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**Effectiveness of Monetary Policy under Different Levels of Capital Flows for  
an Emerging Economy: Turkey**

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## **Effectiveness of Monetary Policy under Different Levels of Capital Flows for an Emerging Economy: Turkey**

### **Abstract:**

This paper assesses the effect of tight monetary policy on economic performance under different levels of capital flows. Empirical evidence from Turkey between 1990 and 2013 suggests that tight monetary policy measured with a positive innovation on interest rate appreciates the Turkish Lira (TL) and decreases output and prices. However, the effectiveness of monetary policy decreases for interest rate and increases for exchange rate and prices if capital flows are high. Specifically, interest rate, local currency value of foreign currency, and prices will be lower for higher levels of capital flows. However, the relative effectiveness of monetary policy on output is virtually unchanged.

JEL Codes: E52; F21; F32; and F41.

Key Words: Monetary policy; Capital flows; and Interacted VAR.

## 1. Introduction

With the financial market globalization, especially in the post-2008 era, the role of capital flows has become more important. Despite the well-documented benefits of capital flows, high levels offer a set of challenges to policy makers, such as limiting policy makers' influence. For example, with higher levels of capital flows, central banks have less power to influence national liquidity such as domestic money supply, and thus a country's economic performance (see, for example, Giannoni and Boivin, 2008; Belke and Rees, 2009; Devereux and Yetman, 2013). The purpose of this paper is to provide empirical evidence on how the effect of monetary policy on economic performance changes with different levels of capital flows for a small open economy, and directly assesses that evidence by using the innovative interactive vector autoregression (IVAR) model for Turkey.

Central banks' toolboxes commonly include methods such as adjusting short-term interest rates, non-borrowed reserves, the reserve requirement, and the discount rate to affect economic performance. In this paper we consider that short-term (overnight) interbank interest rate is a policy tool for the Central Bank of the Republic of Turkey (CBRT). However, changing the policy rate provides extra liquidity to the system through capital flows, and the same amount of interest rate may change the effect of interest rates on economic performance under higher/lower levels of capital flows and higher levels of liquidity. Thus, the effect of the same level of interest rate will have a different effect on economic performance if capital flows are higher versus lower. Following Christiano et al. (1999) in general and Berument (2007) for Turkey, we employ the VAR methodology to identify monetary policy with the innovations policy variable. The existing literature on the effect of monetary policy on economic performance for different levels of capital flows uses methods such as the factor-augmented VAR (for example, Giannoni and Boivin, 2008; Belke and Rees, 2009; Belke and Rees, 2014) and general equilibrium models (for example, Devereux and Yetman, 2013). This paper, however, employs the IVAR method, a novel and more direct form of capturing the differentiated effect, and uses data from Turkey.

The method of using the interacted variable on impulse responses within a VAR model framework was developed by Towbin and Weber (2010). They analyze the transmission of real external shocks to the domestic economy under fixed and flexible exchange rate regimes. Since then, IVAR models have been used in the literature for various altering relationships. Sa et al. (2011) estimate a panel VAR for a sample of OECD countries and identify monetary policy and capital inflows shocks using sign restrictions. To explore how these effects change with the structure of the mortgage

market and the degree of securitization, they use an interacted panel VAR (IPVAR) to exploit the time variation in a mortgage-backed securities index. Wieladek and Lanau (2012) study the effect of financial regulation on current account adjustment by also applying an IPVAR model. Aastveit et al. (2013) modify their IPVAR and explore whether economic uncertainty alters the macroeconomic influence of monetary policy.

To assess the altering effect of monetary policy under different levels of capital stocks, we gather data from Turkey. There are various reasons for using Turkish data: (a) Turkey is a small and open economy and has not significantly re-regulated its capital account since its liberalization in 1989. Thus, economic variables of interest respond to policy variables under different levels of capital flow levels. (b) Due to its young population as well as its high and volatile growth, Turkey needs capital flows. Thus, the capital flow variable is important and volatile, and this high volatility decreases the possibility of Type-II error (not rejecting the null when it is false). (c) Turkey is a relatively big economy and is ranked seventeenth globally for largest nominal GDP and fifteenth for largest GDP by Purchasing Power Parity (IMF, *World Economic Outlook* 2012), which itself makes studying Turkey interesting.

The paper continues as follows: Section Two introduces the econometric methodology. Section Three discusses the data set. Section Four discusses the empirical evidence from Turkey. Section Five concludes.

## 2. Methodology

We employed the IVAR model to capture the effect of a contractionary monetary policy on economic performance under different capital flow conditions. The model we use is a modified version of Saborowski and Weber's (2013) IPVAR specification;  $Y_t$  is a  $q$ -variable vector of the explanatory variables and  $X_t$  stands for the interacted variables. Our IVAR( $p$ ) model can be represented as:

$$A_0 Y_t = C + \sum_{k=1}^p A_k Y_{t-k} + D X_t + \sum_{k=1}^p B_k X_t Y_{t-k} + u_t, \text{ where } t = 1, 2, \dots, T. \quad (1)$$

Vector  $Y_t$  is comprised of interest rate, exchange rate, industrial production, and prices.  $X_t$  is for capital flow measures. We consider an interacted variable as one that influences the dynamic relationship among the endogenous variables in  $Y_t$ .  $X_t Y_{t-k}$  is the interaction term.  $C$  is the  $q$ -vector of the intercept. Vector  $C$  also includes 11 monthly dummies for seasonality, as well as intercept dummies for 1994:03, 1994:05, 2000:12, and 2001:02 – the Turkish financial crises periods.  $A_k$ ,  $B_k$ , and  $D$  comprise the  $qxq$  matrix of coefficients.  $u_t$  stands for the  $q$ -vector of residuals.  $p$  is the lag order.  $A_0$  is a lower triangular  $qxq$  matrix with ones on the main diagonal. To be able to make

inferences, the impulse response functions are gathered at different levels of  $X_t$ . Later, we compare these impulse responses for a shock given to elements of the  $u_t$  vector to understand how the different levels of  $X_t$  will affect the behaviors of  $Y_t$  in that scenario.

### **3. Data**

To construct an IVAR model, we use monthly data from January 1990 to September 2013. Our  $Y_t$  vector includes the interbank overnight interest rate as interest, the domestic currency value of 1 US dollar as exchange rate, industrial production as output, and the consumer price index as prices. All these variables except for interest rate are used in their logarithms. We use portfolio investment and current account deficit as a measure of capital flows. These two variables are deflated with the lag values of the interpolated monthly GDP to standarize them. We use this lag value to eliminate the effect of capital flows on GDP. All data is gathered from the CBRT's electronic data delivery dystem (EDDS) and the interest rate data is supplemented with overnight interest data from the EDDS and Borsa İstanbul (BIST) databases after 2000. Appendix A, Table 1 provides the definitions and sources of the variables.

### **4. Empirical Evidence**

Before discussing the empirical results of our IVAR model, we briefly elaborate on the expected responses of the macroeconomic variables to monetary contraction. Here, a contractionary monetary policy is associated with a positive shock to interest rates. Such a policy for a given expected inflation rate will lead to a nominal appreciation of the domestic currency. A tight monetary policy also decreases prices and not increases the output level (see, for example, Kim and Roubini, 2000 and Berument, 2007).

Note that the source of appreciation is the change in excess supply of foreign exchange. The two main sources of that change are capital inflow and domestic residents' demand for foreign exchange. For the latter, under higher levels of capital flows, appreciation will be higher and price decreases will be greater due to the higher degree of exchange-rate pass-through. Regarding the effect of tight monetary policy on output under higher capital flows is a more complicated issue. On one hand, when local currency appreciates, it decreases the competitiveness of domestically produced tradable goods, and thus net export, and ultimately decreases output (see, for example, Cordero and Montecino, 2010). However, due to factors such as low import input prices, investment goods, the domestic value of foreign currency, and denominated liabilities, appreciation boosts the economy (see Kamin and Rogers, 2000). Berument and Pasaogullari (2003) provide empirical evidence for the latter from Turkey. Thus,

under higher levels of capital, the effect of monetary policy will be greater on appreciation and prices while the effect of appreciation on output will likely be ambiguous.

Identifying monetary policy is not an easy task. The monetary authority determines its policy tool by considering the state of the economy as well as its own intention to set up monetary policy changes. To identify a monetary policy stance, by following Christiano et al. (1999) and the reference cited therein, we specify a VAR model and employ the Cholesky decomposition. Here, the order of the variables is important: The first variable cannot respond to contemporaneous shocks (within the monthly) of any other variables, and the second one can respond to contemporaneous shocks affecting the first variable but not to any others. Our variables' order, then, proceeds as interest rate, exchange rate, industrial production, and prices. We also use two different series as the interaction term: hot money (portfolio investment deflated with the lag value of the interpolated GDP<sup>1</sup>) and current account (current account deflated with the lag value of the interpolated GDP). The exchange rate, industrial production, and price variables enter the system in their natural logarithms. To account for seasonality we include 11 monthly dummies, and to account for financial crises we include intercept dummies.

Figure 1 reports the impulse responses for six periods when a one-standard deviation shock is given to interest rate for interest rate, exchange rate, industrial production, and prices. Here, we use portfolio investment as the interaction term. In the first three columns, the middle line shows the estimates and the other two lines show the bootstrapped confidence intervals at the 95% level, which are computed using 2000 replications. The fourth column shows the estimates of these three different conditions together for each variable. In the first column we set capital flows to zero. In the second column capital flows were equal to the tenth percentile, and in the third column they were equal to the ninetieth percentile.

[Insert Figure 1 about here]

A contractionary monetary policy shock under no capital flows decreases industrial production and prices and appreciates domestic currency. The second column of Figure 1 displays impulse responses when there are capital flows at the tenth percentile. A contractionary monetary policy decreases exchange rate (appreciation), industrial production, and prices similarly. However, the effects of interest rate and prices increase up to three periods (in a statistically significant fashion) when capital flows are higher. The effect of rate increases on output is almost identical when there are capital inflows. The third column repeats the exercise when capital outflows are at the ninetieth percentile. Similarly, a contractionary monetary policy decreases exchange rate, industrial production, and prices. However, the effects of interest rate and prices decrease when capital flows are lower/when there are capital outflows. The effects of interest rate shock are qualitatively similar to the first two columns. When we compare these

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<sup>1</sup> We deflate the portfolio investment with the lagged (rather than current) value of the interpolated GDP to avoid simultaneity bias.

three impulse responses in column four, we observe that (a) a shock to interest rate is less persistent, (b) the effect on exchange is higher, (c) the decrease in prices is more when capital inflow is higher, and (d) the effect of interest rate on output is similar across the three impulse responses functions. Thus, the effect of interest rate on all variables but output is higher under capital inflow.

Identifying monetary policy with the VAR methodology is often criticized due to the well-established puzzles that impulse response functions produce, such as price, exchange rate, and liquidity (Sims, 1992; Grilli & Roubini, 1995; Kim & Roubini, 2000). If a contractionary monetary policy results in prices increasing rather than decreasing (i.e., against expectations), a price puzzle is observed. When a contractionary monetary policy results in a depreciation of the local currency rather than an appreciation, an exchange rate puzzle is observed. When a contractionary monetary policy increases rather than decreases monetary aggregate, a liquidity puzzle is observed (Leeper and Gordon, 1992). In our analysis, all the variables respond to a contractionary monetary policy shock in such a way that they do not produce the above puzzles.

Trade flows may also affect monetary policy. Thus, we repeat the exercise with current account deficit (see Figure 2). The initial impacts of positive innovation on interest rate for interest rate, exchange rate, and prices are similar to those reported in Figure 1. Moreover, as in Figure 1, a decrease in all the variables except industrial production is bigger when there are capital inflows than when there are capital outflows or a balanced current account deficit. When impulse responses are examined carefully, it seems that a tight monetary policy depreciates currency and increases prices in the long run when there are capital outflows. However, this does not prevail in capital-inflow or no-capital-inflow cases.

[Insert Figure 2 about here]

### **Caveats**

This paper overlooks the effects of monetary policy on capital flows. Rather, capital flows are treated as an exogenous variable when impulse responses are gathered. Figure 3 reports the capital flows-GDP ratio and the overnight interest rate in terms of its return in US dollars. The relationship seems negative rather than positive, which suggests that higher rates decrease rather than increase capital flows. Although this result appears counterintuitive, Turkey is small open economy and various other factors determine capital flows, such as political risk, world interest rates, etc. Thus, lower interest rates result in higher capital flows rather than higher interest rates doing so. Capital flows may thus be considered exogenous and can be used as an interactive term.

### **5. Conclusion**

Our aim in this paper has been to explore the effectiveness of a contractionary monetary policy under different capital flow conditions for emerging economies. Empirical evidence from



Turkey between 1990 and 2013 suggests that a positive innovation in interest rate appreciates the Turkish Lira and decreases output and prices. The effectiveness of monetary policy decreases for interest rates but increases for local currency and prices when capital inflows are higher. Specifically, interest rate, local currency value of foreign currency, and prices will be lower under higher levels of capital inflows, but the effectiveness of monetary policy on output is virtually unchanged. These findings have implications for monetary policy frameworks and for monitoring excessive imbalances. In particular, our analysis indicates that there is a strong relevance between capital flows and the effectiveness of interest rate as a monetary policy tool.

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## Appendix:

Table 1: Data Sources

Variable	Definition	Code	Source
GDP	Gross Domestic Product 1987-1997 1998-2013	TP.UR.G23.C TP.UR.GG01.C	CBRT, EDDS
Interest rate	Simple Interest Rate Weighted Average (%) (Overnight) between 1996 and 2000 from CBRT 2000-2013 from BIST	TP.PY.P06.ON	CBRT, EDDS, and BIST
Output	Industrial Production (2010=100) 1990/01-2000/04 2000/05-2004/12 2005/01-2013/12	TP.UR4.U01 TP.TSY01 TP.N2SY01	CBRT, EDDS
Prices	General Index, Consumer (1987=100, General Price Index (Consumer Price) (2003=100)	TP.FG.A01 TP.FG.J0: 0	CBRT, EDDS
Portfolio Investment	Gross Portfolio Investment, Balance of Payments Detailed Presentation, Monthly, USD	TP.OD.Q099: II-B2	CBRT, EDDS
Current Account Balance	Current Account, Balance of Payments Detailed Presentation, Monthly, Million USD.	TP.OD.Q001: I	CBRT, EDDS
US Dollar	USD/TRY Exchange Rate, Selling Prices	TP.DK.USD.S.YTL.1	CBRT, EDDS

Table 2: Descriptive statistics for current account balance and portfolio investment

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Observations
Current Account	-2.93682	-2.86922	8.990111	-15.57141	3.967494	-0.056639	2.844641	285
Portfolio Investment	1.018181	0.583252	14.289	-20.92895	3.823139	-0.817856	8.574963	285

Table 3: Correlations of current account balance and portfolio investment (percent of GDP)

	Current Account	Portfolio Investment
Current Account	1	
Portfolio Investment	-0.2707	1

Figure 1: Impulse responses for 1% interest rate shock under capital flows  
(Portfolio investment to GDP(-1)% ratio) with 95% confidence band

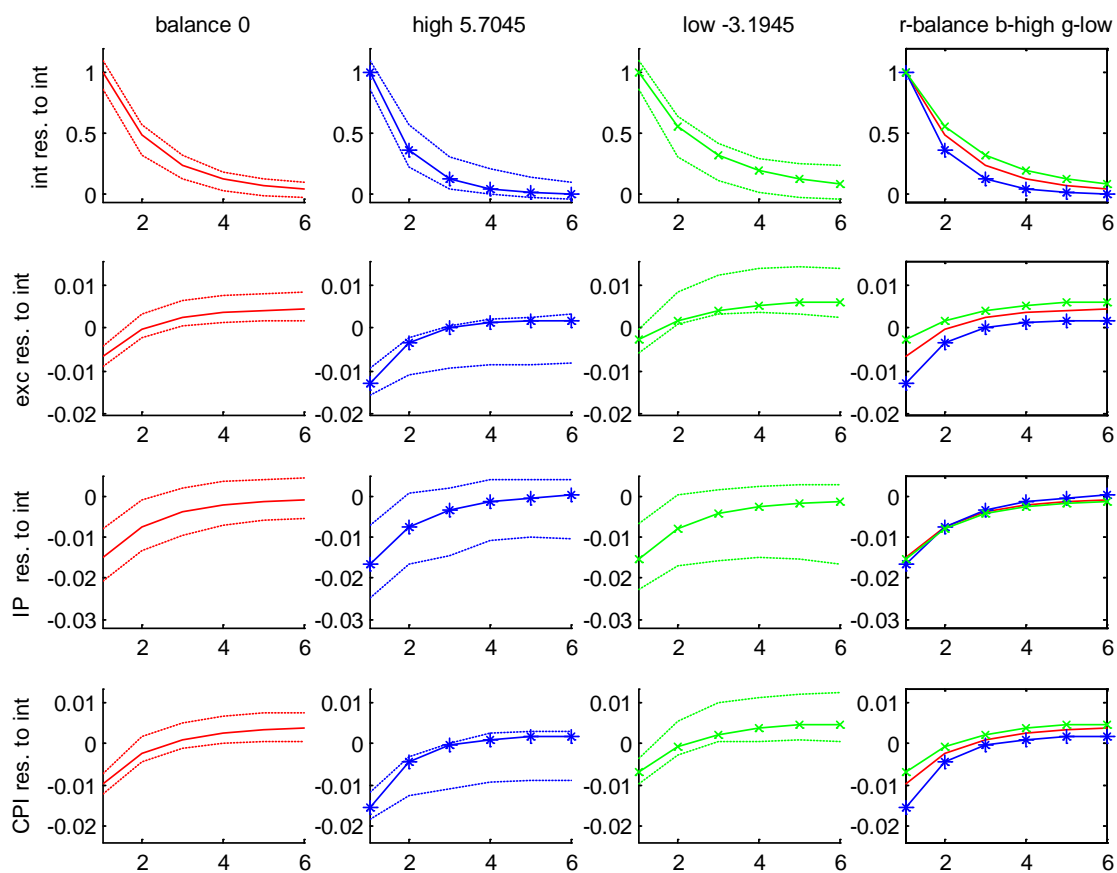


Figure 2: Impulse responses for 1% interest rate shock under current account  
(current account to GDP(-1)% ratio) with 95% confidence band

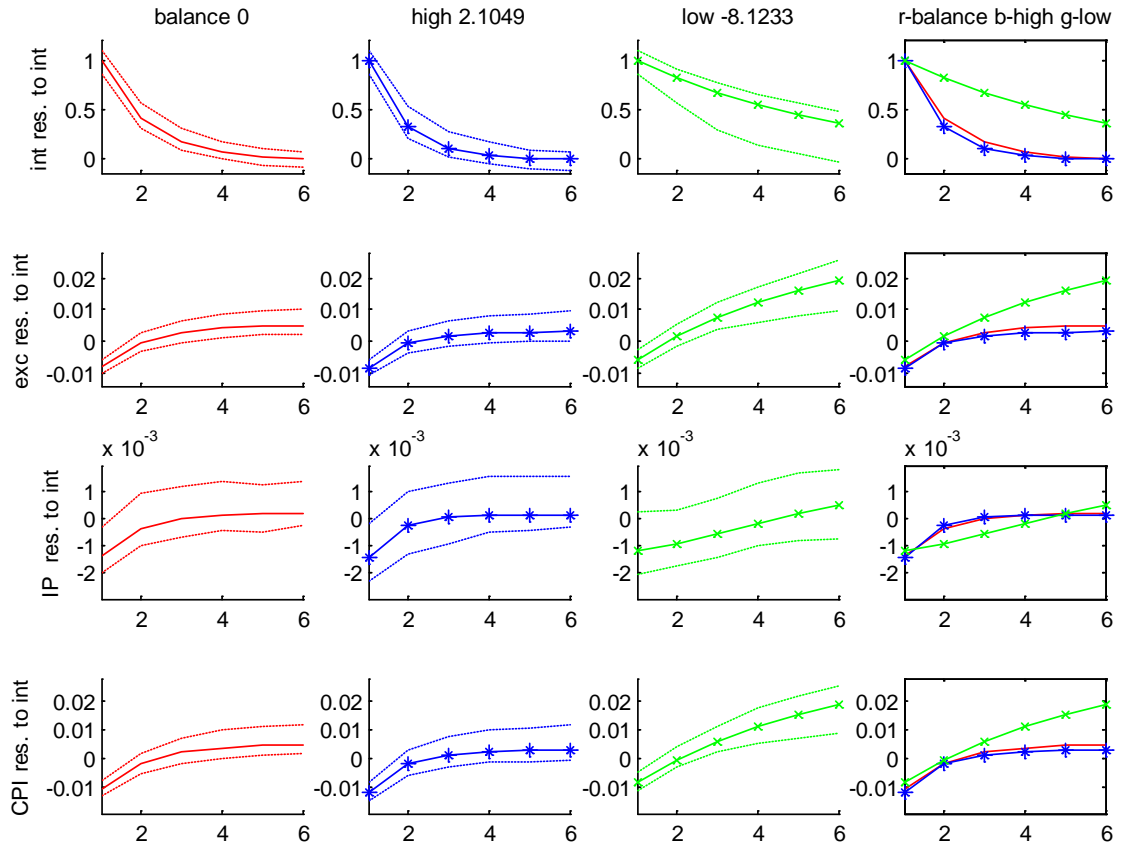


Figure 3: Capital Flow and Interest Rates

