The impact of foreign interest rate on the macroeconomic performance of Turkey

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THE IMPACT OF FOREIGN INTEREST RATE ON THE MACROECONOMIC PERFORMANCE OF TURKEY

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ABSTRACT

In this study, we examine the effects of a shock in foreign interest rate on the macroeconomic performance of Turkey. We use two different structural vector autoregression models (SVAR) and specify them differently for the pre and post 2001:6 period. Based on the results of the SVAR models we conclude that, for the period before 2001:6 a positive foreign interest rate shock appreciates the real exchange rate, decreases the inflation rate, the domestic interest rate and the income. This last effect occurs when the domestic interest rates are excluded from the model, but when they are included the effect on income is positive. After 2001:6, we find that the real exchange rate depreciates, the income decreases, the inflation rate, and the domestic interest rate increases; although this last effect is very small.

I. Introduction

The purpose of this paper is to evaluate the impact of foreign interest rates on the economic performance of a developing small open economy, namely Turkey[1]. Does an increase in foreign interest rate lead to an improvement or a deterioration in the macroeconomic performance of Turkey? These questions have long being discussed for the developed countries but to the best of author's knowledge, this is the first study that uses the data of a developing economy[2].

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[1] We would like to thank Dr. A. Hakan Kara for his outstanding supports and comments.
[2] See Kim (2001), and Kim and Roubini (2000) for an example of the studies on developed countries.

The motivation behind examining foreign interest rate effects is threefold. First, since Turkey is a small open economy, the state of the economy can be affected by policies in the rest of the world and foreign interest rates could be used as an indicator of foreign monetary policy. Within this context, Sims (1992) argues that shocks to foreign monetary policy are captured better with the othogonalized shocks to foreign interest rates rather than with the orthogonalized shocks to money aggregates. One of the most detailed studies in this context is the one by Kim (2001). Kim to analyze the international transmission of the U.S. monetary policy shocks on non-US G-6 countries mainly considers innovations in Federal Funds Rate as monetary policy shocks.

Second, shocks to capital account might be caused by shocks to the foreign interest rate. By examining the effects of foreign interest rate on the macroeconomy we could also capture the macroeconomic effects of capital flows, a topic which became especially important after the financial crises in Asia, Russia and Latin America casted doubts about the benefits of capital inflows. To analyze this topic, we could have used the capital inflow data itself but we believe that the capital inflow data is very volatile, not reliable and more importantly, depends on political decisions that could not be modeled. In fact, Berument and Dincer (2004) in their study have examined the effects of capital inflows on the macroeconomic performance of Turkey by using the logarithm of net international reserves of the Central Bank as a measure of the capital inflows.

Third, interest rates are one of the key economic indicators of the economic performance of a country. Therefore, examining the impact of foreign interest rate will allow us to analyze the effects of foreign countries economic performance on a domestic economy, here Turkey. Especially in an era of globalization, analyzing domestic country effects of foreign economic performance has become prominantly important. However, studies that analyze the effects of foreign economic performance usually use foreign output as an indicator of economic performance[3]. In particular, Berument and Kılınc (2004) have used industrial production of USA, Germany, and a harmonization of industrial countries to analyze the effects of foreign economic performance on Turkey.

To capture the effects of foreign interest rates on Turkey's economic performance, this paper applies an open economy structural vector auto-regression (SVAR) approach and uses the impulse response functions. Impulse response functions have traditionally been used as a means of analysing an estimated SVAR model (Hamilton, 1994). They respresent the dynamic response of a variable in the model to an error term (referred to as a shock or innovation) in one of the structural equations. Therefore identification of shocks that precipitate fluctuations in economic activity represents a major challenge.

In addition, our study covers the 2000 and 2001 financial crises. Turkey, at the begining of 2000, embarked on an ambitious exchange rate based disinflation program. With the Year 2000 Disinflation Program, the exchange rate regime was shifted from a managed float to a crawling peg

[3] See for example the studies by Schmitt-Grohe (1998) and Berument and Kılınc (2004.)

regime. With the implementation of this program, a remarkable growth in the GDP and decline in inflation were seen, but the real exchange rate began to appreciate that could be because of the differential between inflation and the preannounced change in the path of nominal exchange rates. However, after the banking and resulting liquidity crisis in November of 2000 and the serious attack on foreign exchange reserves in February of 2001, Turkish authorities decided to switch the exchange rate regime to a floating regime. Following the collapse of the crawling peg and subsequent devaluation, the authorities responded to the crisis by designing a New Economic Program announced in May 2001. With this new program and the floating exchange rate regime, the internal dynamics of the macroeconomy changed. We take this into account by specifying different models for the pre and post 2001:6 period. Thereby we can analyze if there is any change in the transmission mechanism of a foreign interest rate shock on the domestic economy.

This present paper is merely descriptive. Our aim is to present the impulse response functions resulting from a foreign interest rate shock. Comparing or contrasting the effects found in this paper and the effects predicted by theoretical models like Mundell-Flemming-Dornbusch or intertemporal optimizing models with sticky wage and/or sticky price is beyond the scope of this paper.

The paper is structured as follows. In the next section, we elaborate on the methodology. Section 3 presents the specification of the SVAR model and explains the method used for identification. Section 4 explains the block structure and the structural equations of the Turkish SVAR model. Section 5 explains the data, variables used and the estimation method. Section 6 discusses the empirical evidence obtained. Section 7 summarizes the results and concludes.

II. Methodology

To address the empirical effects of a change in foreign interest rates on the Turkish economy, this paper applies a structural vector auto-regression (SVAR) modeling approach. This approach will allow us to identify the channels through which foreign interest rate exerts an influence on the macroeconomic performance of the Turkish economy. The effects of foreign interest rate innovations on Turkish variables could be measured by using impulse response analysis.

The main point in our VAR model specification is to extend the standard methodology developed by Sims (1986) to our model of a small open economy. Within the context of this methodology, domestic variables, either contemporaneously or in lags, are allowed to affect the foreign variables. However, the main aim in this study is to identify the effects of foreign interest rate shocks from the viewpoint of a small open economy – Turkey and in this setting a domestic shock in a small open economy is less likely to have an affect on the foreign economy. Therefore, the small open economy context makes it necessary to impose block exogeneity.

The particular method we use to impose identifying restrictions is similar to that suggested by Cushman and Zha (1997) in their structural VAR model of Canada. The small open economy extension developed by Cushman and Zha is to impose two blocks of structural equations[4]. One block represents the international economy. The other block represents the domestic economy. Variables appearing in the domestic economy block are completely absent from equations in the international block. This follows naturally from the small open economy assumption of block exogeneity discussed above.

III. Model Specification

Starting with a general specification, we will try to explain the SVAR model of Cushman and Zha (1997) in detail. The approach used is to assume the economy is described by a structural form equation, ignoring constant and other deterministic terms, that is given by:

$$A(L)y(t) = \varepsilon(t) \tag{1}$$

In equation (1) y(t) is an $m\times1$ vector of observations, A(L) is a p^{th} order $m\times m$ matrix polynomial in the lag operator L with non-negative powers, such that $A(L) = A_0 - A_1L - A_2L^2 - \ldots - A_pL^p$ and $\varepsilon(t)$ is an $m\times1$ vector of structural disturbances. The coefficient matrix of L^0, A_0 is a non-singular matrix normalized to have ones on the diagonal and summarizes the contemporaneous relationships between the variables in the model contained in the vector y(t). The structural disturbance vector, $\varepsilon(t)$, is uncorrelated with past y(t-s) for s>0. The variance of $\varepsilon(t)$ is denoted by Ω, a diagonal matrix where elements are the variances of structural disturbances. The structural disturbances cannot be observed and must be inferred from the reduced form shocks.

Associated with the structural model given in equation (1) is the reduced form VAR which is estimated as;

$$B(L)y(t) = u(t) \tag{2}$$

where B(L) is a matrix polynomial in the lag operator L; u(t) is an $m\times1$ vector of serially uncorrelated reduced form disturbances; and $Var(u(t)) = \Lambda$. The relationship between the components of equations (1) and (2) are as follows:

$$B(L) = A_0^{-1}A(L) = I - B_1L - B_2L^2 - \ldots - B_pL^p \tag{3}$$

and

$$u(t) = A_0^{-1}\varepsilon(t) \tag{4}$$

Recovering the structural parameters of the VAR model specified by equation (1) from the estimated reduced form coefficients requires that the model is either just identified or over identified. In the structural VAR approach, A_0 can be any structure as long as it has sufficient restrictions.

There are several ways of specifying the restrictions to achieve identification of the structural parameters. One procedure is to use the restrictions implied by a fully specified macroeconomic model. An alternative procedure is to choose the set of variables and identification restrictions that are broadly consistent with preferred theory and prior empirical research.

[4] The details of the methodology is presented in Cushman and Zha (1997).

As stated above the method used in this paper is similar to that suggested by Cushman and Zha (1997). This is a more flexible method than the Choleski decomposition procedure originally suggested by Sims (1980). The general specification of the identified VAR model of Cushman and Zha (1997), which merely consists of partitioned matrices y(t), A(L) and $\varepsilon(t)$ of equation (1), is as follows:

$$y(t)=\begin{bmatrix} y_1(t) \\ y_2(t) \end{bmatrix}, A(L)=\begin{bmatrix} A_{11}(L) & 0 \\ A_{21}(L) & A_{22}(L) \end{bmatrix}, \varepsilon(t)=\begin{bmatrix} \varepsilon_1(t) \\ \varepsilon_2(t) \end{bmatrix}. \quad (5)$$

where $A_{11}(L)$ is $m_1 \times m_1$, $A_{12}(L)$ $m_1 \times m_2$, $A_{22}(L)$ $m_2 \times m_2$, $y_1(t)$ $m_1 \times 1$, $y_1(t)$ $m_2 \times 1$, $\varepsilon_1(t)$ $m_1 \times 1$, and $\varepsilon_2(t)$ $m_2 \times 1$ with $m_1 + m_2 = m$.

In equation (5), block exogeneity is represented by the $A_{12}(L)$ matrix being equal to zero. This means that the first block $y_1(t)$ is exogeneous to the second block $y_2(t)$ both contemporaneously and for lagged values of the variables. So, verbally, within the small open economy setting, $y_1(t)$ represents the international economy block and $y_2(t)$ represents the domestic economy block.

IV. Block Structure and Structural Equations

The Turkish economy SVAR model is composed of an international economy block and a domestic economy block. Due to the small open economy assumption made, variables appearing in the domestic economy block are absent from the international economy block. In the model that we specify here, the international economy block is only comprised of the foreign interest rate. In terms of the specification given in equation (5), y_1 = {foreign interest rate}. Throughout the study foreign interest rate will be denoted by *finr*. Within this specification the foreign shock that we are analyzing is the foreign interest rate. By setting $A_{12}(L)$ equal to zero in equation (5) we are ensuring that the foreign interest rate does not take any feedback form the domestic economy, but will certainly affect the domestic economy.

With regards to the domestic economy block, we have two different specifications. In the first specification $y_2 = \{\text{Real exchange rate, Inflation, Income}\}'$, whereas in the second specification $y_2 = \{\text{Real exchange rate, Domestic interest rate, Inflation, Income}\}'$. Throughout the study the real exchange rate, inflation, domestic interest rate, and income will be denoted by *rer, inf, dinr, y,* respectively.

Equations (6.1), and (6.2) summarise the first specification mentioned above taking into account the change in the exchange rate policy in 2001 and its effects on the contemporaneous relationships. In the same way, equations (7.1) and (7.2) summarize the second specification.

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} finr_t \\ rer_t \\ inf_t \\ y_t \end{bmatrix} = \begin{bmatrix} \Phi_{11}(L) & 0 \\ \Phi_{21}(L) & \Phi_{22}(L) \end{bmatrix} \begin{bmatrix} finr_{t-1} \\ rer_{t-1} \\ inf_{t-1} \\ y_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \end{bmatrix} \quad \text{before 2001:6} \qquad (6.1)$$

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 \\ a_{31} & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} finr_t \\ rer_t \\ inf_t \\ y_t \end{bmatrix} = \begin{bmatrix} \Phi_{11}(L) & 0 \\ \Phi_{21}(L) & \Phi_{22}(L) \end{bmatrix} \begin{bmatrix} finr_{t-1} \\ rer_{t-1} \\ inf_{t-1} \\ y_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \end{bmatrix} \quad \text{after 2001:6} \qquad (6.2)$$

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & a_{35} \\ a_{41} & a_{42} & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} finr_t \\ rer_t \\ dinr_t \\ inf_t \\ y_t \end{bmatrix} = \begin{bmatrix} \Phi_{11}(L) & 0 \\ \Phi_{21}(L) & \Phi_{22}(L) \end{bmatrix} \begin{bmatrix} finr_{t-1} \\ rer_{t-1} \\ dinr_{t-1} \\ inf_{t-1} \\ y_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \end{bmatrix} \quad \text{before 2001:6} \qquad (7.1)$$

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & a_{23} & 0 & 0 \\ a_{31} & 0 & 1 & a_{34} & a_{35} \\ a_{41} & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} finr_t \\ rer_t \\ dinr_t \\ inf_t \\ y_t \end{bmatrix} = \begin{bmatrix} \Phi_{11}(L) & 0 \\ \Phi_{21}(L) & \Phi_{22}(L) \end{bmatrix} \begin{bmatrix} finr_{t-1} \\ rer_{t-1} \\ dinr_{t-1} \\ inf_{t-1} \\ y_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \end{bmatrix} \quad \text{after 2001:6} \qquad (7.2)$$

In equations (6.1) and (6.2) $\Phi_{11}, \Phi_{12}, \Phi_{21}, \Phi_{22}$, are 1 ×1, 1×3, 3×1, 3×3 matrix polynomials in the lag operator L with non-negative powers, respectively. In equations (7.1) and (7.2) $\Phi_{11}, \Phi_{12}, \Phi_{21}, \Phi_{22}$, are 1 ×1, 1×4, 4×1, 4×4 matrix polynomials in the lag operator L with non-negative powers, respectively. Φ_{12} is equal to zero in both specifications because of the small open economy set up discussed before.

All of the SVAR models specified above are overidentified. In equation (6.1) there are 3 structural parameters to be estimated and in equation (6.2) there are 2, but the number of parameters to be estimated in Λ is 6 (n(n-1)/2). By the same way, in equations (7.1) and (7.2), there are 6 structural parameters to be estimated, but this time Λ has 10 parameters. Or if we put it in a different way, there are 9, and 10 restrictions on the A_0 matrix in equations (6.1), (6.2) but we needed only 6 for exact identification. In case of equations (7.1) and (7.2) the number of restrictions on A_0 is this time 14, but we needed only 10 for exact identification.

As we have stated before, we will use impulse response analysis to analyze the impact of foreign interest rate shocks on the domestic economy, and within this context the transmission of the shock will depend on the form of the structural equations. Using equations (6.1) to (7.2) we have specified the way the foreign interest rate shock will be transmitted to the rest of the economy. In the first specification, a shock to the foreign interest rate will have a contemporaneous impact on the real exchange rate, and the inflation rate, and an impact on these and income one period into the future, two periods into the future,…,etc. However, in the second specification, a shock to the foreign interest rate will have not only effect real exchange rate and inflation contemporaneously but also the domestic interest rate. Thereby, we have specified another channel through which the foreign interest rate can exert an influence on the domestic economy.

Also, we have specified different models for after and before 2001:6. This is mainly done to explore if there is any change in the transmission of the foreign interest rate shock on to the domestic economy after the adoption of the floating exchange rate regime on February 22 of 2001. We had to specify different models for after and before 2001:6 because the way the internal macroeconomic dynamics were specified was changed. Before 2001:6, real exchange rates had an important contemporaneous effect on the inflation rate, but with the new program (after 2001:6) this impact was removed. In addition, before 2001:6, real interest rates did not affect the real exchange rate contemporaneously, but after 2001:6 this was the case. Finally, real interest rates prior to 2001:6 were only affected by the real exchange rate contemporaneously but after 2001:6, real interest rates were influenced by the inflation rate and the output contemporaneously.

V. Data, Variables, and Estimation

The data set used to estimate the models includes observations from 1991:2 to 2004:12. However, when the real domestic interest rates are used in the second specification, the data set starts from 1995:1. The foreign interest rate data are from the IMF's International Financial Statistics (IFS) delivery system. The rest of the data are obtained from the Central Bank of the Republic of Turkey's data delivery system, except the domestic nominal interest rate, which is obtained from the State Planning Organization of Turkey. 'Rer' is the logarithm of the consumer price index based real effective exchange rate index, 'Inf' is the monthly percentage change in the consumer price index, 'Inc' is the private sector capacity utilization rate, and 'Dinr' is the real domestic interest rate calculated by using the consumer price index[5]. An increase in the real exchange rate index implies an appreciation. Here, as an income measure the private sector capacity utilization rate is used rather than the total sector capacity utilization rate because the capacity utilization of the government is more

[5] The inflation rate is calculated by using the formula $[(cpi_t/cpi_{t-1})-1]*100$. The real domestic interest rate is calculated by using the formula: $(1+i_r)= (1+i_n)/(1+\pi)$ where i_r is the monthly real interest rate, i_n is the monthly nominal interest rate, and π is the yearly inflation rate. The data for 2005 is obtained from the Central Bank's expectations inquiry.

likely determined by political decisions rather than current economic environment. We consider the capacity utilization rate of the private sector to be more representative of the economic conditions than the total capacity utilization.

In this paper, two foreign interest rate measures are used: the Federal Funds Rate (FFR), and the London Interbank Offer rates (LIBOR) on 1-month U.S. Dollar deposits. The U.S. rates were chosen to demonstrate the responses of the Turkish economy to the rest of the world. Turkey is clearly affected from U.S's macroeconomic policies and the relative value of its currency. We didn't use euro rates such as the Euribor because of data restrictions. The reason for using the FFR is that is one of the key instruments of the Central Bank of U.S. the Federal Reserve (FED) and therefore we have thought it would be a good indicator of both foreign monetary policy and foreign macroeconomic performance. We have also used LIBOR, because LIBOR has a tendency to increase parallel with FED's interest rate policy and will enable us to test the robustness of our findings

In performing the regression analysis a constant term and eleven monthly dummies to account for seasonality are also added to our model. In addition, depending upon the sample period considered, a dummy controlling for the April 1994 crises, and three dummy variables for controlling the November 2000 financial crisis and February 2001 financial crises in 2000:11, 2001:2, and 2001:3 are also added to our model. All the variables used here enter into the VAR specification in logarithmic level variables except the interest rates and the inflation rates.

The selection of lag length was done using a testing down approach based on the likeli hood ratio (LR) test, the Akaike Information Criteria (AIC), and the Schwartz Bayesian Criteria (SBC). We, initially, see if, at least two of them agree upon a lag length. If there is no agreement, then we use the Ljung-Box (LB) Q-statistic to check for autocorrelation at the candidate lag lengths, and choose the lag length for which there is no (or at least less) autocorrelation. Since the data is monthly, we started with a maximum lag length of 12 and obtained the information criteria and the LR tests such that the variable lags ran first from 12 to 3 in steps of minus 3 and second from 12 to 2 in steps of minus 2. Finally, depending upon our choice in these tests, we performed a final test starting with that lag length and running in steps of minus one this time.

According to the procedure described above, the lag length for the VAR is chosen to be 4 for the first specification and for the first sub sample (before 2001:6). This choice didn't change when 'FFR' or 'LIBOR' was used as the foreign interest rate. Also the LB Q-statistic suggested the reduced form VAR with four lags was absent of autocorrelation. For the same specification but this time with the second sub sample (after 2001:6), the order of the VAR was again chosen to be 4, but this time some lags between 4 and 1 were statistically insignificant and there was an autocorrelation problem at this lag, so we re-estimated the reduced form VAR this time with lag lengths of 5, 3 and 2 and chose the lag length to be 2. But, for comparison purposes we have also calculated the impulse responses for this sub sample using the VAR(4) model.

When the same lag lengt test procedure was applied to the second specification and the first sub sample (before 2001:6), the first lag for which the two criteria agreed upon was 5 but when also the lags between 5 and 2 were tested they were found to be statistically insignificant. When the LB Q-statistic was computed the reduced form VAR with five lags and two lags had autocorrelation but the autocorrelation was much severe for the model with five lags, so for this sample period 2 was chosen as a lag length. The results did not change with the use of FFR or LIBOR as the foreign interest rate measure. For the same specification, but this time with the second sub sample (after 2001:6), the order of the VAR was chosen to be 2. As the lag order above 2 was considered, even if it is not statistically significant, some puzzling responses were present. This may mean that the results presented in this paper are not robust against alternative specification. Alternatively, it may mean that because of the narrow time span used in this second specification, the high lag order over-specified the model.

Given these considerations, the reduced from VAR's were estimated with 4 and 2 lags for the first specification, and 2 for the second specification using the Seemingly Unrelated Regression (SUR). SUR estimators were used because the inclusion of zero restrictions on some lagged variables renders ordinary least squares estimators inefficient.

The contemporaneous matrices given in equations (6.1) to (7.2) were estimated using the Montezha program in Rats. The same program was used to compute the impulse responses and their error bands. This program implements Sims and Zha (1999) approach for overidentified structural VAR's[6].

VI. Impulse Response Functions

A range of impulse response functions can be derived from the open economy SVAR models developed in this paper, however the focus of this paper is the impact of foreign interest rates and therefore the impulse response functions from a foreign interest rate shock will be provided. Figures 1 to 4 report the impulse responses of domestic macroeconomic variables in the first specification to a positive standard deviation disturbance in the Federal Funds Rate and the one-month Libor USD Interest Rate. By the same way, Figures 5 to 8 report the impulse responses of domestic macroeconomic variables this time in the second specification to a positive standard deviation disturbance in the Federal Funds Rate and the one-month Libor USD Interest Rates.

With regards to the first specification, the first thing to note is that (when Figures 1 and 2, and 3 and 4 are compared) the pattern of responses of the domestic variables to a shock in FFR and LIBOR are almost the same for the period after 2001:6. But, in the period before 2001:6, there are some, even if minor, changes. Second, the pre and post 2001 modeling approach shows itself especially in the contradicting responses of the inflation rate and real exchange rate to shocks in FFR or LIBOR. The responses of these variables are quite different before and after 2001:6.

[6] The details of this methodology is presented in Sims and Zha (1999).

Let us now go into details of the responses of the domestic variables. For the period before 2001:6, the response of real exchange rate to FFR is first positive (appreciates) for less than a month, then negative (depreciates) for five months, and then again positive for the rest of the time horizon. This suggests that the real exchange rate appreciates as a result of the foreign interest rate shock. The evidence is only statistically significant for the last 1 or 2 months. The real exchange rate responds in the same manner to a shock in LIBOR, except the initial positive response which is absent in the case of LIBOR. For the period after 2001:6, the response of real exchange rate to FFR is negative for nearly all the periods, except the initial positive response during the first month. This suggests, on the contrary to the pre 2001:6 period, that the real exchange rate depreciates. But again, these responses are mostly statistically insignificant. For this period, as said before, the pattern of responses to a LIBOR shock is nearly the sane as the responses to a FFR shock.

For the period before 2001:6, the response of inflation to FFR shock is negative for almost all the period, except the positive response in the first month. After the eight month, the inflation rate converges to a path below the pre-shock value, but above the initial negative response of the inflation rate. The negative responses are statistically significant for about a three month period between the second and fifth months of the shock. When we compare Figures 1 and 2, the initial response of inflation to a shock in LIBOR is positive as in the case of FFR, but the positive impulse responses first increase and then decrease in the case of FFR but it immediately starts to decrease in the case of LIBOR. For the period after 2001:6, the response of inflation to FFR and to LIBOR is completely reversed. The response of inflation is first negative for about two months and then is positive for the rest of the time horizon. This shows us the importance of modeling the pre and post 2001:6 period differently.

Figure 1 and 2 suggest that, for the period before 2001:6 the Turkish income as measured by the private sector capacity utilization rate responds negatively to a positive shock in the foreign interest rate, whether the shock comes from the FFR or LIBOR. This negative response of the income does not change much after the 2001:6 period. After 2001:6, the response of income to FFR and LIBOR is first positive for about two and a half months, but becomes negative again for the rest of the time horizon. These impulse responses in both periods are mostly found to be statistically insignificant.

Furthermore, when one compares Figures 3 and 4 with the ones in Appendix (A1 and A2), it seems that the choosing the lag length as 2 rather than 4 was more appropriate because for a VAR order of 4, the impulse responses give puzzling results. This brings us to the same discussion of the narrow time span and robustness.

With regards to the second specification, after a visual inspection of Figures 5 to 8, the most important thing to note is that the responses of all our domestic variables to the foreign interest rate shocks become quite different after 2001:6. This may mean that with the inclusion of the domestic interest rate in our specification we were able to capture the policy changes after 2001:6 much better.

This may be due to the fact the foreign interest rates also affects the domestic economy through the interest rate channel and the way this channel works was changed significantly after 2001:6.

Before 2001:6, the real exchange rate responds positively to a FFR and a LIBOR shock for the entire time horizon. The positive response of the real exchange rate to FFR is statistically significant for the entire time horizon while the responses to the LIBOR shock is statistically significant for only two months. After 2001:6, the response of real exchange rate to a FFR shock is first positive for two months, but then it becomes negative but the effect in absolute value decreases steadily and finally cuts the zero line at the last month. These responses are significant between the fifth month and the tenth month for which the real exchange rate depreciates. The response of real exchange rate to LIBOR follows nearly the same pattern as the response to FFR.

The response of the domestic interest rate to a shock in FFR and LIBOR in the pre 2001:6 period is negative for the entire time horizon. These responses are statistically significant for 5 months in the case of an FFR shock and 7 months in the case of a LIBOR shock. However, the responses of the domestic interest rate to the foreign interest rate shocks become quite different after the 2001:6 period. The response of domestic interest rate to a positive shock in FFR is first positive for about two months but then becomes negative for the following four month period. After the tenth month the magnitude of the positive response of the domestic interest rate starts to gradually decline and eventually comes very close to the zero line at the last month. When we come to Figure 8, we see that the domestic interest rate this time responds negatively to the LIBOR shock for about seven months but then positively for the remaining time horizon. Again after the tenth month the positive response of domestic interest rate starts to decrease gradually. These responses are only statistically significant for the first two months of the shock.

The inflation rate, for the pre 2001:6 period, responds first positively and then negatively to a shock in both the FFR and LIBOR. However, the effect of the LIBOR shock on the inflation is larger than the effect of the FFR shock. In most of these periods these effects are statistically insignificant. After 2001:6 the effect of the foreign interest rate shocks are completely reversed as in the case of the first specification. The inflation first responds negatively and then positively. But, the magnitude of the final positive effect again decreases gradually in the case of both shocks. Also the responses are statistically significant for a longer time horizon in the post 2001:6 period; five months in case of a FFR shock and eighth months in case of a LIBOR shock.

Finally, when the effects of the foreign interest rate shocks on the income are considered, for the pre 2001:6 period the effect is positive, but for the post 2001:6 period the effect is negative. For the pre 2001:6 period, when FFR is used as the foreign interest rate measure, the response of income is mostly statistically significant, but in case of LIBOR, the statistical significance of the responses decreases. Also before 2001:6 the response of income to the LIBOR shock becomes negative in the last two months but this effect is statistically significant. After 2001:6, the response of income to a

FFR shock is statistically significant for all the periods after the second month, but in case of LIBOR neither of the shocks seems to be statistically significant.

VII. Conclusion

In this study the impact of a foreign interest rate shock of a large country on the macroeconomic performance of a small open economy are assessed by using a data set from Turkey and United States. To examine these effects an open economy SVAR model is used. When the structure is imposed the domestic economy block is specified in two different ways. In order to assess any change in the transmission of the foreign interest rate shock on the domestic economy after the 2001 crisis, separate models are specified and estimated for before and after 2001:6.

Our principal findings for the period before 2001:6 are that, following a positive foreign interest rate shock, the real value of the Turkish currency rises while the inflation rate and the domestic interest rate fall. However, these results are completely reversed after 2001:6. This time the real value of the Turkish currency decreases while the inflation rate and the domestic interest rate rise, although this last effect is small. While these effects on real exchange rate and inflation are independent of the type of specification used, this is not the case for income. For the period before 2001:6, when the domestic interest rates are included into the model, foreign interest rate innovations cause the domestic income to increase. However, with the omission of the domestic interest rate channel of the foreign interest rate shock the effect on the domestic income becomes negative. After 2001:6, the domestic income is affected negatively from the foreign interest rate shock whichever type of specification is used.

For further research, the findings in this paper could be enriched by using a broader set of foreign interest rate variables. Also money stock and trade balance variables could be incorporated into our domestic economy block to understand the internal transmission dynamics in detail. Finally different identification schemes could be experimented and the results could be compared.

Figure 1. Impulse Response Functions to a shock in FFR for the period before 2001:6

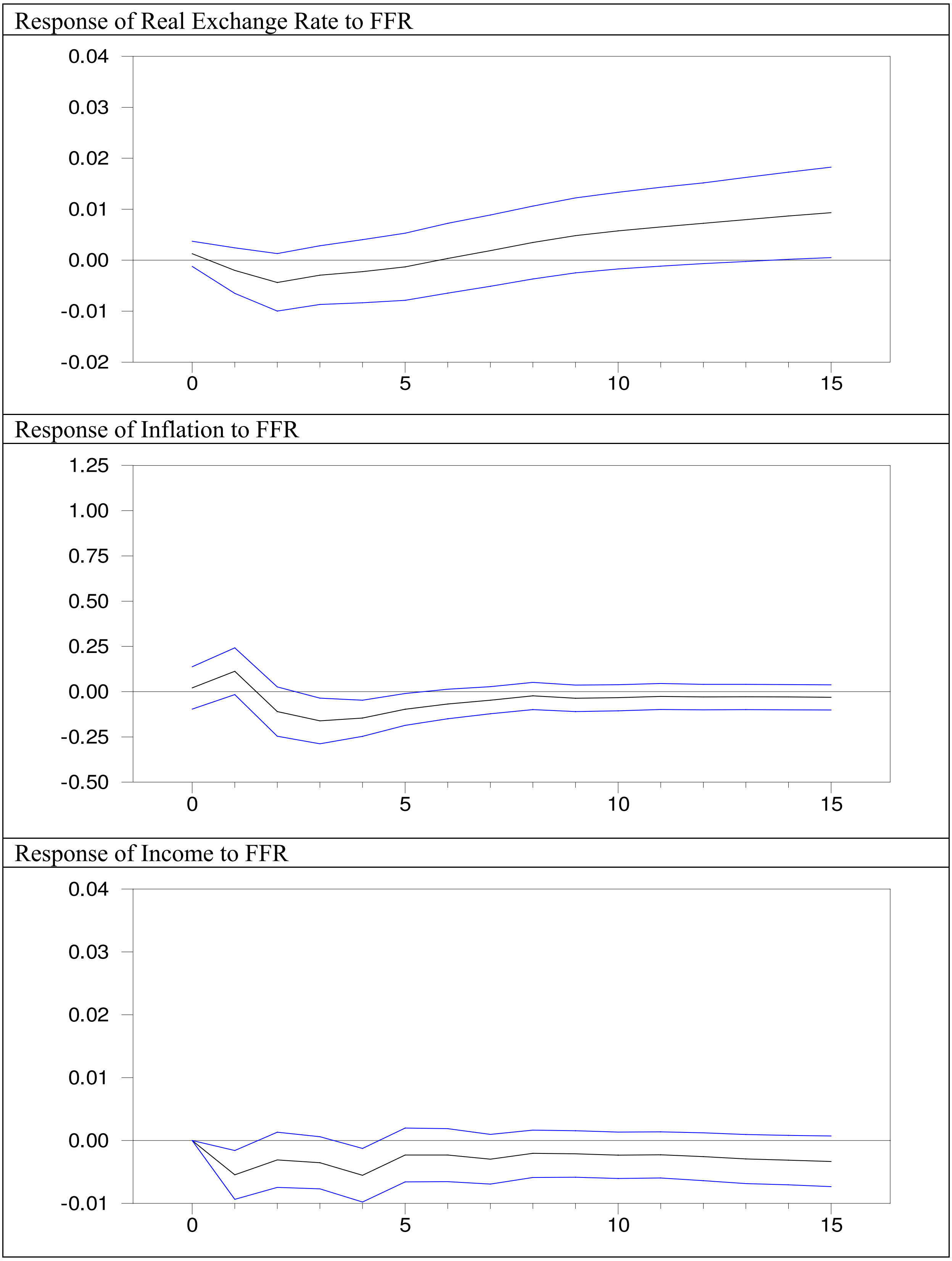


Figure 2. Impulse Response Functions to a shock in LIBOR for the period before 2001:6

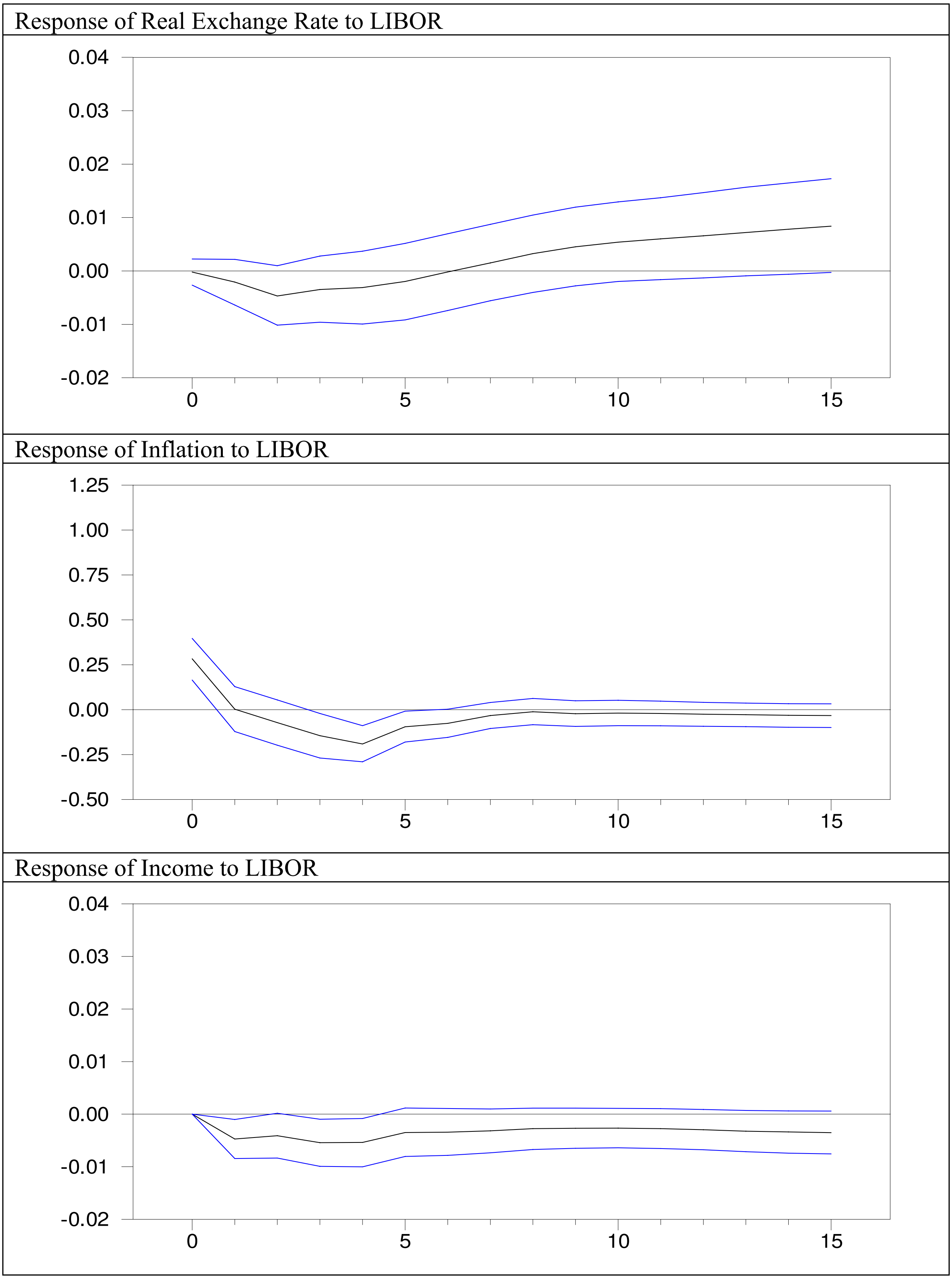


Figure 3. Impulse Response Functions to a shock in FFR for the period after 2001:6

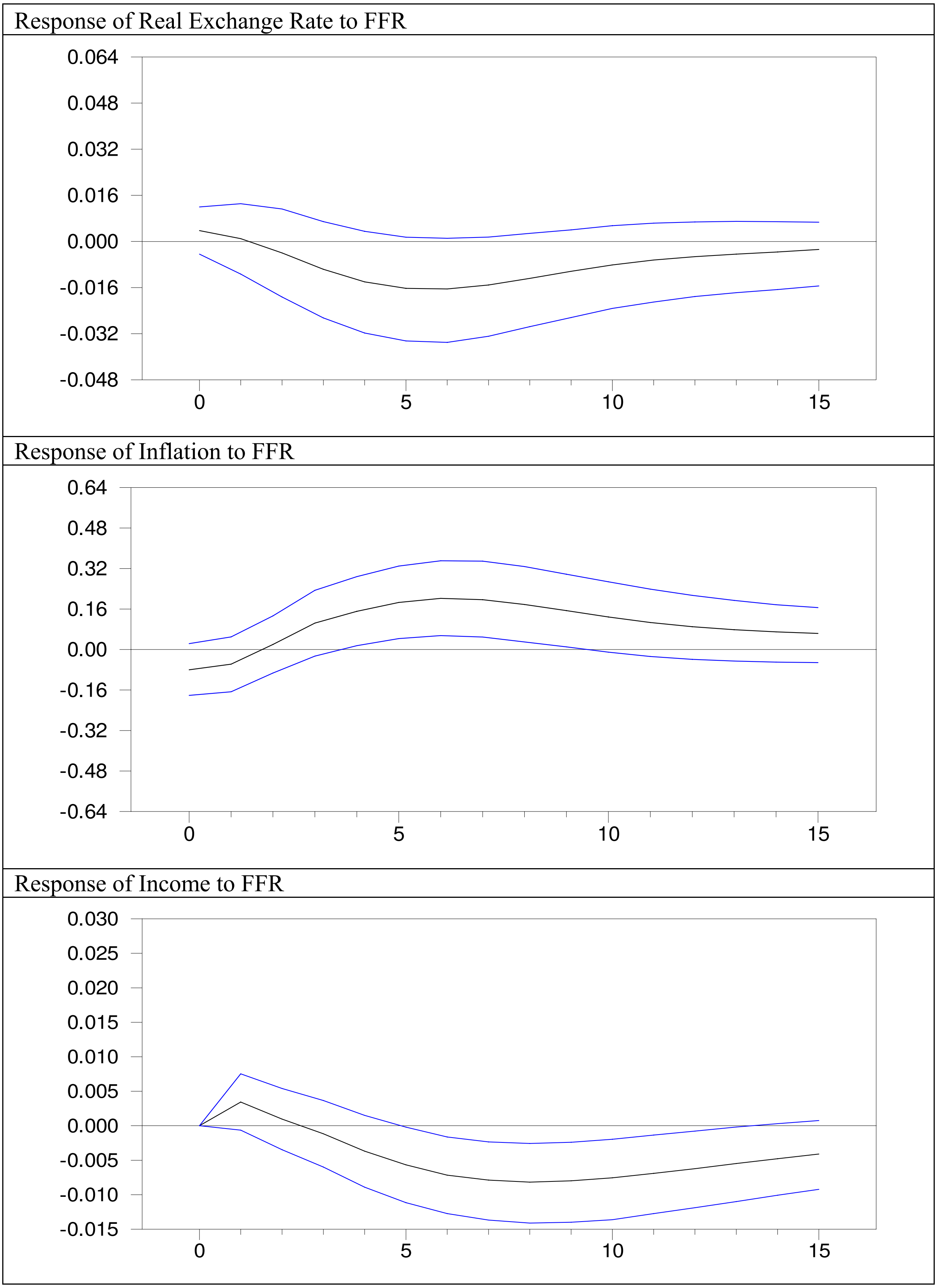


Figure 4. Impulse Response Functions to a shock in LIBOR for the period after 2001:6

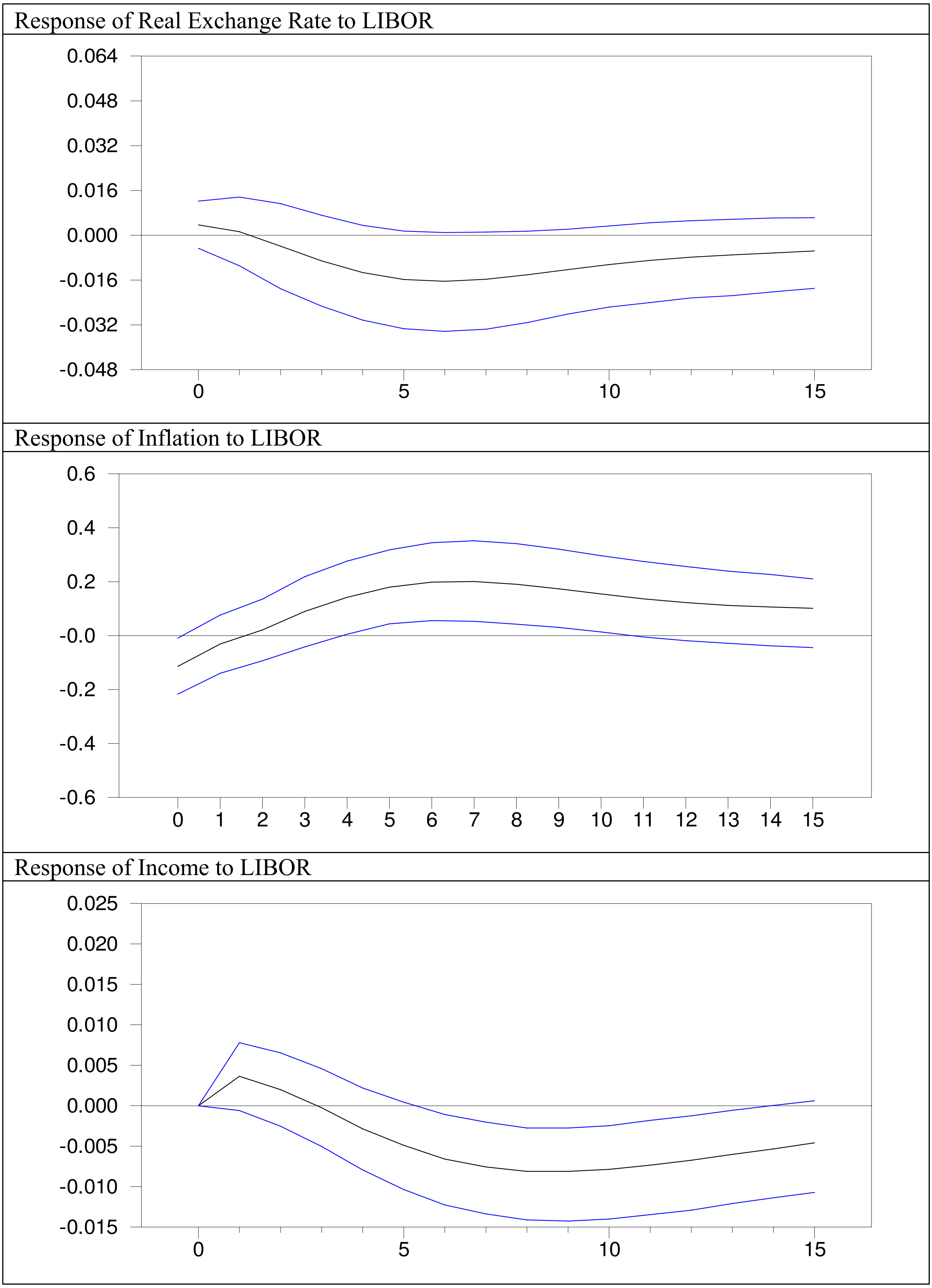
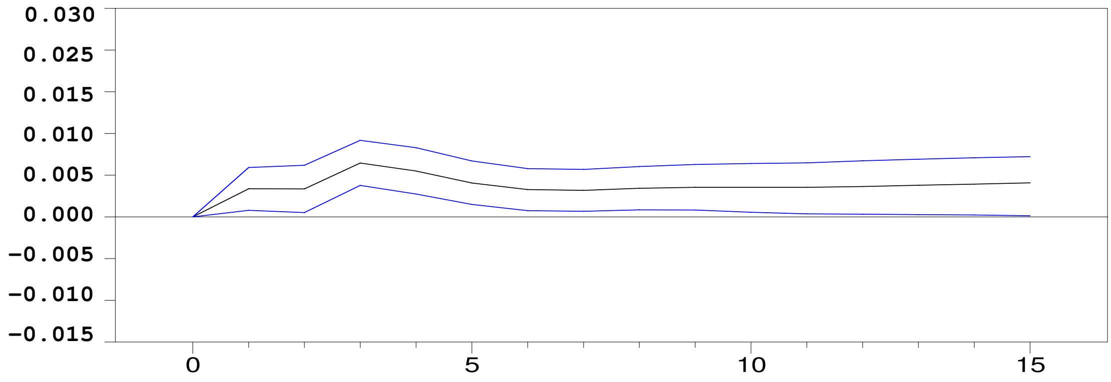
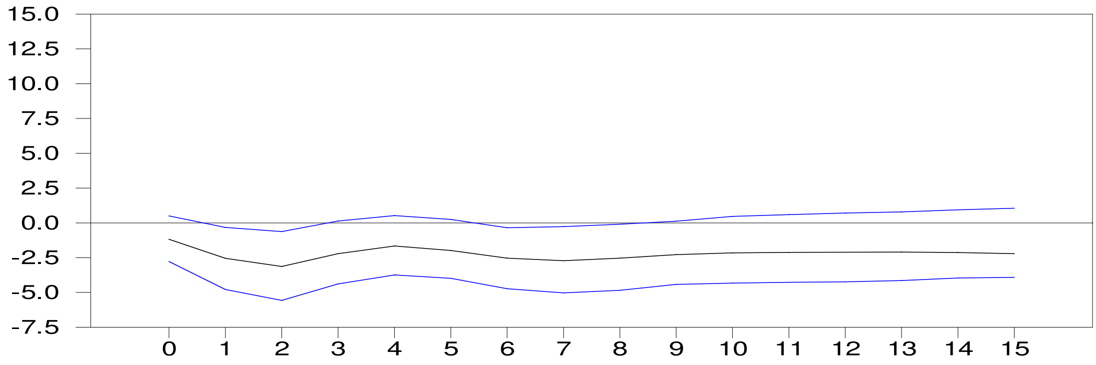


Figure 5. Impulse Response Functions to a shock in FFR for the period before 2001:6

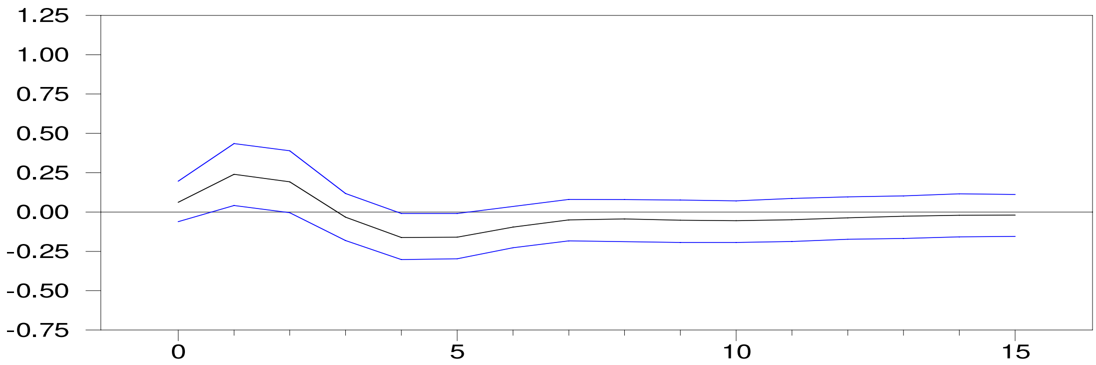
Response of Real Exchange Rate to FFR



Response of Domestic Interest Rate to FFR



Response of Inflation to FFR



Response of Income to FFR

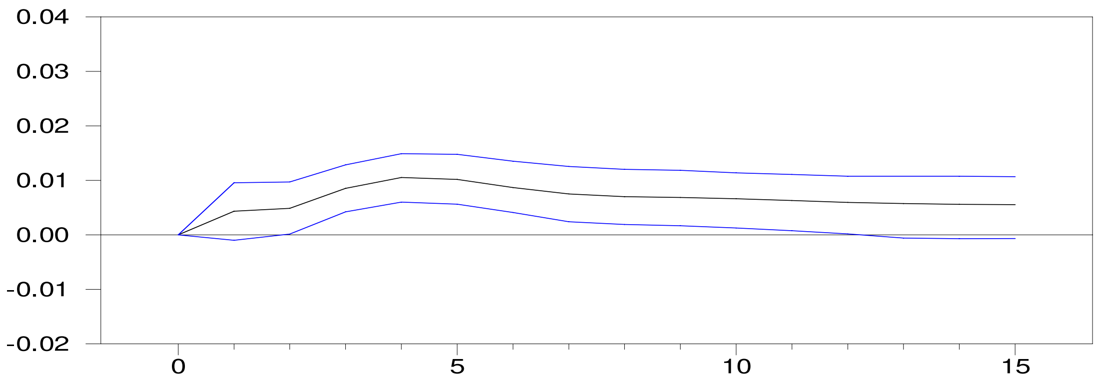


Figure 6. Impulse Response Functions to a shock in LIBOR for the period before 2001:6

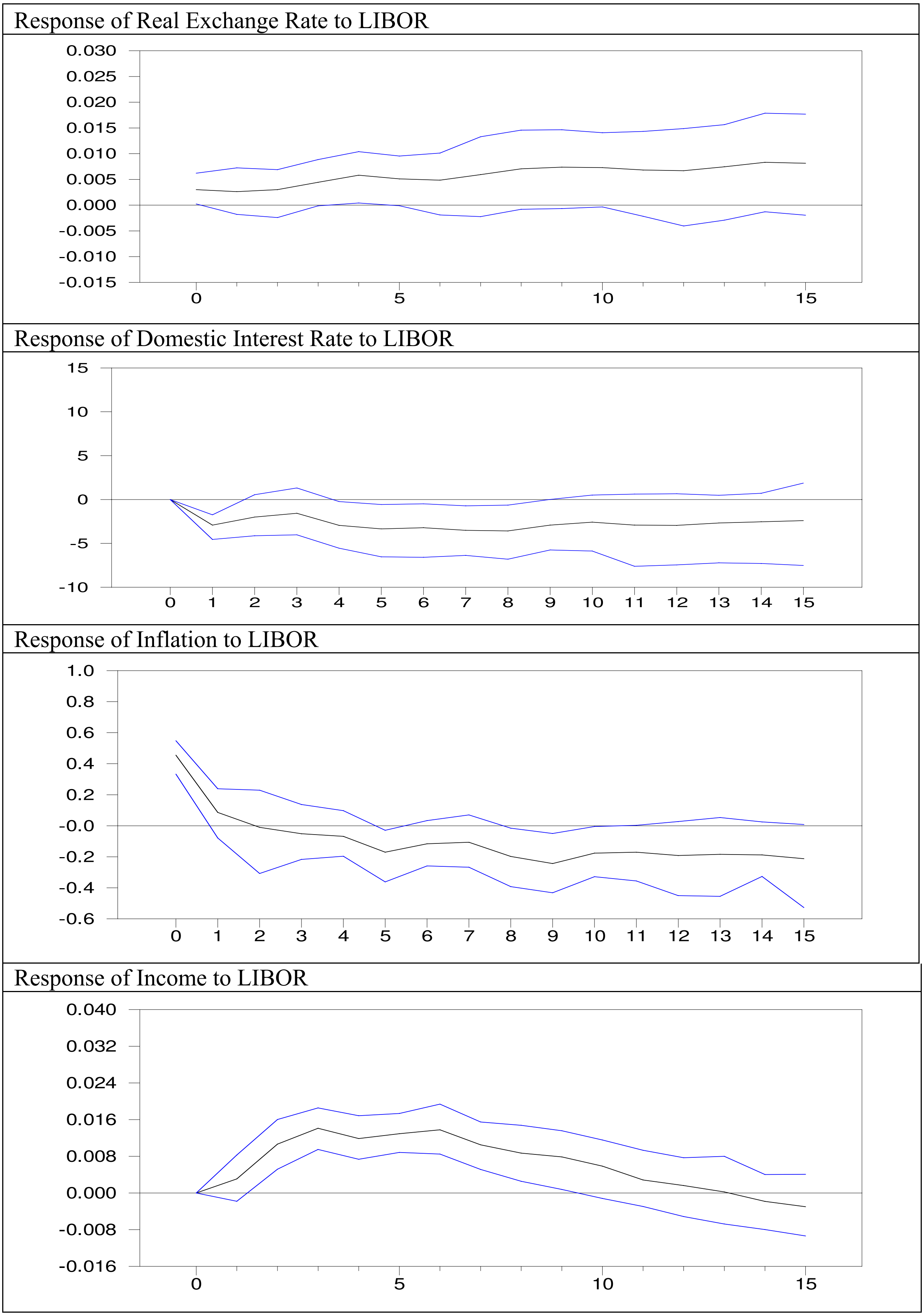


Figure 7. Impulse Response Functions to a shock in FFR for the period after 2001:6

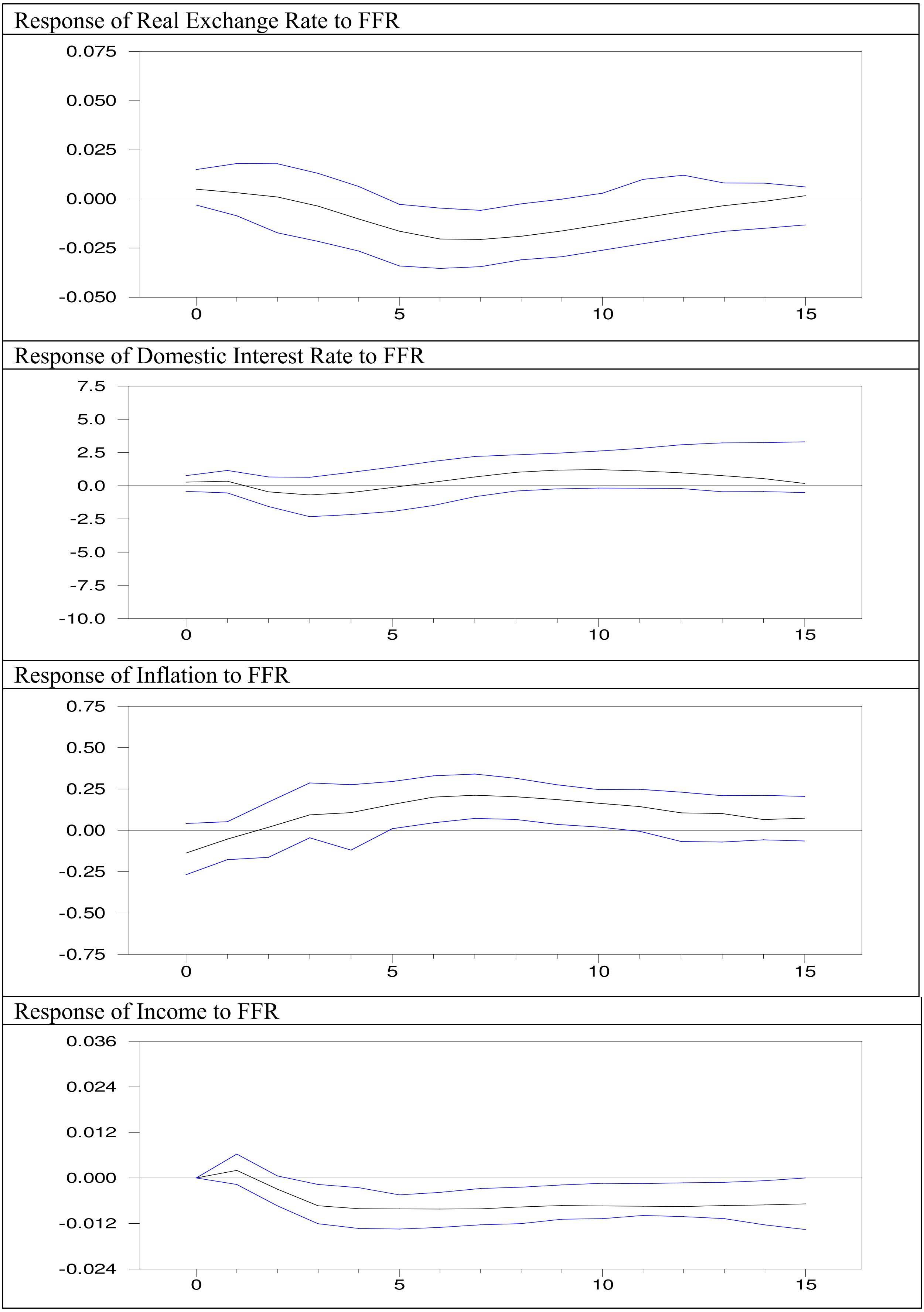
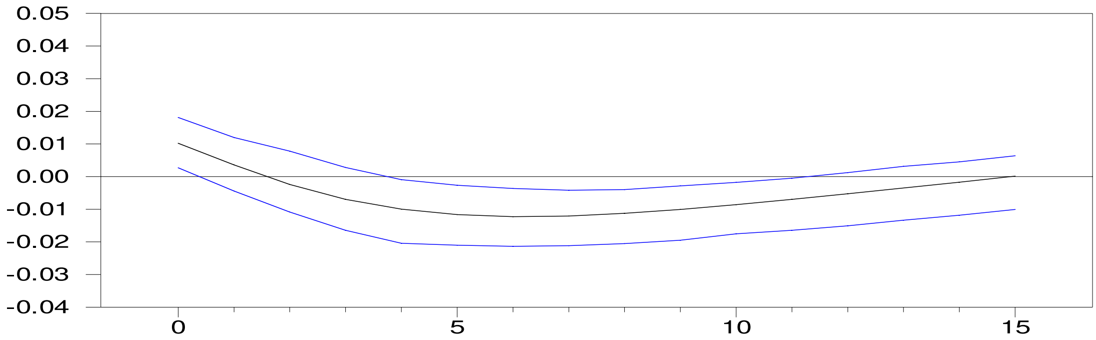
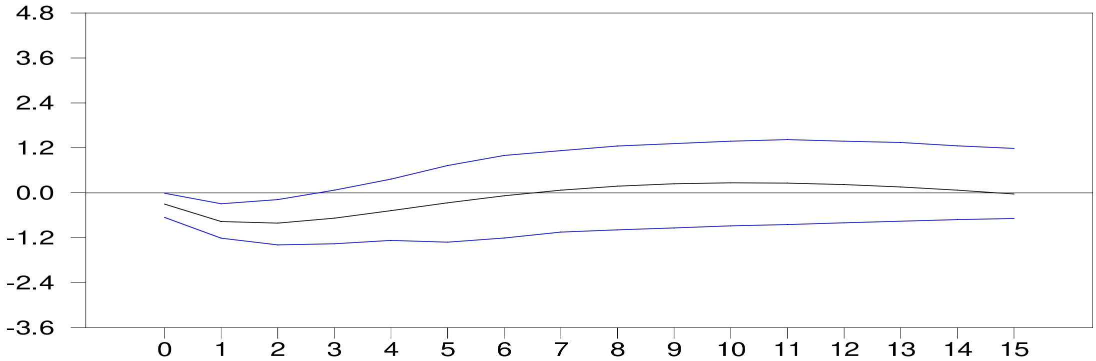


Figure 8. Impulse Response Functions to a shock in LIBOR for the period after 2001:6

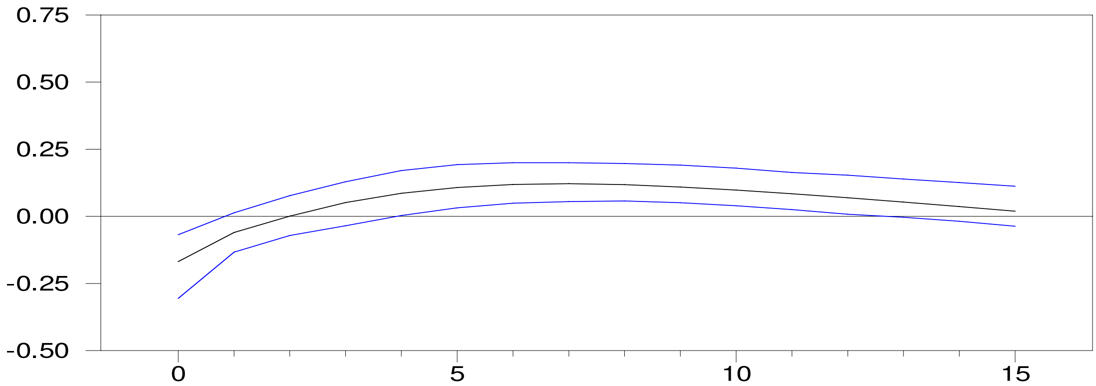
Response of Real Exchange Rate to LIBOR



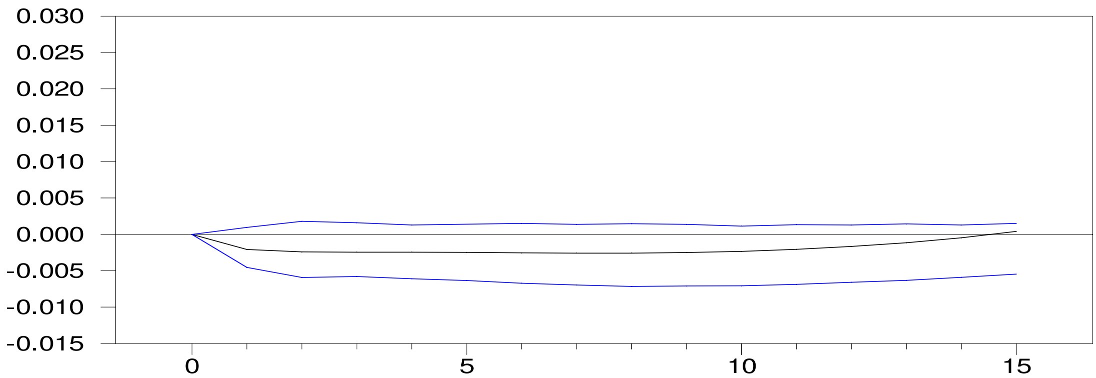
Response of Domestic Interest Rate to LIBOR



Response of Inflation to LIBOR



Response of Income to LIBOR



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Appendix

Figure A1. Impulse Response Functions to a shock in FFR for the period after 2001:6 with a lag length 4

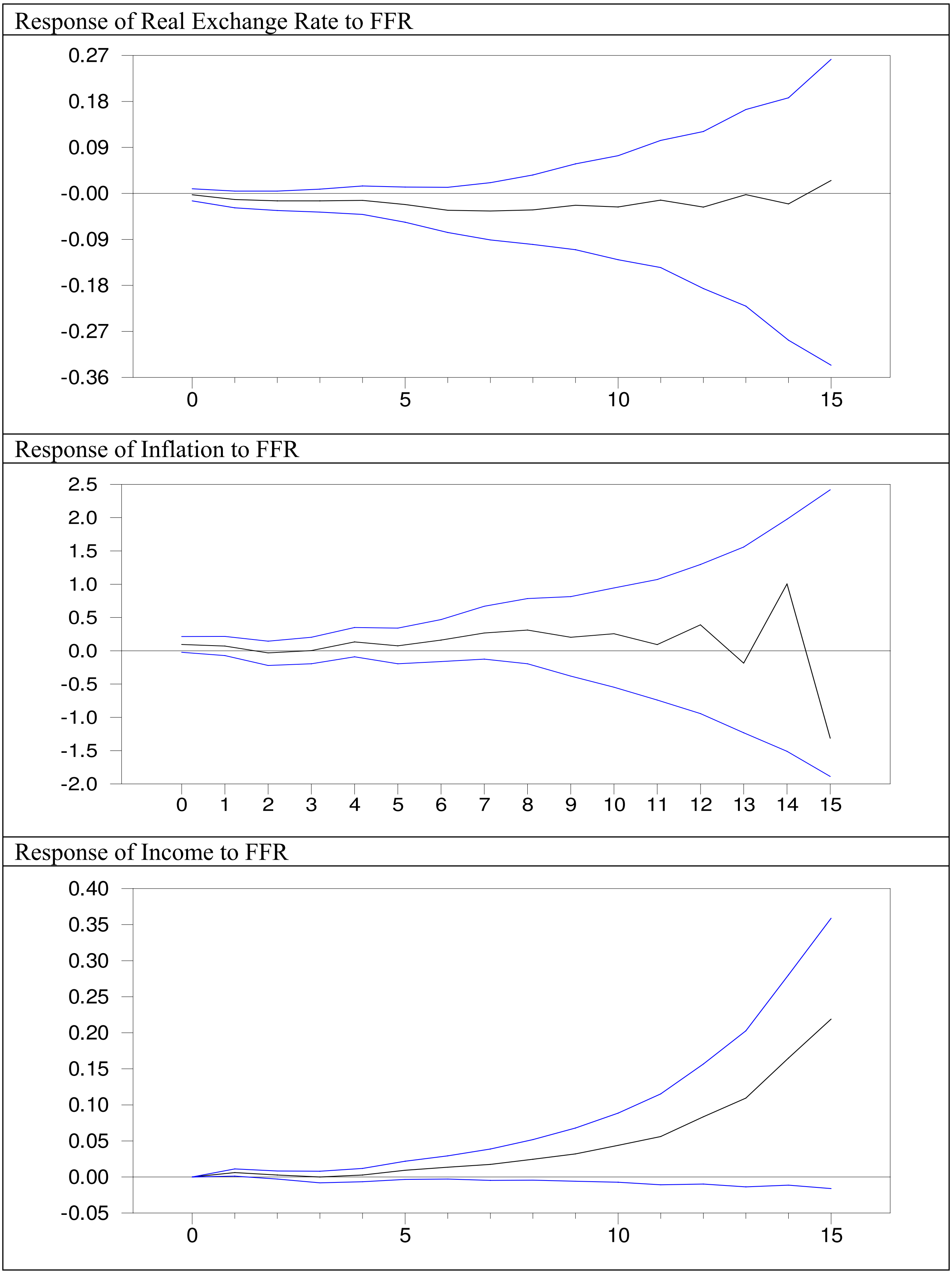

Figure A2. Impulse Response Functions to a shock in LIBOR for the period after 2001:6 with a lag length 4