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FINANCIAL MARKETS INTEGRATION OF IRAN WITHIN THE MIDDLE EAST AND WITH THE REST OF THE WORLD

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Abstract

It is widely argued that Iran’s financial markets are effectively isolated from the rest of the world. To see whether this argument is true and to better understand Iran’s financial development, financial interdependencies of Iran within the Middle East and with the rest of the world are estimated. Monthly financial data from equity, money and foreign exchange markets is applied over 12 years; and integration of each of these markets is analysed in turn. To begin with, testing for stationarity using tests for a unit root in presence of breaks is undertaken. The series are found to contain different orders of integration, a situation that leads to the use an ARDL to test for cointegration. It is found that Iran is not fully integrated nor completely segregated from the rest of the world, thus the question as to whether Iran should be considered as a good choice for international portfolio diversification is controversial.

Keywords: Econometric Modelling-Financial Econometrics, International Financial Markets, Financial Integration, Iran

Jell Classification: C58, G15, F36, N25

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1 Introduction

Financial integration is a process through which one country’s financial markets, including its money, equities, foreign exchange and bank assets become more closely linked with financial markets in other countries. There are a number of ways through which financial integration occurs. According to Elyasiani and Zhao (2008), one way is through trade in capital goods that leads to equal marginal product of capital among trading countries, in which the relationship between stock price indices and marginal product of capital causes interdependencies among the countries’ markets. They believe another way is through policy coordination that creates integration among world financial markets, albeit indirectly. Finally, from their perspective, there are speculative activities in currency markets, portfolio rebalancing and contagion across markets that transfer shocks among financial markets to enhance the integration. In addition, Agenor (2001) believes key factors underlying the process of financial integration are associated with globalization coupled with investors seeking higher rates of return and the prospect of global risk sharing, and ultimately portfolio diversification. Moreover, Bekaert and Harvey (2002) consider two stages for evolution of a country from being segmented to integrated. They believe that economic integration is achievable by removing barriers to trade of goods and services, while financial integration needs unrestricted access by foreigners to domestic capital markets. Another argument, proposed by Phylaktis and Ravazzolo (2002), is that the abolition of foreign exchange controls on financial markets, developments in communication technologies and trading systems, and innovative financial products such as country funds and American Depository Receipts (ADR), all contribute to provide more opportunities for global financial investments, as reflected in increasing financial market integration. Furthermore, Yang et al. (2003) and Bekaert et al. (2005) specify that financial integration among countries is enhanced during periods of economic crisis. Finally, Yu and Hassan (2008) believe that large market capitalisation is an important key to boost financial integration.

The process of global financial integration started in the mid-1980s and has accelerated over the past decade as is evident from the rising stocks of international assets and liabilities held by countries around the world (Prasad, 2011). Increasing global financial liberalization has been coupled with greater global attention to financial market integration since policy makers and portfolio managers found emerging markets present diversification potentials not provided by more mature markets (Neaime 2005). Financial integration may help to financially deepen an economy, which allows entrepreneurs, firms and investors to access
capital markets more easily in that country. Moreover, it could lead to technology spillovers and bring about benefits via risk sharing. Risk sharing through portfolio diversification lowers exposure to overseas domestic risks. However, financial integration makes economies vulnerable to global financial shocks. In other words, through time, global financial integration has deepened with the consequence that financial market movements in one country can considerably affect financial market movements in another country. Financial integration implies free capital movements across countries, as well as substitution of domestic assets for foreign assets.

Shin and Sohn (2006) argue that financial integration is often reflected in increasing price co-movements because deeper financial integration implies a weaker arbitrage opportunity of trading financial assets that leads to quicker convergence of asset prices. They point to previous studies that assess the degree of financial integration between economies by estimating the ‘border effects’. Basically a border between two countries influences financial asset price interaction. Strong border effects imply inefficient resource allocation among countries, meaning border effects will decrease with deeper financial integration.

Co-movements between financial asset prices (in form of a cointegrating relationship) are considered as evidence of financial integration in research commonly used in the literature. This means a greater co-movement in financial asset prices among countries concomitantly reflects greater financial market integration.3

According to Iran’s segregated nature, it is widely argued that Iran’s financial markets are effectively insulated from the rest of the world.4 However, in the last three years privatisation and capitalisation has increased in the Iranian financial market, as well as Foreign Direct Investment (FDI) and equity prices - albeit there is a suspicion of it reaching the bubble level (International Monetary fund (IMF) 2011b). In addition, the major focus of the government over its fourth and fifth development plans (2005-2015) has been to expand foreign trade, actively participate in international markets and increase global integration. Moreover, Iran has experienced significant spillovers in recent years from neighbouring financial markets, especially from Saudi Arabia (IMF, 2010). Also an examination of the financial markets shows that they have suffered from financial uncertainty because of concerns about the

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3 For example see Marashdeh (2005) and Bakri et al., (2009).
4 For example see Elyasiani and Zhao (2008).
presidential election and international negotiations on the nuclear program (IMF 2011a). In addition, different sanctions (e.g., U.S. and United Nations Security Council sanctions) have affected Iranian financial transactions and international trade. This has increased the cost of business and restricted FDI and technology transfer. Importantly, one characteristic of Iran as a developing economy is its vulnerability to effects of shocks in general, meaning that consequential impairment can be extensive and may linger on (Elyasiani and Zhao 2008). Due to vulnerability of the Iranian economy in the environment of increasing financial liberalisation, this research aims to analyse the extent of the integration of Iranian financial markets within the Middle East and with the rest of the world. This research will allow for a better understanding of Iran’s financial development and will provide information for policy makers and portfolio managers in order to set appropriate monetary policy in this environment of increasing financial liberalization.

The order of the discussion in this paper is as follows: after a critical assessment of previous literature, the data, choice of markets and countries are identified; this will be followed by introduction of the models and methods to be adopted, followed by the empirical results. A summary and conclusion are provided at the end the paper.

2 Literature Review

Financial integration and price linkages among financial markets have been widely analysed. These analyses have predominantly focused on equity markets. A partial list of such work includes Fadhloumi et al. (2009), Bessler and Yang (2003), and Yuhn (1997) who have all analysed a selection of developed countries, Yu and Hassan (2008) and Neaime (2005) analysed some selected Middle Eastern, North African and developed countries around the world, while Soofi (2008), Yang et al. (2003). Elyasiani and Zhao (2008) chose some selected developed countries and just Iran from the Middle East without considering all other important countries in the Middle East for their integration analysis. The aforementioned studies mostly have applied similar methods for their analysis clarified as the following.

One of the common approaches adopted in the literature for testing financial integration is to utilise the cointegration framework. Basically, the cointegration framework is used to analyse interdependencies among variables that are not stationary. The procedure starts with testing the stationarity of variables before proceeding to the cointegration test. The stationarity of variables is tested commonly by traditional unit root methods viz., augmented Dickey-Fuller (ADF) (1997) and Phillips and Perron (PP) (1988). But according to Perron (1989), it is
crucial to consider the breaks over the selected period of time, hence the need to apply unit root tests in presence of structural breaks, for example as per Lee and Starzicich (LS) (2004, 2003) and Narayan and Popp (NP) (2010). This issue is clarified further in this paper.

The second step, using cointegration analysis is mostly conducted through the Johansen cointegration approach, based on the non-stationarity nature of price series (some examples are Francisco and Edgar (2010), Chin, and Azali, (2010) and Migiakis and Christopoulos (2009). The exceptions are Marashdeh (2005), Bakri et al., (2009), Bessler and Yang (2003) and Elyasiani and Zhao (2008), all of whom have applied other methods among the previously mentioned selective literature. Marashdeh (2005) and Bakri et al., (2009) applied the Auto Regressive Distributed Lagged (ARDL) cointegration approach to analyse interdependencies among variables. The ARDL method was originally developed by Pesaran et al., (2001) and it differs from Johansen in the sense that it operates one equation at a time and is applicable under general circumstances, for example, using different orders of integration. In other words, according to Pesaran et al., (2001), one of the important advantages of applying ARDL is in not requiring pre-testing of variables for unit roots before proceeding to cointegration analysis when the reliability of non-stationarity of variables is questionable.

On the other hand, Bessler and Yang (2003) used VECM and Direct Acyclic Graph (DAG) to examine interdependencies and causality among markets. They combined cointegration, error correction modelling, innovation accounting, and directed acyclic graphs. They believe individual coefficients of VECM make difficulties for short-run, dynamic exploration, as these coefficients are difficult to interpret. Claiming that the VECM was not suitable when exploring contemporaneous relationships among the variables, they applied DAG in order to cover the aforementioned weaknesses of VECM.

Adding to these approaches, Elyasiani and Zhao (2008) used returns for their analysis and therefore they avoid the issue of stationarity and the use of cointegration. They applied vector auto regression (VAR), generalized impulse response function (GIRF) and generalized variance decomposition.

Previous studies have mostly used daily financial data, with the exception of some studies among the named literature. These exceptions have applied monthly data, for example, Elyasiani and Zhao (2008), Shin and Sohn (2006), Marashdeh (2005) and Yuhn (1997).
There are also studies such as those by Neaime (2005) and Bakri et al., (2009) which have applied weekly financial data.

According to the results reported in previous literature, there may not be a rule to confirm whether existence of the financial integration among countries depends on developed or developing characteristics of the nations involved. But generally, some of the results of these types of research imply there are unidirectional effects from developed to developing countries. For example, Bessler and Yang (2003) declare that some developed markets considerably lead the other countries price movements. For example, the U.S. equity market, which is biased by its own chronological and market innovations.

The above literature survey indicates that the only existing empirical paper that deals with the matter of financial integration involving Iran is Elyasiani and Zhao (2008). They applied GIRF and VAR for their analyses and they discovered weak financial integration (in terms of equity market) was present in Iran with global financial markets. This situation may save the country from the effects of global shocks but might prevent it from receiving a flow of money that would help attain economic prosperity and growth. They also implied that the Tehran Stock Exchange (TSE) is a small operating market in a developing country, which suffers considerable weaknesses. Examples of these weaknesses are that TSE is government controlled with significant authoritarian restrictions and lack of competition; it lacks transparency and poor information distribution; and there is either a lack of, or only rare trading among a large number of companies. Also mentioned was that the Iranian equity market presents a poor choice for international portfolio diversification, in spite of its segregated nature. Other problems are the high cost of capital in Iran because it is not integrated with other global markets, and because there are many limitations affecting Iranian markets such as political, regulatory and technological obstacles.

In summary, previous literature, in order to analyse interdependencies among financial markets generally used the Johansen cointegration approach on the basis that the standard test for stationarity ignored breaks over the selected period of time. In addition, financial data applied in previous studies dominantly considered daily data for equity markets. Only one paper was found, by Elyasiani and Zhao (2008) that examined Iran’s financial integration without considering other important countries in the Middle East for their integration analysis. That paper only is focused on equity markets’ returns and hence has ignored breaks
over the selected period of time where the other methods rather than cointegration approach are used clarified earlier in this section.

It is the intention of this paper to focus on the interaction of Iran’s financial markets’ within the Middle East and with the rest of the world, since it appears there is only one study that has in any way focused on Iran. An examination will be made of a broad number of financial markets, namely equity, money and foreign exchange markets, while structural breaks are considered over the selected periods of time in the analysis. The approach involves an examination of monthly data, as it is less subject to noise and is best suited to the study. A mixed order integrated series was discovered by applying the LS (2004, 2003) unit root approach in presence of structural breaks. Hence, the decision to use ARDL, as it is an appropriate technique in many circumstances, for example, in the case where series have mixed orders of integration. By applying the ARDL cointegration method it was found that although Iran has a fairly isolated foreign exchange market, its equity and money markets are significantly integrated within the Middle East and with the rest of the world. Weak financial integration may save Iran from the effects of global shocks but prevents a flow of money into the country that hinders economic prosperity and growth. Of consequence is whether, based on its segregated nature, Iran should be considered as a good choice for international portfolio diversification.

The following section focuses on clarification of data and selected markets and countries, before models and methods, along with empirical results are presented.

3 Data, Choice of Financial Markets and Countries

Monthly financial data from financial markets, namely equity and foreign exchange markets over the period February 1997 to December 2009, and the money market, which is analysed over the period October 2003 to December 2009,5 is used in this research. The selected financial indices for the financial markets are respectively, the equity price index6, the short-run interest rate-deposit rate on money7 and nominal effective exchange rate.8 All data are collected from IMF-International Financial Statistics (IFS) available online through dXtime (time series data management) software. Symbols used for the applied variables for each

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5 This limitation is imposed regarding the availability of data for the Iran money market.
6 See the data section reported in the Appendix.
7 See the data section reported in the Appendix.
8 See the data section reported in the Appendix.
market are as follows: for the equity market $P_h, P_s, P_k, P_u, P_t$ and $P_r$ symbolize Iran, Saudi Arabia, Kuwait, the U.S., Germany and Japan respectively. For the foreign exchange markets of these respective countries $E_h, E_s, E_k, E_u, E_t$ and $E_r$ are used, while symbols for the money market for these selected countries we will be $R_h, R_s, R_k, R_u, R_t$ and $R_r$.

The selected financial markets are the important global financial markets, viz., equity, money, and foreign exchange, for which data is available for all the selected countries. Also the selected markets are the main available financial markets most likely to be important for the analysis of Iranian monetary policy in the current domestic and global financial atmosphere.

Moreover, monthly financial data is used following Elyasiani and Zhao (2008), Shin and Sohn (2006), Marashdeh (2005), and Yuhn (1997). It is argued that this type of data is less volatile than higher frequency data, for example, daily and weekly, and therefore more suited to the current research framework. However, the possible drawback of using this type of data is that some of the interaction effects may be masked, as they may be completed within the month. Thus, the dynamics caused by monthly frequency data may underestimate interdependencies among the countries (Elyasiani and Zhao, 2008). Marashdeh (2005) claimed monthly financial data is appropriate to avoid biases common in weekly and daily data arising from non-trading and non-synchronous trading, with the benefit of achieving a clearer picture of movements of the indices away from short-term fluctuations. Also according to Elyasiani and Zhao (2008), there are sufficient reasons as to why using the monthly financial data is a more suitable means by which to analyse Iran’s financial markets. First, as previously mentioned, monthly data is less subject to noise than higher frequency types. Second, most of the firms listed in TSE markets show highly infrequent training, meaning the stock of some firms might not be traded for a month, showing that the higher frequency data, such as daily data, is not suitable for consideration in this situation. Importantly, emerging markets such as the TSE react to world events slowly, thus confirming that lower frequency data is more suitable for analysis.

Ultimately, the choice of countries for this research is based on the important recycling of petrodollars, since according to the bulk of funds flowing around the world, the strongest global financial integrations are expected to be found among the biggest oil exporters, such as Iran, Saudi Arabia and Kuwait, representing the Middle East, and their major importer...
countries that include the U.S., Germany and Japan, representing the rest of the world. Although it is not clear where these funds have been invested, some previous research indicates most of the petrodollars have been invested outside the Middle East region, mostly in North America and Western Europe (El-Gamal and Myers Jaff 2008). There is some evidence that either directly or indirectly, the bulk has ended up in the United States, (Higgins et al. 2006). Importantly, the selected oil exporter countries are the biggest holders of net foreign assets and they contain the highest surpluses in the world (IMF 2007). Also the financial markets in the aforementioned major oil importer countries are sophisticated in terms of the large size of their global capital markets and in terms of selected financial indicators such as GDP, total official reserves, bonds, equities, bank assets and exchange market derivatives (for quantitative details refer to Jackson 2008).

Data clarified in this section will be used through appropriate models and methods explained in the next section. Empirical results are simultaneously discussed.

4 Theories, Methods, Empirical Results
Various methods exist to analyse the significance of financial markets in the interdependencies of selected countries in terms of co-movements of financial asset prices, by examining, for example, correlation coefficient and cointegration methods. The use of a correlation coefficient is the most obvious method. But, Goletti et al. (1995) have pointed out the matter of spurious correlation by applying correlation coefficient and other problems related to the often non-stationary nature of the price series, a problem that will be solved by the cointegration analysis used in this paper. Before tackling cointegration analysis, unit root testing needs to be conducted to assess the stationarities of the series. Applications of the unit root methods are illustrated, and results clarified in the following section.

4.1 Unit-Root Approaches
To test the stationarity of series, a variety of different types of unit root tests exist. Unit root testing involves a test of stationarity (or nonstationarity), a method which has become widely adopted over the past several years, as for example, in DF (1979), ADF and PP (1988). For the DF test, it is assumed that the error term is not auto-correlated. But in the case where the error term is auto-correlated, the ADF extended version of DF is more reliable. In Model (1)

9 According to Goletti et al. (1995), referring to some previous literature, applying correlation coefficient for financial integration analysis among markets masks the presence of other synchronous factors, such as general price inflation, seasonality, population growth, and procurement policy. In order to solve these kinds of criticisms on applying a correlation coefficient, the correlation of price differences is considered and interdependencies of price changes among markets is estimated when price change would largely eliminate common trends that introduce spurious correlation.
the ADF test consists of estimating a regression where $Y_t$ is a dependent variable, there is a random walk with drift. Also as it shown in Model (1) lagged values of the dependent variable are added in the model.

$$\Delta Y_t = \beta_0 + \beta_1 t + \delta Y_{t-1} + \sum_{i=1}^{\infty} \Delta Y_{t-i} + \epsilon_t \tag{1}$$

where $\epsilon_t$ is a pure white noise error term, and where the number of lagged difference terms is often determined empirically. Hypotheses and asymptotic distribution are the same as the DF statistic, for both tests the null hypothesis of non-stationary is $\delta = 0$ which is tested using the $\tau$-statistic $\hat{\delta}/SE(\hat{\delta})$ which has a “Dickey-Fuller” distribution.

Another traditional unit root test utilised is the PP unit root test, which uses nonparametric statistical methods in order to take care of the serial correlation in the error terms without adding lagged difference terms. Also the asymptotic distribution of the PP test is similar to the ADF test statistic (PP, 1988). Empirical results achieved by applying the above traditional unit root tests are reported and compared later in this paper, along with other empirical results to be found in the empirical results section.

Perron (1989) argued that the ADF and PP tests in presence of structural breaks are biased toward the non-rejection of the null hypothesis, incorrectly indicating non-stationarity of series. Breaks should therefore be considered in the model over the selected period of time. As example, some of the unit root methods where the structural breaks are considered exogenously and/or endogenously by the data can be seen in, Narayan and Popp (2010), LS (2003) and Lumsdaine and Papell (LP) (1997), where two endogenous breaks are considered in the model; Perron (1997), Zivot and Andrews (ZA) (1992), Perron and Vogelsang (1992) and LS (2004), where one endogenous break is considered in the model. Furthermore, multiple endogenous structural breaks on multiple time series data is another approach proposed by Bai and Perron (2003).

LS (2003) criticized ZA’s (1992) unit root approach for obtaining a biased non-stationary result by just including one break in the model because it meant ignoring other major breaks that affected the result. Following that criticism, LS (2003) and LP (1997) extended the direction and included two structural breaks in their models. According to LS (2003), endogenous break test approaches allow no breaks under the unit root null test and derive their critical values accordingly. LP and ZA (and other similar authors) present an
alternative hypothesis that involves using unit root tests with breaks instead of stationarity. This means rejection of the null hypothesis would imply rejection of a unit root without breaks instead of rejection of a unit root \textit{per se} in the aforementioned situation. Nunes et al., (1997) and LS (2001) provide evidence that by assuming no break under the null in endogenous break tests, the test statistic diverges in order to reject the unit root null significantly when the data-generating process (DGP) is a unit root with break(s). As a solution to these observations, LS (2003) proposed a two-break minimum Lagrange Multiplier (LM) unit root test in which the alternative hypothesis unambiguously implies trend stationarity. Their testing methodology is extended from the LM unit root test that was initially suggested in Schmidt and Phillips (1992). The unit root approach in presence of two structural breaks is applied in the current research as per LS (2003).\textsuperscript{10}

Following Perron (1989), LS (2003, pp. 1082-1083) distinguished three models for unit root testing in presence of structural breaks, viz., A, B and C. Model A is named “Crash” and allows for a break in level; model B allows for a break in trend slope named “Changing growth”; and model C allows for a break in both level and trend. In the current research model C is used.

The two-breaks LM unit root statistics are obtained from the following regression according to the LM principle:

\begin{equation}
\Delta y_t = \delta \Delta Z_t + \phi \tilde{S}_{t-j} + u_t, \quad (2)
\end{equation}

where

\begin{equation}
\tilde{S}_{t-j} = y_t - \bar{y}_t - Z_t \tilde{\delta}, \quad t = 2, \ldots, T \quad (3)
\end{equation}

\(\tilde{\delta}\) is the vector of coefficients in the regression of \(\Delta y_t\) on \(\Delta Z_t\) and \(\bar{y}_t = y_t - Z_t \tilde{\delta}\). and \(Z_t\) is a vector of exogenous variables defined by the data generating process, \(Z_t = [1, t, D_t, DT_t']\)

where

\begin{equation}
DT_{t,j} = t - T_{B_j} \quad \text{if } t \geq T_{B_j} + 1, \quad j = 1, 2 \quad (4)
\end{equation}

and where

\textsuperscript{10} Lee and Strazicich (2003) proposed a unit root test in presence of two structural breaks and Lee and Strazicich (2004) proposed a unit root test in presence of one structural break.
$T_B$ stands for the location of the break.

Testing regression (2) involves using $\Delta Z_t$ instead of $Z_t$. Where $\Delta Z_t$ is described as $[1, B_t, D_t]'$ and $\Delta D_t = B_t$ and $\Delta T D_t = D_t$ then $B_t$ and $D_t$ correspond to a change in the intercept and trend under the alternative and one period jump and a change in drift under the null hypothesis respectively. The unit root null hypothesis, $\phi = 0$, is described in equation (1) and the LM t-test is given by $t = t_\phi$ statistic testing the null hypothesis $\phi = 0$. The augmented terms, $\Delta S_{t-j}$, are included to correct for serial correlation, where $j = 1, \ldots, k$.

Location of the break, $T_B$, will be determined endogenously through LM unit root searches for all possible break points for the minimum t-test statistic as follows:

$$\ln \tau(\lambda) = \ln f_\lambda; \lambda = \frac{T_B}{T}.$$  

Empirical results by applying the traditional unit root tests, viz., ADF and PP methods, show all the series are I(1), with the exception of Germany in terms of time series of deposit rate-interest rate on money, which is I(2), integrated of order two. Previous literature that has mainly applied traditional unit root tests, viz., ADF and PP, such as Yuhn (1997), Yang et al. (2003), Elyasiani and Zhao (2008) and Fadhlaoui et al. (2009), have found non-stationary equity price series for the U.S., Germany and Japan to be similar to the results achieved in the current research. In addition, Neaime (2005) and Yu and Hassan (2008) reported the same result for Saudi Arabia, while Neaime (2005) informed that non-stationary series for Kuwait was similar to other selected countries in the current research. Furthermore, Elyasiani and Zhao (2008) stated the non-stationarity of Iranian stock price indices was integrated to the order one, $I(1)$.

In this paper, the LS (2003) test is applied to equity price indices, with results being reported in Table 1. In the table for each variable, the column headed LM test statistic gives the minimum LM statistics and $T_{B_1}$ and $T_{B_2}$ in the next two columns of the table give the break dates where the t statistic is reported for dummy variables. This considers both the level and trend breaks and on the basis of significance of the trend consideration is given as to whether there is a unit root with breaks or not. Results indicate non-stationarity of all stock price
index series with two significant breaks,\textsuperscript{11} with the exception of Saudi Arabia, which shows stationarity with two significant breaks, and Japan which indicates a unit root with just one significant break over the selected period of time. Results are reported in Table 1.

Table 1: Unit root test for stock price indices according to LS (2004, 2003) Two-Break (break in both intercept and trend)\textsuperscript{12} minimum LM Unit-Root Test

| Variable | LM test statistic | \( T_{B1} \) (T-ratio in parenthesis) | \( T_{B2} \) (T-ratio in parenthesis) | \( k \) | Result |
|----------|-------------------|-------------------------------------|-------------------------------------|------|--------|
| \( P_{\text{It}} \) | -4.0372            | Aug-99 (\( \lambda_1 = 0.205 \)) Dec-04 (\( \lambda_2 = 0.615 \)) | 1 | UR\textsuperscript{a}, two breaks |
|          |                   | B1(t) \( (0.0330) \) D1(t) \( (4.8423*** \) B2(t) \( (0.2730) \) D2(t) \( (-6.4625*** \) |
| \( P_{\text{St}} \) | -6.5674**         | Apr-03 (\( \lambda_1 = 0.487 \)) Feb-06 (\( \lambda_2 = 0.705 \)) | 8 | S\textsuperscript{d}, two breaks |
|          |                   | B1(t) \( (0.9689) \) D1(t) \( (3.4333*** \) B2(t) \( (0.3402) \) D2(t) \( (-7.5066*** \) |
| \( P_{\text{Kt}} \) | -4.3068            | Sep-00 (\( \lambda_1 = 0.288 \)) Nov-04 (\( \lambda_2 = 0.608 \)) | 10 | UR, two breaks |
|          |                   | B1(t) \( (0.9689) \) D1(t) \( (3.4333*** \) B2(t) \( (0.3402) \) D2(t) \( (-7.5066*** \) |
| \( P_{\text{Jt}} \) | -5.0163            | Sep-98 (\( \lambda_1 = 0.134 \)) Oct-01 (\( \lambda_2 = 0.371 \)) | 11 | UR, two breaks |
|          |                   | B1(t) \( (-1.3931*) \) D1(t) \( (2.5334*** \) B2(t) \( (2.5216*** \) D2(t) \( (-3.8612*** \) |
| \( P_{\text{St}} \) | -4.6440            | Feb-02 (\( \lambda_1 = 0.397 \)) Jun-06 (\( \lambda_2 = 0.730 \)) | 12 | UR, two breaks |
|          |                   | B1(t) \( (2.0642** \) D1(t) \( (-4.1323*** \) B2(t) \( (-0.8198 \) D2(t) \( (3.4100*** \) |
| \( P_{\text{Jt}} \) | -4.2543            | Apr-02 (\( \lambda_1 = 0.410 \)) May-06 (N) (\( \lambda_2 = 0.724 \)) | 11 | UR, one break |
|          |                   | B1(t) \( (-1.3931*) \) D1(t) \( (-2.3596*** \) B2(t) \( (-1.6888 ** \) D2(t) \( (1.5727** \) |
| \( P_{\text{St}} \) | -3.6500            | May-05 (\( \lambda = 0.647 \)) | 11 | UR, one break |

\textsuperscript{a} UR stands for Unit Root  
\textsuperscript{b} B1(t) stands for break in intercept  
\textsuperscript{c} D1(t) stands for break in trend  
\textsuperscript{d} S stands for Stationary  
\textbullet All the series are in natural logs  
\textbullet Monthly data series are applied over the period of Jan-1997 to Dec-2009.  
\textbullet Applied model is the model with two breaks in both intercept and trend.  
\textbullet This test is applied with maximum lag which is \( k = 12 \), suitable when monthly data is applied (Hall 1994).  
\textbullet (N) means the break date is not significant at 5% according to the \( t \)-test for the trend break.  
\textbullet The significance of break dates are assessed by \( ***1\%**, **5\% and *10\% critical values of \( T \)-Ratio. Significance of the break points will be generally tested at the \( t_{0.05} \) statistical critical value.  

Source: IMF-IFS and author calculations.

\textsuperscript{11} As explained in the section on method, the unit root test which allows two breaks in both intercept and trend is conducted. Complexity of the results about the significance of one break date in both intercept and trend at the same time, called for consideration of the significance of the breaks in terms of trends.

\textsuperscript{12} The model C which allows the break in both intercept and trend is applied due to the fact that all variables in this study have trend. To accept the significance of the break dates, the t-stat of breaks for trends are considered when the complexity of the results in terms of significant break dates in both intercept and trend caused limitation to be made on decisions.
It was found that in the exchange rate series all series were non-stationary with two significant breaks, except for Kuwait and the United States, which were stationary. Results are reported quantitatively in Table 2.

Table 2: Unit root test for Exchange rates according to LS (2004, 2003)

Two-Break (break in both intercept and trend) minimum LM Unit-Root Test

| Variable | LM test statistic | $T_{B_1}$ (T-ratio in parenthesis) | $T_{B_2}$ (T-ratio in parenthesis) | $k$ | Result |
|----------|------------------|------------------------------------|------------------------------------|-----|--------|
| $E_{It}$ | -4.7498          | Dec-98 ($\lambda_1 = .153$)        | Jul-01 ($\lambda_2 = .352$)        | 10  | UR, two breaks |
|          |                  | B1(t) (2.1042**)                  | D1(t) (-2.7232***)                 |     |        |
|          |                  |                                   | B2(t) (-.4547)                    |     |        |
|          |                  |                                   | D2(t) (1.9405**)                  |     |        |
| $E_{St}$ | -4.7633          | Oct-02 ($\lambda_1 = .448$)       | Dec-03 ($\lambda_2 = .538$)        | 5   | UR, two breaks |
|          |                  | B1(t) (0.4248)                    | D1(t) (-4.8784***)                 |     |        |
|          |                  |                                   | B2(t) (-.9055)                    |     |        |
|          |                  |                                   | D2(t) (2.4298***)                  |     |        |
| $E_{Kt}$ | -6.3281**        | Apr-02 ($\lambda_1 = .410$)       | May-07 ($\lambda_2 = .801$)        | 12  | S, two breaks |
|          |                  | B1(t) (0.0601)                    | D1(t) (-4.2336***)                 |     |        |
|          |                  |                                   | B2(t) (2.1831**)                  |     |        |
|          |                  |                                   | D2(t) (-4.8533***)                 |     |        |
| $E_{Ut}$ | -5.3244*         | Dec-02 ($\lambda_1 = .461$)       | Aug-08 ($\lambda_2 = .897$)        | 5   | S, two breaks |
|          |                  | B1(t) (-0.8485)                   | D1(t) (-5.9457***)                 |     |        |
|          |                  |                                   | B2(t) (-0.0061)                   |     |        |
|          |                  |                                   | D2(t) (3.7950***)                  |     |        |
| $E_{Gr}$ | -4.7903          | Nov-99 ($\lambda_1 = .237$)       | Mar-03 ($\lambda_2 = .480$)        | 11  | UR, two breaks |
|          |                  | B1(t) (2.4225)                    | D1(t) (-2.6402***)                 |     |        |
|          |                  |                                   | B2(t) (-.4228)                    |     |        |
|          |                  |                                   | D2(t) (3.0070***)                  |     |        |
| $E_{It}$ | -4.3216          | Sep-98 ($\lambda_1 = .134$)       | Oct-06 ($\lambda_2 = .756$)        | 12  | UR, two breaks |
|          |                  | B1(t) (2.6538***)                 | D1(t) (2.8086***)                  |     |        |
|          |                  |                                   | B2(t) (0.6431)                    |     |        |
|          |                  |                                   | D2(t) (-2.7184***)                 |     |        |

Source: IMF-IFS and author calculations.

Ultimately, interest rate series show stationarity with two significant breaks for all the selected countries with the exception of Saudi Arabia and Kuwait which are still unit root (same result as when breaks were ignored through applying ADF and PP) and where Saudi Arabia indicates just one significant break over the selected period of time. Results are reported quantitatively in Table 3.
In sum, by applying LS (2004, 2003) in presence of structural breaks it was found that the series are integrated of mixed orders with mostly two significant breaks over the selected period of time. In light of the empirical results, the importance of considering structural breaks in our analysis can be emphasised, since stationary results for a significant number of series were recorded after considering the breaks in the analysis. This was achieved through using the LS method when all series were unit root through traditional unit root tests, for example, ADF and PP.

As explained earlier in this paper, a second step is to apply the ARDL cointegration method. The most popular advantage of ARDL is that it is independent of order of integration of the series (Pesaran and Pesaran 1997). In particular it is applicable when some variables are $I(0)$ and others are $I(1)$. This is the most important advantage of the method given the unreliability of standard stationarity tests (Pesaran 1997). The necessity of having all the variables integrated of the same order in some methods such as the Johansen cointegration approach

Table 3: Unit root test for Interest Rates according to LS (2004, 2003) Two-Break (break in both intercept and trend) minimum LM Unit-Root Test

| Variable | LM test statistic | $T_{B1}$ (T-ratio in parenthesis) | $T_{B2}$ (T-ratio in parenthesis) | k | Result |
|----------|------------------|----------------------------------|----------------------------------|---|--------|
| $R_{gr}$ | -15.9719***      | Jan-07 ($\lambda_1 = 0.533$) | Sep-08 ($\lambda_2 = 0.8$) | 1 | S, two breaks |
|          | B1(t) (-0.9618) | D1(t) (-6.0835*** ) | B2(t) (-10.6824*** ) |  |   |
| $R_{gr}$ | -5.3923*         | May-05 ($\lambda_1 = 0.266$) | Nov-06 (N) ($\lambda_2 = 0.506$) | 7 | S, one break |
|          | B1(t) (-1.2815) | D1(t) (3.6467*** ) | B2(t) (-0.5031) | D2(t) (-1.6124* ) |  |   |
| $R_{kr}$ | -3.1329          | Sep-07 ($\lambda = 0.64$) |  | 11 | UR, one break |
|          | B1(t) (-0.1423) | D1(t) (-4.5651*** ) |  |   |
| $R_{kr}$ | -5.5337*         | May-06 ($\lambda_1 = 0.711$) | Aug-08 ($\lambda_2 = 0.786$) | 5 | UR, two |
|          | B1(t) (-1.7472** ) | D1(t) (3.5586*** ) | B2(t) (6.8036*** ) | D2(t) (-7.4395*** ) |  |   |
| $R_{lt}$ | -5.0163          | Feb-06 ($\lambda_1 = 0.386$) | Nov-07 ($\lambda_2 = 0.666$) | 6 | S, two breaks |
|          | B1(t) (-0.6797) | D1(t) (3.8675*** ) | B2(t) (3.8675*** ) | D2(t) (-6.7193*** ) |  |   |
| $R_{gt}$ | -8.0448***       | Sep-05 ($\lambda_1 = 0.32$) | Feb-08 ($\lambda_2 = 0.706$) | 12 | S, two breaks |
|          | B1(t) (-2.1450** ) | D1(t) (6.3493*** ) | B2(t) (-1.5661*) | D2(t) (2.2965** ) |  |   |
| $R_{jt}$ | -5.7559*         | Sep-05 ($\lambda_1 = 0.32$) | Jan-07 ($\lambda_2 = 0.6$) | 11 | S, two breaks |
|          | B1(t) (-0.5017) | D1(t) (4.2881*** ) | B2(t) (2.9584*** ) | D2(t) (-6.7874*** ) |  |   |

Source: The author’s calculations.
brings a further degree of uncertainty in analyses of relationships in levels (Pesaran et al. 2001). As previously mentioned, the series in this study are found to be integrated of the different orders, $I(0)$ and $I(1)$, which makes the ARDL more suitable for the current study.$^{13}$ Application of the ARDL and the proposed model along with the empirical results are all discussed in the following section.

4.2 Cointegration Approaches

Two variables integrated of order one (stationary first differences of variables) are said to be cointegrated if there is a linear combination of them that is stationary. Frequently used methods for cointegration tests are residual based, such as the cointegration test of Engle-Granger (1987) and maximum likelihood based such as Johansen (1988).$^{14}$ Moreover, some cointegration tests such as Gregory and Hansen (1996) and Saikkonen and Lutkepohl (2000)$^{15}$ consider structural breaks. In the current research rather than using the common Johansen (1988) cointegration approach, the ARDL method proposed by Pesaran and Pesaran (1997) is used, since it is better suited to testing when variables are integrated of mixed orders$^{16}$.

Applying the ARDL process to the original log series by ignoring breaks found no integration among the selected countries’ financial markets. The weakness of this approach is that it ignores the fact that many of the variables have significant breaks both in level and trend as indicated by the LS (2004, 2003) stationarity test. Therefore breaks discovered significant in the previous section either in levels, trends, or both, will all be considered in ARDL. But including dummy variables for all significant breaks for all selected countries in ARDL will consume large amounts of degrees of freedom and will cause high co-linearity that makes it impossible to process the ARDL method. Hence to solve the aforementioned matter the series has been de-trended. This means, before applying ARDL effects of the breaks were removed by regressing each variable on constant, trend and breaks (found to be significant in the stationarity test) and using residuals from these preliminary regressions.

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$^{13}$ The ARDL approach identifies a relationship between a dependent variable and a set of regressors suitable for the current research since the objective is to analyse whether there is any long-run relationship among the selected financial markets irrespective of the number of the relationships that could be answered by Johansen multiple cointegration relationships approach (this is not focus of this research).

$^{14}$ You may look at Johansen and Joselious (1990) and also Johansen (1991 and 1995).

$^{15}$ Refer to the three cited articles of Saikkonen and Lutkepohl (2000 a, 2000 b and 2000 c).

$^{16}$ One of the most important reasons that caused the author to choose the ARDL cointegration method is based on the mixed order integrated series found by applying unit root test (results are discussed later in this paper along with all other empirical results). The ARDL modelling approach is expanded by Pesaran et al. (1996 and 2001), Pesaran (1997), Pesaran and Pesaran (1997 and 2009), Pesaran and Smith (1985, 1998), and Pesaran and Shin (1998).
The structure of the estimated models underlying de-trended series, as clarified earlier, are designed as follows (based on Pesaran and Pesaran (2009, pp. 463-365) ARDL model):

$$
\Delta \ln P_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{p1i}\Delta \ln P_{t(i-\cdot)} + \sum_{i=0}^{p} \alpha_{p2i}\Delta \ln P_{S(t\cdot-)} + \sum_{i=0}^{p} \alpha_{p3i}\Delta \ln P_{K(t\cdot-)} + \sum_{i=0}^{p} \alpha_{p4i}\Delta \ln P_{U(t\cdot-)} +
\sum_{i=0}^{p} \alpha_{p5i}\Delta \ln P_{G(t\cdot-)} + \sum_{i=0}^{p} \alpha_{p6i}\Delta \ln P_{J(t\cdot-)} + \beta_{p1i} \ln P_{t(i\cdot-)} + \beta_{p2i} \ln P_{S(t\cdot-)} + \beta_{p3i} \ln P_{K(t\cdot-)} + \beta_{p4i} \ln P_{U(t\cdot-)} +
\beta_{p5i} \ln P_{G(t\cdot-)} + \beta_{p6i} \ln P_{J(t\cdot-)} + \alpha_{p8i} D(TB) + \alpha_{p9i} DU + \alpha_{p10i} + \epsilon_i \quad (5)
$$

Where $\ln P_t$, $\ln P_S$, $\ln P_K$, $\ln P_U$, $\ln P_G$ and $\ln P_J$ are natural logs of equity price indices for the selected countries’ financial markets which will be applied to the money and foreign exchange markets where interest rates and nominal effective exchange rates are the used financial indices respectively (aforementioned indices clarified in the data section). $D(TB)$ and $DU$ stand for breaks in trend and intercept respectively and $\epsilon$ is a vector of random error term.

Notably, when de-trending our models, in theory, the results will have the generated regressor problem because regressors are generated from the previous regression, which is a regression on trend and breaks. In other words, when a regressor (right hand side variable in a regression) is itself an outcome of the other regression, it would be possible that the random variable is measured with error. The correlation of this regressor with the residual in the original equation could make the regression invalid (refer to Pagan (1981)). Pagan (1984) has suggested number of ways to overcome this problem none of which applicable to estimated cointegrated system and therefore the aforementioned matter is ignored in this research.

Equation (5) is designed and estimated in the ARDL framework for all the selected financial markets (namely, money and foreign exchange rate) in turn, where in each case Iran’s financial markets are dependent variables.

Asymptotic distribution of non-standard F-statistic (irrespective of order of the integration of the regressors) is computed in order to test the null hypothesis $H_0 : \beta_{p1i} = \beta_{p2i} = \beta_{p3i} = \beta_{p4i} = \beta_{p5i} = \beta_{p6i} = 0$ and the alternative defined as $H_1 : \text{not all } \beta_{pji} = 0, \quad i = 1, 2, ..., 6$. Similarly these hypotheses are applied for the foreign exchange and the money markets. Also bounds generated by Microfit (MFit) are used and focus is directed at the 95% bound where the question is whether the F-statistic is inside or
outside the bound, given critical values through the software are flexible and based on the sample size. Moreover, if found the F-statistic between the lower and the upper bonds is at the five per cent significance level, the result will be considered ‘inconclusive’. Following Kremers et al. (1992) and Bahmani Oskooee and Nasir (2004), when dealing with an inconclusive F-statistic, the null hypothesis will still be rejected, since the significance of the error correction term is still a useful way to establish the cointegration relationships.

Application of the method and the achieved empirical results are reported as follows. The ARDL cointegration approach is conducted by following three steps: the first step is to assess the long-run relationship by using the bounds testing approach; the second and third steps evaluate the long-run and short-run relationships respectively. Before discussing the results, diagnostic test results are considered for equation 5 for all the selected financial markets in turn, where in each case Iranian markets are dependent variables. These tests involve, diagnostic tests for serial correlation, functional form, normality and heteroscedasticity. Diagnostic test results can be found in Tables 4, 6 and 7. Clearly there is no evidence of serial correlation, heteroscedasticity, and misspecification of functional form in general but it seems that there are normality problems. Since bounds are not available for non-normal cases, bounds produced by MFit will continue to be used. MFit allows different lag lengths for all the variables on the right hand side of the regression. Therefore different lags starting from the smallest possible lag are tested and the best-suited maximum lag is imposed in each case and then MFit chooses the optimal lags using Akaike (AIC) (1973, 1974) criteria reported in the tables of results, $ARDL(p, q_1, q_2, \ldots, q_k)$, further in this paper (the optimal lags are reviewed to check whether the results are sensitive to the selected maximum chosen lags and we have found that the imposed maximum lags are appropriate for our models in each case.)

Following Pesaran and Pesaran (2009), AIC is chosen for the current research among other options, namely those criteria adopted by Schwarz Baysian and Hannan-Quinn. This choice is applied in light of the fact that the work in this paper does not face the risk of over-
parameterization, as sufficient numbers of data are used (156 observations for equity and foreign exchange markets and 75 observations for money markets).

Table 4 reports the F-statistic indicating the existence of a long-run relationship among the equity markets in selected countries. It means that the calculated F-statistic indicates the coefficients $\beta_{P11}, \beta_{P12}, \beta_{P13}, \beta_{P14}, \beta_{P15}$ and $\beta_{P16}$ are significantly different from zero at the five per cent significance level and the null Hypothesis of no level effects among the variables is rejected. Also, as mentioned earlier in this section if found the F-statistic between the lower and the upper bonds is at the five per cent significance level, the result will be considered ‘inconclusive’. Following Kremers et al. (1992) and Bahmani Oskooee and Nasir (2004), when dealing with an inconclusive F-statistic, the null hypothesis will still be rejected, since the significance of the error correction term is still a useful way to establish the cointegration relationships. As explained previously, the F-statistic is non-standard, irrespective of the order of the integration of the regressors. The most common F-statistic for the joint significance of $\beta_{P11}, \beta_{P12}, \beta_{P13}, \beta_{P14}, \beta_{P15}$ and $\beta_{P16}$, refer to the model demonstrated earlier in this section. As mentioned earlier the bounds generated by MFit are used and focus is directed at the 95% bound where the question is whether the F-statistic is inside or outside the bound. Results reported in Table 4 are based on the model where the dependent variable is the natural log of Iran’s equity market and the right hand-side variables are natural logs of Saudi Arabia, Kuwait, the U.S., Germany and Japan equity markets respectively. In a nutshell, right hand variables, “the long-run forcing variables”, have significant explanatory power for the dependent variable, $Lp_{P11}$.

| Table 4: Cointegration test for equity price indices$^1$ |
|--------------------------------------------------------|
| **F-Statistic** | **Result** | **95% Lower Bound** | **95% Upper Bound** |
|-----------------|------------|---------------------|---------------------|
| 3.4459          | Null hypothesis$^2$ is rejected | 2.1752              | 3.4241              |

$R^2 = .79362$, $\text{DW-statistic} = .78514$, $\text{DW-statistic}=1.9943$

### Diagnostic Tests:

| Test Statistic | LM Version prob | F Version prob |
|----------------|-----------------|----------------|
| Serial Correlation$^3$ | CHSQ(12)=.563 | F(12,134)=.617 |
| Functional Form$^4$ | CHSQ(1)=.865 | F(1,145)=.868 |
| Normality$^5$ | CHSQ(2)=.000 | Not applicable |
| Heteroscedasticity$^6$ | CHSQ(1)=.811 | F(1,151)=.813 |

---

$^1$ The critical value bounds are computed by stochastic simulations using 20000 replications.

$^2$ The null Hypothesis has no level effects among variables.

$^3$ Lagrange multiplier test of residual serial correlation.

$^4$ Ramsey’s RESET test using the square of the fitted values.

$^5$ Based on a test of skewness and kurtosis of residuals.

$^6$ Based on the regression of squared residuals on squared fitted values.

Source: the Author’s calculations
Based on the results reported in Table 4, we could conclude it is possible that previous literature failed to find cointegration (long-run relationship) because they ignored breaks in the data (for example see Neaime (2005) and Elyasiani and Zhao (2008)). Results achieved by the previously mentioned studies where breaks are not considered, can present the matter of spurious non-cointegration, which sheds light on the importance of the breaks to be considered in the analysis over the selected period of time.

Furthermore, Table 5 reports long- and short-run elasticities. Where the error correction coefficient, ecm (-1), is -0.20669 significant and with the correct sign for cointegration of the selected countries’ equity markets, which suggests the moderate speed of convergence to equilibrium after deviating from the equilibrium. These empirical results are based on detrended variables as clarified earlier, which means that the effects of intercept, trend and dummies that are all abstracted in the residuals.
Table 5: Testing long-run and short-run Analysis - equity price indices

| Regressor | Coefficient | Prob | Regressor | Coefficient | Prob |
|-----------|-------------|------|-----------|-------------|------|
| $LP_{St}$ | .066394     | .675 | $LP_{It}$ | .13840      | .088 |
| $LP_{Kt}$ | .076462     | .547 | $LP_{St}$ | .013723     | .693 |
| $LP_{Ut}$ | -.20113     | .420 | $LP_{Kt}$ | .015804     | .541 |
| $LP_{Ut}$ | .20065      | .570 | $LP_{Ut}$ | -.041571    | .437 |
| $LP_{Ut}$ | .53217      | .086 | $LP_{Ut}$ | .041471     | .550 |
| $LP_{Ut}$ | -.20065     | .693 | $LP_{Ut}$ | -.041571    | .437 |
| $LP_{Ut}$ | .53217      | .086 | $LP_{Ut}$ | .041471     | .550 |

$ecm = P_{It} -.066394P_{St} -.076462P_{Kt} +.20113P_{Ut} - .20065P_{Gt} -.53217P_{It}$

$R^2 = .13973, \bar{R}^2 = .10437, F(6,146) = 3.9522 [.001]$

$DW = statistic = 1.9943$

Source: the Author’s calculations

The above table shows all the p-values are insignificant regardless of the significant F-statistic (existence of the long-run relationships among variables). In view of that, as some of the markets would be really important to be considered in the model in comparison to other selected markets, the matter is explored in turn by pairwise (pairwise investigations are for further explorations of the results of joint tests) cointegration tests between Iran and Saudi Arabia, Kuwait, U.S., Germany and Japan. Surprisingly, it was found that only the U.S. is not integrated with Iran among all other five selected countries.

Table 6 reports the results for foreign exchange markets in the selected countries long-run relationships. Analysis of cointegration of foreign exchange markets among the selected countries confirms no long-run relationship between Iran and the selected countries. In this model the dependent variable is Iran’s foreign exchange index and the right hand-side variables in the regression are respectively the foreign exchange markets in Saudi Arabia, Kuwait, the U.S., Germany and Japan.

Table 6: Cointegration test for foreign exchange market indices

| F-Statistic | result | 95% Lower Bound | 95% Upper Bound |
|-------------|--------|-----------------|-----------------|
| 1.5881      | Null hypothesis is not rejected | 2.1752 | 3.4241 |

$R^2 = .84632, \bar{R}^2 = .83550, DW-statistic = 2.0089$

Diagnostic Tests:

| Test Statistic | LM Version prob | F Version prob |
|----------------|-----------------|----------------|
| Serial Correlation | CHSQ(12)=.722 | F(12,130)=.788 |
| Functional Form | CHSQ(1)=.568 | F(1,141)=.584 |
| Normality | CHSQ(2)=.000 | Not applicable |
| Heteroscedasticity | CHSQ(1)=.401 | F(1,151)=.404 |

Source: the Author’s calculations
No related previous literature has been discovered that allows a comparison for the results of the long-run relationship among the selected countries’ foreign exchange markets. However, significant long-run relationships are found between the money markets of the selected countries. In this model Iran’s money market is the dependent variable and money markets in all other selected countries are independent variables. Quantitative results are reported in Table 7.

Table 7: Cointegration test for money market indices

| F-Statistic | Result | 95% Lower Bound | 95% Upper Bound |
|-------------|--------|-----------------|-----------------|
| 8.2584      | Null hypothesis is rejected | 2.2479          | 3.5889          |

$R^2 = .84632$, $\bar{R}^2 = .83550$, DW-statistic=2.0089

| Diagnostic Tests: | LM Version prob | F Version prob |
|-------------------|-----------------|----------------|
| Serial Correlation| CHSQ(12)=.109   | F(12,39)=.370  |
| Functional Form   | CHSQ(1)=-.398   | F(1,50)=.480   |
| Normality         | CHSQ(2)=.001    | Not applicable |
| Heteroscedasticity| CHSQ(1)=.045    | F(1,69)=.046   |

Source: the Author’s calculations

The results of further exploration on the long-run coefficients and of testing the significance of the lagged levels of the variables in the error correction form of the underlying ARDL are shown in Table 8. The AIC lag specification for this model is ARDL (4,3,4,4,0,0)\(^\text{18}\) and the error correction coefficient, ecm (-1), is found to be -.89199 significant; with the correct sign indicating the moderate speed of convergence to equilibrium after deviating from the equilibrium.

\(^{17}\) The matter of heteroscedasticity is resolved by Newey-West adjusted with Parzen weights.

\(^{18}\) This optimal lag chosen for the regressors by MFit through AIC was unreliable. It means a higher maximum lag may be required, but higher lags were masking the existence of the long-run relationship between the money markets in the selected countries.
Table 8: Testing long-run and short-run Analysis – money market indices

| Regressor | Coefficient | Prob  | Regressor | Coefficient | Prob |
|-----------|-------------|-------|-----------|-------------|------|
| $LP_{st}$ | -.1656      | .018  | $LdR_{st}$ | .0972       | .340 |
| $LP_{kt}$ | -.0097      | .918  | $LdR_{kt}$ | .2127       | .019 |
| $LP_{ut}$ | .1666       | .003  | $LdR_{ut}$ | .3210       | .000 |
| $LP_{gt}$ | .1382       | .031  | $LdR_{gt}$ | -.0497      | .296 |
| $LP_{jt}$ | -.4169      | -2.5117 | $LdR_{jt}$ | .1172       | .046 |

\[ ecm = R_{it} + .16557R_{st} + .0097365R_{kt} - .16659R_{ut} - .13818*R_{gt} + .41694R_{jt} \]
\[ R^2 = .82180, \overline{R^2} = .75542, \ F(16, 54) = 14.7002[.000] \]
\[ DW - statistic=2.2332 \]

Source: the Author’s calculations

No related previous literature has been found in order to compare the results of the long-run relationship among the selected countries’ money markets.

In sum, referring to the earlier discussion in this paper, it is believed that financial integration enhances price co-movements when deeper financial integration implies the weaker arbitrage opportunity of trading financial assets, which means quicker convergence of prices of assets. Co-movements between financial asset prices (in the form of a cointegrating relationship) are considered as evidence of financial integration dominantly used in previous literature. This means that co-movement of financial asset prices among countries is seen as a reflection of the integration of financial markets among countries. Financial integration and the price linkages among the financial markets of selected countries are analysed through the ARDL method based on the procedure illustrated earlier. While, basically the cointegration framework is to analyse interdependencies among variables that are not stationary,
ultimately, this cointegration analysis sheds light on the isolation of Iran’s foreign exchange market and integration of its equity and money markets within the Middle East and with the rest of the world.

5 Summary and Conclusion

This paper began by noting the segmentation of Iran’s financial markets from the rest of the world, and points out that in the last three years privatisation has increased in Iranian financial markets as well as capitalization, FDI and equity prices. Albeit there is a suspicion that equity prices have reached the bubble level (IMF 2011b). In addition, the major focus of the Iranian government over its fourth and fifth development plans (2005-2015) has been to expand foreign trade, to actively participate in international markets and to increase their global integration. Importantly, according to the IMF (2010), Iran has received significant spillovers in recent years from neighbouring financial markets, mainly from Saudi Arabia. Therefore, it was decided to analyse Iran’s integration within the Middle East and with the rest of the world to better understand Iran’s financial development and to provide information for policy makers and portfolio managers. The ARDL cointegration approach was applied to analyse interdependencies among financial markets after conducting LS (2004, 2003) unit root test in order to analyse the stationarity of the series.

It was found that there is no significant interaction for the Iranian foreign exchange market within the Middle East and with the rest of the world. But, results show that there are long-run relationships among Iran equity and money markets within the Middle East and with the rest of the world.

In a nutshell, our econometric analysis shows that Iran’s financial markets are neither fully integrated nor completely segmented within the Middle East and with the rest of the world, which immediately suggests the potential for international diversification. However, whether Iran should be considered as a good choice for international portfolio diversification based on its segregated nature is still an issue of controversy. Investigation of the economic background underlying the aforementioned foundation in this research could be considered as one of the future research works concerned by the author.
Appendix

Data Section

Equity price indices: “Indices shown for Share Prices generally relate to common shares of companies traded on national or foreign stock exchanges. Monthly indices are obtained as simple arithmetic averages of the daily or weekly indices, although in some cases mid-month or end-of-month quotations are included. All reported indices are adjusted for changes in quoted nominal capital of companies. Indices are, in general, base-weighted arithmetic averages with market value of outstanding shares as weights.” (IMF-IFS introduction P xx)

*Iran: “Weights reference period: 1990–1991 average. Data cover all companies listed in TSE and are produced as a Laspeyres-type index based on average daily prices” (IMF-monthly notes).

*Saudi Arabia: “Share Prices (End of Period): Domestic Share Index covering agriculture, cement, electricity, other industry, banking, and other services, base 1985” (IMF-monthly notes).

*U.S.: “Market capitalization-weighted index covering domestic and international-based common stocks, ordinary shares, ADRs, shares of beneficial interest, REITs, base February 5, 1971, Tracking Stocks and Limited Partnerships and excluding exchange traded funds, structured products, convertible debentures, rights, units, warrants and preferred issues” (IMF-monthly notes).

*Germany: “Share Prices (End of Period): Share price index, base December 30, 1987, refers to the CDAX share price index (previously called all-share price index FWBX) of the Deutsche Börse A.G. It shows average price movements of all ordinary and preference shares officially listed on the Frankfurt stock exchange of companies with headquarters in Germany” (IMF-monthly notes).

Short-run interest rate-deposit rate on money: “Data refer to weighted average provisional rate of profits from non-public sectors' deposits with state-owned banks. The rate is weighted by the outstanding amount of the aforementioned deposits at the end of the reference period’ (IMF-monthly notes).

*Iran: “Data refer to weighted average provisional rate of profits from non-public sectors' deposits with state-owned banks. The rate is weighted by the outstanding amount of the aforementioned deposits at the end of the reference period’ (IMF-monthly notes).
*Saudi Arabia*: “Deposit Rate: Simple average of daily interest rates on three-month deposits” (IMF-monthly notes).

*Germany*: “Deposit Rate: Rate on three-month deposits in denominations of less than five hundred thousand euro” (IMF-monthly notes).

*Japan*: “Deposit Rate: Average interest rate on unregulated three-month time deposits, ranging in size from three million yen to under ten million yen” (IMF-monthly notes).

**Nominal effective exchange rate**: A real effective exchange rate index represents a nominal effective exchange rate index adjusted for relative movements in national price or cost indicators of the home country, selected countries (“The country compositions of the world and its subgroups are by in large aligned with those published in the IMF’s World Economic Outlook (WEO). Note that some economies are not included in the WEO exercise, but report data to IFS; they are included in the *IFS* groups.” (IMF-IFS P xxv)) and the euro area (IMF-IFS introduction P viii).

*Iran*: “Official Rate: (End of Period and Period Average): The exchange rate system is based on a dual official exchange rate structure; the floating rate and the export rate. The floating rate applies mainly to the imports of essential goods, and the export rate applies to all other transactions. Beginning in March 1993, the exchange rate refers to the official floating rate. Prior to that date, the exchange rate referred to the basic official exchange rate of the Iranian Rial, which was pegged to the SDR. Beginning from March 2002, a unified exchange rate, determined at the inter-bank foreign exchange market, has replaced the dual foreign exchange rate system” (IMF-monthly notes).

*Kuwait*: The nominal effective exchange rate for Kuwait is not available, so the real exchange rate is used which is inverted to Dinar /$US, when it is available as $US/ Dinar in IMF-IFS.
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