45*
Indonesia	538	0.22	0.1	0.03	0.51	4	505	0.21	0.10	0.03	0.51	33	0.18	0.09	0.03	0.35	1.54*
Jordan	163	0.19	0.1	0.03	0.42	7	136	0.17	0.09	0.03	0.42	27	0.24	0.10	0.05	0.41	–3.73***
Kuwait	101	0.16	0.08	0.05	0.52	9	63	0.16	0.07	0.07	0.32	38	0.17	0.10	0.05	0.52	–0.24
Malaysia	321	0.15	0.07	0.03	0.45	10	245	0.15	0.07	0.03	0.40	76	0.16	0.07	0.04	0.45	–1.27
Pakistan	257	0.2	0.1	0.04	0.74	6	201	0.20	0.10	0.04	0.74	56	0.20	0.12	0.04	0.61	–0.31
Qatar	92	0.25	0.16	0.04	0.67	2	66	0.19	0.11	0.04	0.52	26	0.39	0.17	0.14	0.67	–65***
Saudi	129	0.21	0.12	0.02	0.59	5	102	0.20	0.10	0.02	0.48	27	0.25	0.18	0.06	0.59	–1.86**
Turkey	286	0.18	0.19	0.01	0.85	8	245	0.19	0.00	0.00	0.00	41	0.12	0.00	0.00	0.00	–2.08
UAE	235	0.14	0.05	0.03	0.29	11	179	0.13	0.05	0.05	0.29	56	0.11	0.04	0.03	0.22	4.03***
Yemen	39	0.13	0.06	0.04	0.29	12	19	0.14	0.06	0.06	0.25	20	0.12	0.07	0.04	0.29	0.77

Notes: Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level.

Table 4: Efficiency by Country

	All banks						Conventional banks						Islamic bank				
Country	N	Mean	SD	MIN	MAX	Rank	N	Mean	SD	MIN	MAX	N	Mean	SD	MIN	MAX	t stat
Bahrain	156	0.72	0.03	0.74	0.82	7	102	0.73	0.02	0.68	0.80	54	0.72	0.05	0.59	0.82	1.35*
Bangladesh	443	0.69	0.16	0.00	0.8	12	359	0.70	0.14	0.00	0.80	84	0.63	0.23	0.00	0.77	3.49***
Egypt	88	0.73	0.02	0.74	0.76	1	77	0.73	0.02	0.69	0.76	11	0.72	0.01	0.70	0.73	2.07**
Indonesia	521	0.72	0.06	0.73	0.92	7	494	0.72	0.06	0.00	0.92	27	0.69	0.04	0.52	0.73	2.76***
Jordan	169	0.72	0.08	0.73	0.87	7	140	0.71	0.09	0.00	0.76	29	0.74	0.04	0.70	0.87	–1.81**
Kuwait	98	0.73	0.02	0.74	0.76	1	64	0.73	0.01	0.69	0.76	34	0.72	0.03	0.64	0.76	2.45***
Malaysia	359	0.72	0.05	0.74	0.82	7	257	0.73	0.03	0.61	0.82	102	0.71	0.09	0.00	0.79	3.64***
Pakistan	168	0.72	0.09	0.74	0.8	7	117	0.72	0.10	0.00	0.80	51	0.71	0.05	0.50	0.77	0.70
Qatar	95	0.73	0.02	0.74	0.78	1	70	0.72	0.03	0.66	0.78	25	0.73	0.02	0.71	0.78	–2.19***
Saudi Arabia	131	0.73	0.02	0.74	0.82	1	99	0.73	0.01	0.69	0.75	32	0.72	0.03	0.57	0.82	2.43***
Turkey	149	0.69	0.19	0.8	0.82	12	147	0.69	0.19	0.24	0.82	22	0.82	0.00	0.82	0.82	–2.46***
UAE	254	0.73	0.02	0.74	0.77	1	195	0.72	0.02	0.67	0.77	59	0.73	0.02	0.70	0.77	–3.00***
Yemen	43	0.73	0.02	0.74	0.78	1	21	0.72	0.01	0.69	0.74	22	0.73	0.02	0.69	0.78	–1.75**

Notes: Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level.

Table 5: NPL by Country

	All banks						Conventional banks					Islamic banks					
Country	N	Mean	SD	MIN	MAX	Rank	N	Mean	SD	MIN	MAX	N	Mean	SD	MIN	MAX	t stat
Bahrain	129	9.05	15.15	0.05	100	5	97	6.48	6.39	0.05	40.29	32	16.82	27.18	0.22	100.00	–3.49***
Bangladesh	393	8.03	10.6	0.01	80.99	7	321	7.72	8.48	0.01	35.79	72	9.42	17.15	0.10	80.99	–1.22
Egypt	79	15.19	14.2	0.63	59.4	2	71	14.84	13.65	1.97	59.40	8	18.27	19.26	0.63	43.98	–0.644
Indonesia	408	6.71	12.31	–0.45	100	9	382	6.54	12.07	–0.45	100.00	26	9.21	15.55	0.23	60.36	–1.07
Jordan	161	14.45	17.06	0.21	104.7	3	139	12.87	15.15	0.21	104.65	22	24.48	24.21	0.77	62.00	–3.04***
Kuwait	99	8.91	9.59	0.04	48.39	6	66	5.98	5.82	0.59	30.33	33	14.77	12.64	0.04	48.39	–4.75***
Malaysia	380	6.45	7.82	0.01	57.33	11	266	6.81	8.16	0.01	57.33	114	5.64	6.92	0.07	48.24	1.33 *
Pakistan	274	12.84	12	0.17	78.76	4	225	13.33	12.31	0.20	78.76	49	10.56	10.27	0.17	40.48	1.46*
Qatar	101	5.06	8.77	0.05	47.54	12	71	6.10	10.18	0.21	47.54	30	2.58	2.40	0.05	10.55	1.86**
Saudi Arabia	147	3.6	4.25	0	27.46	13	104	3.42	3.44	0.24	21.02	43	4.05	5.78	0.00	27.46	–0.81
Turkey	310	7.53	12.97	0	99.42	8	268	7.73	13.76	0.00	99.42	42	6.26	5.72	1.48	31.87	0.69
UAE	231	6.47	6.22	0.01	33.28	10	182	6.51	5.82	0.65	28.38	49	6.30	7.60	0.01	33.28	0.2
Yemen	58	24.58	19.36	0.38	72.03	1	37	34.42	17.02	6.08	72.03	21	7.24	7.18	0.38	27.36	6.9***

Notes: Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level.

Table 6: Summary Variable

	All bank					Conventional banks					Islamic banks					
Variable	N	Mean	SD	MIN	MAX	N	Mean	SD	MIN	MAX	N	Mean	SD	MIN	MAX	t stat
NPL	2668	9.23	12.70	–0.45	124.04	2245	9.36	12.59	–0.45	124.04	423	8.67	13.2	0.00	100	0.61
Lerner	2668	0.17	0.15	0.00	0.95	2245	0.15	0.13	0.00	0.84	423	0.24	0.21	0.00	0.95	–7.77***
Efficiency	2668	0.71	0.09	0.00	0.93	2245	0.72	0.09	0.00	0.93	423	0.71	0.1	0.00	0.93	3.03***
LTA	2668	7.66	2.96	–3.91	18.42	2245	8.12	2.88	–2.41	18.42	423	6.51	2.85	–3.91	16.28	9.03***
ETA	2668	15.06	15.89	–77.21	100.00	2245	12.5	10.71	–44.62	99.78	423	21.5	23.27	–77.21	100	–17.88***
GTA	2668	24.39	44.11	–99.91	820.06	2245	20.8	36.92	–61.5	631.35	423	33.94	58.08	–99.91	820.06	–4.92***
LIQ	2668	36.31	27.97	0.03	405.19	2245	36.3	24.77	0.09	405.19	423	36.57	38.33	0.03	365.84	–1.25
SMC	2668	40.63	47.17	0.00	224.86	2245	40.7	46.19	0	224.86	423	40.55	49.57	0.00	224.86	
CON	2668	69.21	25.04	0.00	100.00	2245	70.4	20.01	0	100	423	66.24	34.47	0.00	100	
EFI	2668	55.23	15.86	0.00	77.70	2245	57.8	9.49	0	77.7	423	49.4	23.8	0.00	77.7	
FFI	2668	39.13	19.26	0.00	90.00	2245	41.1	15.6	0	90	423	34.76	25.13	0.00	90	
GDP	2668	0.05	0.03	–0.41	0.47	2245	0.05	0.03	–0.41	0.47	423	0.05	0.04	–0.10	0.21	
GOV	2668	–0.43	0.58	–1.93	0.79	2245	–0.39	0.52	–1.93	0.79	423	–0.52	0.71	–1.79	0.79	

Notes: Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level.

Table 7: Correlation Matrix

	NPL	Lerner	Efficiency	LTA	ETA	GTA	LIQ	SMC	CON	EFI	GDP	INF	GOV
NPL	1.000												
Lerner	**–0.074**	1.000											
Efficiency	**–0.218**	**0.069**	1.000										
LTA	**–0.154**	**–0.340**	**0.179**	1.000									
ETA	–0.007	**0.377**	**0.187**	**–0.210**	1.000								
GTA	**–0.138**	0.023	**0.043**	**–0.135**	**0.041**	1.000							
LIQ	**0.124**	**0.077**	–0.009	**–0.157**	**0.439**	0.011	1.000						
SMC	**–0.103**	**0.115**	**0.058**	**0.182**	**0.089**	**–0.057**	**0.053**	1.000					
CON	**–0.048**	**0.283**	0.025	**0.214**	**0.155**	**–0.075**	**0.118**	**0.315**	1.000				
EFI	**–0.038**	**–0.075**	**0.042**	**0.283**	**0.075**	**–0.126**	–0.025	**0.417**	**0.172**	1.000			
GDP	**–0.133**	**0.040**	–0.010	0.004	**0.035**	**0.089**	–0.002	**0.152**	**0.142**	**0.045**	1.000		
INF	0.021	**–0.112**	–0.002	**0.109**	**–0.059**	**0.075**	0.024	**–0.214**	**–0.184**	**–0.309**	**–0.153**	1.000	
GOV	**–0.133**	**–0.040**	**0.072**	**0.375**	**0.137**	**–0.087**	0.035	**0.550**	**0.321**	**0.742**	**0.124**	**–0.334**	1.000

Bold figures are significant at 5% significant level.

Table 8: Competition–Efficiency Relationship Results Based on GMM

	All banks			Conventional banks			Islamic banks		
Dependent: Efficiency	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Efficiency(t–1)	0.039	0.054**	0.052*	0.040	0.035*	0.035**	0.067*	0.030**	0.02**
	(.08)	(2.24)	(1.79)	1.04	(1.85)	(2.05)	(1.76)	(2.52)	(2.01)
Lerner	0.046**	0.044**	0.043**	0.054***	0.038	0.0286**	0.030*	0.077**	0.082**
	(2.12)	(2.44)	(2.26)	(3.29)	(2.00)	(–2.21)	(1.98)	(2.17)	(2.34)
LTA		0.024***	0.023***		0.028***	0.045		–0.008***	–0.020**
		(3.93)	(2.98)		(4.62)	(0.00)		(3.40)	(2.54)
ETA		0.001*	0.0019*		0.002**	0.002		–0.000	–0.001
		(1.73)	(1.71)		(2.22)	(0.00)		(0.16)	(0.46)
GTA		–0.001	–0.007		0.002	–0.003		–0.001*	–0.001
		(0.57)	(1.12)		(0.57)	(0.00)		(1.72)	(0.91)
LIQ		0.001	–0.001		0.001	–0.009		0.001	0.001
		(0.80)	(0.56)		(0.02)	(0.00)		(0.70)	(0.77)
SMC			–0.002			–0.007			0.001
			(1.41)			(0.00)			(1.61)
CON			0.001			0.000			–0.001
			(1.07)			(0.00)			(0.06)
EFI			–0.001			0.002			–0.001
			(0.91)			(0.00)			(0.31)
FFI			-0.001			0.001			-0.001
			(0.08)			(0.00)			(0.52)
GDP			–0.223***			–0.230**			–0.194*
			(3.64)			(2.54)			(1.87)
GOV			0.036			0.045			0.004
			(1.51)			(0.00)			(0.18)
Constant	0.717***	0.490***	0.580***	0.714***	0.436***	0.543***	0.564***	0.652***	0.681***
	(210.81)	(9.01)	(4.81)	(205.19)	(7.18)	–3.21	–6.44	8.6	6.68
Wald test	12.21	27.87	24.42	13.24	20.34	35.05	4.95	20.4	31.19
N	2276	2276	2276	1901	1901	1901	375	375	375
AR(1)	–2.45***	–2.5***	–3.20***	–2.46***	–2.09***	–2.75***	–1.85**	–1.19**	–0.98**
AR(2)	–1.7	2.28	1.26	0.93	2.49	1.18	1.88	0.45	0.59
Hansen test	77.53	75.17	71.39	76.32	73.25	75.85	73.77	37.05	32.38

Notes: Figures in parentheses are t-statistics. Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level. Definitions of all variables are listed in Table 1.

Table 9: Efficiency–Stability Relationship Result Based on GMM

	All banks			Conventional			Islamic		
Dependent: NPL	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NPL(t–1)	0.713***	0.559***	0.626***	0.713***	0.554***	0.626***	0.807***	0.831***	0.840***
	(12.44)	(9.44)	(12.57)	(12.01)	(8.55)	(13.85)	(22.14)	(15.93)	(9.88)
Efficiency	–30.22**	–27.48**	–20.44**	–37.82**	–36.03***	–29.54***	–10.56*	–2.202	–0.840
	(–2.38)	(–2.17)	(–2.18)	(–2.44)	(–3.56)	(–3.44)	(–1.77)	(–0.27)	(–0.09)
LTA		–0.829	–2.054**		0.337	–0.881		–0.267	0.434
		(–0.81)	(–2.49)		(0.47)	(–1.23)		(–0.60)	(0.48)
ETA		–0.217	–0.280***		–0.113	–0.212**		0.041	0.030
		(–1.57)	(–3.22)		(–1.06)	(–2.39)		(1.16)	(0.60)
GTA		–0.025**	–0.053***		–0.032**	–0.055***		–0.030***	–0.023
		(–2.20)	(–4.51)		(–2.37)	(–3.90)		(–2.71)	(–1.46)
LIQ		0.088***	0.098***		0.090***	0.086***		–0.045*	–0.038
		(2.70)	(3.82)		(3.17)	(3.71)		(–1.78)	(–1.06)
SMC			–0.016			–0.011			0.005
			(–0.86)			(–0.72)			(0.47)
CON			–0.032			–0.035*			0.044
			(–1.54)			(–1.88)			(1.19)
EFI			–0.140			–0.145			–0.186
			(–0.93)			(–0.98)			(–0.99)
FFI			0.018			0.025			-0.0554
			(0.39)			(0.53)			(-0.06)
GDP			–31.94***			–28.94***			–20.75**
			(–3.48)			(–2.66)			(–2.02)
GOV			2.877			1.084			0.166

			(0.95)			(0.39)			(0.07)
Constant	23.61**	18.75	46.19***	29.08**	18.94*	41.34***	9.190**	6.420	9.132
	(2.56)	(1.54)	(2.90)	(2.56)	(1.96)	(2.58)	(2.18)	(0.85)	(0.84)
N	2276	2276	2276	1901	1901	1901	375	375	375
Wald Test	176.15	1094.07	1820.68	196.30	972.28	2279	341.07	821.44	477.28
AR1	–3.38	–3.79	–3.56	–3.22	–3.39	–3.10	–2.85	–2.89	–2.48
AR2	–0.349	–0.478	–0.879	–0.55	–1.05	–1.23	–1.17	–1.11	–0.86
Hansen	124.28	227.93	187.61	119.75	198.27	162.34	59.46	35.87	26.97

Notes: Figures in parentheses are t-statistics. Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level. Definitions of all variables are listed in Table 1.

Table 10: Competition–Stability Relationship Result Based on GMM

	All banks			Conventional banks			Islamic banks		
Dependent: NPL	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NPL(t–1)	0.718***	0.619***	0.627***	0.690***	0.628***	0.616***	0.486***	0.821***	0.845***
	(10.09)	(14.72)	(14.11)	(10.81)	(15.42)	(13.19)	(8.39)	(18.80)	(9.55)
Lerner	–2.822	–6.697**	–8.912*	–2.188	–5.284*	–8.640*	–0.025	–7.092***	–7.813***
	(–0.89)	(–2.01)	(–1.95)	(–0.70)	(–1.79)	(–1.82)	(–0.01)	(–2.95)	(–3.16)
LTA		–0.0299	–0.234		0.030	–0.141		0.366***	0.330
		(–0.21)	(–1.26)		(0.24)	(–0.76)		(–2.71)	(0.85)
ETA		–0.096	–0.072		–0.135**	–0.034		0.086**	0.064**
		(–1.62)	(–1.31)		(–2.11)	(–0.65)		(2.28)	(2.12)
GTA		–0.042***	–0.048***		–0.043***	–0.049***		–0.026***	–0.034*
		(–3.11)	(–3.46)		(–2.74)	(–3.02)		(–4.26)	(–1.77)
LIQ		0.065**	0.052**		0.063**	0.051**		–0.046*	–0.0162
		(2.38)	(2.48)		(2.42)	(2.21)		(–1.85)	(–0.86)
SMC			–0.018*			–0.009			–0.003
			(–1.67)			(–1.03)			(–0.30)
CON			–0.016			–0.020**			0.031
			(–1.34)			(–2.02)			(1.29)
EFI			0.087			0.104*			–0.045
			(1.05)			(1.67)			(–0.41)
FFI			0.040			0.036			-0.012
			(0.99)			(0.87)			(-0.22)
GDP			–17.10**			–12.23			–8.180
			(–2.14)			(–1.38)			(–1.26)
GOV			–0.498			–1.244*			–1.003
			(–0.66)			(–1.82)			(–0.77)
Constant	1.886***	3.663*	2.397	2.010***	3.287*	–0.528	3.783***	6.522***	7.536
N	2276	2276	2276	1901	1901	1901	375	375	375
Wald test	(2.68)	(1.82)	(0.50)	(2.94)	(1.77)	(–0.13)	(6.71)	(3.01)	(0.75)
AR(1)	90	90	90	90	90	78	90	90	78
AR(2)	–2.86	–2.16	–1.98	–1.78	–1.85	–1.8	–2.05	–2.78	–2.35
Hansen test	**–1.53**	–1.06	1.48	–1.52	–2.17	–1.01	0.09	–0.93	0.39

Notes: Figures in parentheses are t-statistics. Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level. Definitions of all variables are listed in Table 1

Table 11: Efficiency–Stability Relationship Result Based on Fixed Effect Model

	All banks			Conventional banks			Islamic banks		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent: DD									
Efficiency	6.809***	2.880**	1.551	7.501***	1.865**	0.125	17.76	15.69*	11.40
	(2.91)	(2.15)	(0.86)	(2.96)	(2.10)	(0.07)	(1.40)	(1.84)	(0.84)
LTA		–0.541	–0.436		–0.458	–0.352		–0.432	–0.676
		(–1.33)	(–1.06)		(–1.01)	(–0.78)		(–0.43)	(–0.87)
ETA		0.0523	0.0430		0.091*	0.089		0.003	–0.002
		(1.49)	(1.23)		(1.66)	(1.52)		(0.08)	(–0.06)
GTA		0.068**	0.044		0.067*	0.049		–0.060	–0.074
		(2.04)	(1.30)		(1.83)	(1.29)		(–0.88)	(–1.15)
LIQ		–0.003	–0.004		–0.006	–0.007		0.003	0.005
		(–0.33)	(–0.49)		(–0.54)	(–0.70)		(0.16)	(0.18)
SMC			–0.009**			–0.010**			0.005

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
			(–2.07)			(–2.10)			(0.45)
CON			–0.103***			–0.110***			–0.059
			(–4.49)			(–4.56)			(–1.21)
EFI			0.175***			0.159**			0.206
			(2.76)			(2.25)			(1.27)
FFI			-0.027			-0.022			-0.089
			(-1.45)			(-1.12)			(-1.45)
GDP			–4.174			–4.422			–3.949
			(–1.16)			(–1.17)			(–0.39)
GOV			4.534***			4.019***			8.044
			(3.83)			(3.36)			(1.63)
Constant	–2.766	0.562	–3.337	–3.417*	0.228	–1.999	15.05*	–1.676	–6.224
	(–1.65)	(0.16)	(–0.58)	(–1.86)	(0.06)	(–0.31)	(1.72)	(–0.23)	(–0.63)
N	1339	1339	1339	1139	1139	1139	200	200	200
R–sq	0.009	0.301	0.395	0.011	0.301	0.399	0.015	0.571	0.701
Adjusted R sq	0.008	0.288	0.378	0.010	0.287	0.379	0.010	0.473	0.673

Notes: Figures in parentheses are t-statistics. Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level. Definitions of all variables are listed in Table 1.

Table 12: Competition–Stability Relationship Result Based on Fixed Effect Model

	All Banks			Conventional Banks			Islamic Banks		
Dependent: DD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Lerner	6.330***	4.972**	4.042*	8.074***	6.075**	4.908**	3.827	8.864**	12.18***
	(2.90)	(2.08)	(1.85)	(3.34)	(2.40)	(2.17)	(1.08)	(2.18)	(3.02)
LTA		0.618	0.446		0.817	0.581		–0.883	0.120
		(1.34)	(1.14)		(1.57)	(1.36)		(–0.74)	(0.12)
ETA		0.135**	0.101**		0.176**	0.129**		0.0751	0.015
		(2.29)	(2.09)		(2.37)	(2.17)		(1.15)	(0.21)
GTA		0.005	0.002		0.005	0.001		0.021**	0.020
		(1.32)	(0.50)		(0.96)	(0.20)		(2.20)	(1.56)
LIQ		–0.018	–0.014		–0.022	–0.017		–0.022	0.001
		(–1.37)	(–1.40)		(–1.49)	(–1.54)		(–0.97)	(0.06)
SMC			–0.016***			–0.016***			0.001
			(–3.50)			(–3.05)			(0.13)
CON			–0.099***			–0.101***			–0.122**
			(–4.32)			(–4.11)			(–2.48)
EFI			0.145***			0.144***			0.101
			(2.95)			(2.71)			(0.75)
FFI			-0.0002*			-0.000**			0.000
			(-1.91)			(2.29)			(1.57)
GDP			–7.907***			–6.160**			–31.37***
			(–2.73)			(–2.01)			(–4.06)
GOV			7.541***			7.208***			8.928**
			(5.93)			(5.55)			(2.51)
Constant	1.229***	–7.401*	–6.546	0.947***	–9.481**	–7.536	3.503***	5.366	0.371
	(3.95)	(–1.90)	(–1.24)	(2.93)	(–2.10)	(–1.33)	(5.08)	(0.74)	(0.06)
N	1339	1339	1339	1139	1139	1139	200	200	200
R–sq	0.011	0.290	0.430	0.017	0.286	0.427	0.006	0.612	0.750
Adjusted R sq	0.011	0.279	0.415	0.017	0.274	0.411	0.001	0.545	0.635

Notes: Figures in parentheses are t-statistics. Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level. Definitions of all variables are listed in Table 1

Table 13: Competition–Efficiency Relationship Result Based on IV Tobit Regression

	All banks			Conventional banks			Islamic banks		
Dep: Efficiency	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Lerner	0.0217***	0.0650***	0.0655***	0.0221**	0.0735***	0.0878***	0.0222**	0.0344**	0.0131**
	(2.94)	(6.10)	(5.03)	(2.20)	(5.60)	(5.21)	(2.50)	(2.32)	(2.72)
LTA		0.00531***	0.00570***		0.0556***	0.00612***		0.00271*	0.00520***
		(11.57)	(10.59)		(11.33)	(10.25)		(1.84)	(3.33)
ETA		–0.00448	0.00128		–0.00151	0.000661		0.00209	0.00304
		(–0.25)	(0.61)		(–0.69)	(0.26)		(0.79)	(1.08)
GTA		–0.000209	–0.000514		–0.00164	–0.00426		–0.00592	–0.00583
		(–0.44)	(–0.97)		(–0.30)	(–0.70)		(–0.73)	(–0.70)
LIQ		–0.00489	–0.0000291		0.00000623	–0.0000155		0.0000475	–0.000457**
		(–0.09)	(–0.47)		(0.11)	(–0.23)		(0.30)	(–2.21)
SMC			0.0000113			0.0000116			0.0000746
			(0.40)			(0.37)			(1.13)
CON			–0.0000561			–0.0000581			0.000499***
			(–0.58)			(–0.47)			(2.72)
EFI			–0.000503***			–0.000707**			–0.000717***
			(–3.09)			(–2.37)			(–3.98)
FFI			0.0957***			0.0972			0.1211
			(3.42)			(3.47)			(1.15)
GDP			–0.0193			–0.0178			–0.0284
			(–0.49)			(–0.40)			(–0.44)
GOV			–0.007*			–0.1336**			0.009
			(–1.74)			(2.15)			(1.17)
Constant	0.720***	0.669***	0.700***	0.720***	0.666***	0.705***	0.719***	0.695***	0.701***
	(485.39)	(120.76)	(67.88)	(398.78)	(108.22)	(50.26)	(289.70)	(49.74)	(39.45)
N	2668	2668	2668	2245	2245	2245	423	423	423

Notes: Figures in parentheses are t-statistics. Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level. Definitions of all variables are listed in Table 6.1.

Table 14: Efficiency–Stability Relationship Result Based on IV Tobit Regression

	All banks			Conventional banks			Islamic banks		
Dep: NPL	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Efficiency	–37.86***	–20.26***	–26.15***	–30.53***	–20.50***	–25.85***	–53.27***	–10.13	–17.68
	(–10.65)	(–4.34)	(–6.14)	(–6.73)	(–4.33)	(–6.23)	(–9.66)	(–0.58)	(–0.96)
LTA		–0.567***	–0.373***		–0.529***	–0.310***		–1.212***	–2.013***
		(–5.22)	(–3.61)		(–4.78)	(–3.08)		(–2.76)	(–3.69)
ETA		–0.145***	–0.0217		–0.294***	–0.166***		0.266***	0.257***
		(–3.65)	(–0.56)		(–6.49)	(–3.84)		(3.20)	(2.78)
GTA		–0.0478***	–0.0415***		–0.0778***	–0.0755***		–0.0232**	–0.0222**
		(–5.58)	(–5.46)		(–6.15)	(–6.68)		(–2.07)	(–2.06)
LIQ		0.0629***	0.0371***		0.0733***	0.0528***		0.0125	–0.0777*
		(4.71)	(2.85)		(5.22)	(4.01)		(0.32)	(–1.75)
SMC			0.00478			–0.00401			0.0760***
			(0.88)			(–0.73)			(4.35)
CON			0.0890***			0.0822***			0.0876*
			(4.43)			(3.87)			(1.73)
EFI			–0.124***			–0.136***			–0.106
			(–2.90)			(–3.10)			(–0.79)
FFI			0.0957***			0.0972			0.1211
			(3.42)			(3.47)			(1.15)
GDP			–46.40***			–40.71***			–45.13**
			(–5.94)			(–5.03)			(–2.03)
GOV			–0.4960			0.93			–3.829
			(0.59)			(1.07)			(1.55)

	All banks			Conventional banks			Islamic banks		
Dep: NPL	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	35.48***	27.97***	32.04***	30.31***	29.54***	34.29***	45.83***	21.51*	33.29**
	(13.91)	(8.87)	(9.05)	(9.29)	(9.20)	(9.79)	(11.70)	(1.87)	(2.40)
N	2668	2668	2668	2245	2245	2245	423	423	423

Notes: Figures in parentheses are t-statistics. Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level. Definitions of all variables are listed in Table 6.1.

Table 15: Competition–Stability Relationship Result Based on IV Tobit Regression

	All banks			Conventional banks			Islamic banks		
Dep: NPL	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Lerner	–4.289**	–5.660**	–8.070***	–7.622***	–10.59***	–14.55***	–8.676**	–19.46***	–22.13***
	(–2.01)	(–2.18)	(–3.17)	(–3.05)	(–3.62)	(–5.12)	(–2.37)	(–4.10)	(–4.18)
LTA		–0.846***	–0.751***		–0.811***	–0.724***		–1.626*	–1.222
		(–3.16)	(–3.04)		(–2.87)	(–2.87)		(–1.80)	(–1.24)
ETA		–0.0711	–0.00146		–0.0808	–0.0195		–0.177**	–0.115
		(–1.49)	(–0.03)		(–1.42)	(–0.36)		(–2.26)	(–1.25)
GTA		–0.0332***	–0.0346***		–0.0290***	–0.0298***		–0.0481***	–0.0460***
		(–4.49)	(–4.84)		(–3.46)	(–3.71)		(–4.06)	(–3.49)
LIQ		0.0371***	0.0206		0.0316**	0.0185		0.134***	0.118***
		(2.86)	(1.58)		(2.28)	(1.35)		(3.99)	(2.69)
SMC			–0.00727			–0.00868			0.00263
			(–0.86)			(–0.95)			(0.13)
CON			–0.00828			–0.0154			–0.00651
			(–0.56)			(–0.95)			(–0.22)
EFI			–0.215**			–0.200**			–0.0931
			(–2.53)			(–2.23)			(–0.37)
FFI			-0.0365			-0.0455			0.0974
			(-1.11)			(-1.29)			(1.14)
GDP			–27.70***			–28.11***			–4.411
			(–3.91)			(–3.66)			(–0.29)
GOV			0.405			–0.109			–0.149
			(0.22)			(–0.06)			(–0.03)
Constant	9.303***	20.25***	42.82***	9.915***	22.15***	45.83***	6.502***	15.07**	11.79
	(16.08)	(5.84)	(6.23)	(15.52)	(5.70)	(6.26)	(4.95)	(1.99)	(0.61)
N	2668	2668	2668	2245	2245	2245	423	423	423

Notes: Figures in parentheses are t-statistics. Asterisks denote significance at the * – .10, ** – .05 and *** – .01 level. Definitions of all variables are listed in Table 1.