Effects of Short-run and Long-run Changes
in Foreign Exchange Rates on Banks' Profit

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Abstract

In this article, we have planned to examine the effects of foreign exchange changes on Banks' operations and profits by applying Error Correction Model (ECM) both in short-run and long-run periods. Data of exchange rates, foreign exchange positions, foreign exchange resources and profits have been drawn from the balance sheets and statements of profit and loss in one of the commercial banks in Iran for the period of five years from 2006 to 2010. The results indicate that short-run increase in exchange rate has a reaction over the expected level, whilst the profit is over the equilibrium rate of exchange in long-run. Meantime, there is a significant, stationary model for the bahaviour of exchange rate both in short-run and long-run towards Banks' profit. In general, based on the result of the present research, we can come to this conclusion that despite non-stationarity of exchange rate and foreign exchange profit, there is a co-integration between these two variables. Meanwhile, there is a significant, stationary model for the short- and long-run behaviour of exchange rate and its effects on bank foreign exchange profit. In addition, the effect of exchange rate changes on foreign exchange profit in short-run is more than the one in long-run. Finally, error correction coefficient is 1.23 and the required time to reach long-run equilibrium would be 4, when short- and long-run equilibriums are overlapped.

Keywords: exchange rate, profit, foreign exchange position, foreign exchange resources, ECM, stationarity, co-integration

1. Introduction

As international trade has experienced a tremendous growth in recent decades, international commercial transactions have also undergone great changes, and foreign exchange income has been considered as one of the prominent economic plans in different countries. For exchange rate arrangements, the motives for stabilising exchange rates fall intoroughly two broad categories: (1) concerns about the short-term impact on macroeconomic andfinancial stability; and (2) concerns about the medium- to long-term impact on resource allocation.

A particular concern is that exchange rate fluctuations will encourage speculative behaviour on the basis of expectations that the exchange rate will continue to appreciate. Depending on the maturity structure and currency denomination of assets and liabilities in the economy, sharp exchange rate movements could result in liquidity shortages and trigger significant balance sheet effects, which may require central bank action to stabilise the system – for instance, by providing short-term foreign currency liquidity to the banks. Central banks have been also concerned that much of the recent exchange rate appreciation has been due to the wide interest rate differentials with respect to advanced economies, which is seen to result largely from the continuation of the near zero policy rates in advanced economies; hence, it is of high importance to grasp the roles of foreign exchange and convertibility of currencies in national economy and the interrelationships between banks, as the active financial institutionsin theforex markets with regard to the risk of changes in the exchange rates.

Of course, the position of banks, as commercial brokers in the financial transactions is very significant, so recognizing the situations of financial markets and getting precise, in-time information on the changes in the foreign exchange would result in the profit of financial institutions and in turn their countries.

As profit would be the main aim of the profit making institutions, including banks, bankers and bank managers are required to have a full understanding of the concept of bank profit in their foreign exchange operations. Besides, as

most of the bank foreign exchange income results from the commissions and fees of foreign exchange operations, banks' managers, as the bank policy-makers need to investigate the effects of exchange rate changes (as the first variable in this research) on their foreign exchange reserves and income, contributing them to know how much risk they can take in their foreign exchange operations to ensure maximum profitability for their stakeholders.

2. Related Literature

Economists and bankers believe that international banking deals with the banking relations among the countries, so as the financial part of the commercial transactions is conducted through the payment and settlement systems of the banks and financial institutions, interrelationships between banks in different countries play important role in the economic welfares of most countries. Based on a simple definition, international banking is defined as a part of banking operations, conducted in foreign currencies in international monetary and financial markets. In fact, the main concept in international banking is foreign exchange operations; therefore, in order to supply required foreign exchange for import and export of goods and services among countries, international forex market has been established to furnish banks' required foreign exchange for payment and settlement of international transactions.

In tandem with the establishment of international forex market, exchange rate is defined as a price of one unit of foreign currency against national currency, affecting the price of both local and foreign goods and services. By the increase of the value of a national currency in a country, the price of its exported goods is increased overseas, whilst the price of its imported goods is decreased in the local market and vice versa. Hence, changes in foreign exchange rates undoubtedly affect the price of the imported goods and services, showing great manifestation in recent years. Today, gold exchange standard was replaced and SDR has sometimes been used as a control unit to fix the exchange rate based on the national requirements of any country. Therefore, every morning participants in the forex markets, including both companies and banks quote their exchange rates, based on their portfolios.

However, the main concern of economists and policy makers is the effect of changes in the exchange rates on the main economic indices, such as GDP, employment, general price index and BOP; therefore, all governments plan to define the appropriate foreign exchange rate regime and arrange their monetary and foreign exchange policies in a way to play an active, effective role in international and monetary markets in line with their resources and uses.

Today, in most countries, floating exchange rate regime is applied, in which exchange rates may even experience great changes in a day, so it is of great importance to examine foreign exchange changes which affect not only main economic indices but bank's profit. Considering Iran monetary and foreign exchange policy, Central Bank of Islamic Republic of Iran has employed managed floating exchange rate regime and officially notified whole banking system in Iran; thus complying with the requirements of the said regime, all Iranian banks and other credit and financial institutions plan to extend local and international banking services to gain more profit and acceptable market share.

Banking operations in Iran can be classified into two general categories of local and international banking. Those activities, which are performed in foreign exchange include letters of credits, collections, banking accounts, payment orders, finance and credit lines, guarantees and foreign exchange dealings; therefore, conducting each of the said services requires examining the behavior of the exchange rates and being fully aware of the related risks resulting from fluctuating rates, which affect banks' foreign exchange assets, liabilities and profit.

As mentioned, exchange rate is one of the important factors, affecting both main economic indices and banks' profit and loss in their balance sheets. Precise analysis of foreign exchange behavior and its effects on banks' foreign exchange resources and uses help bank managers make appropriate decisions in conducting banking activities.

3. Empirical Researches

We have quoted previously that changes in exchange rates leave evident effects on banks' income and costs and subsequently their profit and loss, requiring managers to have precise, accurate prediction in evaluating banks' total assets and contingent liabilities. Meantime, unpredicted fluctuations in exchange rate increase error in predicting gross profit margin and real value of the assets and liabilities.

3.1 Related International Studies

Various researches have been carried out in examining the behavior of exchange rate and its influence on different economic indices, banks' profit and the gains of banking operations.

Goodman (1982) in his paper, titled "Banks foreign exchange operations" has examined bank maximum profit, in which decisions on exchange rate behaviors and portfolio managements have been taken simultaneously in banks. Based on this model, banks are required to specify their foreign exchange positions and maintain their paid-up

capital, deposits, and liabilities proportionate to their positions.

Santomero (1983) carried out a research to consider "Fixed Versus Variable Rate Loans" to investigate the stocks' value in compliance with the assets pricing model. The results indicate that banks' foreign exchange positions in Turkey have been affected by fluctuations of US Dollar exchange rate against TR Lyre.

Koray and Lastrapes (1989) in their research, named, "Real Exchange Rate Volatility and US Bilateral Trade: A VAR Approach" and Chowdhury (1993) in his paper "Does exchange rate volatility depress trade flows? Evidence from Error-Correction Models" provided evidences of decrease in international trade, resulting from the fluctuability of exchange rates.

Ammer and Brunner (1994) put this question "Are Banks Market Timers or Marker Makers? Explaining Foreign Exchange Trading Profits" to examine the profit of American commercial banks in foreign exchange dealings. They showed that keeping foreign exchange position would have no considerable effects on bank's profits; however, as there would be no systematic mechanism to have precise prediction of exchange rate changes, banks had better to keep their foreign exchange positions low.

Demirguc-Kunt and Detragiache (1998) carried out a research to study "The Determinants of Banking Crises in Developing and Developed Countries". They explained that decrease in exchange rate leaves no significant effects on banks' vulnerability.

Becker and Sinclair (2004) studied the "Profit of Reserve Bank Foreign Exchange Operations Twenty Years after the Flout". They concluded that Reserve Bank of Australia conducted banking operations by buying in lower rate ad selling in higher rate, stabilizing the trend of exchange rate changes.

Chi Jing, Tripe and Young (2010) in their research set forth the question of "Do Exchange Rates Affect the Stock Performance of Australian Banks?" They used data for the time period from January 1997 to March 2007 in 4 major banks in Australia, but unlike their expectations, the results revealed that there were no significant relations between stock performance of Australian banks and exchange rate.

Filardo et.al. (2011) in their research titled "Exchange rates and monetary policy frameworks in EMEs" concluded that Greater attention to exchange rate stability puts a premium on central banks' understanding of equilibrium exchange rates. However, notions of equilibrium exchange rates are difficult to define conceptually and empirically. In addition, analytical work that incorporates exchange rate stability considerations into standard monetary policy frameworks is still in its infancy. Nonetheless, having achieved and maintained price stability, many emerging market central banks seem likely to extend their policy frameworks to reflect the potential role that exchange rates can play as both a policy tool and a policy target.

Debelle (2011), chaired a study group in Australia investigated "High-frequency trading in the foreign exchange market" and concluded that the growth in algorithmic and high-frequency trading in foreign exchange is likely to have significant implications for both the structure and the functioning of the global FX market. Policymakers will need to keep abreast of changes in this space. In some cases, this is happening through the involvement of policymakers in the Foreign Exchange Committees in various jurisdictions. Beyond that, policymakers should develop appropriate contacts and maintain a dialogue with (i) the various foreign exchange trading platforms, (ii) the prime brokerage service providers, and (iii) the algorithmic and high-frequency trading community in FX in order to track developments and to identify key policy issues in a timely fashion.

3.2 Related Local Studies

Some local researches have also been carried out in this field. Jalaee, et.al. (2006) examined the real exchange rate behavior and its effects on macro-economic variables in Iran during 1959 to 2004 by applying VECM including financial, monetary and foreign exchange variables. The results implied that monetary indices, foreign exchange policy and degree of open economy leave negative effects in short-run and positive effects in long-run on real exchange rate in Iran; whereas, financial indices have positive effects in short-run and negative effects in long-run on exchange rate behavior.

Bagheri (2007) in his research, titled "Analysis of Effective Determinants of Commercial Banks Profits" classified these factors in two internal factors, controlled by banks' management and external factors, out of their control. He estimated and analyzed effective determinants of profit in one of the commercial banks in Iran during 1983 to 2001. Findings showed that efficient cost management is one of the significant distributive for banks' profits. External factors such as economic growth and exchange rate fluctuations also leave positive effects on banks' profits; whereas, inflation rate has reverse, significant effect on their profits.

Abunoori, et.al. (2009) believe that stocks of holding companies and banks in Iran stock market may be changed

based on their foreign exchange reserves. Increase in foreign exchange may also be the result of imbalances, fundamental problems in economy, inflation, industrial raw material shortage, decrease in foreign exchange supply, economic sanctions and the public inclination for changing their cash to US Dollars or any other major currencies instead of Rials.

Regardless of the above studies, most of the researches both by local and international researchers concentrated on the effects of exchange rate on macro-economic variables, especially export and import, and there is a few empirical papers on the effects of exchange rate on banks' operations and profits; therefore, we attempted to deal with this subject to present possible solutions in predicting exchange rate changes and its effects on banks' foreign exchange reserves.

4. Methodology (Introducing Models and Variables)

The aim in this article is to examine the effects of exchange rate changes on the profits of Iranian banks both in short-run and long-run period. As profit would be the main aim of the profit making institutions, including banks, it is of high importance to grasp the concept of bank profit in their foreign exchange operations. Meantime, most of the bank foreign exchange income results from the commissions and fees of foreign exchange operations, so banks' managers need to investigate the effects of exchange rate changes (as the first variable in this research) on their foreign exchange reserves and income, contributing them to know how and to what extent they can take risk in their foreign exchange operations. So, foreign exchange profit is considered as the second variable in this research.

As US. Dollars is among the stable, major currency in the international market, we have applied USD as the base currency in banks foreign exchange operations in Iran during the research period.

Furthermore, in order to decrease the risk of exchange rate fluctuations in banking operations, it is critical to control banks' foreign exchange assets, liabilities and obligations and also their foreign exchange open position (short or long); therefore, banks' foreign exchange position and its equivalent in Rials, which are recorded in banks' ledgers is examined as the third variable in this research.

Error Correction Model has been introduced as one of the efficient model in investigating short-run relations and the long-run adjustment speed between variables. In some cases, economic enterprises may not be able to react quickly to new adjustments, so they cannot afford to adjust their decisions. Meantime, tremendous costs restrict immediate changes, even if predictions are totally correct.

The error correction term tells us the speed with which our model returns to equilibrium following an exogenous shock. It should be negatively signed, indicating a move back towards equilibrium, a positive sign indicates movement away from equilibrium. The coefficient should lie between 0 and 1, 0 suggesting no adjustment one time period later, 1 indicates full adjustment. The error correction term can be either the difference between the dependent and explanatory variable (lagged once) or the error term (lagged once), they are in effect the same thing.

The ECM models the short-run dynamics of the model. As with short-run models including lags, it can be used for forecasting. The coefficient on the error correction term can be used as a further test for co-integration. It is called the Bannerjee ECM test and requires a separate set of critical values to determine if co-integration has occurred. One of the simple forms of short-run model is as follows:

$$y_t = \alpha_0 + \gamma_0 x_t + \gamma_1 x_{t-1} + \alpha_1 y_{t-1} + u_t \tag{1}$$

In this equation, γ_0 shows the reaction of y_t to x_t in short term. The long-run model would be $y_t = \beta_0 + \beta x_t$, in which β indicate the reaction of y_t to the changes of x_t in long-run. In short-run equation, if the model comes to equilibrium, $y_t = y_{t-1}$ and $x_t = x_{t-1}$. So, we will have:

$$(1 - \alpha_1)y_t = \alpha_0 + (\gamma_0 + \gamma_1)x_t + u_t \tag{2}$$

$$\alpha_1 < 1 \, y_t = \frac{\alpha_0}{1-\alpha_1} + \frac{\gamma_0+\gamma_1}{1-\alpha_1} + x_t + \frac{u_t}{1-\alpha_1} xt + vt \tag{3}$$

$$y_t = \beta_0 + \beta x_t \tag{4}$$

Thus, long-run model can be deduced from short-run model.

Johansson Model is one of the general econometric models in determining long-run relations between the time series variables. The first requirement to use Johansson Model is the co-integration between all variables from 0 to 1.

Engle-Granger approach to co-integration (1987) suggested that this is essentially a bi-variant approach and is based on the Augmented Dickey-Fuller test for stationarity. If we have two non-stationary variables containing a unit root (i.e. I(1) variables), then we describe them as being co-integrated, if the error term is stationary (i.e. I(0)). We can test for the stationarity of the error term using the ADF test in the same way as the individual variables.

Co-integration between a set of economic variables would be the basis of using ECMs. These models are famous for showing the relation short-run changes of variables to their long-run equilibrium. ECM consists of two stages:

First Stage: In this stage a long-run relation is examined to ensure its reality, which means stationarity of error term in long-run relations. The general form of this model is as follows:

$$EPB_t = \beta_1\, EXR_t - \beta_2\, EXR_{t-1} - \beta_3\, Q_t + u_t \tag{5}$$

In this equation, (EPB) models banks' foreign exchange profit, (EXR) stands for exchange rate and (Q) is banks' foreign exchange open position. We expected that exchange rate increase resulted in increase in banks' profit during the research period and increase in banks' foreign exchange open position left positive effects on banks' profits. As expected, by the increase of exchange rate, the supply of foreign exchange would be increased to devaluate the rate.

Second Stage: In this stage error lag of long-run relation is applied as the coefficient of error correction to deduce the following equation:

$$\Delta EPB_t = \alpha_1 + \alpha_2\, \Delta EXR_t + \gamma\, U_{t-1} + \varepsilon_t \tag{6}$$

$$\Delta EPB_t = \alpha_1 + \alpha_2\, \Delta EXR_t + \gamma\,(EPB_{t-1} - \beta_1\, EXR_{t-1} - \beta_2\, EXR_{t-2} - \beta_3\, Q_{t-1}) + \varepsilon_t \tag{7}$$

One of the main problems in time series models is the non-stationary variables, resulting in false regression. In order to investigate the stationarity of the variables, there are different models, including Correlogram, Dickey-Fuller Test, Augmented Dickey-Fuller Test (ADF), and Phillips-Perron. In this paper, we have exercised Collerogram, Dickey-Fuller Test, and Augmented Dickey-Fuller Test (ADF) to examine stationarity of variables.

5. Analyses of the Model and Results

In order to examine the stationarity of the variables, we use correlogram test in the first stage, in which correlogram coefficient is about 0.74 at the first lag. As the number of lags decrease, this figure would be increased; thus, neither foreign exchange position nor exchange rate seems to be stationary, whereas, banks' foreign exchange profit is stationary, since correlogram value in different lags on the lagged level is almost zero. Dicky –Fuller test is applied to detect stationarity in time series model. The results of significant coefficients by over 98 pct has been presented in table 1, indicating that null hypothesis of having a unit root cannot be rejected at level of confidence for 90 to 95% and the variable is considered as non-stationary.

Table 1. Augmented Dickey-Fuller test statistic

Variable/t statistics	Computed t	t critical value at 0.01	t critical value at 0.05	t critical value at 0.10	Stationarity
Foreign exchange position	-2.84	-3.53	-2.9	-2.59	Non-stationary
Exchange rate	-2.56	-4.09	-3.47	3.16	Non-stationary
Foreign exchange profit	-9.75	2.6	-1.95	-1.61	Stationary

The results of Phillips-Perron test, presented in table 2 show that null hypothesis of having a unit root is rejected at the level of confidence for 95%, which is not compatible with those in correlogram and Augmented Dicky-Fuller tests; therefore, we can conclude that foreign exchange position is non-stationary in Phillips-Perron test.

Table 2. Phillips-Perron test statistic

Variable/t statistics	Computed t	t critical value at 0.01	t critical value at 0.05	t critical value at 0.10	Stationarity
Foreign exchange position	-2.65	-3.52	-2.9	-2.59	Non-stationary
Exchange rate	-3.91	-4.09	-3.47	3.16	stationary
Foreign exchange profit	-9.75	2.6	-1.95	-1.61	Stationary

As presented in table 2, absolute value of t statistics is more than the absolute value of t critical values, which means null hypothesis of having a unit root is rejected at level of confidence for 100%, i.e. foreign exchange profit is stationary on its lagged level. The statistics of these three test are summarized in table 3.

Table 3. Stationarity test statistic

Variable/t statistics	Correlogram	ADF	Phillips-Perron
Foreign exchange position	Non-stationary	Non-stationary	Non-stationary
Exchange rate	Non-stationary	Non-stationary	Stationary
Foreign exchange profit	Stationary	Stationary	Stationary

The results of optimum lag are displayed in table 4. Based on three statistics of HQC, SBC and AIC, optimum lag is 1, as it would be in DW statistics. It should be noted that coefficients of second and third lags are not significant at the level of confidence for 95%.

Table 4. Optimum lag test statistic

	HQC	SBC	AIC	DW
One lag model	46.52410	46.58169	46.48608	2.200804
Two lag model	46.54386	46.62131	46.49283	2.206186
Three lag model	46.59487	46.69253	46.53064	2.222067

In order to examine long-run relations between exchange rate and bank profits, we have used exchange rate, one lag exchange rate and net foreign exchange position. The results explain that both exchange rate and one lag exchange rate are significant at the level of confidence for 100%, whilst foreign exchange position is significant at the level of confidence for 96%. R_2 and adjusted R_2 is 0.74, which is appropriate for this model and reveals that the selected variables can cover foreign exchange profit in long-run for 74%. This can be clarified in the form of the following equation:

$$PROFIT = 30,317,965.45*EXR - 30,402,769.74*EXR\ (-1) + 25.4*Q$$
$$t:\qquad [13.75]\qquad\qquad [-13.77]\qquad\qquad [2.13] \tag{8}$$

Based on this equation, we can conclude that by the increase of one unit of exchange rate, foreign exchange profit is increased for IRR 30,317,965 in long-run, if other conditions remain unchanged. As expected, foreign exchange position leaves positive effects on foreign exchange profit, i.e. one unit increase of net foreign exchange position leads to 25.4 units increase in bank foreign exchange profit in long-run. Meantime, exchange rate of the previous period has negative effects on bank foreign exchange profit. This means the behaviour of bank foreign exchange profit is variable in line with the changes in exchange rate, which is a symbol of Explosive Equilibrium.

Considering t statistics and level of confidence, we conclude that exchange rate changes and error correction are significant at the level of confidence for 100%. R_2 and adjusted R_2 are about 0.69 which is appropriate for this model. Furthermore, DW statistics show that there is no correlogram in this model. In general, short-run relations between exchange rate and bank foreign exchange profit can be summarized as follows:

$$D(PROFIT) = 43,184,683.4*D(EXR) - 1.23*ECM(-1)$$
$$t:\qquad [11.56]\qquad\qquad [-5.9] \tag{9}$$

According to this model, we can conclude that by the increase of one unit of exchange rate, foreign exchange profit is increased for IRR 43,184,683 in short-run, if other conditions remain unchanged.

The most important point in this model is the error correction coefficient, which is more than 1. Error correction coefficient of 1.23 indicates that 123% of the short- and long-run error is adjusted during a period, i.e. the whole error of the previous period plus 23% of the new error is adjusted by opposite sign, which is called Explosive Equilibrium. In general, it states that adjustment process of foreign exchange profit from short-run to long-run is unstable, until short- and long-run equilibrium are overlapped. It is expected that by a sudden shock in exchange rate, bank foreign exchange profit comes to long-run equilibrium after a period of $\frac{1}{0.23} = 4.35$.

6. Conclusion and Recommendations

Based on the result of the present research, we can come to this conclusion that despite non-stationarity of exchange rate and foreign exchange profit, there is co-integration between these two variables. Meanwhile, there is a significant, stationary model for the short- and long-run behavior of exchange rate and its effects on bank foreign exchange profit. In addition, the effect of exchange rate changes on foreign exchange profit in short-run is more than the one in long-run. Error correction coefficient is 1.23 and the required time to reach long-run equilibrium would be 4, when short- and long-run equilibriums are overlapped.

In consideration of these findings, we recommend all researchers and students to initiate more precise research to investigate exchange rate behavior to find better solution for predicting changes in exchange rate, contributing bank managers and other financial and credit institutions to take better decisions in liquidity management and gain maximum profit.

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