Study of Exchange Market Pressure and the Central Bank's Direct Intervention
In Exchange Market in Periods of Shortage and Abundance of Oil Revenues

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Abstract
The purpose of this study is to investigate the situation of foreign exchange market pressure and the effect of domestic and foreign variables on it and to investigate the direct intervention of the central bank in the foreign exchange market in two periods of shortage and abundance in oil revenue. For this purpose, using the VECM and quarterly data of Iran-US economy from 1990.1 to 2017.4, exchange market pressure index and central bank direct intervention index were calculated and the manner of the direct intervention of the central bank in each season in the foreign exchange market was determined. Then, using the VAR model, the effect of domestic and foreign variables on the exchange market pressure index was investigated. The results show that firstly, the predominant situation of the foreign exchange market in the period of shortage in oil revenue is appreciation in the exchange rate, and in the period of abundance in oil revenue is depreciation in the exchange rate. Secondly, the Central Bank has tried to reduce the supply surplus created in the foreign exchange market and prevent the exchange rate from depreciating during the period of abundance in oil revenues by leaning against the wind interventions and purchasing foreign exchange. Third, in the period of abundance in oil revenue compared to the period of shortage in oil revenue, the relationship among the factors affecting exchange rate fluctuations and the exchange market pressure index has decreased. Therefore, the exchange rate is expected to jump in the long run.
Keyword: Oil Revenues; Exchange Rate; Exchange Market Pressure, Direct Intervention in Exchange Market.

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1. Introduction

In developing countries (with high exchange rate pass-through and limited access to international financial markets), the fear of floating is one of the main reasons which is preventing them to achieve a free float exchange rate regime (Jalali Naini, 2015). Therefore, to stabilize the economy, central banks usually intervene in the foreign exchange market to reduce the nominal exchange rate fluctuations. In economic papers, Exchange Market Pressure (EMP) index is used to express the situation of exchange market and The Direct Intervention index is used to evaluate how central banks intervene in the exchange market.

First, Girton and Roper (1977), according to the monetary approach to the balance of payment, defined EMP. EMP is the sum of changes in the exchange rate and the central bank's foreign reserves with equal weights. Then, Waymark (1995) proposed the more overall definition:

"Exchange market pressure measures the total excess demand for a currency in international markets as the exchange rate change that would have been required to remove this excess demand in the absence of exchange market intervention, given the expectations generated by the exchange rate policy actually implemented."

$$EMP_t = \Delta e_t + \eta \, \Delta f_t \tag{1}$$

$$I_t = \frac{\eta \, \Delta f_t}{EMP_t} \tag{2}$$

Direct intervention of central bank is the share of central bank intervention in Exchange Market Pressure. Overall, $I_t \in [0, 1]$, but if:

1. $I_t < 0$ is meaning that policy authority actively depreciates (appreciates) the domestic currency with respect to its free float value and the exogenously generated excess demand for domestic currency is negative (positive). In this case, intervention by the policy authority magnifies the exchange rate change generated by private market forces. This sort of policy might be thought of as "leaning with the wind".
2. $I_t > 1$ is meaning that the exchange rate is observed to move in the opposite direction to that which would have occurred in the absence of intervention. In this case, the policy authority actively depreciates (appreciates) the domestic currency with respect to its free float value, when the exogenously generated excess demand for domestic currency is positive (negative). This sort of policy might be thought of as "leaning against the wind".

In this paper, regarding the Lucas critique and using oil revenue as a state variable of Iran's economy, two periods of shortage and abundance are considered. Then, using the Weymark model, EMP and direct intervention of the Central Bank of Iran (CBI) are calculated and the effect of domestic and foreign variables on the EMP index were investigated.

2. Literature Review

Abtahi amd Amrollahi Bioki (2019) analyzed the dynamic reaction of the exchange market pressure (EMP) to different states of the foreign exchange market and inflation in the Iranian economy during 1988:4-2017:4. By considering inflation as the threshold variable and using Threshold Vector Autoregressive (TVAR) model, the results showed inflation had significant effects on EMP only in a high inflation regime. The results of the Granger Causality Test showed that only when the EMP switched to a high regime, the inflation would have a significant impact on the EMP. EMP in low inflation regimes could also affect inflation while EMP was not the cause of inflation in high inflation regimes.

Mamipour and Jafari (2017) investigated the factors affecting on EMP in Iran's economy. They used Markov switching model with time varying and fixed transition probability. At first we estimated behavior of exchange rate using single variable markov swiching model with fixed transmission probability during the period of time 1984-2014 and then analyzed affecting factors on exchange market pressure within framework of possibility of changing transfers during time. Results show that the changes of exchange reserves decrease the probability of staying in the depreciation regime of national currency and increase the probability of transition from appreciation regime to depreciation regime.

Siklar and Akca (2020) determined the relationship between monetary policy and EMP in Turkey for the 2002–2018 period with monthly data using Girton and Roper. They set up a VAR model and a Granger causality to analyze the relation between EMP and monetary policy. Regarding to Granger causality test results, there is a unidirectional causality running from domestic credit expansion to EMP and from domestic credit expansion to interest rate differential while there is a bidirectional causality between EMP and interest rate differential.

3. Theoretical Framework

In this article, Using Bai-Perron (1980) method, the Oil revenue as state variable of Iran Economy, two periods are distinguished. Eqs. 3 and 4 is referring to the periods of shortage and abundance in oil revenues respectively.

$$loil\_sa_t = c_0 + c_1 loil\_sa_{t-1} + \varepsilon_t \tag{3}$$
$$loil\_sa_{t'} = c_2 + c_3 loil\_sa_{t'-1} + \varepsilon_{t'} \tag{4}$$

For each period, according to Weymark (1995), EMP were calculated for each season. Considering small open economy, Weymark set up a model as follows:

$$m_t^d = p_t + b_1 y_t - b_2 i_t + v_t \qquad b_2 \, \text{و} \, b_1 > 0 \tag{5}$$

$$p_t = a_0 + a_1 p_t^* + a_2 e_t \qquad a_2 \, \text{و} \, a_1 > 0 \tag{6}$$

$$i_t = i_t^* + E_t \, e_{t+1} - e_t \tag{7}$$

$$\Delta m_t^s = \Delta d_t + \Delta f_t \tag{8}$$

$$\Delta f_t = \frac{[\, h_t f_t - h_{t-1} f_{t-1}]}{M_{t-1}} \tag{9}$$

$$\Delta d_t = \frac{[\, h_t d_t - h_{t-1} d_{t-1}]}{M_{t-1}} \tag{10}$$

In eq.5, Money demand is dependent on domestic CPI, GDP and domestic interest rate. In eq.6, domestic CPI was influenced by foreign CPI and exchange rate as well, but purchasing power parity did not necessarily hold. In eq.7, Foreign and domestic interest rates are linked through an uncovered interest parity condition. Asterisks were used to denote the foreign counterparts of the relevant domestic variables. In eq.8, Change in money supply is depending on the change in domestic credit and in foreign exchange reserves. Money multiplier in period t, h_t , and M is the inherited money stock level. All the variables except Δf_t , Δd_t are in logarithmic form. Regarding $\Delta m_t^s = \Delta m_t^d$, Then:

$$\Delta e_t = \frac{-[\, a_1 \Delta p_t^* + b_1 \Delta y_t - b_2 \Delta i_t^* - \Delta d_t + \Delta f_t - b_2 \Delta E_t \, e_{t+1} + \Delta v_t]}{(a_2 + b_2)} \tag{11}$$

$$\eta = \frac{-1}{(a_2 + b_2)} \tag{۱۲}$$

Therefore, using eqs. 5 and 6, η for each period is estimated. EMP and the direct intervention of CBI are also calculated for each quarter.

4. Description of Data and Methodology
4.1 Data

The data used in this paper are between 1990q1 to 2017q4 and include oil revenue, liquidity (M2), CPI, GDP, domestic interest rate, exchange rate, US CPI, US GDP, US interest rate, oil revenue (constant 2010 US. dollar).

4.2 Methodology

To estimate eqs.5 and 6, we set up a VECM. Then, η for each period and subsequently EMP and the direct intervention of CBI for each quarter are calculated. Finally, using the VAR model, the effect of domestic and foreign variables on the exchange market pressure index was investigated. VAR model was set up using US GDP and Interest rate, oil revenue (constant 2010 US. dollar) and GDP, interest rate and EMP. Structural shock decompositions is as follows:

$$
\begin{bmatrix} u_{wgdp} \\ u_{wi} \\ u_{oil} \\ u_{ir} \\ u_{gdp} \\ u_{EMP} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ \alpha_{21} & 1 & 0 & 0 & 0 & 0 \\ \alpha_{31} & \alpha_{32} & 1 & 0 & 0 & 0 \\ \alpha_{41} & \alpha_{42} & \alpha_{43} & 1 & 0 & 0 \\ \alpha_{51} & \alpha_{52} & \alpha_{53} & \alpha_{54} & 1 & 0 \\ \alpha_{61} & \alpha_{62} & \alpha_{63} & \alpha_{64} & \alpha_{65} & 1 \end{bmatrix} * \begin{bmatrix} \varepsilon_{wgdp} \\ \varepsilon_{wi} \\ \varepsilon_{oil} \\ \varepsilon_{ir} \\ \varepsilon_{gdp} \\ \varepsilon_{EMP} \end{bmatrix}
$$

5. Conclusion

The most notable conclusions of this study can be summarized as follows:

1. the predominant situation of the foreign exchange market in the period of shortage in oil revenue is appreciation in the exchange rate, and in the period of abundance in oil revenue is depreciation in the exchange rate
2. The CBI has tried to reduce the supply surplus created in the foreign exchange market and prevent the exchange rate from depreciating during the period of abundance in oil revenues by leaning against the wind interventions and purchasing foreign exchange.
3. in the period of abundance in oil revenue compared to the period of shortage in oil revenue, the relationship among the factors affecting exchange rate fluctuations (specially the foreign factors) and the exchange market pressure index has sharply decreased. Therefore, the exchange rate is expected to jump in the long run.

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