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and Bany Ariffin Amin Nordin

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Council Countries: Analysis on Revenue, Cost
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Mechanism in Malaysia

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EDITORIAL NOTE

Six papers make up this issue. The first one, titled **Islamic Banking Sectors in Gulf Cooperative Council Countries: Analysis on Revenue, Cost and Profit Efficiency Concepts** by Fakarudin Kamarudin, Annuar Md Nassir, Mohamed Hisham Yahya, Ridzwana Mohd Said and Bany Ariffin Amin Nordin, examines the revenue efficiency, the others efficiencies concepts and profit and cost efficiency levels of 74 banks (47 conventional and 27 Islamic banks) in Gulf Cooperative Council (GCC) countries over the periods 2007 to 2011. The level of efficiencies was measured using Data Envelopment Analysis (DEA) method which applied the intermediation approach. It has been found that the Islamic banks have exhibited a lower efficiency levels for all three efficiencies measures rather than conventional banks. This study seems to suggest revenue efficiency seems to play the main factor leading to the lower or higher profit efficiency levels. The determinants that could improve the revenue efficiency in GCC Islamic banks were identified using Multiple Regression Analysis (MRA). Four bank specific determinants were found to influence the improvement of revenue efficiency: asset quality, non-traditional activities, management quality and liquidity. The improvement of the revenue efficiency in GCC Islamic banks was also influenced by the macroeconomic variable inflation and concentration ratio of the three largest banks.

The second paper, titled **Evaluating the Financial Performance of Turkish Banking Sector: A Fuzzy MCDM Approach** by Aydın Çelen, inspects that at the turn of the century Turkish economy was meltdown due to the one of the harshest crises experienced throughout her history. Since then, thanks to very strict measures taken by Turkish government, the economy proceeded to the recovery period. This period, however, seems to be interrupted once more again by 2008-2009 global financial crisis. In this study, the paper assess the financial performances of the different segments of the Turkish banking sector for the period between 2002 and 2010. In doing this, a combined methodology of Fuzzy Analytic Hierarchy Process (FAHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) methods is utilized. The results indicate that the adverse effect of

the 2001 financial crisis on the Turkish banking sector is enormous while the ongoing global crisis is not so destructive in the sector.

The third paper, titled **The Causal Relationship between Imports and Economic Growth in the Nine Provinces of South Africa: Evidence from Panel Granger Causality Tests** by Tsangyao Chang, Beatrice D. Simo-Kengne and Rangan Gupta, investigates the causal relationship between imports and growth in nine provinces of South Africa for the period 1996-2011, using panel causality analysis, which accounts for cross-section dependency and heterogeneity across regions. Our empirical results support unidirectional causality running from economic growth to imports for Gauteng, Mpumalanga, North West, and Western Cape; a bi-directional causality between imports and economic growth for KwaZulu-Natal; and no causality in any direction between economic growth and imports for the rest of provinces. This suggests that import liberalisation might not be an efficient strategy to improve provincial economic performance in South Africa. Indeed, provincial imports tend to increase in some provinces as economic growth improves.

The fourth paper, titled **Economic Implications of Turkish Migration in Europe: Lessons Learned from Polish EU Accession** by Wadim Strielkowski, Ondřej Glazar and Tomáš Ducháč, aims to predict the economic impact of Turkish EU accession with respect to migration flows. The analysis builds on the empirical evidence of past emigration flows of EU-18 to Germany and Netherlands employing the post EU Enlargement experience of Poland. Both panel data estimators used on the European migration and empirical analysis of Polish migration behavior to the EU after 2004 suggest that Turkish accession to the EU and its access to the EU labor market would not trigger massive labor migration. The most sober scenario predicts that eventual Turkish accession would lead to the short-term increase in migration which would start to fade away quickly soon reaching pre-shock levels.

The fifth paper, titled **Monetary Policy Transmission through the Bank-Financing Channel in Malaysia: Evidence from Bank-Level Data** by Hussam I. Asbeig and Salina H. Kassim, analyses the role of Islamic banks in transmitting monetary policy through the bank-financing channel in Malaysia. Bank size, liquidity and capitalization levels are hypothesized to be sources of cross-sectional differences among banks. If relevant, this implies that the financing channel is operational through the Islamic banks. We evaluate a sample period from 2000 to 2011, using panel data with robust standard errors, to investigate the heterogeneity of the financing

supply in response to monetary policy shocks. The results show no significant differences across banks, based on size, capitalization and liquidity levels, and thus do not support the presence of a bank-financing channel in Malaysia. The study contributes a deeper understanding of the role of Islamic banks in the monetary policy transmission mechanism in Malaysia.

The last and sixth paper, titled **Islamic Banks and Monetary Transmission Mechanism in Malaysia** by M. Shabri Abd. Majid and Zamrah Hasin, explains that Monetary policy influences the real economy through various channels including the bank lending. Currently, Malaysia is operating under dual banking systems; conventional and Islamic banking. The latter has distinctive feature of interest-free. Hence, this study aims to empirically explore the relevance of Islamic banks' financing in channeling the monetary policy effects to the real economy. To achieve this objective, the study relies on an autoregressive distributed lag (ARDL) bound testing approach and innovation accounting approach, and uses quarterly data spanning from 1991:Q1 to 2010:Q4. The study documents that Islamic financing channel for monetary transmission exists in Malaysia. Islamic financing is unequally distributed to economic sectors in response to monetary policy shock. Furthermore, the findings also reflect that Islamic banking as operating in dual banking system is not spared from the interest rate and monetary conditions of the country. This clearly shows the behavior of Islamic banking which cannot shun away from the interest rate while its operation delinks from the interest rates. In designing monetary policy, the central bank should consider Islamic financing as an alternative or complement channel for monetary transmission since this channel is just as active as conventional lending channel.

Islamic Banking Sectors in Gulf Cooperative Council Countries: Analysis on Revenue, Cost and Profit Efficiency Concepts

Fakarudin Kamarudin¹, Annuar Md Nassir², Mohamed Hisham Yahya³,
Ridzwana Mohd Said⁴ and Bany Ariffin Amin Nordin⁵

This paper examines the revenue efficiency and the others efficiencies concepts profit and cost efficiency levels of 74 banks (47 conventional and 27 Islamic banks) in Gulf Cooperative Council (GCC) countries over the periods 2007 to 2011. The level of efficiencies was measured using Data Envelopment Analysis (DEA) method which applied the intermediation approach. We find that, that the Islamic banks have exhibited a lower efficiency levels for all three efficiencies measures rather than conventional banks. This study seems to suggest revenue efficiency seems to play the main factor leading to the lower or higher profit efficiency levels. The determinants that could improve the revenue efficiency in GCC Islamic banks were identified using Multiple Regression Analysis (MRA). Four bank specific determinants were found to influence the improvement of revenue efficiency: asset quality, non-traditional activities, management quality and liquidity. The improvement of the revenue efficiency in GCC Islamic banks was also influenced by the macroeconomic variable inflation and concentration ratio of the three largest banks.

1. Introduction

Islamic bank is an intermediary and trustee of money of other people but the difference is how it shares profit and loss with its depositors. The introduction of the element of mutuality in Islamic banking makes its depositors as customers with some ownership of right in it (Dar and Presley, 2000). Meanwhile the conventional banking follows conventional interest-based principle, the Islamic banking is based on interest free principle and principle of Profit-and-Loss (PLS) sharing in performing their businesses as intermediaries (Arif, 1988). According to

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Santos (2000), the conventional banking theories assume that banks earn profits by purchasing transactions deposits from the depositors at a low interest rate, then reselling those funds at a higher interest rate to borrowers.

Nowadays, the globalization era has improved the financial institutions over the world through the greater deregulation and liberalization. The Islamic Banking is the one of the most growing institutions and become most competitive to the conventional banking. The practice of Islamic banking is now spread world-wide, from Middle East to Europe and the USA.

However, the increasing in advance technology, the liberalization of financial markets at a global scale and the information revolution has put competitive pressure on banking sectors (Carvallo and Kasman, 2005). This competition pressure is particularly significant for banks in the emerging markets as they constitute the main financial intermediaries to channel saving and investment. In this content, the competitive advantage is improved if banks could function efficiently.

Therefore, the conventional banks enjoy several advantages over Islamic banks because they have a good experience and long history, practice and accept the interest from the loan that represent major source of the banks' revenue. In addition, conventional banks also enjoy a huge capital, do not share loss with clients, have much more developed technologies, ask for guaranteed collaterals in most transaction and spread very widely through the large numbers of the banks' branches. Furthermore, the conventional bank could also enter Islamic banking market that gives a more advantage to be a competitive rival to Islamic banking. For example, the Western financial market players such as Citibank, ABN AMRO, HSBC and others established their own Islamic windows or subsidiaries to attract petrodollars' deposits from the Middle East and Muslims clientele in local markets. Most of the previous studies had investigated the efficiency of the both Islamic and conventional banks and the results are mixed and inconclusive. Some of the researchers suggest the conventional banks are more efficient than Islamic (Sairi 2010 and Samad 1999), while others discovered on the other way (Hussien, 2004; Yudistira, 2004 and Samad and Hassan, 1999). Consequently, it is interesting to examine efficiency level form the both banking sectors.

Berger and Humphrey (1997) suggest studies focused on the efficiency of financial institutions have become an important part of banking literature since the early 1990s. A study by Berger et al. (1993a) suggests that if banks are efficient, they could expect improved profitability, better prices and better service quality for consumers and that greater amounts of funds would be intermediated. In fact, the general concept of efficiency covers three components; namely, cost, revenue and profit efficiency (Adongo et al., 2005 and Bader et al., 2008). Evidence on bank efficiency could be produced by discovering these three types of efficiency concept. However, few studies have examined the comprehensive efficiency that consists of these three components. Most previous studies have mainly focused on the efficiency of cost, profit or both (Sairi 2010; Bader et al., 2008; Ariff and Can, 2008; Maudos et al., 2002).

Studies on bank efficiency which ignore the revenue side have been criticised (Bader et al., 2008). It is mainly because most of the studies have only revealed the levels of cost efficiency which are higher than the profit efficiency, but they have not identified the causes. According to Chong et al. (2006), banks desire to maximize the profit to maximize the shareholders' value or wealth. However, the main problem that contributes to the lower profit efficiency comes from revenue inefficiency. Ariff and Can (2008), Sufian et al. (2012a) and Sufian et al. (2012b) found that the inefficient revenue affected the difference between cost and profit efficiency. A study which investigated on the causes of inefficiency was done by Maudos et al. (2002), Rogers (1998) and Berger et al. (1993) who found that revenue inefficiency was caused either by mispricing of outputs or giving wrong choice of output.

Therefore, instead of focusing the Islamic and conventional banks on profit efficiency alone, it is better to compare it with cost efficiency as well in order to identify the existence of revenue efficiency. To the best of our knowledge, this is the first empirical study that has examined the comprehensive efficiencies concept including the revenue efficiency on Islamic and conventional banking sector in GCC countries. By employing a non-parametric Data Envelopment Analysis (DEA) method, we analyze the cost, revenue and profit efficiencies of the GCC Islamic and conventional banks over the period of 2007 to 2011. The preferred non-parametric Data Envelopment Analysis (DEA) methodology has allowed us to distinguish between three different types

of efficiency, which are cost, revenue and profit efficiencies. Furthermore, we perform a series of parametric (t-test) and non-parametric (Mann-Whitney [Wilcoxon] and Kruskal-Wallis) tests to examine whether the Islamic banks are more revenue efficient rather than conventional banks in GCC countries.

The present study also seeks to discover the determinants that are responsible in producing efficient results in terms of revenue efficiency in GCC banking sectors using the Multiple Regression Analysis (MRA). The analysis applied the Generalized Least Square (GLS) method consisting of Fixed Effect Model (FEM) and Random Effect Model (REM) run by Hausman test. This information could be useful to several parties and may have several implications for regulators, bankers, investors and academicians.

The paper is set out as follows: the next section provides the related literature. Section 3 discusses on the methods and variables employed in the study. We present the empirical findings in section 4. The article concludes and provides discussions on the policy implications in section 5.

2. Literature Review

There are some documented studies that compare the performance of Islamic banks with their conventional counterparts. Nevertheless, the previous studies mostly concentrate on the technical, pure technical and scale efficiency (Isik and Hassan, 2002; Hassan and Hussein, 2003; Yudistira, 2004 and Tahir and Haron, 2008). Despite the significant importance of this area, documented studies that address on cost, revenue and profit efficiency are very few (Yudistira, 2004; Hassan, 2005 and Brown and Skully, 2005).

Sufian et al. (2008) perform an analysis on the efficiency of Islamic Banks using empirical evidence from the MENA (Middle East and North Africa) and Asian Countries. Using the non-parametric Data Envelopment Analysis method (DEA), they estimate three different types of efficiency measures, namely technical, pure technical and scale efficiency. The result shows that pure technical inefficiency (PTIE) outweighs scale inefficiency (SIE) in the Islamic bank. Although the Islamic banks have been operating at a relatively optimal scale of

operations, they were managerially inefficient to exploit their resources to the fullest.

On the other hand, Hassan and Hussein (2003) study the efficiency of the Sudanese banking system during the period of 1992 and 2000. They apply a variety of parametric and non-parametric DEA techniques to a panel of 17 Sudanese banks. They discover that the Sudanese banking system have exhibited 37% allocative efficiency (AE) and 60% technical efficiency (TE), suggesting that the overall cost inefficiency of the Sudanese Islamic banks were mainly due to the technical efficiency (managerially related) rather than allocative efficiency (regulatory).

Saaid (2003) investigates the X-efficiency (TE and AE) of 12 Sudanese banks using Stochastic Frontier Approach (SFA). He asserts that the overall inefficiency could be attributed more on TIE rather than on allocative inefficiency (AIE). Thus, the inefficiency in the Sudanese Islamic banks could be associated more with input wasting (TIE) rather than choosing the incorrect input combinations (AIE).

On the other hand, there are many studies had conducted the cost and profit efficiency in the conventional banks rather than Islamic banks and discovered that the different levels between cost and profit efficiency are caused by the inefficiency from the revenue side (such as: Chu and Lim, 1998; Rogers, 1998; Maudos et al., 2002 and Berger and Mester, 2003).

Cost efficiency means that a firm is able to minimise the costs of inputs while producing the same amount of outputs sold at certain prices (Berger and Mester, 1997 and Ariff and Can, 2008). Berger and Humphrey (1997) claimed that most of the previous studies focused on the cost efficiency (such as Srinivasin, 1992; Linder and Crane, 1992; Shaffer, 1993; Berger and Humphrey, 1992; Rhoades, 1993; Pilloff, 1996 and Resti, 1997) and suggested that research on the revenue and profit efficiency has been scarce. Most ignored the revenue and profit side on the efficiency of the banks (Akhavain et al., 1997 and Bader et al., 2008).

Profit efficiency is also a firm's maximisation of profit since it takes into account both the cost and revenue effects on the changes in output scale and scope. Profit efficiency measures how close a bank comes to producing the maximum profit, given an amount of inputs and outputs and a level of their prices (Akhavain et al., 1997; Akhigbe and McNulty,

2003 and Ariff and Can, 2008). Thus, the profit efficiency provides a complete description on the economic goal of a bank that requires banks to reduce the cost and increase the revenue. Furthermore, according to Berger and Mester (2003) and Maudos and Pastor (2003), profit efficiency offers more useful information on management efficiency.

Revenue is defined as how effectively a bank sells its outputs. Maximum revenue is obtained as a result of producing the output bundle efficiently (Rogers, 1998 and Adongo et al., 2005). In fact, revenue efficiency is decomposed of technical and allocative efficiency which are related to managerial factors and is regularly associated with regulatory factors (Isik and Hassan, 2002). English et al. (1993) posits, in order to ascertain the revenue efficiency, banks should focus on both technical efficiency (managerial operating on the production possibilities) and allocative efficiency (bank producing the revenue maximizing mix of outputs based on the certain regulation).

Study by Sufian and Majid (2007) examine the cost and profit efficiency in the Malaysian banks over the period 2002-2003. They find that the cost efficiency was on average significantly higher compared to the profit efficiency. In addition, Rogers (1998), Moudos et al. (2002) and Ariff and Can (2008) also find similar results where the level of the profit efficiency is lower than cost efficiency.

In fact, the revenue efficiency could be the main factor that influences the lower or higher profit efficiency level. Ariff and Can (2008), Sufian et al. (2012a) and Sufian et al. (2012b) found that the inefficient revenue affected the difference between cost and profit efficiency. However according to Berger and Humphrey, (1997), Akhavein et al. (1997), Bader et al. (2008), Sufian et al. (2012a) and Sufian et al. (2012b) stated that there have been limited studies done on revenue efficiency in the banking sectors. A study which investigated on the causes of inefficiency was done by Maudos et al. (2002), Rogers (1998) and Berger et al. (1993) who found that revenue inefficiency was caused either by mispricing of outputs or giving wrong choice of output.

3. Data and Methodology

The present study gathers data from all GCC Islamic and conventional banks from 2007 to 2011. The primary source for financial data is obtained from the BankScope database produced by the Bureau van Dijk which provides the banks' balance sheets and income statements. The data were collected from 74 banks (47 conventional and 27 Islamic banks) and list of banks presented in Appendix 1.

3.1 Method of Measurement in First Stage

The study uses the non-parametric Data Envelopment Analysis (DEA) frontier analysis method, also known as mathematical programming approach. It constructs the frontier of the observed input-output ratios by linear programming techniques. The linear substitution is possible between observed input combinations on an isoquant (the same quantity of output is produced while changing the quantities of two or more inputs) that was assumed by DEA. Charnes et al. (1978) were the first to introduce the term DEA to measure the efficiency of each DMU, obtained as a maximum of a ratio of weighted outputs to weighted inputs. The more the output produced from given inputs, the more efficient is the production. Sherman and Gold (1985) were the first to apply DEA method to banking sectors. According to Bader et al. (2008), the DEA technique is extensively used in many recent banking efficiency studies (Drake et al., 2006 and Sufian 2008). Nevertheless, it was Farrell (1957) who originally developed this non-parametric efficiency approach.

Thus, the DEA Excel Solver developed by Zhu (2009) under the VRS model is adopted in order to solve the cost, revenue and profit efficiency. The cost, revenue and profit efficiency models are given in Equations (1) – (3) below. As can be seen, the cost, revenue and profit efficiency scores are bounded within the 0 and 1 range.

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Frontier Type	Cost Efficiency (1)	Revenue Efficiency (2)	Profit Efficiency (3)
VRS	$\min \sum_{i=1}^m p_i^o \tilde{x}_{io}$ subject to $\sum_{j=1}^n \lambda_j x_{ij} \leq \tilde{x}_{io} \quad i = 1, 2, \dots, m;$ $\sum_{j=1}^n \lambda_j y_{rj} \geq y_{ro} \quad r = 1, 2, \dots, s;$ $\lambda_j, \tilde{x}_{io} \geq 0$ $\sum_{j=1}^n \lambda_j = 1$	$\max \sum_{r=1}^s q_r^o \tilde{y}_{ro}$ subject to $\sum_{j=1}^n \lambda_j x_{ij} \leq \tilde{x}_{io} \quad i = 1, 2, \dots, m;$ $\sum_{j=1}^n \lambda_j y_{rj} \geq \tilde{y}_{ro} \quad r = 1, 2, \dots, s;$ $\lambda_j, \tilde{y}_{ro} \geq 0$ $\sum_{j=1}^n \lambda_j = 1$	$\max \sum_{r=1}^s q_r^o \tilde{y}_{ro} - \sum_{i=1}^m p_i^o \tilde{x}_{io}$ subject to $\sum_{j=1}^n \lambda_j x_{ij} \leq \tilde{x}_{io} \quad i = 1, 2, \dots, m;$ $\sum_{j=1}^n \lambda_j y_{rj} \geq \tilde{y}_{ro} \quad r = 1, 2, \dots, s;$ $\tilde{x}_{io} \leq x_{io}, \tilde{y}_{ro} \geq y_{ro}$ $\lambda_j \geq 0$ $\sum_{j=1}^n \lambda_j = 1$

Source: Zhu (2009)

where

- s is output observation
- m is input observation
- r is s^{th} output
- i is m^{th} input
- q_r^o is unit price of the output r of DMU0 (DMU0 represents one of the n DMUs)
- p_i^o is unit price of the input i of DMU0
- $\tilde{y}_{ro}$ is r^{th} output that maximise revenue for DMU0
- $\tilde{x}_{io}$ is i^{th} input that minimise cost for DMU0
- y_{ro} is r^{th} output for DMU0
- x_{io} is i^{th} input for DMU0
- n is DMU observation
- j is n^{th} DMU
- λ_j is non-negative scalars
- y_{rj} is s^{th} output for n^{th} DMU
- x_{ij} is m^{th} input for n^{th} DMU

By calculating these three efficiencies concepts (cost, revenue and profit), we could observe the GCC Islamic and conventional banks on these efficiency levels and more robust results could be obtained.

3.2 Inputs, Outputs, Approaches and the Choice of Variables

The collection or selection of the bank inputs and outputs could be difficult in the evaluation of the bank efficiency to be used in the first stage of DEA analysis. Bader et al. (2008) stated explicitly that there is 'no perfect approach' in the selection of the bank inputs and outputs. Berger and Humphrey (1997) also found that there are some restrictions on the type of variables since there is a need for comparable data and to minimise possible biases due to different accounting practices in the collection of the variables. In fact, they stated that even in the same country, different banks might apply different accounting standards. The results of the efficiency scores for each study on the bank efficiency will be affected due to the selection of variables. Thus, the DEA method requires bank inputs and outputs as the choice is always an arbitrary issue (Ariff and Can, 2008 and Berger and Humphrey, 1997). Since the issue selecting approaches is still arbitrary, this study had decided to use intermediation approach because we assume bank is more suitable to be classified as intermediary entity

Therefore, two inputs, two input prices, two outputs and two output prices variables were chosen. The overall selection of the variable of banks' input and output was based on Ariff and Can (2008) and other major studies on the efficiency of the banks (Sufian et al., 2012a; Sufian et al., 2012b; Sufian and Habibullah, 2009; Bader et al., 2008; Isik and Hassan, 2002; and Hassan, 2005). The two input vector variables consist of x_1 : deposits and x_2 : labour. The input prices consist of w_1 : price of deposit, w_2 and price of labour

The two output vector variables are y_1 : loans and y_2 : income. Meanwhile, two output prices consist of r_1 : price of loans and r_2 : price of income. The summary of data used to construct the efficiency frontiers are presented in Table 1.

Table 1: Summary statistics of the Variables input and output in the DEA model (in million USD)

Variable	Mean	Minimum	Maximum	Std. Deviation
Deposit (x1)	11,740.227	0.044	69,172.564	13,213.378
Labour (x2)	121.856	0.900	661.387	124.103
Loan (y1)	9,795.650	6.875	54,017.420	10,190.788
Income (y2)	694.820	0.100	3,178.320	711.964
Price of deposit (w1)	0.078	0.001	5.773	0.387
Price of labour (w2)	0.012	0.001	0.120	0.014
Price of loan (r1)	0.101	0.010	6.393	0.377
Price of income (r2)	0.362	0.000	14.333	1.518

Notes: x1: Deposits (deposits and short term funding), x2: Labour (personnel expenses), y1: Loans (total of short-term and long-term loans), y2: income (gross interest and dividend income), w1: Price of deposits (total interest expenses/ deposits), w2: Price of labour (personnel expenses/ total assets), r1: Price of loans (interest income on loans / loans), r2: Price of income (other operating income/ income)

3.3 Method of Measurement in Second Stage

3.3.1 Multiple Regression Analysis

The next purpose of this study is to identify the potential bank specific and macroeconomic determinants which influence the GCC Islamic banking sector's revenue efficiency. Most previous studies have used a multiple regression analysis (MRA) model in order to focus on the relationship between bank profitability and explanatory variables to identify the determinants of the profitability (such as, Maudos et al., 2002 and, Sufian and Habibullah, 2009).

By using the revenue efficiency scores as dependent variable, we developed the following regression model:

$$\begin{aligned}
 \ln \theta_{jt} = & \alpha_t + \beta_{jt} (\ln TA_{jt} + \ln LLRGL_{jt} + \ln ETA_{jt} + \ln NIITA_{jt} + \ln NIETA_{jt} + \ln LOANSTA_{jt} \\
 & + \ln GDP_{jt} + \ln INFL_{jt} + \ln CR3_{jt} + \ln TA_{jt} * IB_{jt} + \ln LLRGL_{jt} * IB_{jt} \\
 & + \ln ETA_{jt} * IB_{jt} + \ln NIITA_{jt} * IB_{jt} + \ln NIETA_{jt} * IB_{jt} + \ln LOANSTA_{jt} * IB_{jt} \\
 & + \ln GDP_{jt} * IB_{jt} + \ln INFL_{jt} * IB_{jt} + \ln CR3_{jt} * IB_{jt}) + \varepsilon_{jt}
 \end{aligned}$$

Where:

$\ln\theta_{jt}$	is the revenue efficiency of the j-th bank in the period t obtained from DEA model
$\ln TA$	is a log total assets (size of bank)
$\ln LLRGL$	is a loan loss reserve to gross loan (asset quality)
$\ln ETA$	is an equity to total assets (capitalisation)
$\ln NIITA$	is a non-interest income over total assets (non-traditional activities)
$\ln NIETA$	is a non-interest expense over total assets (management quality)
$\ln LOANSTA$	is a total loan over total assets (liquidity)
$\ln GDP$	is a log of gross domestic product (economic growth)
$\ln INFL$	is a customer prices index (inflation)
$\ln CR3$	is a concentration ratio of three largest banks assets
$\ln TA*IB$	is an interaction bank size and dummy Islamic bank
$\ln LLRGL*IB$	is an interaction asset quality and dummy Islamic bank
$\ln ETA*IB$	is an interaction capitalisation and dummy Islamic bank
$\ln NIITA*IB$	is an interaction non-traditional activity and dummy Islamic bank
$\ln LOANSTA*IB$	is an interaction liquidity and dummy Islamic bank
$\ln GDP*IB$	is an interaction economic growth and dummy Islamic bank
$\ln INFL*IB$	is an interaction inflation and dummy Islamic bank
$\ln CR3*IB$	is an interaction concentration ratio of three largest banks asset and dummy Islamic bank
j	is a number of bank
t	is a year
α	is a constant term
β	is a vector of coefficients
ε_{jt}	is a normally distributed disturbance term

This study will run the result according to the step-wise or separately models rather than on simultaneous models in order to avoid the multicollinearity problems. Therefore, the proposed model contains 11 models that are used to examine the relationship between the revenue efficiency of the GCC banks and determinants variables.

3.3.2 Determinants Variables Description Used in MRA Models

There are six bank specific and three macroeconomics determinants variables used in the second stage of analysis. In addition, this study also introduces interaction variables. The interaction of all variables against the dummy Islamic banks (IB) produces a specific and robust result on the determinants that contribute to the higher revenue efficiency in GCC Islamic banks. For further description on these variables please refer Appendix 2

3.3.3 Estimation Method: Generalized Least Square

The Generalized Least Square (GLS) method is used in this study rather than the Ordinary Least Square (OLS) as method of estimation to estimate the panel data regression formed. The decision is made following Gujarati's (2002) suggestion that GLS may overcome the heteroscedasticity, resulted from utilizing financial data with differences in sizes. Due to the fact that the sample employed in this study consists of small and large banks, differences in sizes of the observations are expected to be observed.

The usual practice of econometrics modelling assumes that error is constant over all time periods and locations due to the existence of homoscedasticity. Nevertheless, problems could arise which lead to heteroscedasticity issues as variance of the error term produced from regression tend not to be constant, which is caused by variations of sizes in the observation. Therefore, the estimates of the dependent variable will be less predictable (Gujarati, 2002).

Using OLS estimation will solve the problem since it adopts the minimizing sum of residual squares condition. The OLS allows all errors to receive equal importance no matter how close or how wide the individual error spread is from the sample regression function. On the other hand, GLS minimizes the weighted sum of residual squares. In GLS estimation, the weight consigned to each error term is relative to its variance of the error term. Error term that comes from a population with large variance of error term will get relatively large weight in minimizing residual sum of squares (RSS). Consequently, if a problem of non-constant error arises, GLS is able to produce estimators in Best Linear Unbiased Estimators (BLUE) version because it accounts for

such a problem by assigning appropriate weight to different error terms, which in turn, produces an ideal constant variable (Gujarati, 2002).

4. Empirical Results

4.1 First Stage: Results and Tests of DEA

Table 2 and figure 1(graph) illustrates all efficiencies concepts which are cost, revenue and profit efficiency for GCC Islamic and conventional banks.

Figure 1: Graph on Cost, Revenue & Profit Efficiencies for Islamic & Conventional Banks in GCC countries during year 2007-2011

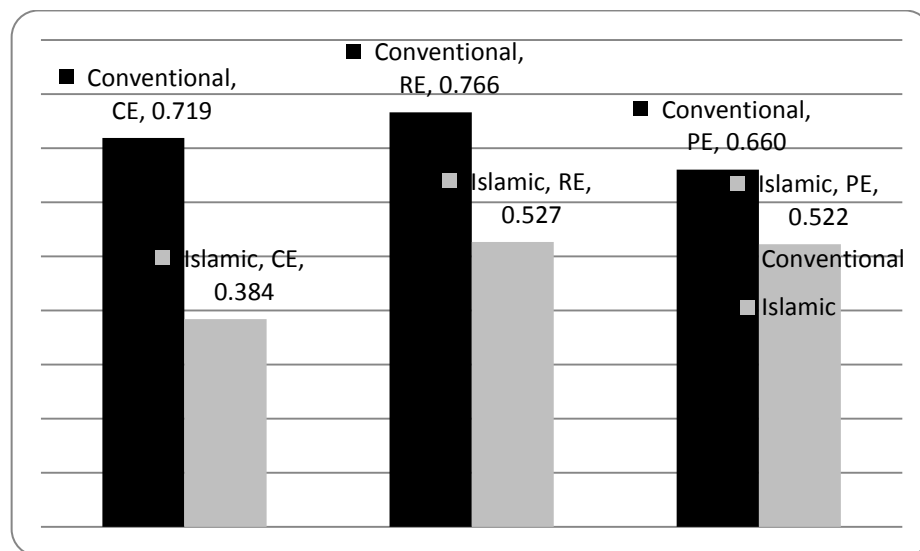


Table 2: Summary on Cost, Revenue and Profit Efficiencies for Islamic and Conventional Banks in GCC countries during year 2007-2011

No.	Islamic Bank	CE	RE	PE	No.	Conventional Bank	CE	RE	PE
1	ABC Islamic Bank (E.C.)	0.058	0.426	0.609	1	Abu Dhabi Commercial Bank	0.999	1.000	1.000
2	Abu Dhabi Islamic Bank	1.000	1.000	1.000	2	Ahli Bank QSC	0.610	0.861	0.761
3	Ajman Bank	0.273	0.300	0.276	3	Ahli United Bank BSC	0.571	0.661	0.334
4	Al Rajhi Banking and Investment Corp	1.000	0.978	1.000	4	Ahli United Bank KSC	0.589	0.638	0.407
5	Albaraka Banking Group B.S.C.	0.955	0.539	0.858	5	Al Ahli Bank of Kuwait (KSC)	0.627	0.772	0.550
6	Albaraka Islamic Bank BSC	0.105	0.096	0.045	6	Al Khaliq Commercial Bank	0.576	0.471	0.320
7	Alinma Bank	0.322	0.488	0.478	7	Arab Banking Corporation BSC	0.680	0.551	0.271
8	Al-Salam Bank-Bahrain B.S.C.	0.008	0.300	0.270	8	Arab National Bank	0.634	0.671	0.586
9	Arcapita Bank B.S.C.	0.007	0.079	0.051	9	Awal Bank	0.494	0.633	0.622
10	Bahrain Islamic Bank B.S.C.	0.012	0.164	0.100	10	Bank Al-Jazira	0.527	0.525	0.415
11	Bank AlBilad	0.017	0.305	0.266	11	Bank Dhofar SAOG	0.829	0.826	0.780
12	Bank Alkhair BSC	0.038	0.008	0.004	12	Bank Muscat SAOG	0.672	0.747	0.652
13	Boubyan Bank KSC	0.007	0.350	0.472	13	Bank of Bahrain and Kuwait B.S.C.(BBK)	0.605	0.601	0.369
14	Dubai Islamic Bank plc	0.599	0.627	0.450	14	Bank of Sharjah	0.732	0.792	0.717
15	Elaf Bank	0.378	1.000	1.000	15	Bank Sohar SAOG	0.779	0.877	0.800
16	Emirates Islamic Bank PJSC	0.002	0.306	0.161	16	Barwa Bank	1.000	1.000	1.000
17	Investors Bank BSC	0.811	1.000	1.000	17	Burgan Bank SAK	0.542	0.688	0.445
18	Islamic Development Bank	0.814	0.974	0.931	18	Commercial Bank International P.S.C.	0.812	0.723	0.614
19	Kuwait Finance House	0.821	0.799	0.713	19	Commercial Bank of Dubai P.S.C.	0.737	0.795	0.725

Table 2: Summary on Cost, Revenue and Profit Efficiencies for Islamic and Conventional Banks in GCC countries during year 2007-2011 (cont.)

No.	Islamic Bank	CE	RE	PE	No.	Conventional Bank	CE	RE	PE
20	Kuwait International Bank	0.019	0.354	0.398	20	Commercial Bank of Kuwait SAK (The)	0.584	0.874	0.751
21	Noor Islamic Bank	0.148	0.469	0.227	21	Commercial Bank of Qatar (The) QSC	0.742	0.761	0.679
22	Qatar International Islamic Bank	0.016	0.230	0.160	22	Doha Bank	0.588	0.640	0.426
23	Qatar Islamic Bank SAQ	0.143	0.439	0.348	23	Emirates Bank International PJSC	1.000	1.000	1.000
24	Seera Investment Bank BSC	0.356	0.916	0.900	24	First Gulf Bank	0.856	0.965	0.903
25	Shamil Bank of Bahrain B.S.C.	0.022	0.127	0.043	25	Gulf Bank KSC (The)	0.641	0.890	0.838
26	Sharjah Islamic Bank	0.407	0.600	0.480	26	Gulf International Bank BSC	0.763	0.843	0.729
27	Venture Capital Bank	0.744	0.696	0.891	27	International Bank of Qatar Q.S.C.	0.561	0.682	0.495
					28	International Banking Corporation BSC	0.810	1.000	1.000
					29	Invest Bank P.S.C.	0.858	0.921	0.901
					30	Mashreqbank	0.721	0.638	0.357
					31	National Bank of Abu Dhabi	0.907	0.991	0.986
					32	National Bank of Bahrain	0.438	0.464	0.284
					33	National Bank of Dubai	0.576	0.725	0.530
					34	National Bank of Fujairah	0.784	0.725	0.592
					35	National Bank of Kuwait S.A.K.	0.804	0.801	0.830
					36	National Bank of Oman (SAOG)	0.711	0.731	0.634
					37	National Bank of Ras Al-Khaimah	0.927	0.770	0.837
					38	National Bank of Umm Al-Qaiwain	0.821	0.836	0.836

Table 2: Summary on Cost, Revenue and Profit Efficiencies for Islamic and Conventional Banks
in GCC countries during year 2007-2011 (cont.)

No.	Islamic Bank	CE	RE	PE	No.	Conventional Bank	CE	RE	PE
					39	National Commercial Bank (The)	0.906	0.838	0.906
					40	Oman Arab Bank SAOG	0.847	0.809	0.770
					41	Oman International Bank	0.729	0.665	0.600
					42	Qatar National Bank	0.830	0.977	0.855
					43	Riyad Bank	0.679	0.778	0.675
					44	Saudi British Bank (The)	0.652	0.697	0.583
					45	Saudi Hollandi Bank	0.583	0.645	0.462
					46	Union National Bank	0.698	0.831	0.656
					47	United Arab Bank PJSC	0.860	0.875	0.885
	MEAN FORM ALL BANKS	0.384	0.527	0.522		MEAN FROM ALL BANKS	0.719	0.766	0.660

4.1.1 Efficiency of GCC Islamic Banks

Table 2 shows the mean of cost, revenue, and profit efficiency for the GCC Islamic banks of 38.4%, 52.7% and 52.2% respectively. In other words, the GCC Islamic banks have been inefficient in producing outputs by using the same input (revenue inefficiency) and by not fully using the inputs efficiently to produce the same outputs (cost inefficiency). Banks are said to have slacked if they fail to fully minimize the cost and maximize the revenue (profit inefficiency). The results indicate that levels of cost inefficiency, revenue inefficiency, and profit inefficiency are shown as 61.6%, 47.3% and 47.8% respectively.

For the cost efficiency, the results indicate that on average Islamic banks have utilized only 38.4% of the resources or inputs to produce the same level of outputs. In other words, on average, Islamic banks have wasted 61.6%, of its inputs, or it could have saved 61.6%, of its inputs to produce the same level of outputs. For revenue efficiency, the average Islamic bank could only generate 52.7% of revenues, less than what it was initially expected to generate. Hence, revenue is lost by 47.3% , indicating that the average Islamic bank loses an opportunity to receive 47.3% more revenues given the same amount of resources, or it could have produced 47.3% of its outputs given the same level of inputs. It is also worth noting that on average, Islamic banks have been more revenue efficient in producing their outputs compared to their ability to generate costs and profits.

Noticeably, the highest level of inefficiency is on the cost side, followed by the profits side. Similarly, the average Islamic bank could have earned 52.2% of what was available, and lost the opportunity to make 47.8% more profits from the same level of inputs. Consequently, the profit efficiency is higher than cost efficiency due to higher revenue efficiency levels. Therefore, the higher revenue efficiency seems to have contributed to the higher profit efficiency or lower profit inefficiency levels compared to the cost efficiency levels.

4.1.2 Efficiency of GCC conventional Banks

The empirical findings presented in Table 2 seem suggest that the GCC conventional banks have exhibited mean cost, revenue, and profit

efficiency (inefficiency) of 71.9% (28.1%), 76.6% (23.4%), and 66.0% (34.0%) respectively. Furthermore, it is interesting to note that on average GCC conventional banks have been found to be more efficient compared to their Islamic bank peers. For revenue efficiency, the average conventional bank could generate 76.7% of revenues than it was expected to generate. Hence, the average conventional bank lost an opportunity to receive 23.4%% more revenue, given the same amount of resources.

As for the cost efficiency, the results seem to suggest that the average conventional bank have utilized only 71.9% of the resources or inputs in order to produce the same level of output. In other words, on average, conventional banks have wasted 28.1% of its inputs, or it could have saved 28.1% of its inputs to produce the same level of outputs. Therefore, there was substantial room for significant cost savings for the conventional banks if they employ their inputs efficiently. Obviously, the inefficiency is on the cost side, which is followed by the profits side. Similarly, the average conventional bank could have earned 66.0% of what was available, and lost the opportunity to make 34.0% more profits when utilizing the same level of inputs.

In conclusion, the empirical findings from this study seem to suggest that the conventional banks have exhibited a higher efficiency levels for all three efficiency measures [eg: cost efficiency (71.9% vs. 38.4%), revenue efficiency (76.6% vs. 52.7%), and profit efficiency (66.0% vs. 52.2%)]. In essence, revenue efficiency seems to play the main factor leading to the lower or higher profit efficiency levels. Besides, results for the conventional banks shows that the level of profit efficiency is lower than cost efficiency due to the higher revenue efficiency or lower inefficiency level from the revenue side. Meanwhile, the level of profit efficiency is higher than cost efficiency due to the higher revenue efficiency level from the revenue side in the Islamic banks.

4.1.3 Robustness Tests

Table 3 shows the robustness tests. The results from the parametric *t*-test and non-parametric Mann-Whitney (Wilcoxon) test suggest that the GCC Islamic banks have exhibited a lower mean cost efficiency level than conventional bank peers ($0.384 < 0.719$) and significantly different at 1%. Likewise, the GCC Islamic banks have also exhibited a lower

mean profit efficiency level compared to conventional banks ($0.522 < 0.660$) and significantly different at 1%. The results from the parametric *t*-test are further confirmed by the non-parametric Mann-Whitney (Wilcoxon) and Kruskal-Wallis tests. Similarly, the parametric *t*-test and non-parametric Mann-Whitney (Wilcoxon) and Kruskal-Wallis tests results indicate that the GCC Islamic banks have exhibited lower revenue efficiency level compared to the GCC conventional banks ($0.527 < 0.766$) and significant different at 1%.

Table 3: Summary of parametric and non-parametric tests on GCC Islamic and Conventional banks during the year 2007-2011

	Test groups					
	Parametric test		Non-parametric test			
Individual tests	t-test		Mann-Whitney [Wilcoxon Rank-Sum] test		Kruskall-Wallis Equality of Populations test	
Hypothesis			MedianIslamic = MedianConventional			
Test statistics	$t(Prb > t)$		$z(Prb > z)$		$\chi^2 (Prb > \chi^2)$	
	Mean	<i>t</i>	Mean Rank	<i>z</i>	Mean Rank	χ^2
Cost Efficiency						
Islamic banks	0.384	9.502 ***	119.182	-5.982***	119.182	35.779***
Conventional bank	0.719		184.766		184.766	
Revenue Efficiency						
Islamic banks	0.527	8.056 ***	124.245	-5.287***	124.245	27.951***
Conventional bank	0.766		182.164		182.164	
Profit Efficiency						
Islamic banks	0.522	3.673 ***	140.709	-3.036***	140.709	9.216***
Conventional bank	0.660		173.701		173.701	

***. Correlation is significant at the 0.01 level (2-tailed). **. Correlation is significant at the 0.05 level (2-tailed). *. Correlation is significant at the 0.01 level (2-tailed).

Based on the results presented in Table 3, this study concludes that conventional bank is more efficient than Islamic bank in GCC countries since all tests shows those efficiencies (cost, revenue and profit efficiency) are significant at 1% .

4.2 Second Stage: Results and Tests of GLS

In essence, when the result from the 1st stage identified that the revenue efficiency on GCC Islamic banks was lower than GCC conventional banks, the study preceded with the second stage which is to identify the determinants that could improve the revenue efficiency in GCC Islamic banking sector. There are 11 models of multivariate regression analysis (MRA) utilised separately under this stage. Model 1 which is a baseline model consists of all six basic proposed bank specific determinants variables: size of bank ($\ln TA$), assets quality ($\ln LLRGL$), capitalisation ($\ln ETA$), non-traditional activities ($\ln NIITA$), management quality ($\ln NIETA$) and liquidity ($\ln LOANSTA$). Model 2 adds the macroeconomic control variables which are economic growth ($\ln GDP$) inflation ($\ln INFL$) and concentration ratio of three largest banks assets ($\ln CR3$) in estimation regression, and maintains the bank specific variables.

Meanwhile, Model 3 to Model 11 represents the focused models adopted to identify the potential determinants on revenue efficiency in GCC Islamic banks. These models (Model 3 to Model 11) retain all the bank specific and macroeconomic variables and include the additional interaction variables with binary dummy Islamic bank variable (IB) namely $\ln TA * IB$, $\ln LLRGL * IB$, $\ln ETA * IB$, $\ln NIITA * IB$, $\ln NIETA * IB$, $\ln LOANSTA * IB$, $\ln GDP * IB$, $\ln INFL * IB$ and $\ln CR3 * IB$. The interaction of all variables against the dummy Islamic banks (IB) produces a specific and robust result on the determinants that contribute to the higher revenue efficiency in GCC Islamic banks.

Hausman test was used in order to decide which estimation technique is more appropriate between FEM and REM. Table 4 shows the Hausman test on FEM and REM. Since the entire chi square (X^2) in all models is significant at 1%, the test suggests that the FEM is more appropriate rather than REM for the estimation technique.

Table 5 shows the MRA models on the relationship between revenue efficiency and explanatory variables and all explanations will be based on this table. This table produced the results on the potential determinants on the revenue efficiency for the overall banks (Islamic and conventional) in GCC banking sector. Next, the determinants on revenue efficiency particularly on GCC Islamic banks are produced in Model 3 to 11 with the interaction variables of IB. The equations are based on 74 banks year observation during the period of 2007 to 2011.

Table 4: Hausman Test

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Chi-Sq. Stat (X ²)	30.835***	73.894***	64.555***	69.452***	71.236***	85.775***	51.180***	66.217***	59.416***	68.634***	60.963***
Prob. X ²	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Est. tech	FEM	FEM	FEM	FEM	FEM	FEM	FEM	FEM	FEM	FEM	FEM

Table 5: Multivariate Regression Analysis Models under Fixed Effect Model

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
CONSTANT	-0.962*	-2.666*	-2.806**	-2.064	-3.233**	-2.350*	-2.551*	-2.449*	-2.458*	-3.715***	-6.964***
Std. Error	0.503	1.366	1.386	1.354	1.397	1.321	1.324	1.358	1.366	1.416	2.367
Determinants Variables											
lnTA	0.183	-0.137	-0.080	-0.118	-0.119	-0.239*	-0.145	-0.123	-0.118	-0.131	-0.123
Std. Error	0.115	0.137	0.164	0.134	0.136	0.134	0.132	0.136	0.137	0.135	0.136
lnLLRGL	-0.088	-0.150***	-0.148***	0.053	-0.150***	-0.128**	-0.178***	-0.149***	-0.143***	-0.152***	-0.150***
Std. Error	0.054	0.055	0.055	0.084	0.055	0.053	0.054	0.054	0.055	0.054	0.054
lnETA	0.157	-0.088	-0.093	-0.087	-0.222	-0.092	-0.085	-0.090	-0.070	-0.092	-0.081
Std. Error	0.122	0.130	0.131	0.128	0.150	0.126	0.126	0.129	0.130	0.129	0.129
lnNITA	0.244***	0.298***	0.303***	0.289***	0.301***	-0.024	0.311***	0.304***	0.284***	0.282***	0.281***
Std. Error	0.042	0.048	0.049	0.047	0.048	0.088	0.047	0.048	0.048	0.048	0.048

Table 5: Multivariate Regression Analysis Models under Fixed Effect Model (cont.)

lnNIETA	-0.104	-0.231**	-0.238**	-0.285***	-0.239**	-0.300***	0.039	-0.203**	-0.215**	-0.251**	-0.234**
Std. Error	0.095	0.098	0.099	0.098	0.098	0.096	0.116	0.098	0.098	0.097	0.097
lnLOANSTA	-0.088	-0.074	-0.067	-0.107	-0.071	-0.041	-0.097	-0.459**	-0.070	-0.074	-0.076
Std. Error	0.077	0.075	0.076	0.074	0.074	0.073	0.073	0.187	0.075	0.074	0.074
Macroeconomic Variables											
lnGDP		0.375	0.419	0.311	0.483	0.537*	0.423	0.407	0.029	0.824**	0.522*
Std. Error		0.300	0.309	0.296	0.305	0.293	0.291	0.298	0.361	0.348	0.305
lnINFL		-0.140	-0.162	-0.104	-0.190*	-0.255***	-0.172*	-0.143	-0.097	-0.468***	-0.334**
Std. Error		0.096	0.102	0.095	0.100	0.097	0.094	0.095	0.099	0.163	0.130
lnCR3		0.765**	0.660*	0.566	0.652*	0.208	0.573*	0.733**	0.921**	-0.260	0.163
Std. Error		0.354	0.393	0.354	0.358	0.366	0.347	0.352	0.365	0.542	0.444
Interaction Variables											
lnTA*IB		-0.146									
Std. Error		0.232									
lnLLRGL*IB				-0.335***							
Std. Error				0.106							
lnETA*IB					0.447*						
Std. Error					0.252						
lnNIITA*IB						0.436***					
Std. Error						0.102					
lnNIETA*IB							-0.722***				
Std. Error							0.178				

Table 5: Multivariate Regression Analysis Models under Fixed Effect Model (cont.)

lnLOANSTA*IB Std. Error	0.448** 0.199										
lnGDP*IB Std. Error	0.733* 0.429										
lnINFL*IB Std. Error	0.463** 0.187										
lnCR3*IB Std. Error	7.474** 3.375										
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
R²	0.835	0.848	0.848	0.854	0.850	0.858	0.857	0.851	0.850	0.851	0.851
Adj R²	0.781	0.796	0.795	0.803	0.798	0.810	0.808	0.799	0.797	0.800	0.799
Durbin Watson	2.314	2.343	2.345	2.313	2.346	2.440	2.391	2.307	2.358	2.373	2.365
F-statistic	15.600***	16.356***	16.123***	16.884***	16.341***	17.541***	17.392***	16.492***	16.323***	16.580***	16.480***
Estimation technique	FEM	FEM	FEM	FEM	FEM	FEM	FEM	FEM	FEM	FEM	FEM

***. Correlation is significant at the 0.01 level (2-tailed).

**. Correlation is significant at the 0.05 level (2-tailed).

*. Correlation is significant at the 0.1 level (2-tailed).

4.2.1 Determinants of Revenue Efficiency

Table 5 presents the results of baseline model (Model 1) on the determinants of revenue efficiency without macroeconomic control variables, dummy variables and any interaction. This model represents the relationship between revenue efficiency and all possible bank specific determinants throughout the GCC banking sector between 2007 and 2011. The results show that the relationship between revenue efficiency and three determinants namely asset quality (lnLLRGL), non-traditional activities (lnNIITA) and management quality (NIETA) are significantly positive and negative in Model 1 and is also consistent in all models. However, the liquidity (lnLOANSTA) is significantly reported only in model 8. The impact of size (lnTA) and capitalisation (lnETA) on the revenue efficiency are totally insignificant in all models in the estimation regression.

The first significant determinant is lnLLRGL proxy of asset quality. The coefficient lnLLRGL reveals a negative relationship and is statistically significant at 1% level. Similar results are applied to all models (except Model 1 and 4), indicating that the lower ratio of lnLLRGL increase the asset quality and lead to higher revenue efficiency. The result is consistent with previous studies such as those by Sufian, (2009), Sufian and Habibullah (2009), Kosmidou (2008) and Cornett et al. (2006) which further support the argument that lower lnLLRGL banks face higher asset quality and this contributes to higher efficiency.

The second significant determinant is non-traditional activities (lnNIITA). The coefficient of lnNIITA is statistically positive and significant at 1% in the all regression model (except Model 6). The positive results imply that banks which derived a higher proportion of its income from non-interest sources such as fee based services tend to report a higher level of revenue efficiency. The study by Canals (1993) also suggests that revenue generated from new business units have significantly contribute to improve bank performance.

Finally, the findings suggest that the management quality (lnNIETA) is statistically significant and negative at the 5%. The negative results indicate the higher management quality tend lower the bank' revenue efficiency. The finding is in consonance with the bad management hypotheses of Berger and DeYoung (1997). The lower coefficient of

lnNIETA represents a good management quality due to the efficient manager to manage the expenses to improve the quality of the bank to increase the banks' profit. Low measure of cost efficiency is a signal of poor senior management practices, which apply to input-usage and day-to-day operation.

On the other hand, Model 2 includes the macroeconomic variables as additional control variables in the estimation regression. The overall results show the economic growth (lnGDP), inflation (lnINFL) and concentration ratio (lnCR3) are insignificantly to the revenue efficiency of the GCC banks.

As a conclusion, asset quality, non-traditional activities and management quality represent the significant determinants that lead to the higher revenue efficiency in the GCC banking sector and non of the macroeconomics determinants that could influence the revenue efficiency level.

4.2.2 Robustness Checks: Controlling for Islamic Banks

In essence, asset quality, non-traditional activities and management quality represent the determinants that influence the higher revenue efficiency of GCC banking sector. However, the second objective of this study is to identify the bank specific determinants of revenue efficiency in GCC banking sector, particularly in GCC Islamic banks. It proceeded with robustness test by allowing all the bank specific determinants to interact and by adding control variables (macroeconomic) against the dummy GCC Islamic banks variable (IB). New six interaction variables lnTA*IB, lnLLRGL*IB, lnETA*IB, lnNIITAIB, lnNIETA*IB and lnLOANSTA*IB were included in Model 3 to Model 11. In addition, the three macroeconomic variables (lnGDP*IB, lnINFL*IB and lnCR3*IB in model 9, 10 and 11) had also interacted against IB variable. Therefore, for these models the discussion will focus on the results of the new variables added to the baseline specification (Model 1).

Table 5 shows a negative coefficient of lnLLRGL*IB in Model 4 and statistically significant at 1% indicating that lower non-performing loans (better asset quality) lead to the higher revenue efficiency of the GCC Islamic banks. Most of the previous studies also discovered the similar

finding on the asset quality with the bank efficiency (Kosmidou, 2008; Sufian and Habibullah, 2009)

The empirical findings in Model 6 seem to suggest a positive coefficient of the $\ln\text{NIITA}^*\text{IB}$ variable (statistically significant at the 1% level) indicating that the relatively higher non-traditional activities of GCC Islamic banks tend to exhibit a higher level of revenue efficiency. Sufian and Habibullah (2009) have shows similar results.

Model 7 summarised in Table 5 shows that the management quality of banks significantly affects the higher revenue efficiency in the GCC Islamic banks since the coefficient of $\ln\text{NIETA}^*\text{IB}$ show a negative and significant result at 1%. The negative finding imply that the lower costs or expenses of the banks lead to the better management quality and contribute to the higher revenue efficiency of the banks (Berger and DeYoung, 1997; Athanasoglou et al., 2008)

In Model 8 of Table 5 we report the $\ln\text{LOANSTA}^*\text{IB}$ result. As observed, the empirical findings seem to suggest a positive and significant coefficient of the $\text{LOANSTA}^*\text{IB}$. The result seems to suggest a positive relationship between the level of liquidity and the GCC Islamic banks' revenue efficiency indicate that higher liquidity of banks higher the revenue of the banks may be due to the strong economy. Sufian and Habibullah (2009) suggest that the loan-performance relationship depends significantly on the expected change of the economy.

On the other hand, there are two macroeconomics determinants that influence the revenue efficiency of the GCC Islamic bank namely inflation and bank's concentration ratio (Model 10 and 11) since the coefficient of $\ln\text{INFL}^*\text{IB}$ and $\ln\text{CR3}^*\text{IB}$ are positive statistically significant at 5% that exhibit in Model 10 and 11. The positive sign showed that inflation was anticipated. This indicated that the interest rates were adjusted accordingly, resulting in revenues to increase faster than costs; subsequently, giving positive impact on GCC Islamic banks' revenue efficiency. Banks will charge a higher interest rate and obtain higher revenue. Other studies (Molyneux and Thornton, 1992; Demirguc-Kunt and Huizinga, 1999; Pasiouras and Kosmidou, 2007) have also shown a positive relationship between either inflation or long-term interest rate and profitability. Turning to the concentration ratio

variable, the coefficient of $\ln CR3$ is significant at 5% and positively related to GCC Islamic banks; revenue efficiency that can be observed in Model 11. The empirical findings seem to support the Structure-Conduct-Performance (SCP) hypothesis. To recap, the SCP hypothesis states that banks in highly concentrated markets tend to collude, and therefore earn monopoly profits (Molynuex et al., 1996).

5. Conclusion

The study was carried out with the main purpose to examine the revenue efficiency with the others efficiencies concepts profit and cost efficiency of the Islamic and conventional banking sector in GCC countries over the period of 2007 to 2011. To date, the majority of researchers have focused more on cost and profit efficiency in banking sectors and only a few have looked on revenue efficiency. Furthermore, most of these studies are carried out on the conventional banking sectors, while empirical evidence on the Islamic banking sectors is relatively scarce. The non-parametric Data Envelopment Analysis (DEA) method is applied to distinguish between three different types of efficiency measures, namely cost, revenue, and profit. Additionally, we perform a series of parametric (*t*-test) and non-parametric (Mann-Whitney [Wilcoxon] and Kruskal-Wallis) tests to obtain the robust result.

We find that interesting results where revenue efficiency seems to play the main factor leading to the lower or higher profit efficiency levels. In essence, the profit efficiency on conventional banks will not be affected by the higher revenue efficiency levels since the result shows the level of profit efficiency is lower than cost efficiency due to the higher revenue efficiency, whereas the higher revenue efficiency only affects the higher profit efficiency levels in GCC Islamic banks. Therefore, the higher revenue efficiency in GCC Islamic banks seems to have contributed to the higher profit efficiency levels and contribute to a higher profit of the Islamic banks.

Other than addressing the revenue efficiency on the GCC banking sector, this study had also focused on examining the determinants of revenue efficiency particularly on GCC Islamic banks. Since the DEA result showed that the revenue efficiency in GCC Islamic banks did not improved, this study moved on to the second stage which was to identify

the determinants that could improve the revenue efficiency in GCC Islamic banks.

The six bank specific determinants that were examined were the size of bank, asset quality, capitalisation, non-traditional activities, management quality and liquidity. Economic growth, inflation and three-bank concentration ratio were three external determinants included to serve as additional control variables. To identify the significant relationship between revenue efficiency and those potential determinants under the second stage, the study used the Multivariate Regression Analysis (MRA). This stage applied the Generalized Least Square (GLS) method consisted of Fixed Effect Model (FEM) rather than Random Effect Model (REM) tested by Hausman test. To obtain robust results, all potential determinants interacted with dummy variables GCC Islamic banks.

It was found that the four bank specific determinants that influenced the revenue efficiency of the GCC Islamic banks were the asset quality, non-traditional activities, management quality and liquidity. The improvement of the revenue efficiency in GCC Islamic banks was also influenced by the macroeconomic variable inflation and concentration ratio of the three largest banks.

The findings of this study are expected to contribute significantly to the existing knowledge on the operating performance of the GCC Islamic and conventional banking sector. Nevertheless, the study has also provided further insights to the bank's specific management as well as the policymakers with regard to attaining optimal utilization of capacities, improvement in managerial expertise, efficient allocation of scarce resources, and the most productive scale of operation of Islamic banks operating in in GCC countries. This may also facilitate directions for sustainable competitiveness of the GCC Islamic banking sector operations in the future.

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**Appendix 1: List of Islamic and Conventional Bank in GCC Countries
2007-2011**

No.	Islamic Bank	No.	Conventional Bank
1	ABC Islamic Bank (E.C.)	1	Abu Dhabi Commercial Bank
2	Abu Dhabi Islamic Bank	2	Ahli Bank QSC
3	Ajman Bank	3	Ahli United Bank BSC
4	Al Rajhi Banking and Investment Corp	4	Ahli United Bank KSC
5	Albaraka Banking Group B.S.C.	5	Al Ahli Bank of Kuwait (KSC)
6	Albaraka Islamic Bank BSC	6	Al Khalij Commercial Bank
7	Alinma Bank	7	Arab Banking Corporation BSC
8	Al-Salam Bank-Bahrain B.S.C.	8	Arab National Bank
9	Arcapita Bank B.S.C.	9	Awal Bank
10	Bahrain Islamic Bank B.S.C.	10	Bank Al-Jazira
11	Bank AlBilad	11	Bank Dhofar SAOG
12	Bank Alkhair BSC	12	Bank Muscat SAOG
13	Boubyan Bank KSC	13	Bank of Bahrain and Kuwait B.S.C.(BBK)
14	Dubai Islamic Bank plc	14	Bank of Sharjah
15	Elaf Bank	15	Bank Sohar SAOG
16	Emirates Islamic Bank PJSC	16	Barwa Bank
17	Investors Bank BSC	17	Burgan Bank SAK
18	Islamic Development Bank	18	Commercial Bank International P.S.C.
19	Kuwait Finance House	19	Commercial Bank of Dubai P.S.C.
20	Kuwait International Bank	20	Commercial Bank of Kuwait SAK (The)
21	Noor Islamic Bank	21	Commercial Bank of Qatar (The) QSC
22	Qatar International Islamic Bank	22	Doha Bank
23	Qatar Islamic Bank SAQ	23	Emirates Bank International PJSC
24	Seera Investment Bank BSC	24	First Gulf Bank
25	Shamil Bank of Bahrain B.S.C.	25	Gulf Bank KSC (The)
26	Sharjah Islamic Bank	26	Gulf International Bank BSC
27	Venture Capital Bank BSC (c)-VCBank	27	International Bank of Qatar Q.S.C.
		28	International Banking Corporation BSC
		29	Invest Bank P.S.C.
		30	Mashreqbank
		31	National Bank of Abu Dhabi
		32	National Bank of Bahrain
		33	National Bank of Dubai Public Joint Stock Company
		34	National Bank of Fujairah
		35	National Bank of Kuwait S.A.K.
		36	National Bank of Oman (SAOG)

Appendix 1: List of Islamic and Conventional Bank in GCC Countries 2007-2011(cont.)

No.	Islamic Bank	No.	Conventional Bank
		37	National Bank of Ras Al-Khaimah (P.S.C.) (The)-RAKBANK
		38	National Bank of Umm Al-Qaiwain
		39	National Commercial Bank (The)
		40	Oman Arab Bank SAOG
		41	Oman International Bank
		42	Qatar National Bank
		43	Riyad Bank
		44	Saudi British Bank (The)
		45	Saudi Hollandi Bank
		46	Union National Bank
		47	United Arab Bank PJSC

Sources: Bankscope database

Appendix 2: Description of Bank specific, Macroeconomics and Interaction Variables

Variable	Description	Note
Bank Specific		
lnTA	Natural logarithm of total assets	Proxy of size of bank. This positive coefficient of size indicates positive relationship between size of banks and revenue efficiency where the larger the size of banks, the higher the revenue efficiency. This regression outcome may suggest that the large bank size is able to become more efficient due to the benefits obtained such as increasing in revenue, service quality and higher leverage from financial capital (Akhavein et al,1997; Sufian and Habibullah, 2009).
lnLLRGL	Loan loss reserve over gross loan	Proxy of asset quality. lnLLRGL is predicted to have negative coefficient (Sufian and Habibullah, 2009). Kosmidou (2008) showed that the ratio of loan loss reserves to gross loans (LLRGL) indicates how much of the total portfolio has been provided for, but not charged off, and is used as a measure of bank's asset quality. The coefficient is expected to be negative because bad loans (non-performing loans) could reduce the bank's efficiency level. A better quality asset is described as having lower non-performing loans or ratio of lnLLRGL (Ismail et al., 2009 and Wang, 2003). In this direction, Miller and Noulas (1997) asserted that the greater financial institutions exposure to high risk loans, the higher the accumulation of unpaid loans, and this lowers the profitability. Therefore, the asset quality will be better if the coefficient is lower. A lower coefficient contributes to a higher asset quality which can increase the revenue of the banks.

Appendix 2: Description of Bank specific, Macroeconomics and Interaction Variables (cont.)

Variable	Description	Note
lnETA	Earning over total assets	Proxy of capitalisation. This coefficient is expected to be positive (Abreu and Mendes, 2001; Casu and Girardone, 2004; Carvallo and Kasman, 2005; Athanasoglou et al., 2008). The positive coefficient of capitalisation signifies the positive relationship between capitalisation and revenue efficiency where the larger the capitalisation of the banks, the higher the revenue efficiency. The regression result may show that the well-capitalised banks would increase banks' revenue and profitability due to the lower expected costs of financial distress, lower expected bankruptcy costs, and lower risk of portfolio and such advantages will then be translated into high profitability (Bourke, 1989; Berger, 1995; Angbazo, 1997 and Demircuc-Kunt and Huizinga, 1999).
lnNIITA	Non-interest income over total assets	Proxy of non-traditional activities. This coefficient is expected to be positive relationship with revenue efficiency. According to Sufian and Habilullah (2009) to recognise the financial in recent years have increasingly been generating income from "off-balance sheet" business and fee income generally, the ratio of lnNIITA is entered in the regression analysis as a proxy for non-traditional activities. Non-interest income contains of commission, service charges and fees, guarantee fees, net profit from sale of investment securities and foreign exchange profit. The ratio is also included in the regression model as a proxy measure of bank diversification into non-traditional activities.
lnNIETA	Non-interest expense over total assets	Proxy of management quality. lnNIETA is applied to provide the information on variation in operating costs across the financial system. It reflects employment, total amount of wages and salaries, as well as the cost of running branch office facilities. The lower or higher cost represents a good management quality. Bourke (1989) argued that reduced expenses tend to improve the profitability of the financial institutions. Therefore, a higher ratio of lnNIETA is assumed to affect performance negatively because efficient banks are expected to operate at lower costs. Moreover, the wages expenses (reduce labour) could be reduced due to the usage of the new technology such as automated teller machines (ATMs) and other automated means of delivering services. Nevertheless, Molyneux and Thornton (1992) showed a contradictory finding in which they observed a positive relationship, suggesting that higher profits earned by banks that are more efficient may be appropriated in the form of higher payroll expenditures paid to more productive human capital. Therefore, the expected coefficient could be negative and may have positive relationship with revenue efficiency. Among studies that employed the similar variables are Berger (1997), Berger and DeYoung (1997), Berger et al. (1999), Athanasoglou et al. (2008), and Sufian and Habibullah (2009).

Appendix 2: Description of Bank specific, Macroeconomics and Interaction Variables (cont.)

Variable	Description	Note
lnLOANSTA	Total loan over total assets	Proxy of liquidity. Bank loans are assumed to be the main source of revenue and are expected to affect performance positively. Nevertheless, the coefficient could also be negative which indicates a negative relationship between liquidity and revenue efficiency because loan-performance relationship depends significantly on the expected change of the economy. While in a strong economy, only a small percentage of loans will default (lower percentage of unpaid loans). On the other hand, banks may be depressingly affected during a weak economy as borrowers are likely to default on their loans. Preferably, banks should capitalise on favourable economic environments and shield themselves during adverse conditions (Sufian and Habibullah, 2009).
Macroeconomics		
lnGDP	Natural logarithm of gross domestic product	Proxy of gross domestic product. Kosmidou (2008) suggested that the coefficient of the lnGDP is expected to be positive with the bank efficiency which shows that higher lnGDP leads to the higher revenue efficiency.
lnINFL	Consumer price index	Proxy of Inflation. Flamini et al. (2009) measured the lnINFL based on the current period of customer prices index (CPI) growth rate. Inflation may have direct effects such as an increase in the price of labour, and indirect effects such as changes in interest rates and asset prices on bank performance (Staikouras and Wood, 2003). Abreu and Mandes (2001) suggested that inflation is negatively related to bank's profitability, implying that the higher inflation will contribute to the lower profit. However, Perry (1992) suggested that the effects of inflation on bank performance depend on whether the inflation is anticipated or unanticipated. In the anticipated case, the interest rates are adjusted accordingly, resulting in faster increase of bank revenues than costs and subsequently gives positive impact on bank performance. In the unanticipated case, banks may be slow in adjusting their interest rates, resulting in a faster increase of bank costs than revenue; consequently, gives negative effects on bank performance.
lnCR3	Concentration ratio of the three largest banks	The concentration ratio of the three largest banks in terms of assets is entered in the regression models as a proxy variable for the banking sector concentration on the profitability of GCC banks. The structure-conduct-performance (SCP) theory posits the banks in a highly concentrated market tend to collude, and therefore earn monopoly profits (Molynuex et al., 1996).

Appendix 2: Description of Bank specific, Macroeconomics and Interaction Variables (cont.)

Variable	Description	Note
Dummy Variable		
IB	Dummy Islamic bank	IB is a binary variable that takes a value of 1 for GCC Islamic bank, and it is 0 otherwise. As expected, this coefficient is to be in positive sign which indicates that the banking sector has been relatively more revenue efficient in GCC Islamic banks.
Interaction Variables		
lnTA*IB	Binary variable that takes a value of 1 for the Islamic bank, 0 otherwise.	lnTA*IB variable is expected to have positive coefficient that indicates positive relationship between size of banks and GCC Islamic banks. The positive relationship suggests that the larger the size of banks, the higher the revenue efficiency of the GCC Islamic banks.
lnLLRGL*IB (cont.)	Binary variable that takes a value of 1 for the Islamic bank, 0 otherwise.	lnLLRGL*IB variable is expected to be negative because bad loans (non-performing loans) could reduce the bank's efficiency level. Therefore, the asset quality in GCC Islamic bank will be better if the coefficient is lower. This could contribute to the higher asset quality and increase the revenue to the banking sector
lnETA*IB	Binary variable that takes a value of 1 for the Islamic bank, 0 otherwise.	lnETA*IB variable is expected to be positive between capitalisation and GCC banks. The positive relationship indicates that the larger capitalisation of banks, the higher the revenue efficiency of the GCC Islamic banks.
lnNIITA*IB	Binary variable that takes a value of 1 for the Islamic bank, 0 otherwise.	lnNIITA*IB is expected to have positive coefficient that indicates positive relationship between non-traditional activities and GCC Islamic bank. The positive relationship explains that higher the non-traditional activities will increase the revenue efficiency of the GCC Islamic banks
lnNIETA*IB	Binary variable that takes a value of 1 for the Islamic bank, 0 otherwise.	lnNIETA*IB variable is expected to be negative or positive because efficient banks are expected to operate at lower or higher costs that represent good quality management. The negative or positive coefficient indicates negative or positive relationship between the banks' cost management and GCC Islamic banks. Thus, lower expenses of banks will lead to higher revenue efficiency in the GCC Islamic banking sector
lnLOANSTA*IB	Binary variable that takes a value of 1 for the Islamic bank, 0 otherwise.	lnLOANSTA*IB is expected to have positive or negative coefficient that indicates positive or negative relationship between liquidity and GCC Islamic bank. The positive relationship explains that higher liquidity of the banks will increase the revenue efficiency of the GCC Islamic banking sector. The negative relationship indicates that the higher liquidity of the banks will reduce the revenue efficiency of the GCC Islamic banking sector.
lnGDP*IB	Binary variable that takes a value of 1 for the Islamic bank, 0 otherwise.	lnGDP*IB variable is expected to be positive with the bank efficiency. It shows that higher lnGDP leads to higher revenue efficiency in GCC Islamic banks.

Appendix 2: Description of Bank specific, Macroeconomics and Interaction Variables (cont.)

Variable	Description	Note
lnINFL*IB	Binary variable that takes a value of 1 for the Islamic bank, 0 otherwise.	lnINFL*IB is expected to be positive or negative with the bank efficiency which indicates that higher or lower inflation leads to higher or lower bank's revenue efficiency in GCC Islamic banks.
lnCR3*IB	Binary variable that takes a value of 1 for the Islamic bank, 0 otherwise.	lnCR3*IB is expected to be positive with the bank efficiency which indicates that higher concentration leads to higher bank's revenue efficiency in GCC Islamic banks.

Evaluating the Financial Performance of Turkish Banking Sector: A Fuzzy MCDM Approach

Aydın Çelen¹

At the turn of the century Turkish economy was meltdown due to the one of the harshest crises experienced throughout her history. Since then, thanks to very strict measures taken by Turkish government, the economy proceeded to the recovery period. This period, however, seems to be interrupted once more again by 2008-2009 global financial crisis. In this study, we assess the financial performances of the different segments of the Turkish banking sector for the period between 2002 and 2010. In doing this, a combined methodology of Fuzzy Analytic Hierarchy Process (FAHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) methods is utilized. The results indicate that the adverse effect of the 2001 financial crisis on the Turkish banking sector is enormous while the ongoing global crisis is not so destructive in the sector.

1. Introduction

All organizations should measure their performances to some extent in order to detect organizational problems and provide improvement. The need for a flawless system of performance measurement is even more crucial in today's competitive business environment. Banking sector is not exception to this. The measurement of the performance in the banking sector has been always one of the major issues for the banks, governments and academicians. However, it is not easy to evaluate performances of the banks given that their products and services are of an intangible nature. For this reason, there is abundant literature discussing different research methods applied to performance measurement of banks.

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Performance measurement of banks has been traditionally achieved by help of several financial ratios such as return on assets (ROA), return on equity (ROE) and earnings per share (EPS). However, the usefulness of traditional financial performance measurement systems started to be discussed as the business environment changed in the last couple of the decades. As a result, the researchers have attempted to overcome the drawback of the traditional measurement system. This can be achieved with two different ways. Firstly, multidimensional performance measurement systems which incorporate both financial and non-financial measures such as customer satisfaction, management capacity and employee relations are introduced. SMART pyramid (Lynch and Cross, 1991), the balanced scorecard (Wu et al. 2009), CAMEL (Christopoulos et al., 2011), DEA (Aydin et al., 2009) and TOPSIS (Secme et al., 2009) are examples of this new performance measurement system. Secondly, instead of using financial ratios individually, sets of these ratios are started to be used. Most of these sets of the ratios are based on ROE and divide ROE into its component ratios. The examples of the sets of ratios are Dupont System of Financial Analysis (McGowan et al., 2011) and Schierenbeck's Basic ROE Scheme (Badreldin, 2009). Since each of these contemporary performance measurement methods has its own advantages and disadvantages, none of them can be seen as perfect. Thus, evaluating pro and cons of each method, one can select the most suitable method according to her study's particular situation.

In this study, we determined our aim as evaluating the overall financial performances of the different segments of the Turkish banking sector. As explained in the following section, there are plenty of literature on performance measurement of the Turkish banks individually. For this reason, in this study, we focused on assessing the overall performances of the different banking segments instead of an individual evaluation at bank level. In addition, although we were aware of the fact that non-financial measures show up as important performance measurement criteria in the banking sector, in this study we deliberately focused on only financial measures because of several reasons. First, it is not an easy task to quantify non-financial measures such as customer satisfaction, quality and flexibility, management capacity, innovation capability and employee relations at individual bank level. At the more aggregated segments level, it is more difficult and even meaningless to try to take into account these non-financial measures. Second, different

from the traditional ratio analysis which relies on limited number of financial measures, in this study, we took into account a large number of financial measures (29 in total) within a combined framework of Fuzzy Analytic Hierarchy Process (FAHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) methods. With FAHP method, the weights attached to these financial performance criteria by expert decision markers are determined. Then, TOPSIS method is used to rank the financial performances of the different segments of the Turkish banking sector.

The remaining of the study is as follows: In the next section, literature review on performance measurement in Turkish banking sector is presented. This is followed by a section explaining the research methodology including FAHP and TOPSIS methods. Then, empirical results are provided, and in the final section, the results of the study are discussed.

2. Performance Measurement in Turkish Banking Sector

In the banking literature, three different approaches have been employed in assessment of the efficiency of the banking sector according to the activities of the banks. These are “production approach”, “intermediation approach” and “profitability approach”. In the production approach, banks are assumed to produce deposits and provide loans by using their workforce and capital. In the intermediation approach, banks are considered to serve as intermediaries between those who deposit and those who withdraw money. In other words, the main functions of the banks are to convert the deposits which they collect into loans. And finally, according to the profitability approach, the main motivation of a bank is to increase its profit (Drake, Hall and Simper, 2005). The approach used in the assessment of the banking efficiency is crucial given that the input/output variables, and probably the results of the applications, may vary depending on the approach used.

A review of the literature on assessing efficiency of the Turkish banking sector reveals that a great number of studies employing all three types of these approaches seem to be conducted. However, these studies generally utilize the non-parametric approaches such as Data Envelopment Analysis (DEA) rather than parametric approaches such as

Stochastic Frontier Analysis (SFA). Among the motivations of these studies, two become prominent: First, the studies are motivated to investigate the effects of liberalization policies on the efficiency of Turkish banking sector. Second, the effects of the ownership structure of banks on their performances are frequently examined by using different time periods.

Some of the studies which are conducted to investigate the relationship between the efficiency and financial liberalization in Turkey are as follows: Based on an intermediation approach, Zaim (1995) analyzes the effects of the liberalization policies of the 1980s on the efficiency of the Turkish commercial banks for the 1981-1990 period. This study witnesses substantial improvements in the efficiencies of the banks following to the liberalization of capital movements. Mercan and Yolalan (2000) also reaches similar results for the 1989–1998 period: The financial performance of the banks increases after the financial reforms but starts deteriorating with the 1994 crisis. However, this result is not in line with Yildirim (1999) and Denizer et al. (2000). Analyzing the efficiency of Turkish commercial banks throughout 1988-1996, Yildirim (1999) reaches the conclusion that efficiency levels in Turkish banking sector did not increase following the liberalization. Denizer et al. (2000), using both the intermediation and the production approaches simultaneously for the period 1970-1994, claims that bank efficiency decreased following the liberalization in Turkey.

Another stream in the literature is examining the effects of the ownership structure of banks on their financial performances: Yolalan (1996) compares the efficiency performances of foreign, private and state-owned banks operation in Turkey during the years 1988-1995 by using financial ratios as inputs and outputs. This study shows that foreign banks in Turkey are more efficient than their domestic counterparts. Among the domestic banks, private banks have higher efficiency scores than public ones. This finding is also supported by Jackson, Fethi, and Inal (1998), Cingi and Tarim (2000) and Mercan and Yolalan (2000). Examining 1992-1996 period by help of a production approach, Jackson et al. (1998) reveals that private commercial banks operated more efficiency than public banks during the 1994 crisis. Cingi and Tarim (2000) applies a mixture of the intermediation and production approaches for the years 1989-1996, and concludes that private

commercial banks are more efficient compared to state-owned banks. Mercan and Yolalan (2000) indicates that both private and foreign banks operate more efficiently than state-owned ones during the before and after 1994 crisis. Atan and Catalbas (2005) also analyzes the impacts of the differentiation in the capital structure of banks and concludes that private and foreign banks are more efficient than state-owned banks. Onal and Sevimeser (2006) also concludes that foreign banks in Turkey operate more efficiently than state-owned and private banks although their growth trends are rather similar. Isık and Uysal (2006) find that private and foreign banks in Turkey are better at adapting themselves to changing operational environments and better motivated to utilize emerging opportunities. Aydin et al. (2009) assesses the efficiency of the banking segments for the period 2002-2004 by using DEA method. Accordingly, the most efficient banks are state-owned, followed by foreign and private banks, respectively. This finding of Aydin et al. (2009) does not comply with findings of earlier research in literature.

In literature, several studies aim to compare the efficiencies of the banking sectors in different countries. For example, employing DEA method on four homogenous groups of countries, Stavárek (2006) examines whether the differences among regions and countries in their stages of European integration and economic development are also visible in banking efficiency. Results suggest that differences in banking efficiency exist among the regions analyzed, and the hierarchy corresponds with the hierarchy of regions in terms of economic development and degree of integration. However, the rapid growth of banking intermediation efficiency recorded in Central and East European countries could trade off the actual efficiency gap compared to traditional EU members. Andries (2011) studies the determinants of the efficiency and productivity of the banking systems of seven central and east European countries by help of DEA and SFA. The results show that the average efficiency of banks in central and east European countries grew during a five-year period, from 2004 to 2008. The improvement is attributed to the increased competition upon EU accession and the entry of foreign banks, as well as to extensive legislative changes that led banks to become more efficient. Based on the results, the highest level of technical efficiency is recorded for the banking systems of Romania and the Czech Republic, and the lowest is recorded for Slovenia.

Performance assessment of the banking sector has been also achieved in a multi-criteria decision making (MCDM) framework. The aim of the MCDM is to obtain the optimum choice that provides the highest degree of satisfaction considering all of the relevant criteria. To the best of our knowledge, Secme et al. (2009), Cetin and Cetin (2010) and Demireli (2010) are the studies which evaluate the performances of Turkish banks using a MCDM model. Secme et al. (2009) proposes a fuzzy performance evaluation model with both financial and non- financial performance indicators for five commercial banks in the Turkish banking sector by using FAHP and TOPSIS methods together. This study suggests that not only financial performance but also non-financial performance such as customer satisfaction and service quality should be taken into account in a competitive environment. Cetin and Cetin (2010) evaluates the financial performances of the Turkish banks which are traded in Istanbul Stock Exchange (ISE) by using Vise Kriterijumska Optimizacija I Kompromisno Resenje (VIKOR) method. Çetin and Çetin (2010) concludes that the researchers using VIKOR method may test their results with alternative criteria's weights given that this method is sensitive to these weights. Demireli (2010) analyzes the performances of three state-owned commercial banks. In doing this, equal weights are given to the financial criteria which are used in the study, and then performance scores are obtained by using TOPSIS method. This study concludes that the state-owned commercial banks are being effected from local and global financial crisis, the performance scores continuously fluctuate, and they cannot show any outstanding performance improvements over time.

3. Research Methodology

3.1. Fuzzy Analytic Hierarchy Process (FAHP)

Analytic Hierarchy Process (AHP), firstly proposed by Saaty (1980), has a wide range of applications. AHP uses hierarchical structures to represent a problem and then calculate weights for alternatives according to the judgments of the decision makers in a pairwise comparison framework. The conventional version of AHP method is often criticized owing to using the exact and crisp judgments of the decision makers. On the other hand, decision makers are more confident about interval judgments than fixed value judgments. Because of the

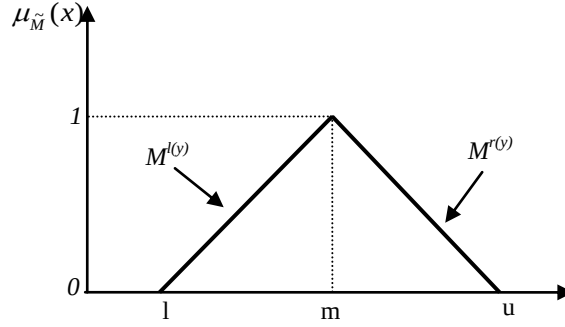
vagueness and ambiguous are inherent of the human judgments and preferences, real life situations can be modeled more adequately by using fuzzy values than the exact numerical values. Another handicap of the AHP method is that the preferences in AHP are essentially human judgments based on their subjective perceptions. Therefore, a fuzzy version of the AHP method, called Fuzzy Analytic Hierarchy Process (FAHP), has been introduced in order to take into consideration subjective uncertainty of the variables.

A fuzzy number is a special fuzzy set $A = \{x \in R \mid \mu_A(x)\}$, where x takes its values on the real line $\mathcal{R}^1: -\infty < x < +\infty$ and $\mu_A(x)$ is a continuous mapping from $\mathcal{R}^1$ to the closed interval $[0, 1]$. Triangular fuzzy numbers and trapezoidal fuzzy numbers are the most popular fuzzy numbers thanks to their computational simplicity. Triangular fuzzy numbers are preferred for representing the linguistic variables in this study.

A triangular fuzzy number can be denoted as $\tilde{M} = (l, m, u)$ and its membership function $\mu_{\tilde{M}}(x): \mathcal{R}^1 \rightarrow [0, 1]$ can be given as

$$\mu_{\tilde{M}}(x) = \begin{cases} 0 & x < l \text{ or } x > u \\ (x-l)/(m-l) & l \leq x \leq m \\ (x-u)/(m-u) & m \leq x \leq u \end{cases} \quad (1)$$

where $l \leq m \leq u$ and l , m , and u describe the smallest possible value, the most promising value, and the largest possible value of a fuzzy event, respectively. Membership function of a triangular fuzzy number $\tilde{M}$ is illustrated in Figure 1 (Deng, 1999):

Figure 1: A Triangular Membership Function, $\mu_{\tilde{M}}(x)$ 

Let $\tilde{M}_1 = (l_1, m_1, u_1)$, $\tilde{M}_2 = (l_2, m_2, u_2)$ be two triangular fuzzy numbers, the basic operations of triangular fuzzy numbers used in this study are defined as follows:

$$\begin{aligned}
 \tilde{M}_1 \oplus \tilde{M}_2 &= (l_1 + l_2, m_1 + m_2, u_1 + u_2), \\
 \tilde{M}_1 \otimes \tilde{M}_2 &\approx (l_1 l_2, m_1 m_2, u_1 u_2), \\
 \lambda \otimes \tilde{M}_1 &= (\lambda l_1, \lambda m_1, \lambda u_1), \lambda > 0, \lambda \in R, \\
 \tilde{M}_1^{-1} &\approx (1/u_1, 1/m_1, 1/l_1)
 \end{aligned} \tag{2}$$

where $l_1, m_1, u_1, l_2, m_2, u_2 > 0$

In this study, criteria weights of the performance measures are calculated by using extent analysis of Chang (1996). To describe the extent analysis of Chang (1996), firstly let $X = \{x_1, x_2, \dots, x_n\}$ an object set, and $G = \{g_1, g_2, \dots, g_n\}$ be a goal set. According to the method, extent analysis for each goal is performed respectively. Therefore, m extent analysis values for each object can be obtained:

$$M_{gi}^1, M_{gi}^2, \dots, M_{gi}^m, \quad i=1, 2, \dots, n, \tag{3}$$

where all M_{gi}^j ($j=1, 2, \dots, m$) are triangular fuzzy numbers. In this framework, Chang's extent analysis can be given as follows (Ertugrul and Karakasoglu, 2009):

Step 1: The value of fuzzy synthetic extent with respect to the i th object is defined as follows:

$$S_i = \sum_{j=1}^m M_{gi}^j \otimes \left[\sum_{i=1}^n \sum_{j=1}^m M_{gi}^j \right]^{-1} \quad (4)$$

To obtain $\sum_{j=1}^m M_{gi}^j$, the fuzzy addition operation of m extent analysis values for a particular matrix is performed as follows:

$$\sum_{j=1}^m M_{gi}^j = \left(\sum_{j=1}^m l_j, \sum_{j=1}^m m_j, \sum_{j=1}^m u_j \right) \quad (5)$$

and to obtain $\left[\sum_{i=1}^n \sum_{j=1}^m M_{gi}^j \right]^{-1}$, the fuzzy addition operation of M_{gi}^j ($j=1,2,\dots,m$) values is performed as follows:

$$\sum_{i=1}^n \sum_{j=1}^m M_{gi}^j = \left(\sum_{i=1}^n l_i, \sum_{i=1}^n m_i, \sum_{i=1}^n u_i \right) \quad (6)$$

and then the inverse of the vector above is computed as follows:

$$\left[\sum_{i=1}^n \sum_{j=1}^m M_{gi}^j \right]^{-1} = \left(1/\sum_{i=1}^n u_i, 1/\sum_{i=1}^n m_i, 1/\sum_{i=1}^n l_i \right) \quad (7)$$

Step 2: When $M_1 = (l_1, m_1, u_1)$ and $M_2 = (l_2, m_2, u_2)$ are two triangular fuzzy numbers, the degree of possibility $M_2 = (l_2, m_2, u_2) \geq M_1 = (l_1, m_1, u_1)$ is defined as

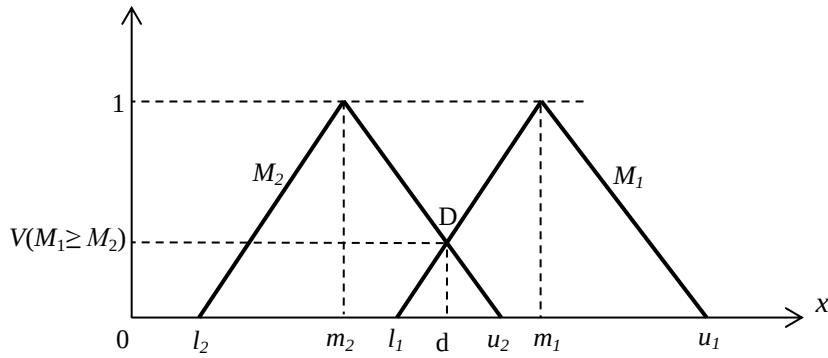
$$V(M_2 \geq M_1) = \sup_{y \geq x} \left(\min(\mu_{M_1}(x), \mu_{M_2}(y)) \right) \quad (8)$$

and can be equivalently stated as:

$$V(M_2 \geq M_1) = \text{hgt}(M_1 \cap M_2) = \mu_{M_2}(d) = \begin{cases} 1, & \text{if } m_2 \geq m_1, \\ 0, & \text{if } l_1 \geq u_2, \\ \frac{l_1 - u_2}{(m_2 - u_2) - (m_1 - l_1)} & \text{otherwise} \end{cases} \quad (9)$$

Figure 2 illustrates equation (9) where d is the ordinate of the highest intersection point D between $\mu_{M_1}(x)$ and μ_{M_2} (Zhu et al., 1999). The values of both $V(M_1 \geq M_2)$ and $V(M_2 \geq M_1)$ are needed to compare M_1 and M_2 .

Figure 2: Intersection Between M_1 and M_2



Step 3: The degree of possibility for a fuzzy number to be greater than k fuzzy numbers M_i ($i = 1, 2, \dots, k$) can be defined by

$$V(M \geq M_1, M_2, \dots, M_k) = V[(M \geq M_1) \text{ and } (M \geq M_2) \text{ and } (M \geq M_k)] \quad (10)$$

$$= \min V(M \geq M_i), \quad i = 1, 2, \dots, k \quad (11)$$

Assume that $d'(A_i) = \min V(S_i \geq S_k)$ for $k = 1, 2, \dots, n; k \neq i$. Then the weight vector is given by

$$W' = (d'(A_1), d'(A_2), \dots, d'(A_n))^T \quad (12)$$

where A_i ($i = 1, 2, \dots, n$) are n elements.

Step 4: The normalized weight vectors are obtained by normalization as

$$W = (d(A_1), d(A_2), \dots, d(A_n))^T \quad (13)$$

3.2. Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

TOPSIS is originally proposed by Hwang and Yoon (1981), and became one of the classical MCDM methods. According to this method, alternatives to be evaluated by n attributes in a MCDM problem are presented as points in an n -dimensional space. A fundamental assumption of TOPSIS is that each attribute has a tendency towards monotonically increasing or decreasing utility. In this method, firstly positive ideal solutions (PIS) and negative ideal solutions (NIS) are determined. The positive ideal solution is a solution that maximizes the benefit criteria and minimizes the cost criteria, whereas the negative ideal solution maximizes the cost criteria and minimizes the benefit criteria (Wang and Elhag, 2006). In short, the positive ideal solution is composed of all best values attainable of criteria, whereas the negative ideal solution consists of all worst values attainable of criteria (Wang, 2008). TOPSIS method considers the distances to both the PIS and the NIS simultaneously by defining “relative closeness to ideal solution”. The alternative which is the closest to positive ideal solution and farthest from the negative ideal solution is selected as the best alternative.

To explain the algorithm of TOPSIS, suppose we have m alternatives $(A_1, A_2, \dots, A_m)$, and n decision criteria $(C_1, C_2, \dots, C_n)$. Each alternative is evaluated with respect to the n criteria. All the rating scores assigned to the alternatives with respect to each criterion form a decision matrix denoted by $X = (x_{ij})_{m \times n}$. Let $W = (w_1, w_2, \dots, w_n)$ be the relative weight vector about criteria, satisfying $\sum_{j=1}^n w_j = 1$. The algorithm of TOPSIS is as follows (Ertugrul and Karakasoglu, 2009):

Step 1: Decision matrix $X = (x_{ij})_{m \times n}$ is normalized by dividing each performance rating of the decision matrix with its norm, which is called vector normalization procedure. In other words, for benefit attributes, the normalized value r_{ij} is obtained by

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}} \quad (14)$$

while for cost attributes, r_{ij} is computed as

$$r_{ij} = \frac{(1/x_{ij})}{\sqrt{\sum_{i=1}^m (1/x_{ij}^2)}} \quad (15)$$

where x_{ij} is the performance rating of i th alternative for attribute C_j .

Step 2: Weighted normalized decision matrix $V = (v_{ij})_{m \times n}$ is obtained by multiplying normalized matrix with the weights of the criteria:

$$v_{ij} = r_{ij} \cdot w_j \quad (16)$$

where $i=1,2,\dots,m$ and $j=1,2,\dots,n$.

Step 3: Positive ideal solution (PIS) and negative ideal solution (NIS) are determined:

$$\text{PIS} = \{v_1^+, v_2^+, \dots, v_n^+\} \text{ where } v_j^+ = \max_i (v_{ij}) \quad (17)$$

$$\text{NIS} = \{v_1^-, v_2^-, \dots, v_n^-\} \text{ where } v_j^- = \min_i (v_{ij}) \quad (18)$$

Step 4: The distance of each alternative from PIS and NIS are calculated:

$$d_i^+ = \sqrt{\sum_{j=1}^n (v_{ij} - v_j^+)^2} \quad (19)$$

$$d_i^- = \sqrt{\sum_{j=1}^n (v_{ij} - v_j^-)^2} \quad (20)$$

where $i=1,2,\dots,m$.

Step 5: The closeness coefficient of each alternative (CC_i) is calculated:

$$CC_i = \frac{d_i^-}{d_i^+ + d_i^-} \text{ where } i=1,2,\dots,m \quad (21)$$

Step 6: The ranking of the alternatives are determined according to CC_i values: The bigger CC_i , the better the relevant alternative. In other words, the alternative with the highest closeness coefficient is determined as the best alternative.

4. Application

Following very severe financial crisis experienced in 2001, rather heavy regulations regarding financial institutions were introduced in Turkey. In this study, we analyze the overall financial performances of the different segments of the Turkish banking sector through the period between 2002 and 2010. The data used in this study is obtained from Banks Association of Turkey (BAT).

Turkish financial sector has been always dominated by banks: According to the asset sizes, as of February 2012, 77% of the assets belong to the banks. As can be seen from Table 1, 44 banks in total operate in Turkey, 31 of them being deposit and 13 development and investment banks. The banks which operate in different segments of the Turkish banking sector are illustrated in Figure 3. Amongst deposit banks, there are 3 state-owned banks, 11 private banks and 16 foreign banks. The Deposits Insurance Fund (DIF) owns 1 bank. As parallel to the growth in the financial market in Turkey, the number of branches and employees of banks increase continuously. As of February 2012, the number of branches and employees reach to 9,841 and 181,277, respectively. Total asset of the banking sector is approximately 626 billion US Dollars. Almost all of this total is owned by the deposit banks. Indeed, the deposit banks dominate not only banking sector, but also all financial sector.

Table 1: Number of Banks, Branches, Employees and Total Asset in Turkish Banking Sector

	Bank	Branch	Employee	Total Asset
Turkish Banking Sector (TBS)	44	9,841	181,277	626,043
Deposit banks (DEB)	31	9,798	176,032	605,570
State-owned banks (SDB)	3	2,894	49,218	185,958
Private banks (PDB)	11	4,996	89,154	334,696
Banks in DIF (DIF)	1	1	243	445
Foreign banks (FDB)	16	1,907	37,417	84,472
Founded (FFB)	10	1,882	36,852	80,281
Branched (FBB)	6	25	565	4,190
Dev't. and inv. banks (DIB)	13	43	5,245	20,472
State-owned banks (SDI)	3	22	3,881	11,543
Private banks (PDI)	6	16	1,030	7,678
Foreign banks (FDI)	4	5	334	1,252

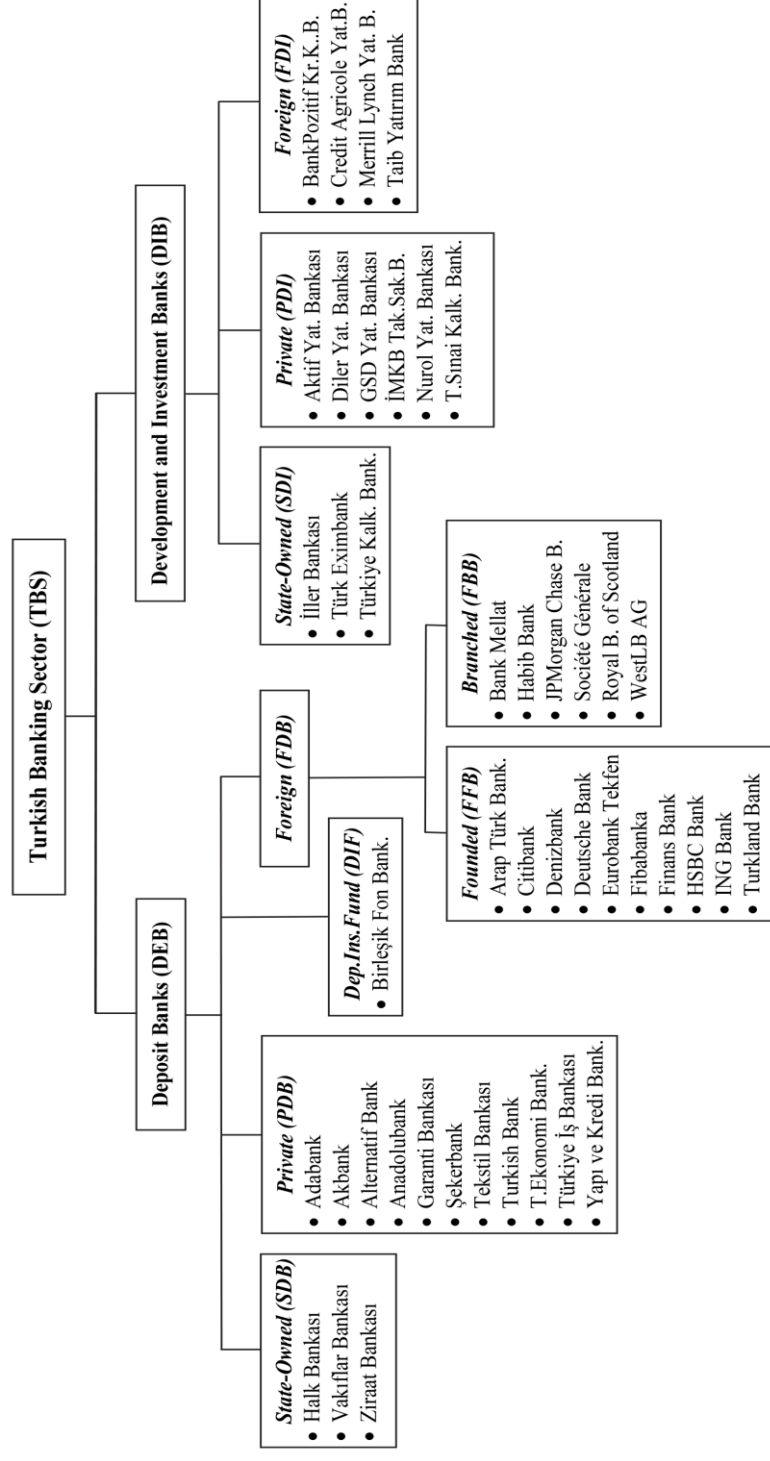
Notes:

(1) The meanings of the abbreviations denoting the segments of the banking sector are as follows: TBS: Turkish Banking Sector, DEB: Deposit Banks, SDB: State-owned Deposit Banks, PDB: Private Deposit Banks, DIF: Banks Under the Deposit Insurance Fund, FDB: Foreign Deposit Banks, FFB: Foreign Banks Founded in Turkey, FBB: Foreign Banks Having Branches in Turkey, DIB: Development and Investment Banks, SDI: State-owned Development and Investment Banks, PDI: Private Development and Investment Banks, FDI: Foreign Development and Investment Banks.

(2) Source: BAT

(3) Total assets are in million USD.

In analyzing the financial performance of different segments of Turkish banking sector, FAHP and TOPSIS methods are used together. While FAHP is used for determining the weights of main and sub-criteria in the light of opinions of an expert group, the TOPSIS method is used for evaluating the performances of the segments. Meanwhile, the expert group consists of three decision makers. The first decision maker is selected from a state-owned deposit bank while the second one is from a private deposit bank. And the third one is an academicians with a considerable experience on banking.

Figure 3: Banks and Segments of Turkish Banking Sector

Although there are many types of financial ratios used in the evaluation of financial performance in banking sector, assessment results can vary according to the different ratios. A bank or banking segment showing a high performance according to one ratio may have a very low performance according to another ratio (Secme et al., 2009). For this reason, we tried to obtain the evaluations of the expert group regarding the relative importance of all available financial ratios. Bearing this in mind, we determined 29 financial ratios which may be relevant, and grouped them under 6 main criteria. These main criteria are Capital Ratios, Balance-Sheet Ratios, Assets Quality, Liquidity Ratios, Profitability Ratios and Income-Expenditure Structure. To determine the relative importance of two criteria, Saaty' 1-9 scale (Saaty, 1980), illustrated in Table 2, is employed. In this study, we only explained how the weights for main criteria are calculated. The explanations regarding sub-criteria were not presented here, but may be provided upon request. The abbreviations denoting financial criteria and their meanings are presented in Table 3. This table also includes the calculated weights for all main and sub-criteria in parentheses.

Table 2: Scales for Pairwise Comparison

Preferences in linguistic variables	Preferences in numeric variables
Equal importance	1
Moderate importance	3
Strong importance	5
Very strong importance	7
Extreme importance	9
Intermediate values if necessary	2,4,6,8

Table 3: Hierarchical Criteria Set

Criterion	Explanation and calculated weight
CR	Capital Ratios (0.20)
CR1	Shareholders' Equity / (Amount subject to credit + market + operational risk) (0.20)
CR2	Shareholders' Equity / Total Assets (0.21)
CR3	(Shareholders' Equity - Permanent Assets) / Total Assets (0.21)
CR4	Net On Balance Sheet Position / Total Shareholders' Equity (0.18)
CR5	Net On and Off Balance Sheet Position / Total Shareholders' Equity (0.20)
BR	Balance-Sheet Ratios (0.06)
BR1	TC Assets / Total Assets (0.16)
BR2	TC Liabilities / Total Liabilities (0.18)
BR3	FC Assets / FC Liabilities (0.17)
BR4	TC Deposits / Total Deposits (0.15)
BR5	Total Deposits / Total Assets (0.17)
BR6	Funds Borrowed / Total Assets (0.17)
AQ	Assets Quality (0.20)
AQ1	: Financial Assets (net) / Total Assets (0.16)
AQ2	: Total Loans and Receivables / Total Assets (0.17)
AQ3	: Total Loans and Receivables / Total Deposits (0.17)
AQ4	: Loans Under Follow-up (net) / Total Loans and Receivables (0.16)
AQ5	: Specific Provisions / Loans Under Follow-up (0.17)
AQ6	: Permanent Assets / Total Assets (0.17)
LR	Liquidity Ratios (0.19)
LR1	Liquid Assets / Total Assets (0.43)
LR2	Liquid Assets / Short-term Liabilities (0.28)
LR3	TC Liquid Assets / Total Assets (0.29)
PR	Profitability Ratios (0.20)
PR1	Net Profit/Losses / Total Assets (0.18)
PR2	Net Profit/Losses / Total Shareholders' Equity (0.44)
PR3	Profit/Losses Before Taxes after Continuing Operations / Total Assets (0.38)
IE	Income-Expenditure Structure (0.16)
IE1	Net Interest Income After Specific Provisions / Total Assets (0.19)
IE2	Net Interest Income After Specific Provisions / Total Operating Income (0.20)
IE3	Non-interest Income (net) / Total Assets (0.16)
IE4	Other Operating Expenses / Total Assets (0.12)
IE5	Personnel Expenses / Other Operating Expenses (0.16)
IE6	Non-interest Income (net) / Other Operating Expenses (0.17)

In constructing the triangular fuzzy numbers from the decision makers' pairwise comparison grades, we used respectively the minimum and maximum grades given by decision makers for the lower (l) and upper (u) bound of the relevant fuzzy number. As for the most promising value of the fuzzy number, we used the arithmetic mean of the grades given by decision makers. The pairwise comparison matrix including the fuzzy numbers calculated is presented in Table 4.

Table 4: Fuzzy Pairwise Comparison Matrix

	CR	BR	AQ	LR	PR	IE
CR	(1, 1, 1)	(7, 8.33, 9)	(0.11, 2.7, 7)	(0.11, 5.37, 9)	(0.11, 2.41, 7)	(7, 8.33, 9)
BR	(0.11, 0.12, 0.14)	(1, 1, 1)	(0.11, 0.41, 1)	(0.11, 0.41, 1)	(0.11, 0.41, 1)	(0.11, 0.41, 1)
AQ	(0.14, 3.38, 9)	(1, 6.33, 9)	(1, 1, 1)	(0.11, 4.7, 9)	(0.11, 4.7, 9)	(1, 5, 9)
LR	(0.11, 3.08, 9)	(1, 6.33, 9)	(0.11, 3.1, 9)	(1, 1, 1)	(0.11, 3.37, 9)	(0.11, 3.37, 9)
PR	(0.14, 6.05, 9)	(1, 6.33, 9)	(0.11, 3.1, 9)	(0.11, 3.37, 9)	(1, 1, 1)	(1, 6.33, 9)
IE	(0.11, 0.12, 0.14)	(1, 6.33, 9)	(0.11, 0.44, 1)	(0.11, 3.37, 9)	(0.11, 0.41, 1)	(1, 1, 1)

Then using the fuzzy numbers in comparison matrix, synthesis values respect to main criteria calculated as in equation (4):

$$S_{CR} = (15.33, 28.15, 42) \otimes (1/206.29, 1/97.48, 1/28.51) = (0.0743, 0.2888, 1.4733)$$

$$S_{BR} = (1.56, 2.75, 5.14) \otimes (1/206.29, 1/97.48, 1/28.51) = (0.0075, 0.0282, 0.1804)$$

$$S_{AQ} = (3.37, 25.12, 46) \otimes (1/206.29, 1/97.48, 1/28.51) = (0.0163, 0.2577, 1.6136)$$

$$S_{LR} = (2.44, 20.26, 46) \otimes (1/206.29, 1/97.48, 1/28.51) = (0.0118, 0.2079, 1.6136)$$

$$S_{PR} = (3.37, 26.19, 46) \otimes (1/206.29, 1/97.48, 1/28.51) = (0.0163, 0.2687, 1.6136)$$

$$S_{IE} = (2.44, 11.67, 21.14) \otimes (1/206.29, 1/97.48, 1/28.51) = (0.0118, 0.1197, 0.7416)$$

By using the equation (9), fuzzy numbers are compared:

$$V(S_{CR} \geq S_{BR}) = 1, V(S_{CR} \geq S_{AQ}) = 1, V(S_{CR} \geq S_{LR}) = 1, V(S_{CR} \geq S_{PR}) = 1, V(S_{CR} \geq S_{IE}) = 1$$

$$V(S_{BR} \geq S_{CR}) = 0.29, V(S_{BR} \geq S_{AQ}) = 0.42, V(S_{CR} \geq S_{LR}) = 0.48, V(S_{CR} \geq S_{PR}) = 0.41, V(S_{CR} \geq S_{IE}) = 0.65$$

$$V(S_{AQ} \geq S_{CR}) = 0.98, V(S_{AQ} \geq S_{BR}) = 1, V(S_{AQ} \geq S_{LR}) = 1, V(S_{AQ} \geq S_{PR}) = 0.99, V(S_{AQ} \geq S_{IE}) = 1$$

$$\begin{aligned}
V(S_{LR} \geq S_{CR}) &= 0.95, V(S_{LR} \geq S_{BR}) = 1, V(S_{LR} \geq S_{AQ}) = 0.97, V(S_{LR} \geq S_{PR}) = 0.96, V(S_{LR} \geq S_{IE}) = 1 \\
V(S_{PR} \geq S_{CR}) &= 0.99, V(S_{PR} \geq S_{BR}) = 1, V(S_{PR} \geq S_{AQ}) = 1, V(S_{PR} \geq S_{LR}) = 1, V(S_{PR} \geq S_{IE}) = 1 \\
V(S_{IE} \geq S_{CR}) &= 0.8, V(S_{IE} \geq S_{BR}) = 1, V(S_{IE} \geq S_{AQ}) = 0.84, V(S_{IE} \geq S_{LR}) = 0.89, V(S_{IE} \geq S_{PR}) = 0.83
\end{aligned}$$

Then, according to the equation (11), priority weights are calculated:

$$\begin{aligned}
d'(CR) &= \min(1, 1, 1, 1, 1) = 1 \\
d'(BR) &= \min(0.29, 0.42, 0.48, 0.41, 0.65) = 0.29 \\
d'(AQ) &= \min(0.98, 1, 1, 0.99, 1) = 0.98 \\
d'(LR) &= \min(0.95, 1, 0.97, 0.96, 1) = 0.95 \\
d'(PR) &= \min(0.99, 1, 1, 1, 1) = 0.99 \\
d'(IE) &= \min(0.8, 1, 0.84, 0.89, 0.83) = 0.8
\end{aligned}$$

When we normalize these priority weights of main criteria, we obtain the weight of 0.20 for Capital Ratios, 0.06 for Balance-Sheet Ratios, 0.20 for Assets Quality, 0.19 for Liquidity Ratios, 0.20 for Profitability Ratios and 0.16 for Income-Expenditure Structure. Accordingly, Capital Ratios, Assets Quality and Profitability Ratios are seen almost equally as the most important criteria while Balance-Sheet Ratios is evaluated as the least important criterion.

After determining the weights of the all main and sub-criteria (financial performance criteria), we proceed to the application of TOPSIS method. Herein we explain only application of TOPSIS method to overall Turkish banking sector (TBS) to save space. The explanations about the application of the model to segments may be provided upon request. Financial performance criteria are normalized according to equations (14) and (15). In doing this, all sub-criteria – except BR6, AQ4, AQ6, IE4 and IE5, are considered as benefit attributes rather than cost attributes. Meanwhile, the criteria which are generated from deposit (namely BR4, BR5 and AQ3) are not considered for development and investment banks (DIB, SDI, PDI and FDI) given that these banks do not collect deposit. The weights of these criteria are distributed to other criteria according to their initial weights. After getting the normalized matrix, we multiply each normalized value of sub-criteria with their weights according to equation (16). Then, these weighted normalized values of sub-criteria under each main criterion are aggregated, and Table 5 is obtained. At the end of application, the total values of main

criteria are multiplied by the weights of the main criteria (0.20, 0.06, 0.20, 0.19, 0.20, 0.16), and total weighted values of main criteria (Table 6) are obtained.

Table 5: Total Values of Main Criteria for TBS

Years	CR	BR	AQ	LR	PR	IE
2002	-0.061	0.307	0.200	0.304	0.194	0.325
2003	0.222	0.325	0.249	0.358	0.362	0.358
2004	0.180	0.329	0.283	0.351	0.330	0.354
2005	0.262	0.331	0.324	0.372	0.247	0.325
2006	0.131	0.324	0.380	0.351	0.377	0.326
2007	0.129	0.337	0.376	0.345	0.401	0.329
2008	0.181	0.333	0.352	0.241	0.300	0.301
2009	0.131	0.351	0.343	0.317	0.381	0.317
2010	0.132	0.350	0.377	0.323	0.345	0.317

Table 6: Total Weighted Values of Main Criteria for TBS

Years	CR	BR	AQ	LR	PR	IE
2002	-0.012	0.018	0.039	0.058	0.038	0.052
2003	0.044	0.019	0.049	0.068	0.071	0.057
2004	0.036	0.019	0.055	0.067	0.065	0.056
2005	0.052	0.019	0.064	0.071	0.049	0.052
2006	0.026	0.019	0.074	0.067	0.074	0.052
2007	0.026	0.020	0.074	0.066	0.079	0.053
2008	0.036	0.019	0.069	0.046	0.059	0.048
2009	0.026	0.020	0.067	0.060	0.075	0.051
2010	0.026	0.020	0.074	0.061	0.068	0.050

After calculating total weighted values of main criteria, positive ideal solution (PIS) and negative ideal solution (NIS) are determined by taking the maximum and minimum values for each criterion according to equation (17) and (18):

$$PIS = \{0.052, 0.020, 0.074, 0.071, 0.079, 0.057\} \text{ maximum values}$$

$$NIS = \{-0.012, 0.018, 0.039, 0.046, 0.038, 0.057\} \text{ minimum values}$$

Then, the distance of each bank from the positive ideal solution and negative ideal solution with respect to each criterion is calculated by using equation (19) and (20). Distances from positive ideal solution and negative ideal solution are presented in Table 7.

Table 7: Distances from Positive Ideal Solution and Negative Ideal Solution for TBS

Years	Distance from PIS	Distance from NIS
2002	0.085	0.013
2003	0.028	0.070
2004	0.029	0.062
2005	0.033	0.074
2006	0.027	0.067
2007	0.027	0.069
2008	0.037	0.061
2009	0.030	0.062
2010	0.030	0.062

Once the distances from positive ideal solution and negative ideal solution are determined, the closeness coefficients of utilities (CC_i) are calculated by equation (21). And finally, according to the closeness coefficient values, the rankings of the utilities are determined, as presented in Table 8.

Table 8: Rankings of the Years According to Closeness Coefficient Values for TBS

Ranking	Years	Closeness Coefficient
1	2007	0.714
2	2003	0.713
3	2006	0.709
4	2005	0.693
5	2004	0.680
6	2009	0.673
7	2010	0.671
8	2008	0.618
9	2002	0.128

By employing the TOPSIS methods to different segments of the Turkish banking sector, we obtained the financial performances of all segments for the period 2002-2010. Before proceeding to interpret the financial performance scores of the banking segments, presented in Table 9, one important point should be emphasized: In this study, we analyze each banking segment separately using TOPSIS method. For this reason, each banking segment should be analyzed independently. In other words, this study enables us to evaluate the annual financial performances of

banking segments over the period 2002-2010. To be more precise, the financial performance scores presented in Table 9 should be interpreted horizontally, not vertically. As an alternative to our study, considering each year individually, one may compare the financial performances of the segments with each others' in a given year. We did not follow this deliberately: It seems to be more meaningful and interesting to analyze each banking segment over the years rather than to compare the different segments which have rather different structures and priorities in a given year. However, admittedly, a cross evaluation of the financial performances of the banking segments in a given year may be carried out, which can be topic of another study.

As seen from the first two row of the Table 9, Turkish banking sector in general and its deposit banking segment has followed similar financial performances during 2002-2010 period: The worst financial performance was exhibited in 2002, which is the year just after the 2001 financial crisis, while the best performance was shown in 2007, which is the year just before the ongoing financial crisis. Indeed, the similarity between performance trends of the banking sector and its deposit banking segment is not surprising given that Turkish banking sector is dominated by deposit banks. As for the remaining segments of the banking sector, the results are as follows: State-owned deposit banks, state-owned development and investment banks, foreign deposit banks in general and foreign deposit banks founded in Turkey seem to be affected most negatively by the ongoing crisis, thus take the lowest performance scores in 2008, the beginning year of the crisis. On the other hand, banks under the Deposit Insurance Fund, foreign development and investment banks, private deposit banks and development and investment banks in general exhibited their worst financial performances in years 2003, 2004, 2005 and 2007 respectively, while foreign banks having branches in Turkey and private development and investment banks performed poorly in 2006. As for the year in which the best financial performances were shown, the results are somewhat mixed: State-owned deposit banks overperformed in 2004 while private deposit banks showed their best performance in 2008. On the other hand, 2003 was the year when foreign deposit banks in general, foreign deposit banks having branches in Turkey, development and investment banks in general, private and foreign deposit and investment banks exhibited their best financial performances. Foreign

deposit banks founded in Turkey and state-owned development and investment banks took their highest performance scores in 2005, deposit banks in general delivered an outstanding performance in 2007.

Table 9: Financial Performance Scores of Different Segments of Turkish Banking Sector

Segment	2002	2003	2004	2005	2006	2007	2008	2009	2010
TBS	0.128	0.713	0.680	0.693	0.709	0.714	0.618	0.673	0.671
DEB	0.125	0.698	0.689	0.681	0.706	0.733	0.618	0.697	0.701
SDB	0.445	0.571	0.717	0.593	0.585	0.671	0.283	0.382	0.387
PDB	0.399	0.593	0.314	0.274	0.364	0.548	0.676	0.634	0.636
DIF	0.450	0.320	0.675	0.536	0.745	0.541	0.540	0.522	0.445
FDB	0.529	0.788	0.619	0.749	0.414	0.235	0.120	0.287	0.207
FF	0.400	0.705	0.631	0.734	0.433	0.243	0.125	0.296	0.218
FB	0.511	0.711	0.379	0.582	0.177	0.432	0.475	0.731	0.528
DIB	0.501	0.664	0.433	0.532	0.574	0.386	0.463	0.487	0.410
SDI	0.569	0.524	0.391	0.607	0.548	0.434	0.380	0.488	0.396
PDI	0.438	0.697	0.526	0.380	0.284	0.292	0.561	0.459	0.365
FDI	0.526	0.824	0.224	0.494	0.467	0.545	0.558	0.543	0.547

Note: The meanings of the abbreviations denoting the segments of the banking sector are as follows: TBS: Turkish Banking Sector, DEB: Deposit Banks, SDB: State-owned Deposit Banks, PDB: Private Deposit Banks, DIF: Banks Under the Deposit Insurance Fund, FDB: Foreign Deposit Banks, FFB: Foreign Banks Founded in Turkey, FBB: Foreign Banks Having Branches in Turkey, DIB: Development and Investment Banks, SDI: State-owned Development and Investment Banks, PDI: Private Development and Investment Banks, FDI: Foreign Development and Investment Banks.

5. Conclusion

The rapid advancements in information technologies and increasing competition in national and international markets have started to challenge all banks to take timely measures to survive. Undoubtedly, the first and crucial step in determining the necessary management decisions is measuring the performances of the banks adequately. However, it is not easy to find the perfect method for the effective evaluation of the performance in banking sectors supplying intangible products and services. For this reason, in literature, a wide range of methods have been applied for performance evaluation of banking sectors. In this

study, we aim to assess the overall financial performances of the different segments of the Turkish banking sector. To be more precise, the effects of two financial crises, which are experienced in 2001 and in 2008 and continuing, on different banking segments are assessed. In doing this, different from other studies in the literature, a large number of financial measures (29 in total) are considered within a combined framework of FAHP and TOPSIS methods. FAHP method is used to determine the weights attached to these financial performance criteria by expert decision markers. Then, the financial performances of the different segments of the Turkish banking sector over 2002-2010 period are ranked according to the TOPSIS method.

The results of FAHP method indicates that Capital Ratios, Assets Quality and Profitability Ratios are almost equally the most important criteria while Balance-Sheet Ratios is the least important criterion. According to the TOPSIS method using the fuzzy weights of the criteria calculated by FAHP, all segments of Turkish banking sector were adversely affected by 2001 financial crisis in which almost half of Turkish banks were failed. After exhibiting rather bad financial performance in 2002, a recovery period started thanks to the restructuring measures taken in the first stage of the financial collapse. Turkish banking sector with its all segments has been somewhat affected by the current financial crisis starting in 2008. However, different from 2001 crisis, the adverse effects of the current crisis is not destructive. One may safely claim that the immunity of Turkish banking sector from the global financial crisis is again the result of the favorable restructuring reforms started in 2001-2002 period. Surrounded with heavy regulations and rules, the sector seems to achieve its stability during the current financial crises. Especially, the limitation of exposure to the toxic assets by regulations helps Turkish banks to save their asset quality. As the global financial crisis turned out to be more serious than what was expected, Turkish government took more measures against it at the end of 2010, aiming mostly contracting the loan supply. As long as the political stability is preserved, the Turkish banking sector seems to have capability of overcoming the current financial crises.

This study may be extended in several directions by carrying out a number of consistency analyses. First of all, the performance of the Turkish banking sector can also be assessed with other MCDM models

such as VIKOR and ELECTRE. Another topic of a consistency study may be analyzing the robustness of the financial performance estimations by using alternative weight values attached to the performance criteria. The result of a given MCDM method will be more reliable when its decision outcome does not vary significantly depending on the normalization procedure used. Thus, it would be of great interest to repeat this TOPSIS application with alternative linear normalization procedures in addition to the vector normalization procedure.

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The Causal Relationship Between Imports and Economic Growth in the Nine Provinces of South Africa: Evidence from Panel Granger Causality Tests

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This paper examines the causal relationship between imports and growth in nine provinces of South Africa for the period 1996-2011, using panel causality analysis, which accounts for cross-section dependency and heterogeneity across regions. Our empirical results support unidirectional causality running from economic growth to imports for Gauteng, Mpumalanga, North West, and Western Cape; a bi-directional causality between imports and economic growth for KwaZulu-Natal; and no causality in any direction between economic growth and imports for the rest of provinces. This suggests that import liberalisation might not be an efficient strategy to improve provincial economic performance in South Africa. Indeed, provincial imports tend to increase in some provinces as economic growth improves.

1. Introduction

There seems to be a consensus among economists that trade openness is favourable to economic growth, with export serving as the primary channel⁴. Consequently, supportive empirical evidence mainly focuses

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⁴ There are conflicting views about the relationship between export and economic growth. One strand of the literature is favourable to the export-led growth hypothesis while the other supports the growth-driven export model. The export-led growth hypothesis is derived from the comparative advantage theory which asserts that trade expansion results in more productive and efficient allocation of resources favourable to economic growth. On the other hand, the growth-driven export model emphasizes that increasing economic activity through human capital

on the export-growth nexus with less attention on the relationship between import and economic growth. However, various openness measures have different linkages with growth and hence different policy implications. In an attempt to complement the economic impact of trade, this study analyses the import-growth nexus in South Africa. Rodrik (2008) indicates that both import-substitution and export-oriented firms in South African face much greater competitive discipline with import penetration levels having increased significantly within manufacturing from around 20% on average before 1990 to around 28 percent in 2000s. Concomitantly, economic growth remains relatively low compared o its pre-1994 levels. Therefore, understanding the causal link between imports and economic growth is crucial from a policy perspective as trade openness represents an important strategy in the South African government's effort to improve the performance of the economy.

Theoretically, the relationship between imports and economic growth is quite complex. Imports are expected to improve the productive efficiency of domestic import-substituting firms through innovation and restructuration which, in turn, enhances the performance of the economy. However, this assumption may lead to different conclusions depending on the market structure and institutional factors. In the neoclassical model with perfect competition, import liberalization reduces factors usage in the short run and guarantees more productive, innovative and competitive industries in the long run; resulting in an upward shift of the supply curve of firms. Conversely, the model with imperfect competition predicts a fall in import-substituting domestic market as imports increase. The resulting decrease in investment trims down the productivity, causing a fall in economic performance. However, a certain level of monopoly which ensures excess profits may boost domestic firms' productivity through research and development (R&D) investment. Furthermore, as imports of capital and intermediate goods that cannot be produced locally increase, domestic firms tend to diversify and specialize, thus improving their productivity (Kim *et al.*, 2007). Endogenous growth models are also favourable to the import-led growth hypothesis and assert that imports are important source of

and technology improvements stimulates export growth since producers need new foreign markets to absorb the subsequent increase in supply. Based on Bootstrap causality approach, Chang *et al.* (2013) provide the evidence that the heterogeneity in the provincial composition of exports play an important role in driving the export-growth relationship in South Africa.

economic growth through the transfer of technology from industrialized to developing countries. Accordingly, foreign R&D generally embodied in imported intermediate goods such as computers, machines and equipments is important for productivity growth which in turn determines the economic growth.

Similarly, theoretical models have documented both positive and negative causalities from economic growth to imports. It is believed that a rise in economic activity stimulates imports through consumption. On the other hand, economic growth improves the productivity of the import-substituting firms, causing the domestic market to increase and hence the imports to fall. In light of this divergent state of the literature, the causality between imports and economic growth should be investigated empirically.

Do imports result in or from economic growth? Only few studies have attempted to address this question; most of the existing evidence focusing on the determinants of imports demand. The selected exception includes Awokuse (2007), Kim *et al.* (2007), Uğur (2008), Rahman Shahbaz (2011) and Islam *et al.* (2012). Awokuse (2007) uses a cointegration approach with Granger causality test to show a unidirectional causality between trade liberalization (including import variable) and economic growth for transition economies. Similar result is reported by Kim *et al.* (2007) who find the evidence of import-led productivity growth for Korea using a Vector Correction Model (VCM). By decomposing Turkey imports in different categories, Uğur (2008) shows that the direction of the causality between import and growth depends on the type of goods. Particularly, a bidirectional causality is reported between GDP and investment goods imports as well as raw materials imports while there is a unidirectional relationship between GDP and other goods imports including consumption. Rahman and Shahbaz (2011) use the Autoregressive Distributed Lag (ADRL) model with the Granger causality test and find a bidirectional causal effect between GDP growth and imports in Pakistan. Based on the same methodology, Islam *et al.* (2012) investigate the import-growth nexus in 62 countries and find that the direction of the causality depends on the level of income. High income countries which included South Africa as well were found to support the import-led growth hypothesis, whereas low income countries exhibit a bidirectional causality between the two

variables. Being at the national levels, these studies however, fail to capture heterogeneity as well as spatial effect across regions which could result in potential bias in the estimates.

The aim of this paper is therefore to re-investigate the causal relationship between imports and economic growth in nine provinces of South Africa over the period of 1996-2011. Besides each province specific factors, it is rational to expect a particular shock to one province to spillover onto other provinces provided their high level of integration. This suggests that provinces are not only heterogeneous but also cross-dependent. Unlike previous studies, we apply panel causality approach which addresses the issue of cross-sectional dependency and heterogeneity across regions. Ignoring cross-section dependency leads to substantial bias and size distortions (Pesaran, 2006), implying that testing for the cross-section dependence is a crucial step in a panel data analysis.

As an open economy, South Africa exhibits imports dependency on various types of goods such as final consumption, capital and intermediate goods. Considering socio-economic imbalances across provinces, the degree of imports liberalisation is likely to vary from one province to another, resulting in different causality between provincial imports and growth. The initial inspection of the data seems to corroborate this hypothesis as provincial trends in imports and GDP plotted in Figure 1 display different patterns across provinces. We also observe a relatively high volatility in provincial imports compared to GDP, possibly suggesting a variation in trade policy orientation and productivity performance across provinces. Empirical results could not reject this hypothesis. Specifically, we find that the direction of the causality between imports and economic growth varies across provinces; most of them being unfavourable to the causal relationship in any direction between the two variables. While KwaZulu-Natal is favourable to a bi-directional causality between economic growth and imports, a unidirectional causality running from economic growth to imports is reported in four provinces, namely, Gauteng, Mpumalanga, North West and Western Cape. This suggests that import liberalisation might not be an efficient strategy to improve provincial economic performance in South Africa. Indeed, provincial imports tend to increase in some provinces as economic growth improves. The rest of the paper proceeds as follow: Section 2 presents the

methodology, section 3 discusses the empirical results and section 4 concludes.

2. Methodology and data

2.1. Preliminary Analysis

One important issue in a panel causality analysis is to take into account possible cross-section dependence across regions. This is because high degree of economic and financial integrations makes a region to be sensitive to the economic shocks in other region with a country. Cross-sectional dependency may play important role in detecting causal linkages of housing activity for South Africa.

The second issue to decide before carrying out causality test is to find out whether the slope coefficients are treated as homogenous and heterogeneous to impose causality restrictions on the estimated parameters. As pointed out by Granger (2003), the causality from one variable to another variable by imposing the joint restriction for the panel is the strong null hypothesis. Furthermore, as Breitung (2005) contends the homogeneity assumption for the parameters is not able to capture heterogeneity due to region specific characteristics. In the housing activity and economic growth nexus – as in many economic relationships – while there may be a significant relationship in some regions, vice versa may also be true in some other regions.

Given the above consideration before we conduct tests for causality, we start with testing for cross-sectional dependency, followed by slope homogeneity across regions. Then, we decide to which panel causality method should be employed to appropriately determine the direction of causality between housing activity and economic growth in nine provinces of South Africa countries. In what follows, we outline the essentials of econometric methods used in this study.

2.1.1. Testing cross-section dependence

To test for cross-sectional dependency, the Lagrange multiplier (LM hereafter) test of Breusch and Pagan (1980) has been extensively used in empirical studies. The procedure to compute the LM test requires the

estimation of the following panel data model:

$$y_{it} = \alpha_i + \beta_i' x_{it} + u_{it} \quad \text{for } i = 1, 2, \dots, N; \quad t = 1, 2, \dots, T \quad (1)$$

where i is the cross section dimension, t is the time dimension, x_{it} is $k \times 1$ vector of explanatory variables, α_i and β_i are respectively the individual intercepts and slope coefficients that are allowed to vary across states. In the LM test, the null hypothesis of no-cross section dependence- $H_0 : \text{Cov}(u_{it}, u_{jt}) = 0$ for all t and $i \neq j$ - is tested against the alternative hypothesis of cross-section dependence $H_1 : \text{Cov}(u_{it}, u_{jt}) \neq 0$, for at least one pair of $i \neq j$. In order to test the null hypothesis, Breusch and Pagan (1980) developed the LM test as:

$$LM = T \sum_{i=1}^{N-1} \sum_{j=i+1}^N \hat{\rho}_{ij}^2 \quad (2)$$

where $\hat{\rho}_{ij}$ is the sample estimate of the pair-wise correlation of the residuals from Ordinary Least Squares (OLS) estimation of equation (1) for each i . Under the null hypothesis, the LM statistic has asymptotic chi-square with $N(N-1)/2$ degrees of freedom. It is important to note that the LM test is valid for N relatively small and T sufficiently large.

However, the CD test is subject to decreasing power in certain situations that the population average pair-wise correlations are zero, although the underlying individual population pair-wise correlations are non-zero (Pesaran *et al.*, 2008). Furthermore, in stationary dynamic panel data models the CD test fails to reject the null hypothesis when the factor loadings have zero mean in the cross-sectional dimension. In order to deal with these problems, Pesaran *et al.* (2008) proposes a bias-adjusted test which is a modified version of the LM test by using the exact mean and variance of the LM statistic. The bias-adjusted LM test is:

$$LM_{adj} = \sqrt{\left(\frac{2T}{N(N-1)} \right)} \sum_{i=1}^{N-1} \sum_{j=i+1}^N \hat{\rho}_{ij} \frac{(T-k)\hat{\rho}_{ij}^2 - \mu_{Tij}}{\sqrt{\nu_{Tij}^2}} \quad (3)$$

where μ_{Tij} and ν_{Tij}^2 are respectively the exact mean and variance of $(T-k)\hat{\rho}_{ij}^2$, that are provided in Pesaran *et al.* (2008, p.108). Under the

null hypothesis with first $T \rightarrow \infty$ and then $N \rightarrow \infty$, LM_{adj} test is asymptotically distributed as standard normal.

2.1.2. Testing slope homogeneity

Second issue in a panel data analysis is to decide whether or not the slope coefficients are homogenous. The causality from one variable to another variable by imposing the joint restriction for whole panel is the strong null hypothesis (Granger, 2003). Moreover, the homogeneity assumption for the parameters is not able to capture heterogeneity due to region specific characteristics (Breitung, 2005).

The most familiar way to test the null hypothesis of slope homogeneity- $H_0: \beta_i = \beta$ for all i - against the hypothesis of heterogeneity- $H_1: \beta_i \neq \beta_j$ for a non-zero fraction of pair-wise slopes for $i \neq j$ - is to apply the standard F test. The F test is valid for cases where the cross section dimension (N) is relatively small and the time dimension (T) of panel is large; the explanatory variables are strictly exogenous; and the error variances are homoscedastic. By relaxing homoscedasticity assumption in the F test, Swamy (1970) developed the slope homogeneity test on the dispersion of individual slope estimates from a suitable pooled estimator. However, both the F and Swamy (1970)'s test require panel data models where N is small relative to T [24]. Pesaran and Yamagata (2008) proposed a standardized version of Swamy (1970)'s test (the so-called $\tilde{\Delta}$ test) for testing slope homogeneity in large panels. The $\tilde{\Delta}$ test is valid as $(N, T) \rightarrow \infty$ without any restrictions on the relative expansion rates of N and T when the error terms are normally distributed. In the $\tilde{\Delta}$ test approach, first step is to compute the following modified version of the Swamy (1970)'s test:

$$\tilde{S} = \sum_{i=1}^N (\hat{\beta}_i - \tilde{\beta}_{WFE})' \frac{x_i' M_\tau x_i}{\tilde{\sigma}_i^2} (\hat{\beta}_i - \tilde{\beta}_{WFE}) \quad (4)$$

where $\hat{\beta}_i$ is the pooled OLS estimator, $\tilde{\beta}_{WFE}$ is the weighted fixed effect pooled estimator, M_τ is an identity matrix, the $\tilde{\sigma}_i^2$ is the estimator of σ_i^2 .⁵ Then the standardized dispersion statistic is developed as:

⁵ In order to save space, we refer to Pesaran and Yamagata (2008) for the details of estimators and for Swamy (1970)'s test.

$$\tilde{\Delta} = \sqrt{N} \left(\frac{N^{-1}\tilde{S} - k}{\sqrt{2k}} \right) \quad (5)$$

Under the null hypothesis with the condition of $(N, T) \rightarrow \infty$ so long as $\sqrt{N}/T \rightarrow \infty$ and the error terms are normally distributed, the $\tilde{\Delta}$ test has asymptotic standard normal distribution. The small sample properties of $\tilde{\Delta}$ test can be improved under the normally distributed errors by using the following bias adjusted version:

$$\tilde{\Delta}_{adj} = \sqrt{N} \left(\frac{N^{-1}\tilde{S} - E(\tilde{z}_{it})}{\sqrt{\text{var}(\tilde{z}_{it})}} \right) \quad (6)$$

where the mean $E(\tilde{z}_{it}) = k$ and the variance $\text{var}(\tilde{z}_{it}) = 2k(T - k - 1)/T + 1$.

2.2. Panel Causality Test

Once the existence of cross-section dependency and heterogeneity across South Africa is ascertained, we apply a panel causality method that should account for these dynamics. The bootstrap panel causality approach proposed by Kónya (2006) is able to account for both cross-section dependence and region-specific heterogeneity. This approach is based on Seemingly Unrelated Regression (SUR) estimation of the set of equations and the Wald tests with individual specific region bootstrap critical values. Since region-specific bootstrap critical values are used, the variables in the system do not need to be stationary, implying that the variables are used in level form irrespectively of their unit root and cointegration properties. Thereby, the bootstrap panel causality approach does not require any pre-testing for panel unit root and cointegration analyses. Besides, by imposing region specific restrictions, we can also identify which and how many states exist in the Granger causal relationship.

The system to be estimated in the bootstrap panel causality approach can be written as:

$$\begin{aligned}
y_{1,t} &= \alpha_{1,1} + \sum_{i=1}^{ly_1} \beta_{1,1,i} y_{1,t-i} + \sum_{i=1}^{lx_1} \delta_{1,1,i} x_{1,t-i} + \varepsilon_{1,1,t} \\
y_{2,t} &= \alpha_{1,2} + \sum_{i=1}^{ly_1} \beta_{1,2,i} y_{2,t-i} + \sum_{i=1}^{lx_1} \delta_{1,2,i} x_{2,t-i} + \varepsilon_{1,2,t} \\
&\vdots \\
y_{N,t} &= \alpha_{1,N} + \sum_{i=1}^{ly_1} \beta_{1,N,i} y_{N,t-i} + \sum_{i=1}^{lx_1} \delta_{1,N,i} x_{1,t-i} + \varepsilon_{1,N,t}
\end{aligned} \tag{7}$$

and

$$\begin{aligned}
x_{1,t} &= \alpha_{2,1} + \sum_{i=1}^{ly_2} \beta_{2,1,i} y_{1,t-i} + \sum_{i=1}^{lx_2} \delta_{2,1,i} x_{1,t-i} + \varepsilon_{2,1,t} \\
x_{2,t} &= \alpha_{2,2} + \sum_{i=1}^{ly_2} \beta_{2,2,i} y_{2,t-i} + \sum_{i=1}^{lx_2} \delta_{2,2,i} x_{2,t-i} + \varepsilon_{2,2,t} \\
&\vdots \\
x_{N,t} &= \alpha_{2,N} + \sum_{i=1}^{ly_2} \beta_{2,N,i} y_{N,t-i} + \sum_{i=1}^{lx_2} \delta_{2,N,i} x_{N,t-i} + \varepsilon_{2,N,t}
\end{aligned} \tag{8}$$

where y denotes real income, x refers to imports, l is the lag length. Since each equation in this system has different predetermined variables while the error terms might be contemporaneously correlated (i.e. cross-sectional dependency), these sets of equations are the SUR system.

In the bootstrap panel causality approach, there are alternative causal linkages for each province in the system that (i) there is one-way Granger causality from x to y if not all $\delta_{1,i}$ are zero, but all $\beta_{2,i}$ are zero, (ii) there is one-way Granger causality running from y to x if all $\delta_{1,i}$ are zero, but not all $\beta_{2,i}$ are zero, (iii) there is two-way Granger causality between x and y if neither $\delta_{1,i}$ nor $\beta_{2,i}$ are zero, and finally (iv) there is no Granger causality in any direction between x and y if all $\delta_{1,i}$ and $\beta_{2,i}$ are zero. Details about the Bootstrap procedure see Appendix.

The annual data used in this study covers the period from 1996 to 2011 for nine provinces of South Africa. The variables include real GDP and real imports. Real GDP is measured in constant 2005 Rand and comes from the Statistic South Africa (SSA). Nominal imports are obtained from the RSA Provincial Trade Indicators (Quantec). We use the consumer price index (CPI) drawn from the International Monetary

Fund database to obtain the real imports. Tables 1 and 2 show the summary statistics of real GDP and real imports for nine provinces, respectively. Based on Tables 1 and 2, we find that Gauteng and Northern Cape have the highest and lowest mean real GDP of R517 billions and R33.1 billions, respectively, and Gauteng and North West have the highest and lowest mean real imports of R2 billions and R12.8 millions, respectively. With the exception of real imports for Limpopo, the remaining series are approximately normal as the Jarque Bera test could not reject the null of normality for eight provinces.

3. Empirical findings

Before we test for causality we first test for both cross-sectional dependency and region-specific heterogeneity as we believe that these nine provinces in South Africa are highly integrated in their economic relations. To investigate the existence of cross-section dependence we carried out four different tests (LM , CD_{lm} , CD , LM_{adj}). Secondly, as indicated by Kónya (2006), the selection of optimal lag structure is of importance because the causality test results may depend critically on the lag structure. In determining lag structure we follow Kónya (2006)'s approach that maximal lags are allowed to differ across variables, but to be same across equations. We estimate the system for each possible pair of ly_1 , lx_1 , ly_2 and lx_2 respectively by assuming from 1 to 4 lags and then choose the combinations which minimize the Schwarz Bayesian Criterion.

Tests for cross-sectional dependency and heterogeneity are presented in Table 3. As can be seen from Table 3, it is clear that the null hypothesis of no cross-sectional dependency and slope heterogeneity across the countries is strongly rejected at the conventional levels of significance. This finding implies that a shock that occurred in one of these provinces countries seems to be transmitted to other provinces. Furthermore, the rejection of slope homogeneity implies that the panel causality analysis by imposing homogeneity restriction on the variable of interest results in misleading inferences.⁶ In this respect, the panel causality analysis based on estimating a panel vector autoregression and/or panel vector error correction model by means of generalized method of moments and

⁶ Though $\tilde{\Delta}_{adj}$ fails to reject the null hypothesis of slope homogeneity, both $\tilde{\Delta}$ and $\tilde{S}$ reject the null hypothesis of slope homogeneity.

of pooled ordinary least square estimator is not appropriate approach in detecting causal linkages between housing activity and economic growth in nine provinces of South Africa.

The establishment of the existence of cross-sectional dependency and heterogeneity across nine provinces suggests the suitability of the bootstrap panel causality approach. Results of the bootstrap causality tests are presented in Tables 4 and 5. Our empirical results support unidirectional causality running from economic growth to imports for Gauteng, Mpumalanga, North West, and Western Cape; a bi-directional causality between imports and economic growth for KwaZulu-Natal; and no causality in any direction between economic growth and imports for the rest of provinces. In KwaZulu-Natal, there was a bidirectional causality between imports and economic growth thus supporting the feedback hypothesis where imports and GDP serve as complements to each other. The policy implication of our finding is that reduced imports may lead to adverse effects on economic growth in KwaZulu-Natal.

These findings appear to corroborate the hypothesis that import-growth nexus is mainly driven by the heterogeneity in the geographical composition of import goods. Consistent with Uğur (2008), provinces whose imports mostly depend on consumption goods exhibit a unidirectional causality running from growth to imports. This is particularly the case for Gauteng, Western Cape and Mpumalanga where socio-economic advantages favour imports of consumption goods. Gauteng and Western Cape are the leading provinces in term of economic development while Mpumalanga has great potential for fast growth; manufacturing and mining being its major sources of income. On the other hand, provinces with diversified economy tend to exhibit a bidirectional causality between imports and growth. KwaZulu-Natal is an illustration. It is the second largest contributor to South Africa's GDP and its economy depends on various activities including tourism, agriculture and manufacturing. Finally, neither imports nor economic growth is sensitive to each other in rural provinces, namely Northern Cape, Eastern Cape and Limpopo. This may suggest that the level of the development matters for the import-growth relationship.

4. Conclusions

This study applied the bootstrap panel Granger causality approach to test the causal link between imports and economic growth using data from the nine provinces of South Africa over the period of 1996-2011. Our empirical results support unidirectional causality running from economic growth to imports for Gauteng, Mpumalanga, North West, and Western Cape and a bi-directional causality between imports and economic growth for KwaZulu-Natal. However, a neutrality hypothesis was found for the rest of provinces indicating neither imports nor economic growth is sensitive to each other in these two provinces.

Our findings provide important policy implications in South Africa. Firstly, import liberalisation might not be an efficient strategy to improve provincial economic performance in South Africa. Indeed, provincial imports tend to increase in some provinces as economic growth improves. Secondly, national level- based studies hide important differences in import-growth nexus among provinces, resulting in misleading inference. For instance, the import-led growth evidence established by Islam *et al.* (2012) for South Africa implies that imports could be beneficial for economic growth. However, this policy implication is likely to result in adverse effects in all provinces except in KwaZulu-Natal where there is a dual causality between the two variables.

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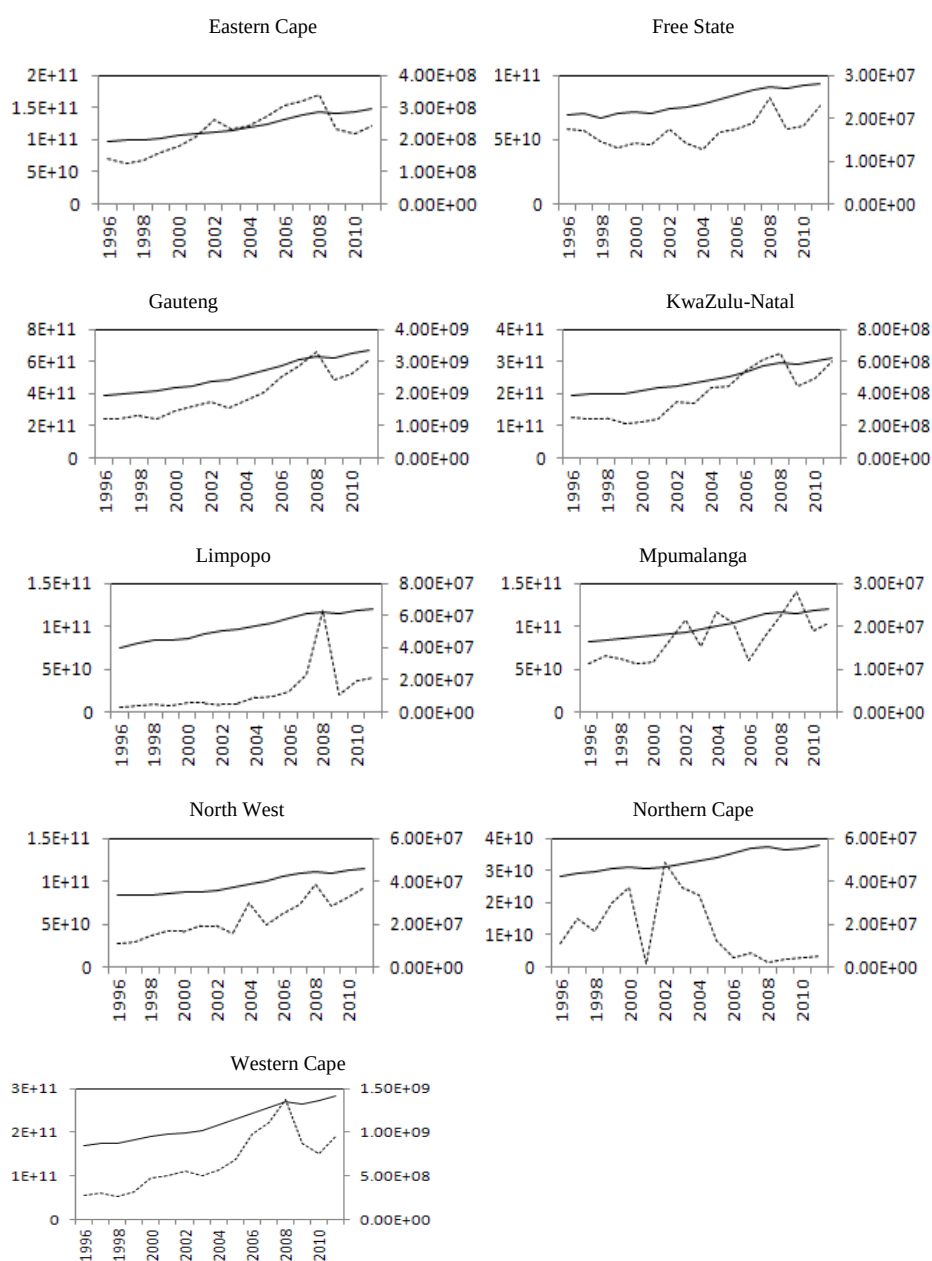
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Figure 1: Real Imports and Real GDP across provinces

Notes: Real GDP (solid line, scale on the left axis), real imports (dotted line, scale on the right axis).

Table 1: Summary Statistics of Real GDP

Province	Mean	Max.	Min.	Std. Dev.	Skew ^a .	Kurt ^b .	J.-B ^c .
Eastern Cape	1.20E+11	1.49E+11	9.81E+10	1.80E+10	0.272	1.571	0.708
Free State	7.92E+10	9.40E+10	6.73E+10	9.58E+09	0.284	1.479	0.794
Gauteng	5.17E+11	6.72E+11	3.89E+11	9.78E+10	0.208	1.570	0.626
KwaZulu-Natal	2.45E+11	3.13E+11	1.92E+11	4.23E+10	0.245	1.568	0.673
Limpopo	9.92E+10	1.21E+11	7.47E+10	1.51E+10	-0.042	1.615	0.484
Mpumalanga	1.00E+11	1.21E+11	8.13E+10	1.36E+10	0.149	1.523	0.604
North West	9.72E+10	1.15E+11	8.44E+10	1.17E+10	0.283	1.429	0.830
Northern Cape	3.31E+10	3.80E+10	2.80E+10	3.33E+09	0.109	1.572	0.541
Western Cape	2.20E+11	2.83E+11	1.70E+11	3.94E+10	0.255	1.547	0.701

Note: 1. The sample period is from 1996 to 2011

2. a, b, c refer to Skewness, Kurtosis and Jarque Bera statistics, respectively.

Table 2: Summary Statistics of Real Imports

Province	Mean	Max.	Min.	Std. Dev.	Skew ^a .	Kurt ^b .	J.-B ^c .
Eastern Cape	2.26E+08	3.38E+08	1.26E+08	6.48E+07	0.284	2.045	0.230
Free State	1.70E+07	2.46E+07	1.29E+07	3271329	0.865	3.261	2.012
Gauteng	2.00E+09	3.32E+09	1.20E+09	7.07E+08	0.487	1.870	0.951
KwaZulu-Natal	3.97E+08	6.50E+08	2.14E+08	1.54E+08	0.273	1.649	0.655
Limpopo	1.29E+07	6.28E+07	3198303	1.47E+07	2.542	9.095	26.52***
Mpumalanga	1.74E+07	2.80E+07	1.13E+07	5167183	0.388	2.092	0.607
North West	2.28E+07	3.89E+07	1.07E+07	8880199	0.409	1.945	0.724
Northern Cape	1.74E+07	4.91E+07	1530053	1.55E+07	0.672	2.062	1.424
Western Cape	6.56E+08	1.37E+09	2.65E+08	3.01E+08	0.634	2.492	1.138

Note: 1. The sample period is from 1996 to 2011

2. a, b, c refer to Skewness, Kurtosis and Jarque Bera statistics, respectively.

Table 3: Cross-sectional Dependence and Homogeneous Tests

Test			
LM	223.052***		
CD_{LM}	22.044***		
CD	13.793***		
LM_{adj}	21.507***		
Swamy's Test	40.099***		
$\tilde{\Delta}$	7.33***		
$\tilde{\Delta}_{adj}$	0.525		

Note: *** indicates significance at the 0.01. LM Tests test the null hypothesis of no cross province dependency against the alternative of cross province dependency. Swamy's Tests test the null hypothesis of homogeneity against the alternative of heterogeneity. In both cases, the null hypothesis is rejected as the statistics are significant.

Table 4: Granger causality test running from Imports to GDP

	Wald Statistics	Bootstrap Critical Value		
		10%	5%	1%
Eastern Cape	2.635	31.268	50.313	121.272
Free State	0.497	40.288	62.970	156.381
Gauteng	9.413	33.716	56.972	141.894
KwaZulu-Natal	50.538**	29.609	47.337	109.283
Limpopo	3.988	39.877	63.831	153.235
Mpumalanga	3.589	33.884	54.724	140.618
North West	16.168	27.261	41.071	87.062
Northern Cape	0.324	44.243	71.297	170.314
Western Cape	2.714	21.566	36.539	98.221

Note: 1. ** indicates significance at the 0.05 level. The entries refer to the statistics of the null hypothesis testing that Imports do not Granger cause GDP against the alternative that Imports do Granger cause GDP. The null hypothesis is rejected in KwaZulu-Natal as the corresponding statistic is significant.

2. Bootstrap critical values are obtained from 10,000 replications.

Table 5: Granger causality test running from GDP to Imports

	Wald Statistics	Bootstrap Critical Value		
		10%	5%	1%
Eastern Cape	1.560	19.159	30.133	63.971
Free State	0.774	12.153	19.141	37.858
Gauteng	16.515**	6.983	10.789	22.083
KwaZulu-Natal	15.497*	14.257	21.618	44.590
Limpopo	7.435	19.338	29.955	62.909
Mpumalanga	118.549***	9.768	14.632	30.186
North West	40.995**	20.902	31.752	61.427
Northern Cape	6.869	7.778	11.834	25.481
Western Cape	22.926**	12.198	18.167	39.042

Note: 1. ***, ** and * indicate significance at the 0.01, 0.05 and 0.1 levels, respectively. The entries refer to the statistics of the null hypothesis testing that GDP does not Granger cause Imports against the alternative that GDP does Granger cause Imports. The null hypothesis is rejected in Gauteng, KwaZulu-Natal, Mpumalanga, North West and Western Cape as the corresponding statistics are significant.

2. Bootstrap critical values are obtained from 10,000 replications.

Appendix

The appropriate method to estimate (7) and (8) depends on the properties of the error terms. If there is no contemporaneous correlation across countries, then each equation is a classical regression. Consequently, the equations can be estimated one-by-one with OLS and the OLS estimators of the parameters are the best linear unbiased estimators. On the other hand, in the presence of contemporaneous correlation across countries the OLS estimators are not efficient because they fail to utilize this extra information. In order to obtain more efficient estimators, the equations in (7), and also in (8), must be stacked and the two stacked equations can be estimated individually with the feasible generalized least squares or maximum likelihood methods. In this study we use the SUR estimator proposed by Zellner (1962).

Prior to estimation, we have to specify the number of lags. This is a crucial step because the causality test results may depend critically on the lag structure. In general, both too few and too many lags may cause problems. Too few lags mean that some important variables are omitted from the model and this specification error will usually cause bias in the retained regression coefficients, leading to incorrect conclusions. On the other hand, too many lags waste observations and this specification error will usually increase the standard errors of the estimated coefficients, making the results less precise.

Following the Konya (2006), the Bootstrapping procedure is as follows:
Step 1: Estimate (7) under the null hypothesis that there is no causality from X to Y (i.e. imposing the $\delta_{1,i,l} = 0$ restriction for all i and l) and obtain the residuals

$$eH0_{i,t} = y_{i,t} - \hat{\alpha}_{1,i} - \sum_{i=1}^{ly_1} \beta_{1,1,i} y_{i,t-1} \quad \text{for } i=1,2,\dots,N \text{ and } t=1,2,\dots,T.$$

From these residuals develop $N \times T[eH0_{i,t}]$ matrix.

Step 2: Re-sample these residuals. In order to preserve the contemporaneous cross-correlation structure of the error terms in (7), do not the draw the residuals for each country one-by-one, but rather randomly select a full column from the $[eH0_{i,t}]$ matrix at a time.

Denote the selected bootstrap residuals as $e^*H0_{i,t}$, where $t=1, 2, \dots, T^*$ and T^* can be greater than T .

Step 3: Generate a bootstrap sample of Y assuming again that it is not caused by X , i.e. using the following formula:

$$y^*_{i,t} = \hat{\alpha}_{1,i} + \sum_{l=1}^{ly1} \hat{\beta}_{1,i,l} y^*_{i,t-1} + e^*H0_{i,t} \quad t=1, 2, \dots, T^*$$

Step 4: Substitute $y^*_{i,t}$ for $y_{i,t}$, estimate (7) without imposing any parameter restrictions on it, and for each country perform the Wald test implied by the no-causality null hypothesis.

Step 5: Develop the empirical distributions of the Wald test statistics repeating steps 2–4 many times, and specify the bootstrap critical values by selecting the appropriate percentiles of these sampling distributions. In Step 5, the bootstrap distribution of each test statistic is derived from 10,000 replications.

A similar procedure is applied for causality from Y to X in equation (8).

Economic Implications of Turkish Migration in Europe: Lessons Learned from Polish EU Accession

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The paper aims to predict the economic impact of Turkish EU accession with respect to migration flows. The analysis builds on the empirical evidence of past emigration flows of EU-18 to Germany and Netherlands employing the post EU Enlargement experience of Poland.

Both panel data estimators used on the European migration and empirical analysis of Polish migration behavior to the EU after 2004 suggest that Turkish accession to the EU and its access to the EU labor market would not trigger massive labor migration. The most sober scenario predicts that eventual Turkish accession would lead to the short-term increase in migration which would start to fade away quickly soon reaching pre-shock levels.

1. Introduction

Turkey's efforts to integrate into the European structures dates back to 1963, when the country gained associate membership of European Economic Community (EEC) and submitted its application for the EU membership four years later, however without managing to achieve full membership. Turkey experienced partial success when it entered in the European customs union in 1995. Four years later it applied formally for the EU membership and the negotiation rounds began in 2005. Up to today, Turkey closed only 1 of the 35 chapters of the "Acquis communautaire" (the body of European Union law) and negotiations are still ongoing.

While there are several factors that hinder quick progress of accession rounds, as it will be discussed later on, this paper will discuss one of the economic implications of possible Turkish EU accession, namely

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Turkish migration to the EU. The hypothetical Turkish EU accession raised many questions regarding its advantages and disadvantages in both public and academic debate. Proponents of the EU widening process argue that the inclusion of Turkey would significantly boost energy security, especially with regard to the energy dependence of the EU on Russian sources. For instance, Triantaphyllou and Fotiou (2010) show that Turkey's energy strategy in the 2010s might oscillate between using "pipeline diplomacy" as a means to achieve its energy independence and to enhance its security, or using it as a leverage to increase its power as a regional hegemony. Bagdonas (2012) suggests Turkey might be attractive to the EU New Member States (NMS), such as the Baltic countries or Poland due to its geopolitical role as a transit hub for energy supplies to Europe, and its potential to become a great power, engaging in regional competition with Russia.

Another positive impact of Turkish EU accession might be fueling the European moribund labor market. For example, Krieger and Maître (2006) use the study based on Eurobarometer data from 2002 and point out that migration from Turkey (mostly students and better-educated people in Turkey have a propensity to migrate) may open up important opportunities: e.g. to reduce the gap in labor supply in Europe due to ageing as well as to contribute to an improved financial sustainability of the social security systems of the EU countries. Tarifa and Adams (2007) analyze the situation after the opening of EU official accession talks with Turkey in 2005 and come to the conclusion that Turkey might help Europe in its struggle to define itself as it expands and confronts a series of demographic, social, economic, and bureaucratic challenges. Moreover, Uslu and Polat (2012), analyze the impact of foreign trade on labor market by using the random coefficient panel data analysis and the quarterly data of 17 sectors in manufacturing industry of Turkey between 1994 and 2010 showing that production had positive impact on labor and negative impact on wages, while imports and exports have a significant and positive impact on labor.

Additionally, Turkish EU accession might increase the economic competitiveness of the EU. With regard to that Mıhçı and Wigley (2009) examined the effects of the creation of Customs Union between Turkey and the EU in 1996 by performing a direct and indirect tests of the technology-led growth induced by the Custom Union via estimating total factor productivity and labor productivity equations for Turkish

manufacturing industry sectors using the data set of 12 manufacturing industry sub-sectors for the period 1994-2001 and arriving at the conclusions that import volume had a positive and significant effect on output per labour and volume of imports from EU countries which implied that the Customs Union had a positive effect on both economies. Furthermore, Ozturk and Acaravci (2011) empirically prove the causal relationship between economic growth, export and FDI in Turkey (the proxy of the trade with the EU) using the ARDL bounds testing approach and the error-correction based Granger causality test examining the both long-run and short-run causality issues between the variables by using quarterly data from 1994 to 2010. Finally, Ghani (2011) examined the effects of trade liberalization on imports, exports and GDP per capita in the Organization of Islamic Conference (OIC) member countries since the 1970s and concluded that in case of Turkey the liberalization had slightly significant impact on imports than on exports, implying how important Turkey might be for the EU imports in the times of the economic and financial crisis.

Additionally, Ersöz and Karaman (2011) highlight the strategic military advantage of Turkish EU accession by using fourteen innovation indicators from European Innovation 2008 Scorecard Report and employing multidimensional scaling analysis and K-means cluster analysis to derive Turkish defense capability perspective.

All of the arguments above have some valid grounds. The EU faces ageing population prospects and the young migrants could deliver necessary stimulus to its economy. Furthermore, Europe is highly dependent on the foreign energy suppliers, but more importantly it seeks to diversify its sources. The eventual success of Nabucco pipeline project would help the EU to move towards achieving its goals, naturally only in the situation when Turkey is a member of the EU.

On the contrary, there are others who view Turkey as a threat to the EU integration. Accepting a new member of this magnitude and geographical location would make the EU face the possibility of several economic and non-economic system shocks. One of the possible scenarios might represent massive migration inflows of labor from Turkey to the EU. Ozcure and Eryigit (2006) analyze the experience of former EU enlargements and come the conclusion that only the full EU membership option within a foreseeable future of a free movement of

labor regime can balance Turkey's interests in the EU; otherwise Turkey has the option of refusing offers from the EU and will ultimately send more migrant workers to the EU without membership perspective. Erzan et al. (2006) conduct an econometric study of Turkish migration to the EU between 2004-2030 using several scenarios and employing cross-country, time-series and panel regressions, as well as maximum likelihood and SUR to error correction models. Their findings suggest that a successful EU accession period with high growth reduces and gradually eliminates the migration pressures but the lower growth and higher unemployment associated with a suspension in Turkey's accession might result in more immigrants than a successful EU membership and would endanger the job opportunities of EU workers. Moreover, some authors (e.g. Sartori 2005) view Muslim religion and culture as inconsistent with European tradition and democratic values that includes the separation of church and state powers. Last but not least, Turkish accession would make the EU a neighbor with several states of the Middle East towards which the diplomatic relations of the EU cannot be described as accommodating.

1.1. Methodology, research question

The purpose of this paper is to analyze whether the integration of Turkey to the EU and the access of Turkish workers to the European labor market would trigger massive emigration, and thus attempts to answer the question whether the European fears of Turkish accession can be empirically justified.

Our analysis of the literature on pros and cons of Turkish EU accession conducted above sets up the further path for this paper. Overall, one can see that the economic effects of Turkish accession for the EU countries are small but positive. The accession would raise European exports and provide the solution for the ageing population and labor market shortages. It can be seen that Turkey experiences larger economic gains than the EU and its consumption per capita rises as a result of accession to the internal market and free movement of labor with benefits spilling all over the EU.

There are various approaches to the problem of estimation of Turkish migration that would be possibly initiated by its participation in the EU labor market. This paper combines two approaches to tackle the issue

using both rigorous statistical tools and an unorthodox approach, a comparative study. Utilizing data on migration collected throughout decades from various sources the paper tries to predict the behavior of Turkish migration in a hypothetical situation when Turkey was to join the EU labor market. The main sources of the data we use are the official statistics databases obtained at Destatis, Eurostat, Polish Central Statistical Office, UN, OECD and AMECO.

The paper is divided into two parts. The first part uses the data on migration from the EU-18 countries to Germany and Netherlands. We do not include the migration to the other big EU economies (e.g. France or Spain) because the majority of Turks migrates to Germany and the Netherlands due to the network effects (approximated in our model by the number of specific migrants in a given country). Moreover, the migration policies for the Turkish citizens did not change over the 25 years (which means that Turks could always migrate to Spain but did not do so) and there was no change so it is unlikely that perspective Turkish migrants would suddenly change their migration behavior. Therefore, the value added for additional countries in the model is very limited.

Using econometric modeling, it delivers predictions of future Turkish migration flows to the EU in the case of hypothetical accession. Our results reveal that Turkish EU Accession would only temporarily increase Turkish migration to the EU with migration flows negligible in absolute terms.

The second part analyzes Polish outward migration after the 2004 Enlargement based on the empirical data. Studying the changes in Polish migration with respect to the EU accession and gaining access to labor markets of different EU countries might enable us to predict eventual Turkish migration flows. We analyze the migration flows from Poland and conclude that they were more sensitive to the opening of the new labor markets for Polish citizens. This might be explained by the fact that the propensity to migrate is higher in case of Poles than in the case of Turks.

Finally, the conclusions at the end of the paper compare the results and conclude that migration flows are mostly influenced by employment rates and GDP in the destination country. Massive labor migration does

not represent a threat in case of Turkish EU accession, should it happen sooner or later.

1.2. Literature review

In the second half of 20th century, Turkey experienced substantial emigration flows. The 1960s and first half of the 1970s presented the period of massive labor migration where Western Europe became the main destination for the Turkish migrants (predominantly represented by the West Germany). However, it was also accompanied by large scale return migration which accounted for about 400 000 people. Nevertheless, the numbers of Turks abroad did not decrease. This period was followed by a different type of migration characterized by the family reunifications, marriages migrations, politically motivated migrations, and migrations of illegal laborers (see e.g. Akgündüz1993).

The Turkish migration resulted in an increase of stocks of Turks in the EU reaching 3 million in 2004 with 70 percent of Turks residing in Germany. The total number of Turks in the EU reached over 5 million (if one added the Greek Turks and ethnic Turks living in Bulgaria, Romania, and Greece) (Ozcure and Eryigit 2006). According to Akkoyunlu and Silverstovs (2009), a large share of the total amount of workers presented an unskilled labor. Chart 1 illustrates the fact that during the first phase majority of the total amount of migrating Turks chose Europe as their destination which is in high contrast to the later periods. Since then, the migration flows from Turkey to Europe plummeted and remained low.

Stalker (2002) estimated that in the short and medium term the EU demand for labor would be met by migration flows from within the EU but later on, in the long run, by greater migration from developing countries, such as Turkey. He did not, however, specify any precise estimates. The number of Turkish citizens residing in the EU decreased to 2.4 million in 2010, which constitutes 7.2 percent of all non-nationals in the EU (Eurostat 2011). If second-generation migrants are also taken into account (those born in Europe to parents born in Turkey), the total rises to close to 4 million (Biffl 2012). Turks in the EU mostly live in Germany (1.5 million), France (230,000), the Netherlands (200,000) and Austria (158,000). The decrease can be explained by return migration and acquisition of new citizenship. In 2009, 51 800 Turks acquired

citizenship of an EU country (5 percent increase in comparison to 2008), which amounted for 7 percent of all EU citizenship acquisitions in 2009 (Eurostat 2011).

The future propensity of Turks to migrate also depends on their motivation. Glazar and Strielkowski (2010) stress the importance of network effects and situation of the target country labor market while at the same time they consider Turkish per capita income as being nearly of no significance. Icdygu et al. (2001) bring to the attention the socio-economic variables such as poverty of the region of origin. They conclude that increasing poverty creates stronger incentives to migrate but only in the bell shaped manner. If poverty reaches extreme values migration decreases as people have no funds to migrate. Age is also an important factor. Not only are younger people more prone to migration but also migration propensity of persons in family phase of life (25-39) seems to decrease with increasing age (Krieger and Maître 2006). Higher generosity of social systems of hosting countries towards the unemployed and migrants appears to be uncorrelated with migration (Giulietti et al. 2011).

2. EU-18 Migration to Germany and Netherlands

2.1. Data and methodology

In order to analyze possible scenarios of Turkish labour migration in Europe, we conduct broad empirical analysis using the data on migrations from EU-18 to Germany and the Netherlands from 1967 until 2011, time series from OECD database (complemented by AMECO database) and Eurostat databases. Migration data were compiled from German central register of foreign nationals, German Statistical Office and Statistics Netherlands. The breaks in migration stock data series are dealt with using the methodology applied in Alvarez-Plata et al. (2003) and Glazar and Strielkowski (2010).

We decided to include these two receiving countries because they have the largest Turkish Diasporas in the EU. They reveal similar patterns in regard to the Turkish migration, such as family reunifications, network effects and return migration, and both have good migration statistics. Other large economies of the EU were not included to the model for the reasons described in section 1.1.

Our dependent variable is normalized with the home countries population representing the difference in migration stocks as a % of the original home population. The difference could be in different population growth rates, i.e. of population in original home country (in our case Turkey) and of appropriate population of foreign citizens in receiving country (in our case Germany and the Netherlands) and also in the rate of naturalization. We proceed with the assumption that population growth rates are equal (and therefore cancel out) and the naturalization rates are zero, which results in that ratio of the stock of foreign residence from country h in foreign country f to the original home population is equal to the ratio of actual net migration from country h into home country f to the original home population.

2.2. Empirical model and prediction

The first part of the theoretical model is consistent with those models based on human capital approach (Sjaastad 1962, Harris and Todaro 1970, or Hatton 1995) and deals with investment in human capital and expected future income. The model applies the econometric methods used by Boeri and Brücker (2000) and Alvarez-Plata, Brücker and Siliverstovs (2003) in estimating migration from CEEC into the EU15 and most recently by Glazar and Strielkowski (2010) and Glazar and Strielkowski (2012). According to these models, the decision to migrate can be viewed as an investment in human capital whose returns are determined by the net present value of expected income streams in the future (see Sjaastad 1962; or Glazar and Strielkowski 2012). The costs of migration include not only the pecuniary costs of moving places, but also non-pecuniary costs that includes intangible (social and psychological costs) of moving to the new environment. An individual will migrate if the expected benefits from moving exceed the expected costs (Strielkowski and Turnovec 2011).

Now, migrant's expectations about the income in the target country are pre-conditioned by the opportunity to find a job. Following Harris and Todaro (1970), the average employment rate serves as a proxy for the individual probability to find a job. Similar arguments apply to the expectations on future income in the home countries. On the other hand, uncertainty on future income levels may hamper migration even if potential migrants are risk-neutral. According to Hatton (1995), uncertainty depends on the risk of unemployment rather than on

different wage levels. This implies that one can expect the coefficients for the employment rates to be higher than those on the wage variables.

The majority of the migration literature assumes a static relation between migration rates, the hypothesis is that individuals are homogenous and that the same decision situation is replicated over time. Contrary to that assumption, we consider all individuals to be heterogeneous (i.e. differing in their preferences and the human capital characteristics relevant for migration decisions). As a result, the propensity to migration declines with the increasing share of migrants in the population of the source country. Therefore, for any given income differential, the stock of migrants reaches a steady state where its growth is determined by the natural rate of population growth. However, this does illuminate the possibility that chain and network effects affect migration positively. Nevertheless, in the long run these effects are dominated by declining preferences to migrate in the population. Thence, migration can be viewed as a disequilibrium phenomenon which vanishes when the equilibrium stock of migrants is saturated. This implies that net migration rates may fall to zero even when there exist small differences in wages and employment opportunities between the countries. We assume that people make expectations regarding the future income in the target (host) country and source (home) country. The differences in former incomes influence expectations about the future possible income. A country's GDP per capita serves as a proxy for individuals' incomes both in source and target countries (the selection of GDP per capita can be justified by limited data sources available for other variables). The average employment rate in both target and source countries is taken as a proxy for the labor market conditions. More precisely, the probability of finding a job is rising with higher employment and vice versa. The lagged migration stocks serves as a proxy for network effects. If migration flows are based on expectations about past variables that mean present values are influenced by past values (Hatton 1995), thus it should be first-order autoregressive process (AR (1)). However, in our model, we used AR (2) and assumed that it was general enough to allow us to compare various estimators. We include a further lag of the endogenous variable in our data samples in order to impose fewer restrictions on the adjustment process. Further lags of the dependent variable have turned out to be insignificant based on the Q test. For the purpose of estimation we have constructed the following simple error-correction model:

$$\Delta m_{fht} = \alpha_h + \beta_1 \ln(w_{ft}/w_{ht}) + \beta_2 \ln(w_{ht}) + \beta_3 \ln(e_{ft}) + \beta_4(m_{fh,t-1}) + \beta_5(m_{fh,t-2}) + \beta_6 * DummyF + Z_{fh}\gamma + \varepsilon_t$$

where:

m_{fht} - the dependent variable representing the share of migrants from source country h living in target country f as a % of source country population h .

w_{ht} – country of origin income level

w_{ft}/w_{ht} – foreign to home country income difference

e_{ft} – employment rate in country f

$m_{fh,t-1}$ – lagged migrants stock of home country h in country f

$m_{fh,t-2}$ – lagged migrants stock of home country h in country f

Z_{fh} – vector of time-invariant variables which affect the migration between two countries such as geographical proximity and language.

DummyF – Free mobility of labour.

We employ Seemingly Unrelated Regression (SUR), Panel data Least Squares (PLS) and General method of moments (GMM). This choice is based on the different properties of the estimators and the fact that for the panels with rather small time series dimensions and rather large cross-sectional dimensions, the GMM estimator described Arellano and Bover (1995) will be superior to the rest of the other available estimators due to the fact that the traditional estimators would perform rather poorly due to the unresolved simultaneous equation bias. However, when relatively large time series and rather small cross-sectional dimensions of the panel are employed, the motivation for using the GMM estimators is less obvious and the inflation of the moment conditions might somewhat worsen their performance in panels typically considered in macroeconomic studies. On the other hand, either the WITHIN or SUR estimator is expected to have a comparative advantage over the rest of the estimators as the Nickell bias is likely to be of considerably smaller magnitude than in panels with a small time

dimension as described by the Monte Carlo study of Judson and Owen (1999).

The results are shown in Table 1. All 3 models cover the data on migration stocks and economic factor in Germany and the Netherlands from 1967 until 2011.

Income differential has positive and significant impact on migration. Furthermore, the income in the source countries is also significant and has a positive impact on migration. Employment rate in Germany and the Netherlands (used as an indicator of the labor market conditions) is significant and positive. Lagged variables of migration also have significant and positive impact on migration. The dummy variable has a positive sign and it is significant, however its impact is rather small. It might be that migrants with the highest incentives to move have already done so before introduction of free movement of labor. Hence, migration flows appear not to be much influenced by the free movement of labor.

The impact of GDP per capita both in Turkey and the EU on the stocks of Turkish residents living in Europe is rather small in the long run. German GDP strongly influences the migration flows but the same thing cannot be said about Turkish GDP. Employment rate in the EU (taken as a proxy variable for German labor market conditions) seems to have a greater impact on migration stock.

From the obtained results, we are able to construct a scenario of Turkish migration in case of EU accession. Assuming that employment rate remains unchanged and GDP in Germany and Turkey grows annually at rate of 2 % and 4 %, respectively, the prediction can be seen in Figure 1. It shows that the EU accession is associated with roughly 50% increase in migration flows but that constitutes increase by only 10 thousand in real numbers. Therefore, eventual Turkish accession to the EU is not going to increase Turkish labor migration in Europe. It seems like most of the Turks who wanted to migrate have already done so, as can be seen in Chart 2.

3. Empirical Study of Polish Migration

3.1. Similarities of Polish and Turkish economies and migration

In this section we compare Turkish and Polish economies in order to show their similarities and thus defend the choice of Poland as a reasonable predictor for the Turkish behavior. Surely, there are factors like type of regime or religion that might influence migration and in which the countries differ significantly. However, this paper does not strive to control for all of the influential variables and so its predictive value should be regarded as rather limited.

Chosen economic indicators of Poland and Turkey in 2010 are shown in Table 2 (OECD, 2012). The amount of incoming FDI is similar, so are the GDP per capita rates and the rates of unemployment. With respect to population, Turkey is nearly twice as large. Additionally, both countries have lower GDP per capita than is the average in the EU 27 (Poland reaches a bit more than 60 percent and Turkey about 50 percent). Nevertheless, the material conditions in sending countries are usually deemed insignificant by most of the used literature. On the contrary, the occupation status of migrants seems to be influential as well as level of education (Krieger and Maître 2006).

Both countries also share similarities in migration flows. Historically, until 2004 Germany presented by far the most favorite destination for both Polish and Turkish migrants. Therefore, both countries accumulated a significant number of migrants in Germany over time, which established positive network effects for additional migration. The difference, however, lies in the preferred destinations. Most of the Turkish migrants lost their interest in Europe after the first wave of migration (from the 1960s until the mid-1970s) and since then the migration flow to Europe is basically inferior. On the contrary, Poles always migrated predominantly within the European borders. As Chart 2 reports, for the last 20 years, three quarters of total Polish migration targeted European countries (Polish Central Statistical Office 2012).

Finally, both Poland and Turkey have extensive pools of young labor force which reveals significant propensity to migrate. In Poland, in the age group between 15 to 24 years 12 percent are willing to migrate,

while in Turkey it was 8 percent (Krieger and Maître 2006). According to their results, age had the strongest influence on migration decisions.

3.2. Polish migration flows after the EU 2004 Enlargement

Similar to Turkey, Poland has a long tradition of international migration which dates back to the Divisions of Poland in the 18th century and numerous uprisings in the 19th century. Despite of reign of Communism from 1945 until 1989, Polish workers were active in other Communist states and there were several waves of outward migrations from Poland in the 1950s, the 1960s, the 1970s and especially in the beginning of the 1980s when the Solidarity movement became active and the Martial Law was introduced. Since the 1990s, Polish citizens began to enjoy the benefits of open borders and free travel . Chart 2 shows the total amount of Polish emigrants and respective share of those heading to other European destinations (Polish Central Statistical Office 2012). Three quarters of the migrants settled in Europe while one fourth headed to North and South America. There is a noticeable increase after 2004 which corresponds to the Polish EU accession. However, the Polish Central Statistical Office's data is underestimated because only those who stayed abroad for at least one year are counted which excludes seasonal workers. Nevertheless, it still offers general insights and a basis for comparisons.

The two charts that follow offer the breakdown of most preferred destinations of Polish migrants in Europe. The source data are taken again from the Polish Central Statistical Office's database so they should be taken only as approximate values. Chart 3 shows that while emigration to Germany was quite high and stable in the long run, the United Kingdom experienced a considerable increase of Polish migrants after Poland joined the EU in 2004 (the UK did not use its right to postpone the opening of its labor market to Poland and so Polish citizens were able to work in the UK immediately without any restrictions). Chart 3 shows the number of Poles who stayed outside Poland for more than a year (the amount of people who migrated for work is much higher). Polish labor immigration to the UK was highest in 2007 when it exceeded 96 000 citizens, while in 2009 it was only 39 000 (ONS 2012). In 2010, the net Polish immigration increased again by 43 000 (Workpermit.com 2011). *“In the second quarter of 2011 the number of Polish-born people aged 16 plus working in the UK was 449,888, an*

increase of around 60,000 on the previous quarter” (ONS 2012). However, it is not true that all of the migrants stayed. Many used the UK only as a transit destination and also many returned home.

Chart 4 (Polish Central Statistical Office 2012) depicts increase of Polish emigration to other countries of the EU after 2004. All of the countries experienced slight increases in immigration of Polish citizens, namely Ireland, where the value of 2007 was 28 times the value of 2004 (these numbers are again rather underestimated and track only deregistered citizens). Another way how to look at the distribution of migration flows is to track the changes in destinations. It can be seen from Chart 5 that free labor market gave incentives to many to choose unprecedented destinations for work. Typically, the UK and Ireland offered jobs in construction sector in times of booming economy prior to the crisis. Polish citizens took advantage of no labor restrictions on the expense of Germany which still had restricted access (until 2011).

Finally, Chart 6 (UN 2011; Federal Statistical Office (Destatis 2011) draws immigration rates to Germany from Poland and Turkey between 1970 and 2011. Germany was a long-term leader in attracting Polish migrants. Additionally, there is visible decline in Turkish immigration to Germany at the brink of the 1980s. Since then, the Turkish migration remained low and stable. The Polish case proved to be more interesting.

Since the mid-1990s to 2004 the migration flows from Poland were rather stable and constant. When Poland gained the EU membership the number of migrants increased and in 2005 the value was 50 percent above the value in 2003. Furthermore, as the latest preliminary data from German Federal Statistical Office suggests, there is another significant increase in migration going on related to the collapse of 7-year transition period, which Germany used to protect its labor market from new member states that acceded in 2004. The German labor market restrictions broke down in May 2011 and it immediately led to the increase in Polish migration. The overall immigration to Germany experienced a 15% increase in the first half of 2012 in comparison to the first half of 2011. The number of Polish migrants alone increased from 114 thousand in 2010, to 163 thousand in 2011. In the first half of 2012 89 thousand Poles have migrated which could lead to figures around 180 thousand for the whole year, assuming no change in trend in the second

part of 2012. There were 10.7 million migrants living in Germany in 2012 out of which 1.5 million originated from Turkey and 1.1 million from Poland (Destatis 2012).

Unfortunately, there is not sufficiently long time period yet to determine the true impact and duration of the effect. Additionally, it is not possible to wholly attribute the change of migration to the closure of labor market restrictions because the migration flows could also be influenced by the financial crisis.

The EU had quite a linear approach towards migration. In 1999 European Council declared in Tampere (Finland) the direction in which it wanted steer migration policy. The two steps consisted of establishing basic common legal framework and gradual convergence of legislation of member states. The EU decided to dedicate its resources in the long-term to tackle illegal immigration by providing economic assistance to developing countries and preventing conflicts. (European Commission 2002) This approach seems to be valid and in line with up to date migration research even today because the development of economies yields creation of new jobs and conflict prevention makes them more secure. By doing this, the EU alleviates the effects of one of the strongest push factors driving international migration – unemployment.

During AENEAS program that run from 2004 to 2006, the EU incorporated migration policy directly into the relationships with third countries. Migration and asylum thematic program (2007-2013) with the total budget of €384 million continues to prioritize well managed migration tied with economic development and stresses the need to combat illegal migration. More importantly, the EU always viewed legal migration as beneficial (European Commission 2002). Nevertheless, facing further enlargements, the EU came up with transitional agreements which reflected fears of particular EU countries of excessive migration flows. If Turkey is to accede EU in the future, it is likely to sign transitional agreements with some of the EU countries, regardless of the tangibility of migration threat.

Economically speaking, the EU is working hard to promote Turkish economy. Turkey is a member of the WTO and Euromed since 1998 and has a free trade area (FTA) with the EU since 1996. The EU is also Turkey's number one trade partner for both import and export

(European Commission 2013). Furthermore, Turkey has established several bilateral trade agreements in the Mediterranean region, has FTA with EFTA countries and Macedonia, Bosnia-Herzegovina, and Georgia. Combined with its geographic location it is becoming a trade hub in the Euromed region. This is likely to stabilize, or even diminish, the strength of push factors which should ultimately transmit into lesser incentives to migrate.

Therefore, the most likely scenario, based on Polish past experience with respect to collapse of other countries labor market restrictions, is that the Turkish entry into the EU free labor market would cause short-term increase of migration of low-medium magnitude, although the change expressed in percentage points could be high. This short-term increase would, however, begin to fall again at a rather fast pace. Availability of free labor market stimulates immediate and short-term increase in migration with short-term duration but it does not lead migration spikes. The positive effects of free labor market on illegal migration should also not be disregarded.

3.3. Migration flows of selected countries after the accession to the EU

In this section we would like to provide additional pieces of evidence in support of our findings by reviewing the emigration flows of several EU countries at the time when they joined the Union. We focus on the populous countries of the 2004 and 2007 accessions.

Looking at Romania and Bulgaria that joined the EU in 2007 one can discover similar patterns to that of Poland. Chart 7 displays largely decreasing trend in total Romanian emigration but it does not really corresponds to the real numbers. More reliable data is provided by national authorities of receiving countries. Population statistics and data from the EU Labour Force Survey show that at the end of 2010, around 2.9 million Bulgarians and Romanians reside in the rest of the EU, more than twice as many as before the EU accession. This represents an average inflow of 360 000 migrants per year but most importantly the growth began before the accession itself, being of around 220 000 per year between 2003 and 2006 (European Commission 2011). Unlike the case of Poland, the migrants tend to favour Spain and Italy rather than other destinations. The report to from the EU Commission (2011) further shows that the migration flows peaked in 2007 and from then on

decreased significantly. In 2010, Italy reported only 88 000 Romanian immigrants, while Spain only 33 000. Chart 8 demonstrates generally steady levels of migration in the number of destination countries and significant steep decrease can be seen for Italy and Spain. (OECD 2012) The migration seems to be heavily influenced by economic conditions – in this case both by financial crisis and unfavourable conditions on the Spanish labour market. Even though the migration flows have lowered, Spain still requested and received the full 7 year transitional period.

Apart from Poland, countries that joined the EU in 2004 did not constitute any larger potential for migration due to their limited populations. Therefore, there were no fears within the Union that their workers would cause any serious disturbances on national labor markets. Chart 9 depicts the data for these 9 countries. Estonia, Malta and Cyprus did not face any transitional agreements as their migration potential was minimal. The emigration flows of Czech Republic, Slovakia, Latvia, Slovenia and Hungary remained largely unchanged during the 2000s, were low, and did not present any serious deviations with regard to the accession.

The only country of the selection that experienced significant spike in the post-accession period was Lithuania. In 2010, Lithuanian emigration high-rocketed and nearly quadrupled with respect to 2009 reaching about 83 000 migrants. However, Lithuanian entry into the free labor market is not to the main factor blame. The migration wave was a product of severe austerity measures introduced by the Lithuanian government that cut public spending by 30% including wage cuts between 20-30% and reduced the pensions by as much as 11% (Pidd 2013). Unemployment rate began to rise rapidly and wage differentials climbed as well. In 2010, about 50% of all migrants moved to the UK and 15% to Ireland. Unemployment and wage differentials were the main push and pull factors (IOM 2011).

The empirical evidence gathered in this chapter supports our hypothesis that free labor market does not invoke unprecedented increase in migration. Although the effects are not marginal, they are rather low and short-term.

4. Conclusions and Discussions

Based on the both econometric and empirical analysis performed in the paper we demonstrated that eventual Turkish EU Accession would only increase Turkish migration to the EU in the short term horizon. Based on the evidence of behavior of EU-18 labor migration, the various migration scenarios in the case of Turkey could be quite high when expressed in percentage points but negligible in absolute terms. The migration shock would not last long and the level of migration would head back towards its previous values after the people with strongest incentives to migrate would do so.

On the other hand, Polish migrants appeared to be quite susceptible to the collapses of labor market restrictions in the EU Member states. Generally high stable trend of Polish migration to Germany was replaced by migration to the UK and Ireland when they removed labor market restrictions. Most recently, preliminary data shows that the same thing happened again in Germany where the 7-year period of labor market protectionism ended in middle of 2011. Nowadays, Germany is facing one of the highest immigration in the last 20 years.

The results of our study should be comprehended with great care as their predicative capability is limited. The second part of the paper relies on simplified assumptions that Poland and Turkey are similar countries to the point that their migration flows would react similarly. While they are both nations with long history proving propensity to migrate, migrants from both countries have established networks in Germany, and there were historically economic incentives for migration (such as low unemployment rate in Germany), the countries are not exactly the same.

The data that this paper was based on also demonstrate some controversies. Questionable precision and unavailability of data complicate rigorous research. The predictions are further bound to current institutional, economic, and many other conditions. Significant change of institutional design in Turkey might severely distort any predictions counting on supremacy of current regime.

To sum it all up, the this research suggesst that migration flows are mostly influenced by employment rates and GDP in the destination country, while the same does not hold for the variables of the country of origin. Even though there would be increase in migration if Turkey was to accede it would not fulfill the fears of critics that fear the possibility of Turkish massive immigration wave in case of hypothetical EU accession.

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Appendix: Tables, Figures and Charts**Table 1:** Panel data estimation results, Turkish migration in Germany and the Netherlands (1967-2011)

	PLS	GMM	SUR
C	-2.7144**		-2.3420**
w_{ht}	0.0320**	0.0166**	0.0155**
w_{ft}/w_{ht}	0.0445**	0.1140**	0.0240*
e_{ft}	0.4206**	0.3552**	0.4188**
$m_{fh,t-1}$	1.4452**	1.1693**	1.4491**
$m_{fh,t-2}$	-0.5347**	-0.5587**	-0.5228**
Dummy	0.0128**	0.0305**	0.0110**
**, * coefficients are significant at 1 and 5% level, respectively			
Cross section fixed effects (Turkey)	0.1355		

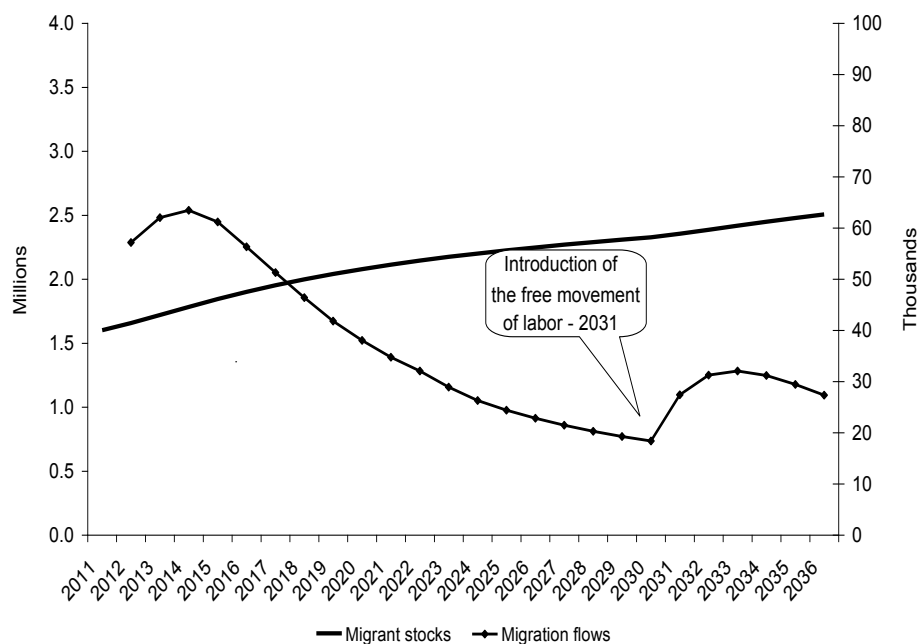
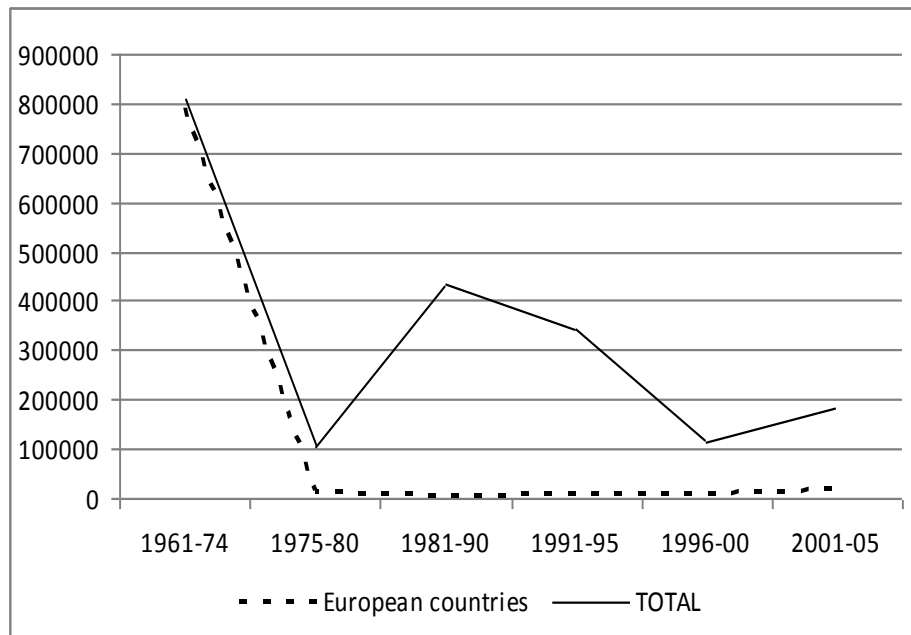
Source: Own calculations**Figure 1:** Scenario of Turkish migration in the EU (2011-2036)**Source:** Own calculations

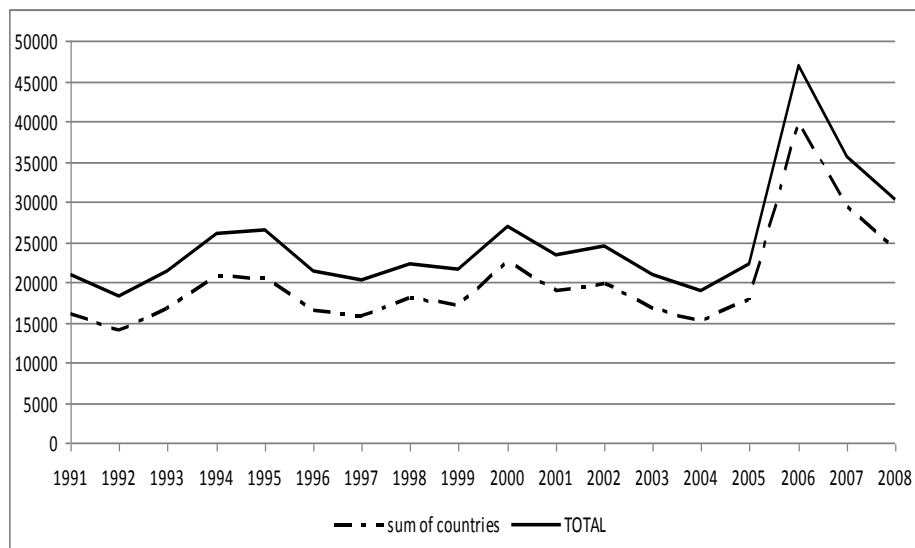
Chart 1: Migration from Turkey to Europe compared to the total emigration

Source: Turkey Country and Research Areas Report (2010)

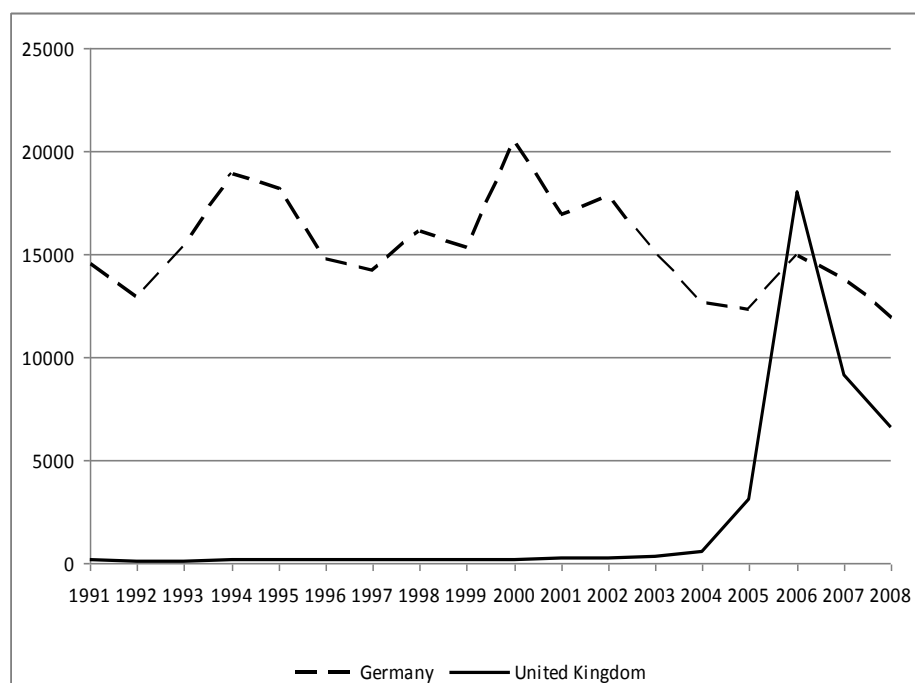
Table 2: Chosen Economic Indicators of Poland and Turkey (2010)

	Poland	Turkey
Population	38 million	73 million
GDP per capita (USD current PPPs)	19 747	15 320
Inward FDI	201 million USD	186 million USD
Unemployment rate (total civilian labor force)	9.6%	10.6%
Government deficit	-7.9% of GDP	-4.6% of GDP
Inflation	2.6%	8.6%

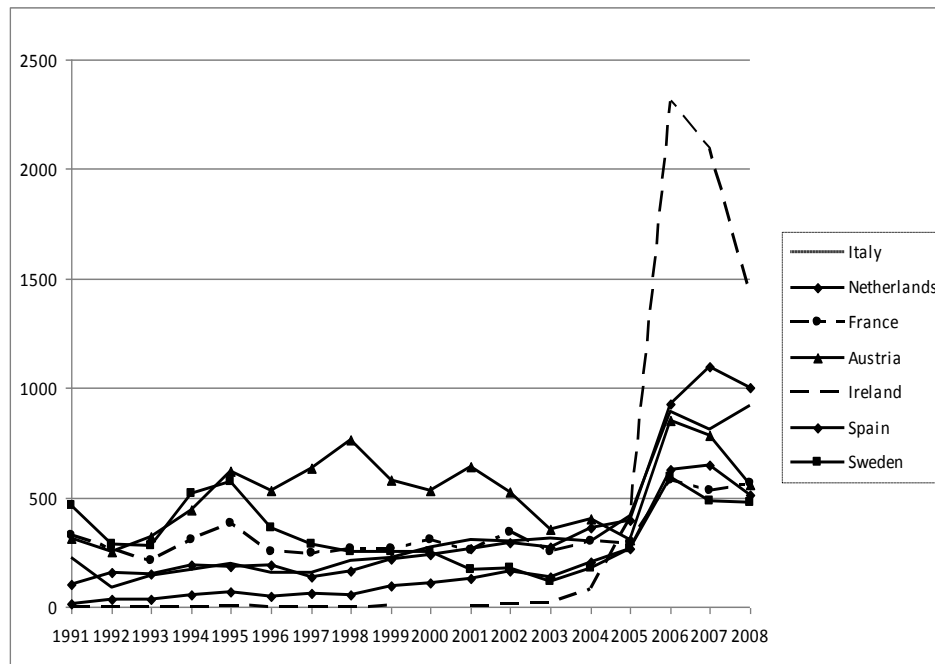
Source: Own compilation

Chart 2: Polish migration 1991-2008

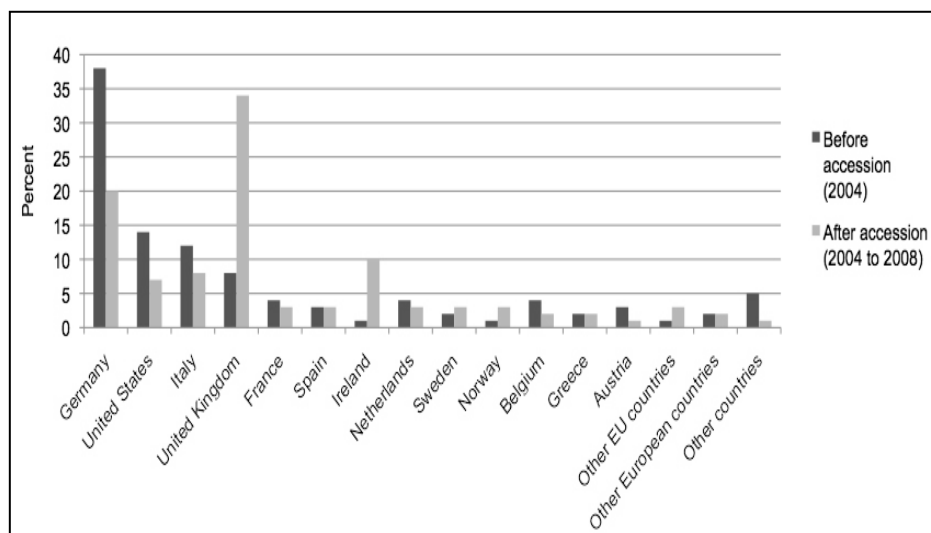
Source: Polish Central Statistical Office (2012)

Chart 3: Polish emigration to Germany and UK

Source: Polish Central Statistical Office (2012)

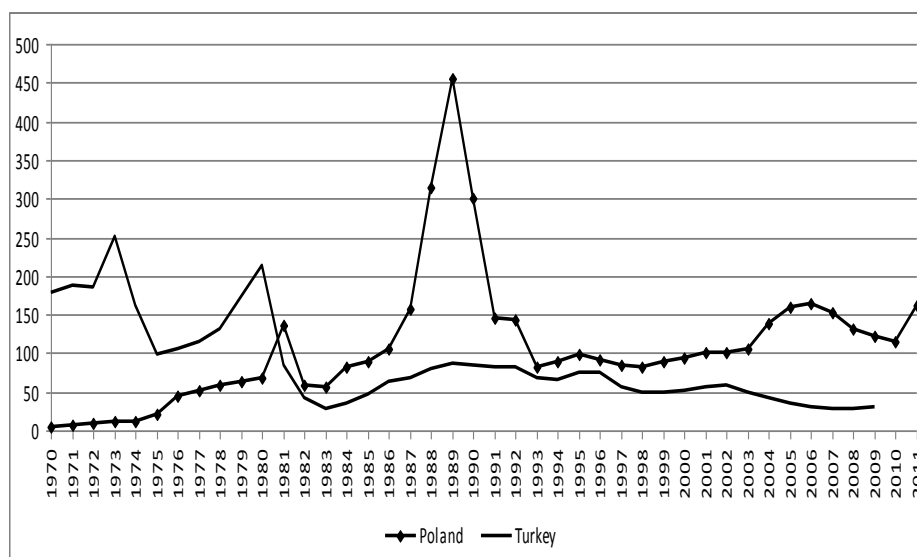
Chart 4: Polish emigration to other countries

Source: Polish Central Statistical Office (2012)

Chart 5: Destinations of Polish migrants before and after the EU Accession

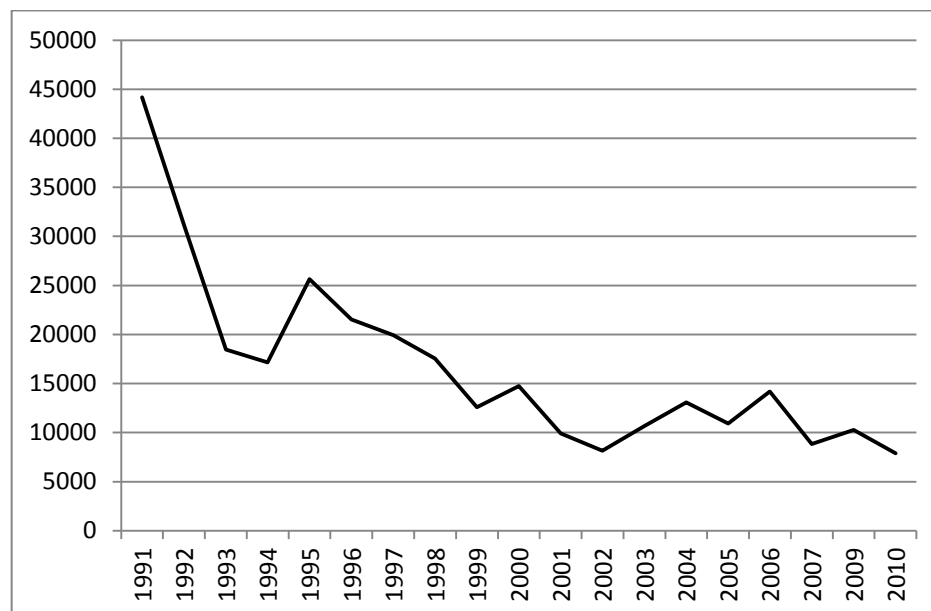
Source: migrationinformation.org (2010)

Chart 6: Labor migration to Germany from Poland and Turkey, 1970-2011
(thousands)

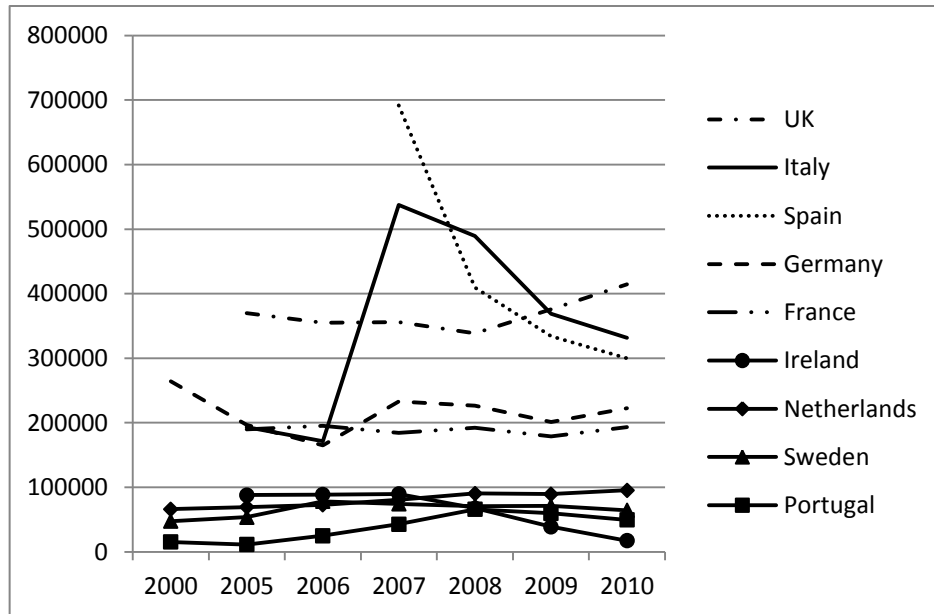


Source: United Nations (2012); Destatis (2012).

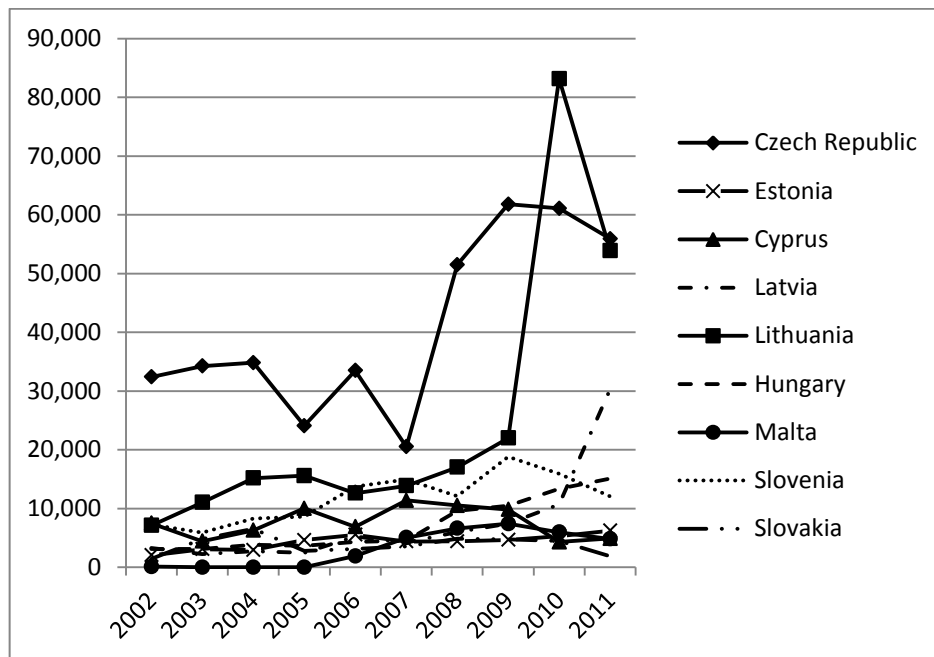
Chart 7: Emigration from Romania, 1991-2010



Source: CRCE (2010); OECD (2012).

Chart 8: Permanent immigration to selected European countries, 2000-2010

Source: OECD (2012).

Chart 9: Emigration from selected European countries, 2002-2011

Source: Eurostat (2013).

Monetary Policy Transmission through the Bank-Financing Channel in Malaysia: Evidence from Bank-Level Data

Hussam I. Asbeig¹ and Salina H. Kassim²

This study analyses the role of Islamic banks in transmitting monetary policy through the bank-financing channel in Malaysia. Bank size, liquidity and capitalization levels are hypothesized to be sources of cross-sectional differences among banks. If relevant, this implies that the financing channel is operational through the Islamic banks. We evaluate a sample period from 2000 to 2011, using panel data with robust standard errors, to investigate the heterogeneity of the financing supply in response to monetary policy shocks. The results show no significant differences across banks, based on size, capitalization and liquidity levels, and thus do not support the presence of a bank-financing channel in Malaysia. The study contributes a deeper understanding of the role of Islamic banks in the monetary policy transmission mechanism in Malaysia.

1. Introduction

Monetary authorities study the transmission mechanism of monetary policy to adopt suitable monetary policy frameworks. Successful monetary policies depend on accurate interpretations of the relationship between policy Measures and policy objectives. The literature shows that opposition to policy activism is based on the argument that there is not enough information about these relationships (Mishkin, 2007). Therefore, studying the mechanism of monetary policy transmission mechanism is important for both academics and policymakers. In Malaysia, the monetary policy framework has continuously evolved alongside the development of its economic and financial system. Malaysian authorities are in constant pursuit of effective monetary policy implementation. However, the rapid ascent of interest-free

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banking, alongside the existing conventional banking system, may have complicated the transmission process of monetary policy and added further challenges to the assessment of the effectiveness of monetary policy in the country.

Over the last decade, the Islamic banking industry has been successful in Malaysia. At the end of 2000, Malaysia had 2 full-service Islamic banks and 17 commercial banks with Islamic windows. By 2011, Malaysia had 17 full-fledged Islamic banks and subsidiaries, aided by liberal and accommodating measures of the Financial Sector Master Plan. Islamic financing in Malaysia surged from 2% of gross domestic product (GDP) in 2000 to about 42% of GDP in 2012. This trend is expected to continue as Islamic financing is projected to account for 40% of total financing advances in 2020, compared to 20% in 2000, in Malaysia (Bank Negara Malaysia Financial Stability Report, 2011). This attests to the importance of the Islamic banking institutions in financing the economy, and thus, policymakers should have a clear picture of the role of these banks in the transmission process of monetary policy.

The significant expansion of the Islamic banking in Malaysia may undermine the potency of the traditional interest rate channel and caution the impact of monetary actions. However, the lending channel may provide an alternative explanation to how monetary policy in a dual banking system can influence financing advanced by Islamic banks. The lending channel theory assumes that bank deposits and sources of wholesale funds are not perfect substitutes for each other. Following strict monetary policies, some banks (based on their characteristics) cannot fully replace lost deposits, which leads them to decrease lending. Based on the assumptions of bank-dependent borrowers, this leads to a reduction in aggregate demand components (mainly investment and consumption), which ultimately affects price level and output.³ Thus, the lending channel mechanism works by affecting credit availability, not loan cost, as the traditional interest rate channel suggests.

The Islamic banks, although non-interest financiers, they share the underlying basis of deposits with conventional banks and thus it is

³ Alistair et al. (2009) argue that the possibility for the lending channel to either amplify or attenuate monetary policy depends on the net effect between the supply of deposits and demand for lending. This means that the bank lending channel should not be viewed as a freestanding mechanism that is independent of the traditional interest rate channel.

possible for them to be affected by changes of monetary policy stance. Depositors of the Islamic banks may switch to conventional banks during rising interest rates, making the outflow of deposits even worst for the Islamic banks leading to a reduction in supply of financing (Kasri and Kassim, 2009). This is conceptually known as the Displaced Commercial Risk. Although Bank Negara Malaysia (BNM) has introduced regulatory measures to mitigate this unique risk, it is not clear to what extent these measures can caution the destabilising effects of monetary policy changes upon Islamic financing. By adopting a bank-level data approach, this study tries to identify the Islamic financing channel and to investigate the determinants of financing supply in response to monetary policy actions in Malaysia.

2. Literature Review

Since Bernanke and Blinder (1988) first laid the foundation for the lending channel theory, research has been conducted on the role of banks in the monetary policy transmission process. For example, Bernanke and Blinder (1992), Kashyap and Stein (2000), and Kishan and Opiela (2000) find evidence in support of the presence of the lending channel in the United States. Most of the evidence is from the cross-sectional differences among banks of different characteristics such as liquidity, size, and capitalization. Ehrmann et al. (2003) also adopt a bank-level data approach and find evidence to suggest that the lending channel is operational in the Eurozone. Olivero et al. (2011) use panel data to obtain a sample from emerging and developing economies in Asia and Latin America and find that the transmission of monetary policy through the lending channel has weakened because of consolidation in the banking sector. Several studies focus on the transmission of monetary policy through the bank-lending channel in Malaysia. Goh and Yong (2007) adopt aggregate data approach and conclude that bank lending is generally insensitive to changes in monetary policy after the Asian crisis period.

A limited number of studies address the role of Islamic banks in the transmission mechanism of monetary policy. Kassim et al., (2009) adopt VAR methodology to investigate the effect of monetary policy shocks on the balance sheet items (deposits and financing) of Islamic banks, in comparison to conventional banks. They find that the Islamic banks' deposits and financings are more responsive to monetary policy actions,

compared to their conventional counterparts. Said and Ismail (2007) use panel data methodology to investigate how changes in monetary policy affect the financing behaviour of Islamic banks in Malaysia. The results suggest that monetary policy has a significant impact on the volume of financing advanced by Islamic banks. However, they find that bank characteristics (profitability and capitalization) have no role in determining the banks reaction to monetary policy, which does not help to identify the financing channel. Muhammad et al., (2012) also adopt the bank-level approach. They utilised annual data on the Islamic banking institutions in Malaysia covering the period from 1997 to 2010. Using the Islamic Interbank Rate as a monetary policy indicator, the monetary policy changes are found insignificant in determining the level of the Islamic financing in Malaysia. Characteristics found influential in determining financing supply are capitalization, liquidity, and specific risk.

Some similar studies were conducted in other Muslim countries. For instance, Zaheer et al. (2011), use disaggregate data from Pakistan to examine the responses of the Islamic banks to monetary policy in comparison to conventional banks. They find that, unlike conventional banks, the Islamic banks maintain the volume of their financing irrespective of their size and liquidity positions. They concluded that the monetary policy transmission mechanism through the lending channel might be attenuated by the growth of the Islamic banking industry. Their findings were justified by the lack of competitiveness and investment opportunities as well as inefficiency of Islamic interbank market in Pakistan.

Malaysian Islamic banking industry has weathered the global financial crisis thanks to the well-developed Islamic financial system as well as sound supervisory and regulatory framework (IMF Country Report, 2013). This study is an effort to shed light on one of the aspects of the Islamic banking in Malaysia, namely their role in the transmission mechanism of monetary policy. From the review of the literature, previous studies use the Islamic interbank rate as a monetary policy indicator to investigate the existence of the financing channel in Malaysia. Although this rate closely follows the precursor rate (the conventional rate), there might be some lag in this relation which does not help reflect the real speed of pass-through of the policy rate in the transmission of monetary policy. Moreover, this study use data from its

primary sources and all variables included are calculated manually to obtain more representative information.⁴

3. Empirical Framework

3.1 Data

We use annual data from 11 Islamic banks that operated in Malaysia from 2000 to 2011. The 11 banks are selected from 17 Islamic banks, based on available data. The data are sourced from the banks' annual reports, BNM's annual reports, and Department of Statistics Malaysia. Table 1 describes the variables used in the model. These variables represent bank-specific characteristics, namely capitalization, liquidity and size in addition to macroeconomic variables, namely GDP, inflation, and a monetary policy indicator. The bank-specific variables are calculated using the formulas in Table 1.

Table 1: Model Variable Definitions and Sources

Variable	Definition	Source
GDP	Real Gross Domestic Product based on 2000 price	Department of Statistics Malaysia
Monetary policy indicator (BLR)	annual average of Base Lending Rate	BNM annual reports
Inflation rate(Inf)	inflation rates (CPI based on 2000 price)	Department of Statistics Malaysia
Liquidity (Liq)	(liquid assets/ total assets)*100	Banks' annual reports
Capitalization (Cap)	[(total equity + reserves) / total assets]*100	Banks' annual reports
Size (S)	(bank total assets/banking system total assets)*100	Banks' annual reports and BNM annual reports
Islamic Financing (F)	volume of Islamic financing, as reported at the end of the period (31- December)	Banks annual reports

⁴ Ehrmann (2003) believes that the bias in the BankScope database information is responsible for the contrasting results obtained from studies used BankScope information and other studies used the national banks information in the Euro zone.

3.2 Model Specification and Methods of Investigation

Aggregate data is widely used to investigate the existence of lending channels in different economies. However, the problem of identifying the lending channel requires disentangling the demand effects from the loan supply effects, which is not completely resolved by using the aggregate data approach (Kashyap and Stien, 2000). Following Ehrmann (2003) and Kashyap and Stein (1995, 2000), we examine the heterogeneity of Islamic banking institutions across size, liquidity and capitalization to identify the financing channel. The estimation model can be written as follows:

$$\log(F_{it}) = a_0 + \beta_1 \log GDP_t + \beta_2 inf_t + \beta_3 r_t + c_k x_{itk} + e_k r_t x_{itk} + \varepsilon_{it} \quad (1)$$

$$i = 1, \dots, N, \quad t = 1, \dots, T$$

where F is the volume of financing for bank i in time t . The subscript k stands for the number of the bank specific factors. GDP is included to capture financing demand. Because GDP can also be obtained as a general proxy for business cycle and real activities, we assume that time effect also can be captured by including GDP and inflation rate in the model. The bank-specific characteristics are given as x_{it} , which denotes the levels of liquidity (Liq) capitalization (Cap).and size (S).

In the model, the coefficient β_3 refers to the impact of monetary policy on the average bank in the sample, regardless of their size, liquidity and capitalization levels. The coefficient e_k is a vector of interactions between the monetary policy indicator and the interval-independent variables of bank characteristics. Because these variables are hypothesised to be moderators, the heterogeneity among banks should be reflected in significant and positive (or, more accurately, a less negative) interaction terms.⁵ Multiplicative models usually have high

⁵ The coefficients of the interaction terms give the ratio by which β_2 is moderated when Cap and Liq are taken into account. Therefore, our primary aim is to investigate whether increases in capitalization and liquidity make the relationship between policy rate and bank lending less negative (e.g. see Franklin and College, 1982).

levels of multicollinearity. Balli and Bent (2010) suggest reducing collinearity by demeaning the interaction terms.

As for the model specifications, if the following assumptions hold, then nothing is special about our data and pooled ordinary least squares (OLS) estimator can be applied safely.

$$E(\varepsilon_{it}) = 0 \quad (2)$$

$$Var(\varepsilon_{it}) = E(\varepsilon_{it}^2) = \sigma_\varepsilon^2 \quad (3)$$

$$cov(\varepsilon_{it}, \varepsilon_{js}) = E(\varepsilon_{it}, \varepsilon_{js}) = 0 \text{ for } i \neq j \text{ or } t \neq s \quad (4)$$

$$cov(\varepsilon_{it}, x_{2it}) = 0, \quad cov(\varepsilon_{it}, x_{3it}) = 0, \quad (5)$$

where x is regressor

To ensure that, we conduct the following tests:

Lagrange Multiplier Test: Breusch and Pagan (1980) describe the theoretical background of the Lagrange Multiplier (LM) test, which assesses the property of random-effect estimation (RE) against pooled estimation. For the pooled method to be correct, the heterogeneity among banks should not be explained by the cross-sectional dimension, but instead by other micro and macro explanatory variables. To test for unobserved bank effects, the error terms in equation (1) can be decomposed into:

$$\varepsilon_{it} = u_i + e_{it} \quad (7)$$

where u_i is the bank-specific random effect.

Given the basic assumptions, the presence of bank heterogeneity can be investigated by testing these hypotheses:

$$H_0 : \sigma_u^2 = 0$$

$$H_A : \sigma_u^2 > 0$$

If u_i in equation (7) equals zero for each bank, then there is no bank effect, either random or fixed to count for.

Over-identifying Restrictions Test: The ordinary Hausman test investigates the consistency of the RE model. If $\sigma_u^2 \neq 0$ and $cov(u_i, x_{itk}) = 0$, then the RE is more appropriate (more efficient) than the fixed-effects (FE) estimator. The main limitation for this test is that it assumes that both estimators are efficient under the null hypothesis, which requires assumptions (3) and (4) to hold. Moreover, the RE model uses the orthogonality condition $(u_i, x_{itk}) = 0$, which may be difficult to maintain for panels. In our data, where financing is provided by varying bank size, we expect to encounter heteroskedasticity in the disturbance term. In this case, the FE is a consistent but inefficient estimator, and thereby, the ordinary Hausman test becomes invalid. Arellano (1993) and Wooldridge (2002) propose an alternative approach, to assess FE models against RE models, which is robust to heteroskedasticity and autocorrelation. Under the homoscedasticity and independence assumptions, this test is asymptotically equivalent to the popular Hausman test.⁶

4. Empirical Results

This section includes the description of the data and the major specifications conducted to ensure an unbiased estimation.

4.1 Descriptive Statistics

In Table 2, the uppercase N denotes the overall observations, and the lowercase n denotes the number of banks. The min and max columns give minimums and maximums of x_{it} for overall variance, $\bar{x}_i$ for between-group variance, and $x_{it} - \bar{x}_i + \bar{x}$ for within-group variance (Cameron and Trivedi, 2010).

⁶ The Stata software (College Station, TX) includes an over-identifying restrictions test (xtoverid).

Table 2: Descriptive Statistics

variable		mean	median	std	min	Max	Obs
Log loans	overall	14.53	14.92	1.73	9.36	17.72	N =132
	between			1.33	12.21	16.43	n =11
	within			1.17	10.07	17.16	T=12
Log GDP	overall	19.93	19.51	.16	19.69	20.19	N =132
	between			0	19.93	19.93	n =11
	within			.16	19.69	20.19	T =12
Inflation	overall	2.29	1.77	1.32	.57	5.38	N =132
	between			0	2.29	2.29	n =11
	within			1.32	.57	5.38	T =12
BLR	overall	6.32	6.39	.36	.551	6.87	N =132
	between			0	6.32	6.32	n =11
	within			.36	5.51	6.87	T =12
Capital Strength	overall	7.59	6.6	4.03	2.4	23.5	N =132
	between			2.3	5.02	11.87	n =11
	within			3.37	.62	19.22	T =12
Liquidity	overall	46.99	48.5	19.71	10	96.5	N =132
	between			12.5	26.92	66.02	n =11
	within			15.87	1.42	85.09	T=12
Size	overall	.94	.74	.86	.01	5.33	N =132
	between			.76	.09	2.54	n =11
	within			.45	.9	3.72	T =12

Although log loans show more variations between groups, the bank-invariant regressors (GDP, inflation, and BLR) have zero between-group variations; hence, the between-group estimation is not appropriate for these data. Liquidity and capitalization levels show greater variance within banks than between banks. This is due to the considerable development of Islamic banking during the 2000s. Inflation rate and bank specific factors are skewed. Thus, we use log transformation to meet the normality assumption.

4.2 Results of the Specification Tests

To have a clear picture of the sequences of testing process, Table 3 combines results of different estimators. It also includes tests for the consistency of the RE model and the presence of heteroskedasticity, multicollinearity as well as a poolability test (LM test).

Table 3: Results of the Specification Tests

Dependent Variable log Financing	Model 1 Fixed Effect (OLS)	Model 2 Random Effect (FGLS)	Model 3 Pooled OLS
Constant	-22.434*** (7.349)	-19.652*** (6.292)	19.96*** (6.35)
GDP	1.96*** (0.364)	1.854*** (0.306)	1.87*** (0.308)
Inflation	0.122 (0.107)	0.113 (0.111)	0.112 (0.144)
Blr	-0.026 (0.189)	-0.021 (0.195)	-0.023 (0.201)
Capitalization	0.445*** (0.13)	0.286** (0.119)	0.231** (0.117)
Liquidity	-0.651*** (0.116)	-0.703*** (0.104)	-0.718*** (0.101)
Size	1.032*** (0.093)	1.099*** (0.048)	1.097*** (0.044)
Blr*Cap	-0.729** (0.428)	-0.935*** (0.439)	-1.003*** (0.444)
Blr*Liq	-0.341 (0.386)	-0.444 (0.389)	-0.479 (0.394)
Blr*S	-0.641*** 0.265	-0.609*** (0.272)	-0.6*** (0.278)
LM test	$\chi^2 = 3.94***$		
Over-identifying restrictions test	Sargan-hansen = 231.59***		
Multicollinearity test (VIF)			Mean VIF= 1.85
Modified Wald test for group-wise Heteroskedasticity	$\chi^2 = 323.71***$		

Notes: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively

In Table 3, Model 1 is the FE within-group estimation, Model 2 is the FGLS RE estimator, and Model 3 is the OLS pooled regression. These are the default methods for FE, RE, and pooled models. For the selected variables, each model exhibits different results, which signals the presence of bias. The LM test clearly detects the influential presence of bank effects; therefore, pooling the data leads to biased estimates. Before testing how the unobservable effects should be treated, we first, test the efficiency of Model 1 (FE model). The result reveals that the null hypotheses that panels are homoskedastic is rejected at better than 95% level of confidence. Therefore, the usual Hausman test is not valid. The over-identifying restrictions test provides evidence in favour of FE model as the test significantly rejects the null hypothesis that the over-

identifying restrictions of consistency hold for RE model. As our tests suggest, assumptions (3) and (5) are violated. Therefore, the efficiency of Model 1 and the reliability of the hypotheses testing are questionable. In order to insure valid statistical inference, it is common in the literature to rely on “robust” standard errors that developed by Huber (1967), White (1980) and Arellano (1987). This provides residuals that are valid even if the residuals are heteroskedastic.

4.3 Findings

Table 4 displays the results of the model, specified to estimate the impact of monetary policy on our sample of Islamic banks. The main estimate (α) represents the baseline for the different conditions, namely capital strength, liquidity degree and size. The table shows that the coefficient of monetary policy is small and insignificant, even at 90% level of confidence. This implies that the financings of the Islamic banks are explained by other micro and macroeconomic factors. This result is in line with Muhammad et al., (2012), yet inconsistent with the conclusion of Said and Ismail (2007).

Table 4: Results of the Fixed Effect Model

Dependent variable log Financing		Coef	Robust standard errors
Constant		-22.434***	(4.92)
Control variables			
log GDP		1.968***	(0.251)
inflation		0.122***	(0.037)
Monetary policy indicator			
	BLR	-0.026	(0.282)
Bank characteristics			
	Capitalization (cap)	0.445**	(0.156)
	Liquidity (liq)	-0.651***	(0.99)
	Size (S)	1.032***	(0.096)
Interaction terms			
	BLR*cap	-0.729	(0.632)
	BLR*liq	-0.341	(0.623)
	BLR*S	-0.641	(0.418)
R^2		within = 0.86 between = 0.97 overall = 0.92	
F(9,10)		214.6***	

Notes: ***, **, * indicates significance at 1%, 5% and 10% respectively. Bank dummies are not reported.

The findings of this study can be understood in the context of monetary policy implementation in Malaysia. The inflationary pressures have been assessed to be broad based and due to supply factors rather than excessive local demand. Accordingly, monetary policy has not been used aggressively as the BNM believes that there are limits to what monetary policy can achieve in combating rising price levels (BNM Annual Report, 2007). The result can also reflect the development of the Islamic financial system in Malaysia, which enables the Islamic banks to diversify their assets and efficiently manage their liquidity to hedge against liquidity shocks caused by monetary operations.

The coefficients of capitalization and size exhibit significant positive effects on loan supply. As for liquidity, in spite of highly significant coefficient, the relationship is negative. This can be explained by *flight to quality* phenomenon, where banks prefer liquid assets than financing as a hedge against credit and market risks. Capitalization levels for the Islamic banks are highly significant in their association with the financing levels. This can be understood in the context of the dramatic development in the Islamic banking industry during the past 10 years. Since 2002, the Malaysian banking system has witnessed the transformation of Islamic banking windows into full-fledged Islamic subsidiaries. Amidst growing demand for the Islamic banking services, the new-established banks had to increase their start-up capital in order to comply with the regulatory standards.

The changes in real GDP have a positive and statistically significant impact on the volume of Islamic financing. With elasticity of 1.96, our findings suggest that Islamic financing is sensitive to changes in real activities. This result is compliant with most studies conducted on Malaysia, such as Ibrahim (2006), Ibrahim and Shah (2012), Said and Ismail (2007) and Kassim et al., (2009).

The coefficients of the interaction terms are also not statistically significant, suggesting that bank responses to monetary policy are not influenced by the capitalization, size, and liquidity conditions of Islamic banks. According to Goh and Yong (2007), these findings can be attributed to the low interest rate regime prevailed in Malaysia over the last decade. It is also can be justified by Ample liquidity enjoyed by Islamic banks in Malaysia, which shields Islamic financings from the consequences of deposit outflow hypothesised by the lending channel.

Similar results reported by Zaheer et al. (2011) for Pakistan and Said and Ismail (2007) for Malaysia. Yet, it is not consistent with other studies such as Muhammad et al. (2012) who find that monetary policy effect depends on bank specific factors.

The inconsistency between this study and other studies conducted on Islamic banks in Malaysia is probably due to adopting different monetary policy indicators and different data sources. Previous studies rely on the Islamic interbank rate whereas this study uses the conventional interest rate as a monetary policy indicator. It is also noteworthy that the discrepancy among different sources of data (banks' financial statements and BankScope database) can lead to varying results.

5. Conclusion and Discussion

This study investigates the transmission mechanism of monetary policy through the Islamic banks in Malaysia during the period from 2000 to 2011. We adopt a bank-level approach to investigate whether the supply side of financing plays any role in the transmission of monetary policy through the Islamic banks. The study does not find any evident effect for the supply side of financing. Thus, the financing channel seems to have little importance in the transmission mechanism of monetary policy through the Islamic banks. It may, at the first glance, imply that the growth of the Islamic banking industry hinders the transmission of monetary policy through the lending channel. However, such a conclusion requires further investigation into whether weak reaction to monetary policy can be seen as an Islamic banking idiosyncrasy. To answer this question, future research should evaluate the financing behaviour of the Islamic banks in comparison to the conventional banks. The shortcoming of this study is that it employs a static model with a dynamic relationship between monetary policy and loan supply. Because of a lack of quarterly data for bank balance sheet items covering a reasonably long period, we use static model with a longer period to capture the changes of monetary policy.

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Islamic Banks and Monetary Transmission Mechanism in Malaysia

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Monetary policy influences the real economy through various channels including the bank lending. Currently, Malaysia is operating under dual banking systems; conventional and Islamic banking. The latter has distinctive feature of interest-free. Hence, this study aims to empirically explore the relevance of Islamic banks' financing in channeling the monetary policy effects to the real economy. To achieve this objective, the study relies on an autoregressive distributed lag (ARDL) bound testing approach and innovation accounting approach, and uses quarterly data spanning from 1991:Q1 to 2010:Q4. The study documents that Islamic financing channel for monetary transmission exists in Malaysia. Islamic financing is unequally distributed to economic sectors in response to monetary policy shock. Furthermore, the findings also reflect that Islamic banking as operating in dual banking system is not spared from the interest rate and monetary conditions of the country. This clearly shows the behavior of Islamic banking which cannot shun away from the interest rate while its operation delinks from the interest rates. In designing monetary policy, the central bank should consider Islamic financing as an alternative or complement channel for monetary transmission since this channel is just as active as conventional lending channel.

1. Introduction

The monetary policy conducted by central banks targets to influence the overall performance of the economy in order to achieve its objectives. The common objectives of monetary policy are: sustainable economic growth, stable price, full employment, and exchange rate stability. To achieve such objectives, central banks set an intermediate target, i.e.

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monetary aggregate or interest rate that are strongly linked to economic activities. For example, during boom period, a central bank conducts tight monetary policy by raising interest rate or using other monetary policy tools, i.e. increase of statutory reserve requirement (SRR) or selling bonds, to reduce inflation. An increase in the interest rate causes the price of loans to increase as well and this in turn will induce investors to reduce their borrowings. As a result, investment spending declines, thereby causing aggregate demand to decrease. Hence, output falls.

The channel of monetary transmission in affecting economic activities is also important and much relevant to the effectiveness of monetary policy. The above description has illustrated on the mechanism of monetary transmission through the interest rate channel. The interest rate is used to influence the decision of investors in making borrowing and investment. Investment spending is part of GDP; lower investment spending will reduce aggregate demand, thereby causing the economic activities to decline. However, the interest rate channel is not the only channel that monetary policy can be transmitted. There are also other channels which can be conduits for monetary transmission such as bank lending, exchange rate, asset price and balance-sheet channels.

Bank lending is one of conduits through which monetary policy can be transmitted. In boom period with high inflation, a central bank might implement tight monetary policy by increasing the statutory reserve requirement (SRR) in order to reduce inflation. Upon this regulation, bank reserve decreases, causing fewer bank loans to be made available. Consequently, the investment spending will declines due to fewer number of investors applying for getting loans. Consequently, aggregate demand decreases, affecting output to decline. In this channel, banks play an important role as financial intermediary that have specialized knowledge in making credit which cost them less than other sources. In market imperfection, there are some borrowers who depend on loans of banks. In other words, loans are perceived as imperfect substitution for other types of credit, i.e., raising money in capital market. Hence, the reduction of loans leads to the decline in investment spending, and consequently, output decreases.

Bank lending channel has captured the attention of many economists and researchers. There is substantial literature in this area for developed

countries, such as those by Bernanke and Blinder (1992), Gertler and Gilchrist (1993), Kashyap and Stein (1997), and Brissmis et al. (2001). There have been many studies documented evidences supporting the existence of the bank lending channel in both advanced and emerging economies. Altunbas et al. (2002), for example, have found the bank lending channel in Europe. Also, many aspects of the bank lending channel have been analyzed, among them are: the issue of sensitiveness of bank lending with different size, capital strength and liquidity on monetary policy (Brissmis et al., 2001; Gambacorta, 2005; Worm, 2001), and also the issue of sectoral effects of monetary policy (Dale and Haldane, 1995; Dedola and Lippi, 2001; Arnold and Vrugt, 2002).

Furthermore, many studies on monetary transmission for developing countries were also conducted by those such as Arena et al. (2006), Agung (1998) and Ramlogan (2004). Various channels of monetary transmission are investigated in those countries. The results vary from one country to another, yet all of these studies seem to suggest the existence of credit channel (Ramlogan, 2004; Huang and Pfau, 2008; Ahmad, 2008). Some studies also document on the factors affecting the activeness of the bank lending channel, i.e. size, liquidity and origin of banks (Arena et al., 2006; Agung, 1998). However, these studies mainly focus on bank lending from conventional banking system only.

Unlike other countries, Malaysia is operating under the dual banking system, namely conventional and Islamic banking systems. This makes Malaysian banking system unique. Therefore, the bank lending channel in Malaysia can be viewed in two aspects. The first aspect is traditional lending channel through conventional banks, while the second one is financing channel through Islamic banks.

However, both conventional and Islamic banks provide similar products and services, but with different underlying contracts. Deposit and financing are based on loan contract in conventional case. In contrast, Islamic banks provide its deposit and financing based on Islamic contract such as *wadi'ah*, *mudarabah*, *musharakah* and *murabahah*. The important reason why such practices are exercised is that the interest is prohibited by Islam. Such practices help avoid the elements of interest. Thus, this unique feature of Islamic banking has brought a new avenue to banking industry, and it affects all parties involved in the industry

including depositors, investors, borrowers and also those in economic and social welfare organizations.

Like conventional banks, Islamic banks are under supervision and regulation of the central bank of Malaysia, Bank Negara Malaysia (BNM). Therefore, BNM has the power to control and influence the Islamic banks, as it has the control on conventional banks. For example, deposit of Islamic banks is subjected to SRR and also liquidity requirement ratio (LRR). An increase (decrease) of SRR will affect bank reserve to (decrease) so that banks' financing will reduce (increase). Based on the theoretical background of the bank lending channel, it is questionable whether monetary policy can be passed through the Islamic financing channel or not? If yes, how strong it is?

In this light, both bank lending and Islamic financing channels are investigated. In term of bank lending channel, existing studies show that monetary transmission through the bank lending channel is active, for example Goh and Yong (2007), Kassim and Majid (2009), Kassim (2006) and Sayuti (2009). Few other studies, such as Domac (1999), Ibrahim (2005) and Karim et al. (2006) focus on the distributional effects of monetary policy in Malaysia. These studies seem to suggest the disparities in the effects of monetary policy on bank lending and economic sectors.

With regard to the Islamic financing channel, hardly there are any studies. This may be due to the recentness of the establishment and improvement of Islamic banking system in Malaysia. The limited existing studies, however, investigate mainly to prove the existence of Islamic financing channel for monetary transmission in Malaysia (Said and Ismail, 2007; Sukmana and Kassim, 2010; Sayuti, 2009). Other than documenting the presence of Islamic financing channel for monetary transmission in Malaysia, they do not employ methodologies such VAR model, structural VAR model in producing empirical results (Sayuti, 2009; Said and Ismail, 2007; Kassim et al., 2009). Then, there are few studies which analyze the causality between interest rate and Islamic financing by using Toda-Yamamoto approach. The results show strong causality between the interest rate and Islamic financing (Ibrahim and Sukmana, 2011). Nevertheless, yet no study explored the distributional effects of monetary policy on Islamic financing. This aspect still thus demands further investigating.

To this end, the present study tries fill up the existing gaps in this area of the study by re-examining the currently existing of Islamic financing channel using different methods, ARDL model, for instance. The study also would take the challenge of exploring distributional effects of monetary policy on Islamic financing as well as economic sectors. The study expects to produce findings that would enrich the literature of this line of research more.

Specifically, this study aims at investigating the existence of Islamic financing channel in Malaysia; analyzing the distributional effects of monetary policy on the Islamic financing provided for various economic sectors such as agriculture, manufacturing and construction; and assessing the sensitivity of various economic sectors to monetary policy stance and Islamic financing change.

The remainders of the study are organized in the following manner: Section 2 provides the review of literature on the bank lending channel. Section 3 is devoted to discuss methodology employed in this study while Section 4 discusses the empirical results and findings of the study. Finally, Section 5 concludes and summarizes the major findings of the study.

2. Monetary Transmission Mechanism

Monetary transmission mechanism is one of the economic topics of research that has been paid attention by many researchers. This may be because of the importance and the dynamic of the matter itself. Understanding the monetary transmission mechanism would give the central bank the most effective channel in conducting monetary policy and in affecting economic activities. This is perhaps the challenging task for many central banks since there are many channels that could be conduits for monetary transmission.

2.1 Channels of Monetary Transmission Mechanism

The objectives of monetary policy are to achieve its targets such as sustainable economic growth and instituting stable price. It is important for policy makers to understand monetary transmission mechanism in order to influence economic variables. The channels of monetary transmission have been well established at least in theory. For the

purpose of this research, four channels of monetary transmission will be discussed.

2.1.1 Interest rate channel

Monetary transmission mechanism with interest rate channel has been established for over fifty years. The mechanism is based on the basic Keynesian IS/LM model in mainstream economics (Mishkin, 1996). This channel also known as money view. In money view, monetary policy stance can influence economic variables via interest rate. The mechanism of this monetary transmission can be illustrated as below, assuming that it is monetary contraction:

$$M \downarrow \Rightarrow i \uparrow, I \downarrow \Rightarrow Y \downarrow$$

When monetary contraction is implemented, it affects real interest rate to increase. High real interest rate would increase the cost of borrowing to investors. Therefore, the decline in investment spending will cause the aggregate demand to decrease, thereby causing economic output to decrease.

2.1.2 Bank lending channel

Monetary policy can be transmitted through the bank lending channel. In this channel, banks as financial intermediary play a crucial role. To understand this channel, two assumptions must be hold. Firstly, monetary policy must have the ability in influencing bank loans. Secondly, there is no perfect substitutability between retail bank deposits and other sources of fund for banks. The following schematic will show the mechanism.

$$M \downarrow \Rightarrow \text{deposit} \downarrow \Rightarrow \text{bank loan} \downarrow \Rightarrow I \downarrow \Rightarrow Y \downarrow$$

When the central bank conducts monetary contraction, bank loans decrease in response to the fall in the bank reserve. Therefore, supply of bank loans to investors decreases leading to decline in investment spending. As a consequent, output will decrease.

2.1.3 Asset price channel

Under the asset price channel, there are two conduits that monetary policy has to pass-through: Tobin's q theory of investment and wealth effects. However, these two channels are almost the same except that the Tobin's q channel will affect investment decision while wealth effect channel will involve with consumption decision.

Tobin's q theory can be the channel for monetary transmission affecting economic variables through the valuation of equities. Tobin defines q is "the market value of firms divided by the replacement cost of capital" (Mishkin, 1996). If the value of q is high then the company will invest more because the value of the firm is higher than the replacement cost of capital and otherwise. The schematic of this channel can be presented as below.

$$M \downarrow \Rightarrow P_e \downarrow \Rightarrow q \downarrow \Rightarrow I \downarrow \Rightarrow Y \downarrow$$

From the above schematic, money supply decreases in the economy because of monetary contraction. Individuals would have less money than they want. Therefore, in order to smooth their consumption they will try to sell their asset, securities for instance. This will decrease the demand for stock thereby leading the price of stock to decrease. Hence, the q value of firms falls. Firms will reduce their investments which will cause output to fall.

Under wealth effect, monetary transmission goes through wealth effect on consumption. Based on life-cycle hypothesis model, consumption spending is determined by life time resources. If the value of wealth increases permanently, this would also increase the consumption of individuals. The following schematic is presenting the mechanism.

$$M \downarrow \Rightarrow P_e \downarrow \Rightarrow W \downarrow \Rightarrow C \downarrow \Rightarrow Y \downarrow$$

Monetary contraction affects the value of stock price to decline. Since most of the financial asset is common stock, the decrease of stock price leads to decrease of wealth. Therefore, the individual will decrease their consumption. As a result, because of the decrease in aggregate demand output will fall.

2.1.4 Exchange rate channel

With an open economy, the country has to involve with international transaction. To accommodate international trade, exchange rate has to be preset. Under flexible exchange rate system, the impact of change in interest rate can be absorbed by the exchange rate (Mishkin, 1995). Therefore, monetary transmission can also pass-through the exchange rate which affects economic variables such as inflation and output. The schematic of the exchange rate channel is presented below.

$$M \downarrow \Rightarrow i \uparrow, I \downarrow \Rightarrow Y \downarrow$$

From the schematic above, when monetary policy contraction is implemented, the real interest rate increases, which makes the domestic real interest rate to be relatively higher than the foreign real interest rate. Consequently, the fund from foreign investors will flows into the country and the exchange rate will appreciate causing the price of exported products to be relatively higher than other foreign competitors. Therefore, as a result of decrease in aggregate demand output will decline.

There have been many studies on the monetary transmission through the bank lending channel. Most of the studies support the presence of the bank lending channel. Nevertheless, the effectiveness of this channel is still conclusive.

Among the early empirical studies on the bank lending channel is Bernanke and Blinder (1992). They investigate the sensitivity of supply of reserve of banks in the US on the federal fund rate shock as a monetary policy by employing VAR model from 1959-1978. The finding shows that monetary policy contraction works in part by affecting the composition of bank asset. During tight monetary policy, banks will sell its security to smooth their loan supply. Nevertheless, over time banks will cut for new loan and terminate the old loan in response to such monetary policy.

Cetorelli and Goldberg (2008) examined monetary policy through the bank lending channel of two different categories of banks, namely domestically-oriented banks which do not have international operation, and global-oriented banks. Their study showed that monetary policy

only passes-through domestically-oriented banks while global-oriented banks rely on internal capital market in smoothing their liquidity. Therefore, they concluded that the bank lending channel in the US would be diminishing in strength if banking becomes more globalized.

Agung (1998) used bank level data of Indonesia spanning from 1983-1995 to investigate the responses of different bank classes to monetary policy change by employing VAR model. The study concluded that monetary contraction does not influence the lending of state banks, but does so to the lending of small banks. Besides, credit for investment and working capital from small banks decline more than state banks during tight monetary policy. However, consumer loan falls for all bank types.

Yusof (2006) examined the monetary policy channels in affecting aggregate and sectoral output in Asian countries namely Malaysia, Indonesia, the Philippines, Singapore and Thailand. The study employed cointegration and VECM approach. The most effective variable in effecting output is M1 for Malaysia and the Philippines, M2 for Indonesia and Thailand, and bank lending for Singapore. Nevertheless, only the impact of monetary policy on sectoral output of Malaysia is significant. The results indicated that agriculture and manufacturing, services and construction sectors are affected most by M1, M2 and credit lending respectively.

Said and Ismail (2005), investigated the bank lending channel in Malaysia and also attempted to examine the size and capital strength of banks for the effectiveness of the channel. They used bank level data and applied fixed effect cross-sectional model with GLS estimation. The results supported the presence of the bank lending channel, but they seemed to suggest that size and capital strength are irrelevant on the performance of the channel. Ghazali (2005) conducted a similar study but with different method. The study used aggregate data of loan during 1982 till 1999 and employed Granger causality approach. The findings showed that there is strong causation running from bank liabilities to bank asset while the result also indicated significant causation running from the credit variables to the performance of the economy.

Sayuti (2009) employed the structural VAR model under small open economy framework. The study documented the presence of the bank lending channel in Malaysia. In the same vein, Goh and Yong (2007)

used bank level data and employed Autoregressive distributed lag (ARDL) model in finding the evidence for the existence of bank lending transmission in Malaysia before and after the structural shift in interest rate. The results are different in these two periods. Before the shift, tight monetary policy influenced loan supply which in turn supported the bank lending view. However, it had a limited strength after the shift, which indicated to the less effectiveness of the channel.

A similar study by Kassim (2006) applied multivariate causality analysis based on VECM and Toda-Yamamoto method, and Variance decomposition. The overall results showed the presence of bank lending channel in Malaysia. Besides, the study also showed that smaller banking institutions are more sensitive to monetary change than larger banking institutions.

In addition, Karim et al. (2006) analyzed the impacts of monetary policy on commercial banks in Malaysia lending to various economic sectors by using VAR model. The results showed that the tight monetary policy gives a negative impact on bank lending to economic sectors. Meanwhile, bank lending to economic sectors also responds differently to monetary policy shocks. A similar study by Ibrahim (2005) also confirmed potential disparities in the effect of monetary policy on real sectoral activities in Malaysia.

Said and Ismail (2007) analyzed the role of Islamic banks in the transmission of monetary policy in Malaysia. He employed fixed effect model with GLS estimation and used 15 commercial Islamic bank balance sheets. The study showed the presence of financing channel in Malaysia. On the other hand, Sayuti (2009) employed the structural VAR model in investigation of monetary policy transmission through the Islamic financing channel in Malaysia. The study confirmed the results of earlier studies.

Sukmana and Kassim (2010) analyzed the effects of Islamic financing and deposits in monetary transmission on real economy. They found that Islamic financing and deposits can be the conduits in linking the monetary policy indicator to economic activities. In addition, Ibrahim and Sukmana (2011) evaluated the dynamic interactions between Islamic financing and macroeconomic and financial variables using Toda-Yamamoto causality test and innovation accounting approach. The

results suggested strong causal influences of interest rate, but not of real stock price and real production, on Islamic financing.

Kassim, Majid and Yusof (2009) investigated the impact of monetary policy shocks on conventional and Islamic banks in Malaysia. The study employed VAR model with monthly aggregate data. The finding showed that the impact of monetary policy change is more sensitive for Islamic banks than the conventional banks.

To summarize, the existing studies seem to agree that the Islamic financing channel is active in Malaysia. However, there are other issues which are yet to be investigated such as distributional effects of monetary policy on Islamic financing to various economic sectors and the effectiveness of the channel in respect to size, capital strength and liquidity of Islamic banks. To fill up the space left, the present study takes the challenge of exploring the issue of distributional effects of monetary policy on Islamic financing as well as economic sectors. The study would also reinvestigate to prove the presence of Islamic financing channel in Malaysia.

3. Empirical Framework

3.1 Data

This research attempts to examine whether Islamic financing can be the channel for monetary transmission or not and also to analyze the distributional effects of monetary policy in the context of Malaysia. The study utilizes quarterly data from 1999.Q1 to 2010.Q4. The study uses five main variables, namely interest rate, total Islamic financing and eight sectoral Islamic financing, economic growth (proxied by real Gross Domestic Product (GDP) and eight sectoral GDP, inflation rate and real effective exchange rate. Table 1 describes the data and their sources.

3.2 Methodology

To accomplish the objectives of the study, various techniques and methods were employed. The study cautiously chooses the methods and approaches which the most suitable to the purposes and objectives of the study as well as to the data.

To simplify the analysis, the analysis is divided into three systems namely aggregate system, financing system and output system. This is purposely made in order to answer each of the objectives of the study. The aggregate system refers to a five-variable system consisting of interest rate, real exchange rate, Islamic financing, inflation rate and GDP. This system is designed to examine the existence of the transmission of monetary policy through Islamic financing channel. Meanwhile, the financing and output system are designed to analyze the distributional effects of monetary policy on Islamic financing and economic sectors. Each system consists of eight-sub system. The financing system refers to a six-variable consisting of interest rate, real exchange rate, total Islamic financing less financing to the sector under consideration (i.e. total financing less financing given to agriculture sector (*sfga*)), financing to the sector under consideration (i.e. financing providing to agriculture sector (*fga*)), inflation rate and GDP.

Similarly, the output system refers to a six-variable system consisting of interest rate, real exchange rate, total Islamic financing, inflation rate, GDP less the sector under consideration and the output for the sector under consideration. The inclusion of aggregate financing and output (by less the amount of interested sector) into disaggregate systems is meant to increase the likelihood shocks in the monetary policy similarly across sectors (Ibrahim, 2005).

As a requirement for the time series analysis, it is necessary to examine the property of time series, i.e., the stationary properties. This is very critical to avoiding the spurious regression. In this study, we employ augmented Dickey-Fuller (ADF) unit root test which was developed by Dickey and Fuller (1979). The test may be estimated in three different forms to allow various possibilities. The regressions are as follow:

Table 3.1: Data Description

Variable	Description	Abbr.	Source
Monetary Policy	interbank overnight money rate	<i>Int</i>	IMF
Financing	total Islamic financing	<i>Fnc</i>	BNM
	Islamic financing for primary agriculture sector	<i>Fag</i>	BNM
	Islamic financing for mining and quarrying sector	<i>Fmi</i>	BNM
	Islamic financing for manufacturing sector	<i>Fma</i>	BNM
	Islamic financing for electricity, gas and water sector	<i>Fel</i>	BNM
	Islamic financing for wholesale and retail trade, hotels and restaurants sector	<i>Fwh</i>	BNM
	Islamic financing for construction sector	<i>Fco</i>	BNM
	Islamic financing for transport, storage and communication sector	<i>Ftr</i>	BNM
	Islamic financing to finance, insurance and business services sector	<i>Ffi</i>	BNM
Output	aggregate gross domestic product	<i>Gdp</i>	BNM
	output in agriculture, forestry and fishing sector	<i>Gag</i>	BNM
	output in mining and quarrying sector	<i>Gmi</i>	BNM
	output in manufacturing sector	<i>Gma</i>	BNM
	output in electricity, gas and water sector	<i>Gel</i>	BNM
	output in wholesale and retail trade, accommodation and restaurants sector	<i>Gwh</i>	BNM
	output in construction sector	<i>Gco</i>	BNM
	output in transport, storage and communication sector	<i>Gtr</i>	BNM
	output in finance, insurance, real estate, and business services sector	<i>Gfi</i>	BNM
Inflation Rate	consumer price Index, 2005 base year	<i>Inf</i>	IMF
Exchange Rate	real effective exchange rate	<i>Rex</i>	IMF

Note: The BNM data are from the *Monthly Statistical Bulletin* (various issues) while the IMF data are from *International Financial Statistics* CD-ROM. BNM = Bank Negara Malaysia; IMF = International Monetary Fund; Abbr = Abbreviation.

(1) The regression with intercept

$$\Delta Y_t = \beta_1 + \delta Y_{t-1} + \sum_{i=1}^m \alpha_i \Delta Y_{t-i} + \varepsilon_t \quad (3.1)$$

(2) The regression with intercept and trend

$$\Delta Y_t = \beta_1 + \beta_2 T + \delta Y_{t-1} + \sum_{i=1}^m \alpha_i \Delta Y_{t-i} + \varepsilon_t \quad (3.2)$$

(3) The regression without intercept

$$\Delta Y_t = \delta Y_{t-1} + \sum_{i=1}^m \alpha_i \Delta Y_{t-i} + \varepsilon_t \quad (3.3)$$

where T is trend, Δ is difference operator and ε is pure white noise error term.

This requires us to test the significance of δ whether the time series is stationary or otherwise. In each form, the hypotheses are as below.

Null hypothesis: $H_0 : \delta = 0$ (i.e. the time series is non-stationary)

Alternative hypothesis: $H_0 : \delta < 0$ (i.e. the time series is stationary)

The next step of analysis is to conduct cointegration test. The test examines the existence of long-run equilibrium relationship among variables. In this regards, the autoregressive distribution lag (ARDL) framework for cointegration which is introduced by Pesaran et al. (2001) is adopted. There are numerous advantages of the ARDL approach. Firstly, it employs only one single reduced form equation. Secondly, it does not require pre-testing variables. This means that the cointegration test is applicable to underlying regressors regardless of its integration whether purely $I(0)$ or purely $I(1)$ or mixture of both. Thirdly, the ARDL is also applicable for small number of observations. Fourthly, it avoids the larger number of specification made in the conventional cointegration (Duasa, 2007). Lastly, it takes sufficient of lags to capture the data generating process whereby it estimates $(p + 1)^k$ number of regressions to obtain optimal lag-length for each variable, where p is the maximum lag and k is the number of variables in the equation (Karim and Majid, 2010). Having a small number of observations of 48 as well as considering the advantages of ARDL, it justified that the study employ the ARDL approach for cointegration test.

The ARDL involves estimating the conditional error correction version of the ARDL model relating to dependent variables and its determinants. The process of cointegration test is applied to all three systems in our analysis. To conserve space, only the ARDL model for aggregate system is shown below:

$$\begin{aligned}\Delta fnc = & \alpha_0 + \sum_{i=1}^p \lambda_{1i} \Delta fnc_{t-i} + \sum_{i=1}^p \lambda_{2i} \Delta int_{t-i} + \sum_{i=1}^p \lambda_{3i} \Delta rex_{t-i} + \\ & \sum_{i=1}^p \lambda_{4i} \Delta inf_{t-i} + \sum_{i=1}^p \lambda_{5i} \Delta gdp_{t-i} + \emptyset_1 fnc_{t-1} + \emptyset_2 int_{t-1} + \emptyset_3 rex_{t-1} \\ & + \emptyset_4 inf_{t-1} + \emptyset_5 gdp_{t-1} + \varepsilon_t\end{aligned}\quad (3.4)$$

where Δ is the difference operator, fnc is total Islamic financing, int is overnight interest rate, rex is real exchange rate, inf is inflation rate, gdp is aggregate output, ε_t is white noise error term and p is the optimal lag length.

In order to test cointegration, the null hypothesis $H_0: \emptyset_1 = \emptyset_2 = \emptyset_3 = \emptyset_4 = \emptyset_5 = 0$ (i.e. there is no cointegration among variables) is tested against the alternative hypothesis $H_1: \emptyset_1 \neq \emptyset_2 \neq \emptyset_3 \neq \emptyset_4 \neq \emptyset_5 \neq 0$ (i.e. there is cointegration among variable or there exists the long-run relationship among variables.). The F-test has a non-standard distribution. Therefore, the critical value bounds are generated. The critical value bound consists of the critical values for $I(0)$ and $I(1)$ series which are referred as lower bond and upper bound respectively. If the calculated F-statistics exceed their respective upper critical values, we conclude that there is evidence of long-run relationship and that the null hypothesis cannot be accepted, and vice versa. Narayan (2005)'s critical value bounds is used as the study has a small sample size.

Following the cointegration test, the study extent its aggregate system analysis to long-run and short-run dynamic. Accordingly, the following long-run model is estimated.

$$\begin{aligned}fnc_t = & \alpha_1 + \sum_{i=1}^p \beta_{1i} fnc_{t-i} + \sum_{i=1}^p \gamma_{1i} int_{t-i} + \sum_{i=1}^p \delta_{1i} rex_{t-i} \\ & + \sum_{i=1}^p \theta_{1i} inf_{t-i} + \sum_{i=1}^p \sigma_{1i} gdp_{t-i} + \mu_t\end{aligned}\quad (3.5)$$

In addition, the short-run dynamics based on ARDL specification is derived by constructing an error correction model as below:

$$\begin{aligned}\Delta fnc_t = & \alpha_2 + \sum_{i=1}^p \beta_{2i} \Delta fnc_{t-i} + \sum_{i=1}^p \gamma_{2i} \Delta int_{t-i} + \sum_{i=1}^p \delta_{2i} \Delta rex_{t-i} \\ & + \sum_{i=1}^p \theta_{2i} \Delta cpi_{t-i} + \sum_{i=1}^p \sigma_{2i} \Delta gdp_{t-i} + \psi_t ECM_{t-1} + \zeta_t\end{aligned}\quad (3.6)$$

where ECM_{t-1} is the error correction term.

To further investigate the presence of the Islamic financing channel, the study explores further by conducting multivariate causality tests. This

test enables to see the direction of causality between variables, i.e. causality relationship between monetary policy and Islamic financing. To this end, the vector error-correction model (VECM) for aggregate system is formed as below;

$$\begin{bmatrix} \Delta fnc_t \\ \Delta int_t \\ \Delta rex_t \\ \Delta inf_t \\ \Delta gdp_t \end{bmatrix} = \begin{bmatrix} k_1 \\ k_2 \\ k_3 \\ k_4 \\ k_5 \end{bmatrix} + \sum_{i=1}^p \begin{bmatrix} n_{11i} & n_{12i} & n_{13i} & n_{14i} & n_{15i} \\ n_{21i} & n_{22i} & n_{23i} & n_{24i} & n_{25i} \\ n_{31i} & n_{32i} & n_{33i} & n_{34i} & n_{35i} \\ n_{41i} & n_{42i} & n_{43i} & n_{44i} & n_{45i} \\ n_{51i} & n_{52i} & n_{53i} & n_{54i} & n_{55i} \end{bmatrix} \begin{bmatrix} \Delta fnc_{t-1} \\ \Delta int_{t-1} \\ \Delta rex_{t-1} \\ \Delta inf_{t-1} \\ \Delta gdp_{t-1} \end{bmatrix} + \begin{bmatrix} \lambda_1 \\ \lambda_2 \\ \lambda_3 \\ \lambda_4 \\ \lambda_5 \end{bmatrix} [ECM_{t-1}] + \begin{bmatrix} \varpi_{1t} \\ \varpi_{2t} \\ \varpi_{3t} \\ \varpi_{4t} \\ \varpi_{5t} \end{bmatrix} \quad (3.7)$$

where k is constant term, n is coefficient of lagged independent variables, λ is error-correction coefficient, and ϖ is error term.

4. Empirical Results

The results will be reported step by step as the study progresses. It starts with unit root test's results and it is followed by cointegration's results. For extension of aggregate system analysis, a long-run model and short-run dynamic derived from the ARDL model as well as multivariate causality analysis are included.

4.1 Unit Root Tests

Table 4.1 summarizes the results of the ADF unit root test for the data series. The results may be classified into five cases. Firstly, almost all the data series are not significant at level, but they are significant at first difference. Secondly, some data series are significant with intercept, at level and also significant at least at 5% level at first difference. They are *fma*, *fel*, *gmi*, *sfag*, *sfma*, *sfco*, and *sftr*. Thirdly, there are four data series namely *fco*, *gag*, *gfi* and *sgmi* under this case. The variables are only significant with trend and intercept at log level with 1% significance level except for *fco* at 5% significance level.

Fourthly, for *fag*, *fmi* and *sffi*, their null hypotheses are rejected at log level with intercept, and trend and intercept at 1% significance level. For *sfwh*, it is also under this group but slightly different in term of significance level. The series is significant at 5% level with intercept and at 10% level with intercept and trend. At first difference, the series are also significant at least at 10% level. Lastly, two data series are found to be non-stationary both in level and in first difference, i.e., *gco* and *gwh*. Therefore, the study decided to drop these variables in the analysis because they do not suggest any stationarity at first difference despite of being dependent variable in the ARDL model.

4.2 Cointegration Tests

To examine the existence of long-run relationship among variables, the study adopts bound testing approach and Autoregressive distributed lag (ARDL) model for cointegration test. This framework was originally proposed by Pesaran et al. (2001). The advantages of ARDL model are that it is applicable for underlying regressors which are purely $I(0)$, or $I(1)$, or mixture of both. It is also able to deal with even small sample number (Duasa, 2007). In the present case, it was that the variables are mixture of $I(0)$ and $I(1)$ with observation number of only 48. Therefore, it is justified to apply the ARDL model for cointegration test in the study.

To be consistent with our objectives, we report the results into three tables namely Tables 4.2, 4.3 and 4.4., each representing the aggregate, financing, and output system respectively. The aggregate system refers to a five-variable system consisting of total Islamic financing, overnight interest rate, real exchange rate, inflation rate and GDP.

The financing system is a six-variable system consisting of Islamic financing to sector under consideration, overnight interest rate, real exchange rate, inflation rate, economic growth and total Islamic financing less the financing of sector under consideration. Due to the deletion of *fag* and *fmi* in previous section, the total financing sub-systems are left to be only six, namely *fmas*, *fels*, *fwhs*, *fcos*, *ftrs* and *ffis*.

Table 4.1: Unit Root Tests Summary Statistics

Variable	Augmented Dickey-Fuller					
	Level			1 st difference		
	Intercept	Trend & Intercept	None	Intercept	Trend & Intercept	None
<i>Int</i>	-2.321	-2.254	0.038	-10.109***	-9.626***	-10.382***
<i>Fnc</i>	-2.501	-2.228	2.696	-3.863***	-4.303***	-2.476**
<i>Fag</i>	-4.863***	-4.466***	1.703	-7.966***	-8.505***	-7.517***
<i>Fmi</i>	-5.212***	-6.231***	0.627	18.402***	18.357***	18.230***
<i>Fma</i>	-5.144***	-2.985	2.992	-4.542***	-5.687***	-3.336***
<i>Fel</i>	-2.619*	-2.595	0.876	-6.866***	-5.575***	-6.776***
<i>Fwh</i>	-1.240	-1.551	2.890	-7.599***	-7.574***	-3.521***
<i>Fco</i>	-2.663	-3.738**	3.309	-6.578***	-6.543***	-5.593***
<i>Ftr</i>	0.083	-1.586	2.232	-6.299***	-6.450***	-5.928***
<i>Ffi</i>	-1.033	-2.855	3.107	-7.687***	-7.622***	-6.361***
<i>Gdp</i>	-0.793	-2.079	2.787	-4.363***	-4.319***	-3.065***
<i>Gag</i>	-0.273	-3.961**	1.424	-6.789***	-6.804***	-8.625***
<i>Gmi</i>	-2.699*	-2.550	1.840	-4.986***	-5.115***	-4.778***
<i>Gma</i>	-0.740	-2.222	1.438	-7.614***	-7.555***	-3.816***
<i>Gel</i>	-1.155	-2.568	4.037	-10.374***	-10.331***	-2.103**
<i>Gwh</i>	-0.161	-2.358	2.154	-2.538	-2.516	-1.310
<i>Gco</i>	0.409	-0.826	1.471	-1.827	-2.401	-1.212
<i>Gtr</i>	-1.345	-2.564	2.491	-3.579**	-3.533**	-2.330**
<i>Gfi</i>	-1.588	-4.895***	3.182	-9.695***	-9.719***	-8.325***
<i>Inf</i>	0.468	-2.489	4.657	-5.415***	-5.416***	-4.069***
<i>Rex</i>	-2.226	-1.536	0.350	-5.069***	-5.000***	-5.110***
<i>Sfag</i>	-4.513***	-2.892	2.681	-3.717***	-4.268***	-2.223**
<i>Sfmi</i>	-2.538	-2.239	2.657	-3.824***	-4.284***	-2.473**
<i>Sfma</i>	-3.921***	-2.022	2.763	-10.215***	-11.321***	-2.600**
<i>Sfel</i>	-2.593	-2.171	2.561	-3.642***	-4.157**	-2.332**
<i>Sfwh</i>	-4.375***	-3.406*	6.122	-11.205***	-12.635***	-1.621*
<i>Sfco</i>	-2.673*	-2.361	2.609	-3.762***	-4.308***	-2.418**
<i>Sftr</i>	-2.628*	-2.423	2.700	-3.904***	-4.284***	-1.594
<i>Sffi</i>	-5.075***	-5.476***	2.618	-3.772***	-4.248***	-1.553
<i>Sgag</i>	-0.932	-1.991	2.617	-4.151***	-4.126**	-2.976***
<i>Sgmi</i>	-0.506	-4.524***	3.042	-4.226***	-4.154**	-2.635***
<i>Sgma</i>	-0.709	-2.555	2.746	-4.034***	-3.986**	-2.701***
<i>Sgel</i>	-0.789	-2.084	2.756	-4.349***	-4.304***	-3.079***
<i>Sgwh</i>	-1.230	-2.766	2.823	-6.756***	-6.732***	-3.328***
<i>Sgco</i>	-0.850	-2.012	2.722	-4.301***	-4.265***	-3.052***
<i>Sgtr</i>	-0.760	-2.064	2.766	-4.413***	-4.366***	-3.146***
<i>Sgfi</i>	-0.688	-1.824	2.859	-4.775***	-4.705***	-3.482***

Note: *, **, *** denote significance at 10%, 5% and 1% level respectively. Critical values are based on MacKinnon (1996). Lag lengths are based on Schwarz Info Criterion (SIC) with maximum lag of 10.

Like financing system, output system is a six-variable system consisting of output sector under consideration, overnight interest rate, real exchange rate, inflation rate, and GDP less the output of sector under consideration. There are only six sub-systems for output namely, *gags*, *gmis*, *gmas*, *gels*, *gtrs* and *gfis* since *gco* and *gwh* are dropped out from the analysis in previous section.

In each table the computed F-statistics for each lag length are presented. The last column of each table also includes the critical values bounds for unrestricted intercept and no trend, which were obtained from Narayan (2005), for sample size between 30 and 80. If the F-statistics exceed their respective upper critical values at any lag-length, it implies that there exists the long-run relationship among variables and vice versa.

Table 4.2 shows calculated F-statistics from lag length 1-6 for the aggregate system. At lag length, 1-5 are found to be significant at least at 5% level. This implies that the null hypothesis of no cointegration cannot be accepted at 5% level. Therefore, there is a cointegration relationship among the variable in aggregate system, implying that the variables tend to move together in the long-run.

Table 4.2: ARDL Cointegration Test for Aggregate System

Lag	F-statistics	Bound critical values (unrestricted intercept and no trend)
1	9.121***	k= 4 & n=48
2	4.845**	
3	5.209**	
4	4.748**	1% ; 4.306-5.874
5	4.841**	5% ; 3.136-4.416
6	3.653	10% ; 2.614-3.746

Notes: *, **, *** denote significance at 10%, 5% and 1% level respectively. The critical value bounds are obtained from Narayan (2005).

Table 4.3: ARDL Cointegration Test for Financing System

Lag length	F-statistics						Bound critical values (unrestricted intercept and no trend)
	<i>fmas</i>	<i>Fels</i>	<i>fcos</i>	<i>Fwhs</i>	<i>ftrs</i>	<i>ffis</i>	
1	4.082*	3.456	2.035	3.473	1.919	4.267**	K= 5 & n= 48
2	2.375	4.272**	2.501	3.025	1.725	3.950**	
3	4.320**	2.180	1.871	3.526	1.217	3.635*	1% ; 3.955-5.583
4	5.985***	8.087***	1.164	4.769**	3.070	3.652*	5% ; 2.900-4.218
5	2.529	2.326	1.923	1.263	8.769***	6.580***	10% ; 2.435-3.600

Notes: *, **, *** denote significance at 10%, 5% and 1% level respectively.
The critical value bounds are obtained from Narayan (2005).

Table 4.3 presents the ARDL cointegration's results for financing system. The calculated F-statistics of all financing sub-system, except *fcos*, are found to be higher than their upper bound critical value at least at 10% level of significance with at least one lag length, if not all. The null hypothesis of no cointegration can be rejected at 10% level. This implies that *fmas*, *fels*, *fwhs*, *ftrs* and *ffis*, have long-run relationship among the variables in the system. Regarding to *fcos*, it is found that there exists no cointegration. Hence, and since it is not consistent with the other systems it was dropped from the analysis.

Table 4.4: ARDL Cointegration Test for Output System

Lag Length	F-statistic						Bound critical values (unrestricted intercept and no trend)
	<i>gags</i>	<i>gmis</i>	<i>gmas</i>	<i>Gels</i>	<i>gtrs</i>	<i>gfis</i>	
1	1.159	3.606*	2.725	3.624*	2.501	2.321	K= 5 & n= 48
2	0.781	2.443	0.775	1.216	1.959	8.319***	
3	0.501	1.858	1.633	1.734	2.176	2.155	1% ; 3.955-5.583
4	0.753	4.245**	2.104	3.311	7.245***	2.520	5% ; 2.900-4.218
5	0.656	1.419	6.893***	3.146	9.679***	1.708	10% ; 2.435-3.600

Notes: *, **, *** denote significance at 10%, 5% and 1% level respectively.
The critical value bounds are obtained from Narayan (2005).

Table 4.4 shows the result of ARDL cointegration test for output system. Only *gags* is not significant at all levels and at all lag length. The remaining namely *gmis*, *gmas*, *gels*, *gtrs* and *gfis* are found to be significant at least at 10% level with at least one lag length, if not all. Their null hypothesis of no cointegration is rejected at 10% level of significance. This provides evidence that each output sub-system, except *gags*, is cointegrated implying that the long-run relationship among the variables in the system exists. Like *fcos*, the study had to drop *gags* from the analysis since the system is not cointegrated, that is because it will not consistent with the present analysis.

4.3.1 Cointegrating Regression Results (Long- run model)

In order to serve the objective of the study, the aggregate system analysis was extended and the long-run relationship of aggregate system is investigated. If the variables have long-run relationship, then the long-run model can be constructed. In previous section, the study found evidence of cointegration in the aggregate system. This implies that there is a long-run relationship among the variables in the aggregate system. Hence, the long-run model can be established. Table 4.5 presents the long-run model using the ARDL approach. By estimating it, the study follows Majid and Yusof (2007), Majid (2007) and Karim and Majid (2010) in identifying the maximum lag order. The lag order of 1 is chosen as it reveals the highest F-statistics value (see Table 4.2). The ARDL (1,0,0,0,0) is selected based on Schwarz Bayesian Criterion (SBC).

Table 4.5: Long-run Model

Dependent variable	Independent variables			
	int _{t-1}	rex _{t-1}	inf _{t-1}	gdp _{t-1}
Fnc	- 0.041*** (0.009)	0.284** (0.105)	- 0.294 (0.194)	0.254*** (0.086)

Notes: *, **, *** denote significance at 10%, 5% and 1% level respectively. Standard error is in parentheses.

In the long-run model, it seems that overnight interest rate has a negative relationship with Islamic financing. If the interest rate increases by one percent, the Islamic financing will decrease by 0.04 percent. This suggests that interest rate as a proxy of monetary policy can affect

Islamic financing and it proves the existence of the active of bank lending/financing channel for monetary transmission. This result is also consistent with many studies (Said and Ismail, 2007; Sayuti 2009; Sukmana and Kassim, 2010).

The model also indicates positive relationship between the real exchange rate and Islamic financing. One percent increase in real exchange rate will increase Islamic financing by 0.28 percent. The explanation for this could be indirect. When the currency depreciates (i.e. real exchange rate index increases), the domestic good becomes cheaper than foreign goods, thereby causing net export to increase, and hence in aggregate demand (Mishkin, 1996). This, in turn, raises the demand for money thereby increasing Islamic financing. For the GDP, it also shows a positive relationship with Islamic financing. When GDP rises by one percent, Islamic financing will increase by 0.25 percent. When aggregate output increases, it raises the demand for credit thereby causing the financing to increase. This may infer that Islamic financing cannot shun away from the fluctuation in the real economic activities (Ibrahim, 2005).

In conclusion, the findings seem to suggest that overnight interest rate, real exchange rate and GDP are linked to Islamic financing in the long-run. We could see at least in the long-run, the direction of relationship of the variables with Islamic financing where interest rate shown to have positive relationship while real exchange rate and GDP are evidently opposite.

4.3.2 Error Correction Model (ECM)

This section turns to short-run dynamics of Islamic financing. The error correction model (ECM) is established based on the ARDL model by retaining the lag length of 1 as suggested in previous section. The ECM of the ARDL (1,0,0,0,0) based on SBC is reported in the Table 4.6.

Table 4.6: Error Correction Model

Independent variables	Coefficient	Standard Error
Δint	-0.058**	0.024
Δrex	0.236	0.201
Δinf	-1.333**	0.502
Δgdp	0.242**	0.088
Δc	-2.432***	0.753
Ecm_{t-1}	-0.077***	0.024
Diagnostic tests		
R^2	0.919	
Adj- R^2	0.895	
DW	2.175	
χ^2 LM	7.068	
χ^2 RESET	3.702*	
χ^2 Norm	6.022**	
χ^2 Hetro	9.172***	

Notes: *, **, *** denote significance at 10%, 5% and 1% level respectively. LM is Lagrange multiplier test of residual serial correlation. RESET is Ramsey's RESET test of functional form. Norm is Jarque-Bera test of normality. Hetro is White test for heteroscedasticity. DW is Durbin-Watson statistics.

Except real exchange rate, the coefficients of variables are significant at least at 5% level. The sign of coefficient of these variables are same as the long-run model. The Islamic financing still evidently has negative relationship associated with interest rate whereby it positively links with GDP. Here coefficient of inflation rate appears to be significant while it failed in long-run model. The inflation rate seems to have negative relationship with Islamic financing. The findings seem to suggest that monetary policy, i.e. overnight interest rates, together with GDP, are linked to the change of Islamic financing at least in the short-run. The explanation for the first could be that, contraction monetary policy may reduce the availability of Islamic financing by means of raising statutory reserve requirements. On the other hand, during recession when aggregate demand decreases, it results in decrease of demand for financing.

The coefficient of the ECM is negative and highly significant at 1%. This confirms the existence of stable long-run relationship among the

variables. The coefficient of ECM is -0.077 indicating slow rate of convergence to equilibrium. It implies that a deviation from the long-run equilibrium following the short-run shock is corrected by 7 percent after one quarter. Table 4.6 also provides the diagnostic test. The underlying ARDL equation fits very well at adjusted $R^2 = 0.895$ while DW is more than 2. We only find no evidence of serial correlation, but fail for functional form, normality and heteroscedasticity test.

4.4 Multivariate Causality Test

To produce more evidence for aggregate system, multivariate causality analysis is conducted. The VECM approach makes us differentiate between short- and long-run forms of Granger causality. Here, the F-statistics of lagged difference independent variables indicate the short-run causal effects while the t-statistic of the lagged error correction terms shows the long-run causal effects (Yusof, 2003).

Table 4.7 reports multivariate causality analysis. The findings show that at least one way of Granger causality is active for all variables, namely Islamic financing, interest rate, real exchange rate, inflation rate and GDP. At the same time, the error correction for all variables also seems to be negatively significant at least at 5% level of significance. This implies that the variables appear to bear the brunt of short-run adjustment to long-run equilibrium.

Based on Table 4.7, it seems that the causation may run from overnight interest rate to real exchange rate to GDP to inflation rate to Islamic financing then go back to overnight interest rate. We also can see the causation from Islamic financing to GDP and return back to overnight interest rate. At the same time, overnight interest rate may also directly affect GDP thereby causing Islamic financing and then go to the interest rate. In short, it can be seen here that Islamic financing can cause the GDP at least in short-run, implying that the financing channel can be conduit for monetary policy to influence the aggregate demand although the causal effect from interest rate to financing is not significant in this test.

Table 4.7: Multivariate Causality Analysis

Dependent variable	Independent variable					Coefficient
	F-statistic					
	Δfnc	Δint	Δrex	Δinf	Δgdp	Ecm _{t-1}
Δfnc	-	0.003 [0.954]	0.042 [0.836]	8.151*** [0.006]	5.153** [0.028]	-0.077*** (-3.190)
Δint	4.851** [0.013]	-	1.745 [0.194]	1.484 [0.230]	3.815* [0.058]	-0.207** (-2.551)
Δrex	0.919 [0.407]	5.071** [0.030]	-	1.344 [0.253]	5.220** [0.027]	-0.180** (-2.166)
Δinf	2.318 [0.111]	0.077 [0.782]	2.106 [0.154]	-	3.824* [0.057]	-0.134** (-2.481)
Δgdp	3.806** [0.030]	7.052** [0.011]	3.077* [0.087]	7.979*** [0.007]	-	-0.515*** (-3.869)

Notes: *, **, *** denote significance at 10%, 5% and 1% level respectively.

Figure in the parentheses is t-statistics.

Figure in the bracket is probabilities for the F-statistics.

5. Conclusion

The findings suggest clearly that there is monetary transmission through Islamic financing although it shows only in short period. Islamic financing seems to be able to influence the output, which reconfirms the existence of its channel. Regarding to disaggregate analyses, it suggests that Islamic financing is disproportionate in its distribution. It is found that Islamic financing is unequally distributed to economic sectors in response to monetary policy shock. The most affected sectors for Islamic financing is electricity, gas and water while finance, insurance and business services sector is the least affected. The findings also found that monetary policy shock and financing shock unevenly affect economic sectors. It seems to show that the mining and quarrying sector is the most sensitive to these two shocks in comparison to the remaining sectors.

The results from the study seem to suggest that Islamic financing channel for monetary transmission exists in case of Malaysia. The cointegration results first indicate that there is long-run relationship among the variables; monetary policy, Islamic financing, GDP, exchange rate and inflation. Based on the ARDL model, it was proved that the interest rate has a significant negative relationship to Islamic financing in the long-run model. In addition, based on the multivariate

causality analysis, the study showed that there is a bi-directional causality between Islamic financing and GDP. In short run, an increase in Islamic financing can significantly cause GDP to increase and vice versa. In the meantime, the long-run model derived from the ARDL model also shows the similar results. To an increase in GDP, Islamic financing also increases in long-run. These evidences seem to imply that while Islamic financing influencing the economic activities, meanwhile it is also affected by the fluctuation of the economy. All in all, it could be inferred that monetary transmission through Islamic financing exists in Malaysia. Monetary mechanism runs from tight monetary policy affecting the quantity of Islamic financing to decrease, thereby causing economic activities to decline. Furthermore, the findings also reflect that Islamic banking as operating in dual banking system is not spared from the interest rate and monetary conditions of the country (Ibrahim and Sukmana, 2011). When interest rate increases, it affects Islamic financing to decrease. This clearly shows the behavior of Islamic banking which cannot shun away from the interest rate while its operation delinks from the interest rates.

From the study it could be suggested that in designing monetary policy, the central bank may consider Islamic financing as an alternative or complement channel for monetary transmission since this channel is just as active as conventional lending channel. This means that the BNM can use monetary policy by influencing Islamic financing to overcome the recession and inflation in the economy (Said and Ismail, 2007). In addition, the study may suggest Islamic banking to follow the pricing strategy in competing with the conventional banking since the evidences show that Islamic banking shares the similar risk, i.e. interest rate exposure and monetary condition, with conventional one (Ibrahim and Sukmana, 2011).

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