INFLATION TARGETING IN ROMANIA: A SVAR APPROACH

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Abstract

Romania has recently adopted inflation targeting and fully liberalized its capital account as part of its commitments towards the European Union. In the present thesis I analyze the successfulness of the IT since its inception in 2005 and whether there were macroeconomic effects and to what extent associated with this particular monetary policy regime. I will do this by estimating a structural VAR derived from a dynamic general-equilibrium model with sticky prices and monopolistic competition and compare the impulse responses to the simulation results of Berkmen and Gueorguiev (2004) which I am using as a benchmark. I find that so far Inflation Targeting was successful.

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INTRODUCTION

For the past two years Romania has been successfully targeting the inflation while the exchange rate did not have episodes of excessive volatility. 2005 was a year of switch in monetary policy regime when the National Bank gave up on the exchange rates as the nominal target. Officially, Romania has had a managed exchange rate ever since. The National Bank of Romania (NBR) had to cope with considerable amount of capital inflows which both exerted appreciation pressure and required sustained efforts for the Romanian authorities to drain excess liquidity from the economy. 2006 was a record year for FDI inflows which increased by 75% (Unicredit, 2007).

The successfulness of inflation targeting (IT) had probably to do both with non-monetary factors and monetary ones. In this thesis I am particularly interested to investigate how much a contribution to the efforts of taming the inflation the monetary authorities have had. I will do so by estimating a monetary structural vector auto-regression (SVAR). This is because while temporary factors may help economies and monetary authorities to reach their objectives at some point, the successfulness of inflation targeting regimes depends crucially on the trust that the monetary authorities both want and are able to control inflation. On the other hand, though, trust is built on past success.

Among the non-monetary factors that are significant for the behavior of inflation in Romania are: the large contribution of food prices in total consumption index (which are known to have a more volatile behavior and are therefore less easy to control), the large agricultural content of GDP in Romania (which is subject to uncontrollable exogenous factors like the weather); the still large share of administered prices and lastly, the backward indexation of wages to name just a few. For instance, the recent slow in inflation was driven mainly by food price deflation given that this item makes up to 39% of the Consumer Price Index basket (CPI) (Unicredit, 2007).

The paper proceeds as follows. The first chapter surveys the current literature on inflation targeting and discusses some recent experiences with IT. Romania's case is then taken separately and the evolution of the economy during the disinflation years is analyzed as well as some practical aspects of IT implementation in Romania. Chapter two then describes the benchmark model derived from a New Open Economy Macroeconomic DSGE model and the simulation results of Berkmen and Gueorguiev (2004). Chapter three proceeds with the description and estimation of the Structural VAR used for estimating the dynamic responses of the economy to several structural shocks. Before concluding, chapter four presents and discusses the main results.

CHAPTER 1 - INFLATION TARGETING: AN OVERWVIEW

In this chapter I survey the literature on the ongoing debate over the virtues and weaknesses of Inflation Targeting and then describe the Romanian approach to IT.

1.1. Inflation targeting between rhetoric and facts

Inflation targeting grew in popularity in the last 10 to 15 years as being a successful monetary policy regime. IT gained appeal especially in countries with historical high levels of inflation and which, after implementing this regime, managed to bring down the speed of price movements. Prima-facie statistical data (IMF, 2005) shows that on average, governments experienced sizable decreases in their respective inflation rates after implementing the IT.

In the empirical literature, inflation targeting has been praised for several achievements. Neumann and von Hagen (2002) for instance, find for the countries they analyzed that, after inflation targeting was introduced, the volatility of inflation, interest rates and output declined to the levels of successful non-IT countries like the US, Germany and Switzerland. The estimated Taylor rules were found to place more weight on inflation and some VAR evidence showed that the relative importance of inflation shocks as a source of variance of interest rates rises after IT starts, suggesting greater focus on controlling inflation. In light of this evidence, it is obvious why IT was deemed so appealing for the accession countries as well. Several transition economies like Hungary, Czech Republic or Poland, engaged in targeting inflation though their performance was rather disappointing so far, their regimes being characterized by repeated failures.

According to Svensson (1996), the most fundamental measure for evaluating the effectiveness of an IT regime should be its success in anchoring expectations One of the main features of IT is the increased transparency of the central bank operations which contributes positively to stabilizing inflation expectations: agents understand the central bank behavior and trust that, in case of deviations or adverse shocks, the bank will act such as to comply with the target (Kuttner and Posen, 2005). Trust increases the room for maneuver in the short run and arguably allows the Central Bank to pursue secondary objectives like output growth or exchange rate stabilization without jeopardizing the future prospects of inflation. IT offers also the advantage of focusing the monetary policy on low and stable inflation and of eliminating the time inconsistency problem through strong commitment to a numerical target.

However, skepticism about the desirability of IT is not absent, especially if it implies a non-accommodative monetary stance. In its strictest sense, "pure" IT requires that the monetary policy rule sets full weight on the inflation deviation from the target and zero weight on the deviation from the optimal output. In policy making jargon, "0" weight on the output gap means that the government is insensitive to output losses stemming from defending a specific level of inflation (Kuttner and Posen, 2005).

The case of developing countries brings in additional sources of skepticism. Since IT is built on expectations stabilization, in order to be successful, the monetary authority has to enjoy a fair amount of credibility. Credibility is however a limited resource in transition countries and more generally in economies with high inflation history, simply because credibility is hard to build. The contradictory nature of the credibility requirement stems from the fact that credibility is not only a function of current behavior; it is also heavily discounted by the memory of the past. Inflation inertia caused by unadjusted expectations may be an important part in the current inflation due to the backward looking behavior of the agents.

McCauley and Corrinne (2003) survey some interesting experiences with inflation targeting to show that in their case the trade-off between the exchange rate and inflation is particularly high, which therefore complicates IT. They note that such a regime may often come in contradiction with the economic features of developing countries. For instance, the inflation target is threatened in the presence of significant exchange rate swings as was the case for Brazil in 2001. The accelerated depreciation of the currency had led to an inflation hike well above the target. As a consequence interest rates had to increase aggressively for four months in a row.

To answer the challenges stemming from the restrictive approach to IT countries formulated more flexible versions of IT. A source of flexibility is given by larger band or longer term inflation targeting: when inflation is within the variation bands the monetary policy can be used for other supplementary purposes; it can also be allowed to temporarily breach the bands in the same vein. But even if flexible approaches to IT are chosen, they are still unable to solve all the complications related to this approach: targeting a narrower definition of prices is less representative of the loss in purchasing parity for the agents concerned with the whole basket of consumption, and thus with more flexibility there is a trade-off away from IT effectiveness. (Fraga et al, 2003)

Tensions appear especially in an environment of persistent low growth and increasing debt or when the exchange rates and the inflation at a particular moment call for conflicting monetary policy actions. IT requires also that fiscal dominance is absent which has hardly been the case for the poor inflation performers.

Other features of the developing countries that are likely to complicate IT implementation are the currency mismatch, the high levels of dollarization and the related high pass through from exchange rates to prices (Hrnčíř and Kateřina, 1999). As put forward by Leiderman et al 2006, in partially dollarized economies the transmission mechanism makes implementing IT a particularly difficult task. The balance sheet effects can exacerbate the financial stress of depreciations and lead to a situation whereby real depreciations have the reverse effect normally predicted by theory. The net effect is then a matter of empirics.

1.2. IT in Romania

For Romania, inflation was one of the most daunting realities of transition. Romania was the last among the new member states to tame inflation and to bring it to one-digit levels. On the other hand IT so far seems to have worked fairly well.

Every year, the Bank sets a target of inflation agreed upon with the government. This fact in itself does not represent a major novelty because this was the practice before adopting the new regime also. The difference lies in the strength of the commitment and the credibility attached to such a commitment. Credibility is not an issue for the Romanian monetary authorities at the moment: they have built a considerable amount of it in the recent years along the disinflation path. The problem that the authorities might come across is the "flying without instruments" scenario. That is to say that the Central Bank may enjoy all the credibility on the side of the markets, but without the proper forecasting tools and moreover the proper policy instrument to fence off the shocks that may cause inflation to deviate from the target, the Central Bank may be "shooting itself in the leg" when setting an unrealistic target.

To better understand what might have changed in the behavior of the Central Bank for the past two years I will briefly describe the evolution of monetary policy followed during the disinflation period (following Daianu, 2001). In 1997 the foreign exchange market was set up. Capitals could flow inside the country freely with no restriction in 1999 but restrictions were kept in place for outflows. Completion of the gradual capital account liberalization was reached in September 2006.

Given delayed structural reforms and poor economic stabilization performance the financial difficulties did not fail to occur: such an episode happened in 1999 when Romania was close to defaulting on its external debt. After this brief episode, capitals started to pour in and continued real appreciation pressures ensued. In this context, preoccupied with the impending competitiveness loss, the NBR intervened heavily in the foreign exchange markets. This practice was most common before 2005 for Romania but with inflation targeting such intervention is restricted by law and can be used only in exceptional cases.

When central banks intervene in the markets they have to make sure that they have enough reserves to do so. Romania started building considerable foreign exchange reserves but at an equally considerable price: nowadays, unlike in the case of the developed countries, the Romanian National Bank is a net debtor towards the commercial bank sector.

This feature of the monetary transmission bears a great deal of importance for the outcomes of inflation targeting: the Central Bank is a price taker, that is it has to offer a sufficiently high yield on the deposits it attracts (above the going rates set by the market) in order to perform an efficient sterilization. This may in turn lead to crowding out useful credits necessary for the economic activity. It is understandable why fears of non-effectiveness of the IT monetary instruments were justified (and still are). In the absence of a powerful policy instrument, successful inflation targeting may be a dream far off from becoming true. After all, this was why the government switched to the new regime: to reap the benefits of a seemingly better instrument (like the interest rate) when fighting off inflation (given also that the Central Bank preferences migrated towards less inflation away from the "more competitiveness"[1] objective). Currently the central bank policy rate is the interest rate applied to the 1 month commercial bank deposits kept at NBR.

[1] It is also likely that there was no shift in the preferences of the NBR given that often competitive devaluations led to real appreciation instead of real depreciation due to a very fast pass-through (Pascalau, 2003)

The main challenges that the NBR had to deal with in the last years were the excess demand fueled by a credit boom, increasing foreign imbalance and capital inflows, the unfinished process of price liberalization (many prices are still state administered like energy prices) and a considerable degree of dollarization.

Given these conditions, Romania implemented a flexible approach to inflation targeting. The NBR keeps track of three types of prices: core inflation (computed as consumer price index less administered prices), a restricted version of the former which excludes volatile prices, like those for excise goods, and the administered price changes. The CPI inflation has been above the core by 1-2.5% in the last years. The bank targets the CPI but it sets multiple-year targets which it adjusts according to its forecasts; the CPI is allowed to fluctuate within +/-1% bands around the target. The flexibility of the monetary policy has its source in the safeguard clauses which exonerate the bank from keeping with the pre-announced target if shocks outside its influence hit the economy. Flexible prices that are volatile in response to external shocks can lead to missing the pre-set target. The safeguard clauses refer to commodity price shocks, natural disasters (that may affect agriculture), large swings of the exchange rates which do not reflect the economic fundamentals and government breaches of the annual agreement on price liberalization or fiscal policy. The flexible formulation of the policy specifies the need to achieve the target in the medium term thus allowing for short term deviations (as was the case in February 2006) (Quarterly Inflation Report 2006)

Due to capital inflows, appreciation pressures make the duty of the bank more difficult because with open capital account and increased interest rates (necessary to fight back the inflation resulted from larger money base) a spiral of appreciation-inflation can be triggered. In such a case the room for maneuver over the interest rates is limited. The extent to which the bank has to intervene in the inter-bank market depends on the monetary transmission in a crucial way: if banks are fast to follow the official rates then inflation can be calmed much easier. Some relief to the policy stance is provided by the quantitative restrictions on bank loans through minimum liquidity ratios. In fact, the situation is not so tight anymore. The steep decline in the money rate during the last years came on the background of a sharp increase in NBR sterilization operations after 2005.

Against all the above mentioned pressures, the monetary policy has been successful in keeping close to the pre-announced targets: it had actually achieved its inflation objectives ever since 2002 bringing it down from 2 digit levels at a current below 4%.

The first signs that the policy instrument is starting to work is that inter-bank rates became more sensitive to the policy rates (NBR Inflation Report, 2005). Neither a contradiction between disinflation and growth was there apparent.

CHAPTER 2-THE BENCHMARK MODEL

In this chapter I present the benchmark model of Berkmen and Gueorguiev (2004) and the simulation results derived from that model.

2.1. Short description of the benchmark model

In assessing the performance of the monetary authorities, I will refer during my investigation to the findings of Berkmen and Gueorguiev (2004). They obtain simulation results derived from a dynamic general equilibrium model applied to Romania and describe the macro-implications of adopting an IT regime combined with capital account liberalization.

Since the paper was written before the implementation of IT, I am interested to see if the conclusions of the authors apply to the Romanian case or to what extent they do. To answer this question I look at the similarities between the data and what the authors find.

The comparison model is developed from a dynamic general equilibrium model with sticky prices and monopolistic competition applied to a small open economy: it is based on the optimizing behavior of the households who maximize the lifetime utility function with respect to the consumption bundle, real money balances and labor. The main assumptions of the model refer to the consumers who exhibit unit elasticity of substitution between home and foreign produced goods; the consumption index is a Dixit Stiglitz aggregate and the price elasticity of demand is constant.

Though little in the benchmark model is applicable only to Romania (in fact, it is a rough approximation of any small open economy), the clear picture it conveys about how the macroeconomic variables shift in response to shocks under different sets of regimes, makes it much easier to evaluate how far from an optimal behavior the Romanian economy really is (that is true so long as we believe that the underlying simplifying assumptions of the benchmark model are not crucial in determining that one regime is optimal against the other).

The main equations of the model are in line with the classical IS-LM models with

1)a money demand derived from the first order condition of the households maximization problem;

$$x_t = E_t x_{t+1} - \sigma i_t + \varphi_\pi E_t \pi_{h,t+1} + \gamma(y_t^* - E_t y_{t+1}^*) + \varphi_s(s_t - E_t s_{t+1}) - \varphi_a(a_t - E_t a_{t+1})$$

where x_t is the output gap, i is the interest rate, y_t* is foreign output , s_t is exchange rate and a_t is productivity;

2) inter-temporal aggregate demand derived from a classical Euler equation;

$$m_t = \varphi_y c_t - \varphi_i i_t$$

Where m_t is money demand and c_t is consumption

3) aggregate supply following a standard Phillips curve derived from the underlying labor market equilibrium;

$$\pi_{h,t} = \beta E_t \pi_{h,t+1} + \kappa_x x_t + \kappa_q(p_t^* + s_t - p_{h,t}) - \kappa_y y_t^*$$

$$\pi_t = \gamma(s_t - s_{t-1}) + (1-\gamma)(\pi_{h,t})$$

Where the first equation is expressed in terms of domestic inflation and the second in CPI inflation,

4) a monetary policy rule which is expressed in terms of the policy instrument (either exchange rate or interest rate).

The model is closed by the inclusion of the uncovered interest parity condition which ensures the automatic adjustment based on market forces of interest rates or exchange rates depending on the regime in question and the market clearing condition.

The monetary policy rule changes with the regime. In the presence of partial capital controls, the central bank uses the exchange rate as its instrument. The rule implies a certain degree of smoothing:

$$s_t = \rho_s s_{t-1} + (1 - \rho_s)\overline{s}_t + \varepsilon_t^t$$

where $\bar{s}_t$ places different negative weights on inflation deviation and output gap.

With such a rule a condition similar to uncovered interest rate parity must hold:

$$i_t = i_t^* + E_t s_{t+1} - s_t + \zeta_t$$

where ζ_t represents the wedge coming from capital controls.

With perfect capital mobility interest rates are the policy instrument according to the rule:

$$i_t = (1 - \rho_t)\overline{i}_t + \rho_i i_{t-1}$$

$$\bar{i}_t = \phi_\pi (E_t \pi_{t+k} - \overline{\pi}) + \phi_x x_t + \phi_s s_t + \varepsilon_t^i$$

This rule implies again smoothing. Then the exchange rates are determined through the uncovered interest rate parity:

$$i_t - i_t^* = E_t s_{t+1} - s_t$$

There are four AR(1) exogenous processes: for the foreign output, foreign interest rates, technology and capital controls. These processes complete the model.

A critical note may be useful when considering the assumption of complete financial markets because a potential differing pattern of data can be accounted at least in part by such an assumption. Complete markets imply that agents are able to ensure themselves at all times against all contingent states of the economy. Of course this is in sharp contrast with what happens in Romania: if anything, the T-bill market is utterly limited and does not ensure the necessary hedging while the derivatives markets are underdeveloped. The fundamental implication of such an assumption is that the balance of payments is always in equilibrium.

As the authors themselves explain, such a condition entails that when the real exchange rate depreciates due to a foreign price shock, the loss in purchasing power is exactly offset by the gains induced by foreign demand and as a consequence nominal income increases and there is no international asset movement and no gain from inter-temporal trade. Basically the assumption of complete markets assumes no relative wealth shift and thus no current account and net foreign assets dynamic propagation mechanisms (Lane, .). The impulse responses from the SVARs will however incorporate such mechanisms if they really are at work.

In fact, the external imbalance that a country faces at some point can be an important source of welfare loss; therefore trying to counter the shocks coming from such an external imbalance can become a primary objective of the central banks especially in the case of small open economies which for instance deal with dollarization problems.

Considering the pre-IT regime, it should be acknowledged that the government did place a great weight on external competitiveness. The above assumption is shaky because it implies that there is no role for current account or net foreign assets dynamics and for their relation with the exchange rates in determining the behavior of domestic inflation and output. Consequently there would be no role for the net foreign asset position in influencing the choice of optimal monetary policy. But Malik (2005) finds that dirty floating out-performs flexible exchange rate regime with domestic inflation targeting.

2.2. Simulation results of the benchmark model

The basic conclusions of the Berkmen and Gueorguiev (2004) paper refer to three possible regimes: a) an exchange rate anchor and partial capital account mobility; b) free capital account combined with flexible CPI-IT (consumer price index inflation targeting) and managed exchange rate; (flexible domestic inflation targeting is a particular case of the afore mentioned) and c) strict IT with free-float. The welfare criteria considered are both the compensating variation of Lucas and a standard central bank loss function which in addition to output gap and inflation deviation places some weight on the real exchange rate also. The compensating variation of Lucas measures the amount by which consumers' original consumption basket has to be increased for them to enjoy the same lifetime utility under each regime.

According to the simulation results, the second and the third regime are best performers in terms of output and consumption (on the background of capital account liberalization and resultant lower interest rates). More stable real exchange rates come also with the trade-off of increased inflation volatility. The third regime minimizes the loss function for real and exogenous shocks and stabilizes output given that free floats absorb these shocks (but comes with highest inflation volatility). The second regime minimizes loss from nominal shocks. Higher real exchange rate volatility in the first regime has the benefit of more stable inflation. A particularly interesting result is that a flexible IT regime has about the same stabilizing properties and welfare implications as the old regime (according to the Lucas criterion).

There are some ways in which the SVAR results may differ from the results in the reference paper. Impulse-responses resulting from SVARs are potentially able to capture changes in the transmission mechanism of the structural shocks which is not the case in a simulation exercise. The assumption of no current account propagation mechanism may not hold in reality, therefore the responses computed from the simulation may underestimate the volatility of exchange rates and therefore bias the welfare analysis.

In the benchmark model, a **capital account shock**[2] under the first regime leads to larger loss in output but negligible CPI inflation, nominal and real exchange rates depreciate while the interest rates rise under the parity condition. In the other versions of policy regimes output losses are reduced because output recovers rapidly; there is however non-negligible initial rise in CPI inflation under *free capital mobility* and *flexible CPI-IT* (CPI inflation targeting). CPI decreases on impact with strict IT. In all the IT versions the exchange rates appreciate though to different extents. In all specifications nominal interest rates rise, but they do so more aggressively under *CPI-IT* and flexible *domestic IT* and less so in the *strict IT* case.

Shocks **to exchange rates** lead to output gains under *capital controls* but also to high spikes in CPI inflation which smoothes somehow the extent of real exchange rate depreciation. Nominal interest rates fall in response. The initial rise in prices is even bigger under *strict IT* and nominal interest rates fall more aggressively. In contrast, in the other regimes nominal interest rates rise in response to the shock and therefore we also see important initial output losses. There are smaller CPI inflation consequences under *domestic IT* though.

Foreign interest rate shocks reduce output on impact with *capital controls*, there is insignificant CPI inflation effect, exchange rates depreciate and nominal interest rates rise significantly. Depression is prolonged under *CPI-IT*, there is initial inflation followed by volatility, the depreciation of the real exchange rates is more important and prolonged but the rise in the interest rates is smoothed. *Strict IT*

[2] To facilitate comparisons, I report the impulse response results of the authors in appendix 7

implies an initial rise in output which then falls (output is more volatile); exchange rates change steady state at the new depreciated level.

Foreign (positive) output shocks raise output on impact in all specifications but by less in the stricter version of IT which also registers deflation while there are almost no price consequences in the other regimes. Also, the *strict IT* leads to a new appreciated steady state for exchange rates. Depreciation is only temporary in the other regimes.

Technological shocks lead to inflation under *strict IT*, volatility in prices for the other versions of IT and no price consequence for capital controls. While there is nominal exchange rate depreciation in all cases, exchange rates change their steady state again under *strict IT*. Nominal interest rates are almost irresponsive with the latter version of IT, they rise on impact with capital controls but they decrease slightly more under the remaining regimes.

CHAPTER 3- DATA ANALYSIS AND ESTIMATION METHODOLOGY

In this section I present the data I am using in my research and describe the main variables in the model. I then explore the theoretical approach to structural VARs and estimate the model using various specifications.

3.1 The SVAR approach

The estimation methodology used to analyze the inflation targeting regime in Romania employs a monetary structural vector auto-regression (SVAR) built on the endogenous and exogenous variables from the macro-economic model in Berkmen and Gueorguiev (2004). I estimate three alternative SVAR models with output, inflation, interest rates, exchange rates and any of the following three: European exchange rates, European output or capital account in the above mentioned order.

VARs are widely used in the empirical literature to produce forecasts or to investigate the effects of shocks on a system of variables. Structural VARs differ from unrestricted VARs in the sense that they allow the researcher to model the contemporaneous relations between the underlying variables explicitly based on economic theory. Thus SVARs have the merit that they combine the statistical methodology of simple VARs with restrictions dictated by economic theory and thus benefit from the advantages of both approaches (Bank of England, Ch 5). The limitations of SVARs consist in that the number of shocks that need to be considered when estimating such models has to be equal to the number of endogenous variables analyzed in order to achieve exact identification; however the economy may be hit by more shocks than are usually identified in SVAR estimations. Some recent work relaxed this inconvenient by using the so-called reduced rank identification (Gorodnichenko, 2004). In the present research the number of shocks that hit the economy exactly equals the number of endogenous variables.

I can use a monetary SVAR to analyze the speed with which monetary policy changes feed through to the real economy and the nominal variables. Forecast error variance decompositions can help determine the relative importance of the structural shocks in the movements of macroeconomic variables. The advantage of comparing results derived from data to the theoretical ones derived from general equilibrium analysis is that the impulse response functions may reveal different outcomes and thus point at some set of unrealistic assumptions in the underlying theoretical model: the assumption that current account dynamics does not matter for the formulation of monetary policy may lie in this category.

A reduced form VAR (Boivin and Giannoni, 2002) written in matrix form is:

$$Y_t = a + A_1 * Y_{t-1} + .. + A_k Y_{t-k} + u_t$$

where a is the vector of constants, $A_{1....}A_k$ are matrices of coefficients and u_t is the vector of innovations. The estimates of the A matrices are obtained by running OLS equation by equation. This is possible under the fundamental assumption that the variance covariance matrix of the system innovations is assumed to be diagonal; therefore there should be no contemporaneous cross-correlation between the residuals of the unrestricted VAR and no serial correlation. The disturbances are also assumed to be "0" mean and homoskedastic.

The residuals of the reduced VAR are a linear combination of the fundamental shocks that hit the economy represented by a vector $\varepsilon_{t,}$. The structural VAR then takes the form:

$$B_0 Y_t = b + B_1 Y_{t-1} + \ldots + B_p Y_{t-k} + \varepsilon_t$$

where B_0 is an invertible matrix normalized to have only 1's on its main diagonal; the variance covariance matrix of the fundamental disturbances $E(\varepsilon_t \varepsilon_t') = \Sigma\varepsilon$ is assumed to be diagonal. Then the following equations should hold: $a = B_0^{-1}b$; $A_j = B_0^{-1} B_j$ for $j = 1\dots k$;

$u_t = B_0^{-1} \varepsilon_t$ and $\Sigma_u = B_0^{-1} \Sigma\varepsilon (B_0^{-1})'$.

To achieve full identification of the SVAR, n*(n-1)/2 restrictions need to be placed on the contemporaneous matrix of coefficients, where n is the number of endogenous variables in the system (I will thus need to place 10 restrictions altogether). I will employ a 5 variable VAR in which full identification is achieved as follows:

there is no contemporaneous reaction of output to shocks in prices, interest rates, exchange rates and European interest rates (the identification is the same in the other SVAR specifications in which I place instead of the European interest rates, the measure of European real output and of capital account respectively). Prices are allowed to shift contemporaneously under demand shocks but not under the monetary policy shocks coming from interest rates: this way I assume that it takes time for the monetary policy to transmit its signals to the economy. But prices have an important volatile component, especially when expressed in consumer price indexes and it is possible for them to adjust immediately to demand shocks. The easiest way to think about it is to consider the indirect pass-through effects coming from exchange rates. Naturally in making this assumption I also imply that unexpected shifts in exchange rates do have an immediate impact on prices;

interest rates react instantaneously to all the above variables (except for the European interest rates) for which contemporaneous information must be available. Exchange rates with their high volatility incorporate any news coming from the macroeconomic variables with no time lag. In my model the fifth variable should by nature be exogenous to the model to keep consistency with the benchmark DSGE model. It is unlikely that the European interest rates or the EU25 GDP would be reactive to any shock stemming from Romania. As such, placing 0 restrictions on all but one coefficient should not be in contradiction with reality (I will allow the exchange rate innovations to have an immediate impact, if applicable, on the European variables; this in turn will achieve full identification).

The capital account coefficients deserve a note of caution since it is likely that capital flows are resilient to news in prices, output or interest rates faster than implied by my identification scheme. To deal with this I used alternative identification restrictions in order to relax the assumptions about the capital account variable which I do not report here and which yielded similar results.

All the variables respond naturally to their own shocks. The resulting identification matrix is:

$$\begin{matrix} 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 \\ 1 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 \end{matrix}$$

where 1 means that the endogenous variable is allowed to respond contemporaneously to a shock in the right hand-side variable and 0 means no contemporaneous response. The contemporaneous variance covariance matrix between the underlying structural shocks is a five by five matrix in which the main diagonal is normalized to 1, namely the variances of the underlying economic shocks are assumed to be unity.

3.2. The data

For the present empirical investigation I use monthly data starting with May 1997 in order to avoid the financial turmoil at the beginning of the year and ending February 2007. 1997 is the year when unified exchange rates were set in place for Romania. The variables included in the SVARs are obtained by taking the natural logarithm of the seasonally adjusted underlying data series (except for the interest rates which are expressed in percentage points). Seasonal adjustment is performed using the Census 12 method. For domestic output (GDP) I use the monthly industrial production index; my measure of inflation (INFL) is the month on month change in the consumer price index; the interest rate (IR) is the 3 month BUBOR rate, the exchange rates (ER) are measured in ROL versus Euro (and versus ECU where applicable), real exchange rate (RER) is a trade weighted real exchange rate with the EU25 countries, European interest rates (IR^*) are the 3 month ECB rates and finally capital account (KA) is given by the monthly total capital inflows. The data comes from the National Bank of Romania, from the Eurostat and from the International Financial Statistics of IMF.

3.3 VAR Specification

The VARs I estimate are of order 3. The lag length was chosen based on various information criteria like AIC or Hannan-Quinn or the Schwarz criterion. While AIC favored larger lag length, HQ and the Schwarz criteria almost invariably validated the choice of 3 lags. Though I do not completely eliminate autocorrelation in the VAR according to the LM autocorrelation tests, I am concerned with parameter accuracy and thus make a trade-off between the degrees of freedom necessary to estimate more stable coefficients given the short data set and the need to eliminate the residual autocorrelation in the model necessary for credible test statistics (I believe however that it is highly likely that the first three lags capture most of the autocorrelation in my model).

I check the stability of each SVAR on each sub-sample by running the AR root test. All the roots of the characteristic polynomial lie inside the unit circle and therefore I conclude that the estimated SVARs are stable. The SVAR equations are estimated using the variables in levels along with a time trend and a constant. The time trend is introduced to eliminate some of the non-stationarity in the variables. According to the unit root tests, all the variables specified are I(1) and thus have the same order which allows me to enter them into the SVAR without further transformation. The estimated coefficients are super-consistent and exhibit asymptotic efficiency according to Fuller (1976 in Sun,…), even if the variables are integrated of order one. I avoid differencing because I am concerned that this way I might through away valuable information about the behavior of the variables.

Naïve Chow breakpoint tests and Chow forecast tests detect no structural break in the data at the moment of January 2005. Of course this confirms my previous expectations. The CUSUM and CUSUM square tests performed for the equations in the VARs find good stability of the coefficients in general (although the VAR specifications using real exchange rates instead of nominal exchange rates exhibit more instability). The problem of instability in monetary VARs is widely recognized however (Boivin, 1999 in Boivin and Giannoni, 2002).

CHAPTER 4- RESULTS INTERPRETATION

In this chapter I explore various ways to identify the change in monetary policy regime in Romania. I first discuss some approaches to regime switch identification that are used in the related literature, then I proceed to the comparison among the impulse responses estimated with the SVAR and those resulted from the benchmark simulation of Berkmen and Gueorguiev (2004). I will then look at the variance decompositions for more evidence.

4.1. The approach to IT identification-some remarks

There are many ways in which the IT literature manages to identify the IT effects. Some authors look at the evolution of inflation and output volatility in connection to the interest rate volatility (Haldane, 1997). Others perform dynamic simulations and compare the results with the actual evolution of the data (Hofmeister, 2001). A particularly interesting method is that of Boivin and Giannoni (2002) who build counterfactuals by restricting the monetary policy coefficients to the pre-change in regime levels and re-estimate the impulse responses with data for the after-regime change.

Given the small time span on which IT has been in effect in Romania, it will be probably difficult to perform the task of identification with much accuracy. Nonetheless I will supplement the comparison of the impulse responses to the benchmark simulation with the analysis of the variance decompositions, following other authors (Neumann and von Hagen, 2002; Leiderman et al, 2006). However this method or any of the above mentioned alternatives is not without flaws.

This method has been criticized among others by Mishkin (2002). The observed decrease in volatility might be the result of other factors also (in case of Romania the European integration might have acted as a stabilizing force); SVAR models do not impose too much structure nor include too many variables; therefore they may not be able to exactly identify the real source of shocks: exchange rate shocks may be generated by current account shocks also. Good outcomes of inflation targeting may be a result of predominantly favorable types of disturbances. The Lucas critique is applicable as well: if one observes decreased reaction of interest rates to inflation, interpreting the result as a reduced focus of monetary policy on inflation would be wrong if what happened in reality was a result of low inflation expectations (that is, markets believing the policy would not allow deviations from the target substituted for the need of interest rate reaction). Bearing this note of caution in mind, I proceed to the results.

First I estimate the impulse responses and by visual inspection I compare my results with those from the simulation trying to identify common patterns. To ease my task I split the sample in two parts: one spanning from May 1997 to May 2004 and the other from January 2000 to January 2007. The main rationale behind my approach is that while I am interested in capturing behavioral changes in the impulse responses (IR) between the different regimes by choosing samples with an overlap as small as possible, I am also concerned with sample length in order to preserve the accuracy of the estimation.

I then look at variance decompositions in order to see how much of the interest rate variability is due to inflation, output, exchange rates or capital account. I will compare the results across the 2 samples to see how the relative composition of the interest rate variance has changed. The reason for doing so is that under inflation targeting the monetary authorities use an interest rate rule in which the total (or at least the greatest) weight is set on the deviation of forecasted inflation from the medium term target. To the extent that this objective is not jeopardized the monetary rule may also place some weight on the exchange rate deviation consistent with some degree of discretionary exchange rate management. This is the so called flexible IT (this definition does not correspond to that in the benchmark model).

Under the previous regime an exchange rate rule was used to obtain a certain appreciation which would be consistent with a pre-announced disinflation path. This was made possible by keeping some degree of capital controls. Without capital controls, switching from an explicit managed exchange rate to targeting inflation was crucial in avoiding excessive speculative capital. Under the new regime exchange rates are allowed to float freely but interest rates are adjusted to keep inflation within the targeted bands.

Econometrically, if these rules were applied in the textbook sense, one should be able to estimate an interest rate rule without preoccupying too much for the contemporaneous simultaneity between interest rates and exchange rates. This is simply because the theory implies that, since the uncovered interest parity holds, when the Central Bank picks the exchange rate it automatically picks the interest rates too (and thus exchange rates are exogenous to the interest rates) and vice versa. In this light the two regimes seem strikingly similar.

In practice however things are by far not so easy. The first thing that should come to mind as obvious is that the Central Bank might not have full influence on exchange rates and that interest rates may not be as effective as they are supposed to be. The natural conclusion is that the Central Bank will try to gear both instruments in the same time (each for differing purposes) or water down a "regime" or the other according to the specific shocks or circumstances. Interpreting the interest rate equation in my SVAR as an uncovered interest parity condition would therefore be wrong(after all, the empirical evidence has failed so far to find convincing evidence in favor of uncovered interest rate parity). Adding the interest rates to the model with exchange rate anchor is not redundant as interest rates are not deterministic or put differently, adding them to the model will not cause an over-identification problem.

Simultaneity between the two instruments is likely in the case of Romania which officially manages the exchange rates in parallel with targeting inflation. That is, when the inflation keeps close to the target, competitiveness considerations may come to the forefront of monetary policy so long as the primary objective of inflation is not in peril.

Identifying IT effects is likely complicated by the fact that the previous regime also targeted (dis)inflation in a less stringent way. Therefore, given also the moderate transition to the capital account liberalization I do not expect to see a structural break in the data at the moment of 2005. A naïve Chow breakpoint test confirms this suspicion.

4.2. SVAR impulse responses:

4.2.1. Foreign interest rate shocks

Foreign interest rate shocks have much less inflationary consequences with IT. Output rises which is a feature of *strict IT* in the simulation exercise. In the pre-IT regime there was an initial output loss on impact but then output rose to a new steady state in the next 2 years. With IT real exchange rates appreciate in the first 4 months but they reverse trend to depreciate even by more in the next two years. Interest rates rise considerably in the first 6 months and they recover in the next 6 months. Interest rates rise more rapidly in the first sample suggesting less smoothing. Real exchange rates behave roughly the same. The subsequent relaxation of monetary policy follows the pattern of the foreign rates but they have a steeper decline which probably explains the real depreciation. The reactions point to the patterns found by Berkmen and Gueorguiev (2004) in the simulation results.

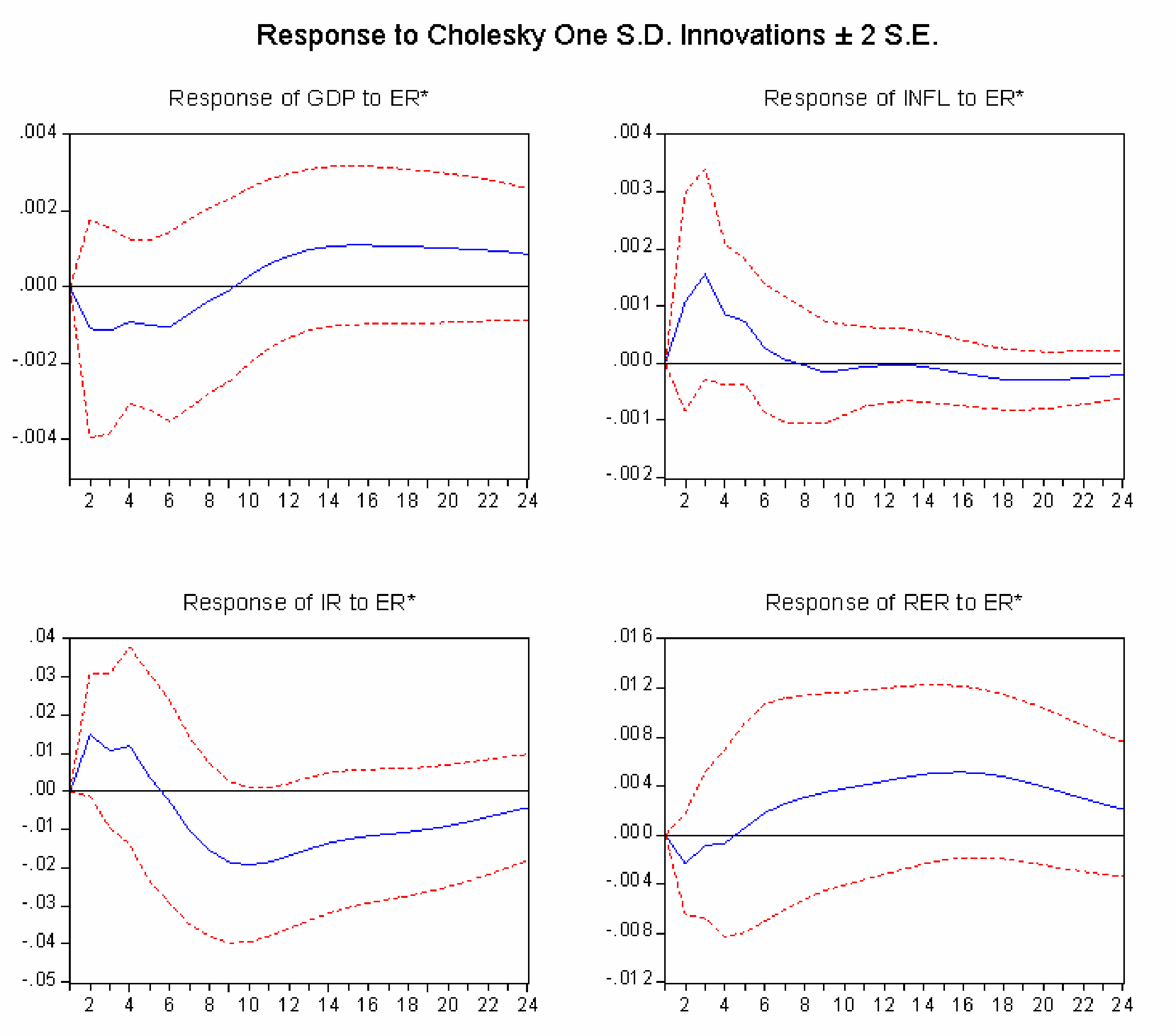

Fig.1. Pre-IT sample foreign interest rate shock

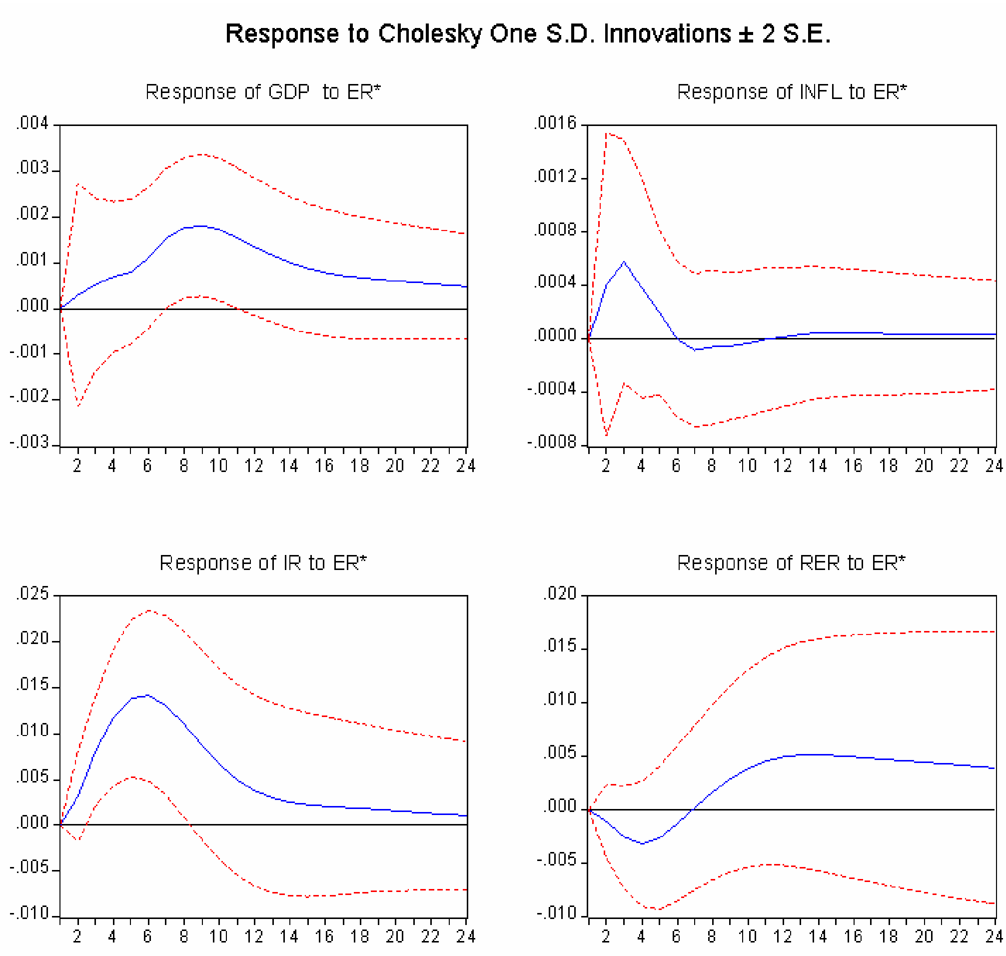

Fig2. IT-sample foreign exchange rate shocks

4.2.2. Positive output shocks

Positive output shocks in the initial sample reproduce similar results to the productivity shocks under *partial controls* in the reference paper. The output reaction on the IT sample is steeper, similar to *stricter IT*. The real exchange rate depreciation is prolonged in the IT period, a feature which peaks up some characteristics of the inflation targeting regimes. There is a muted and volatile reaction of the interest rates.

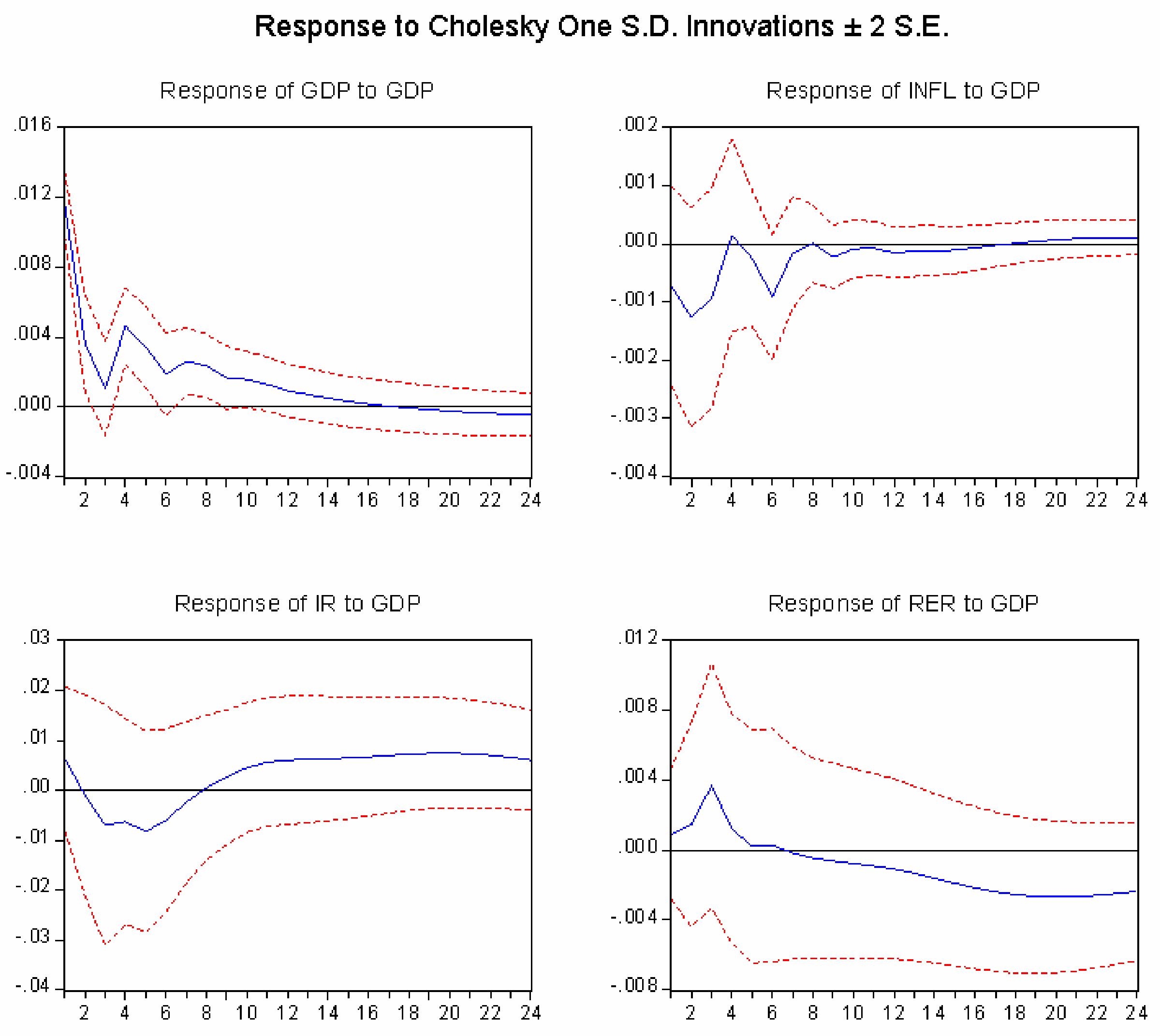

Fig. 3. Pre-IT sample output shocks

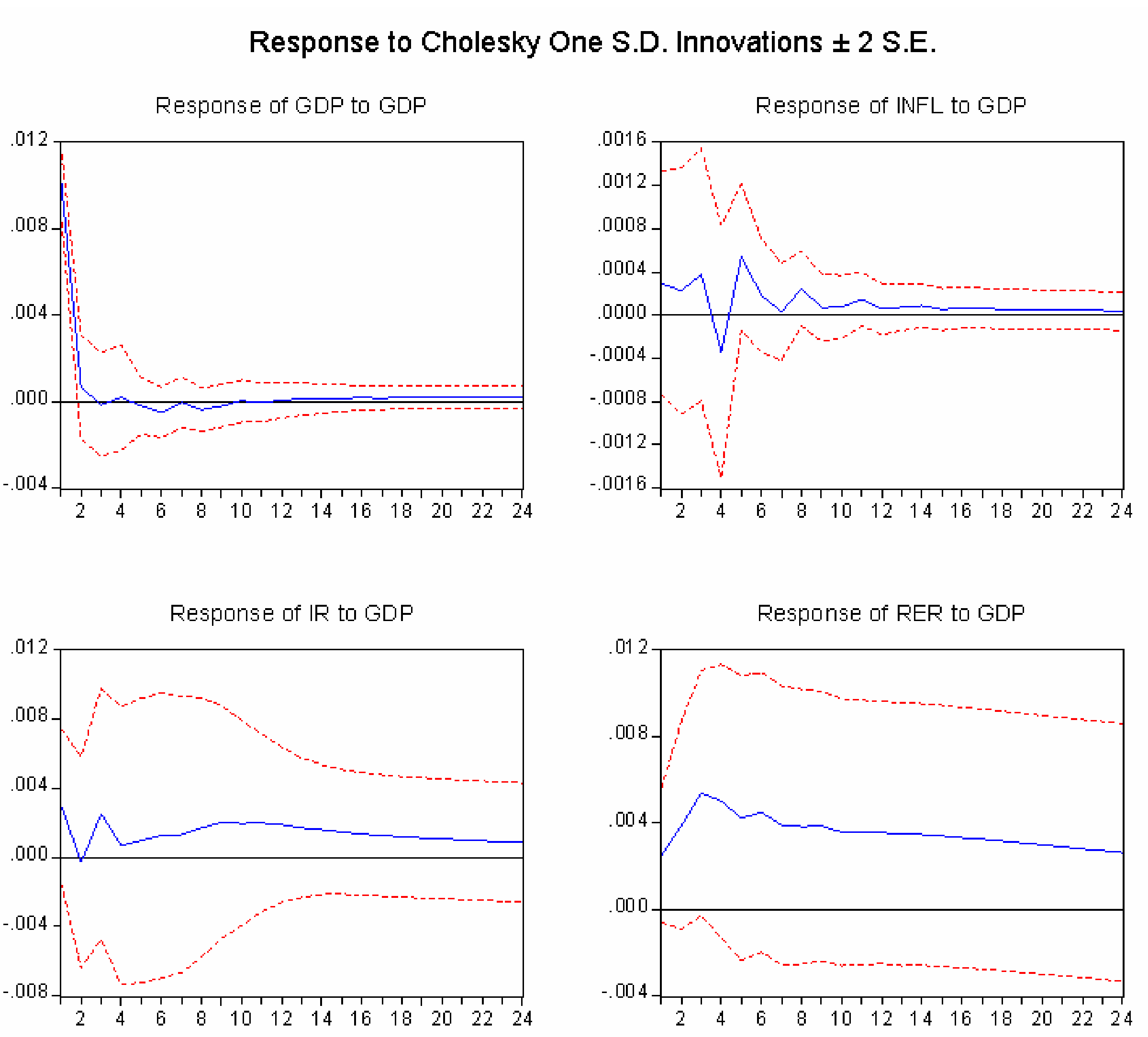

Fig 4. IT sample output shocks

4.2.3. Real exchange rate shocks

In my model they exhibit the smoothed pattern specific to a *strict CPI-IT* in the IT sample. Output looses altitude after an initial mild increase and then recovers showing signs of volatility which is a common pattern to what we see under the *flexible CPI-IT*. Inflation behaves similarly across estimation and simulation, with some volatility attached. Interest rates are somewhat cyclical in the first months but then they rise to a higher steady state. Since interest rates have opposite responses in the different simulated regimes, such behavior on real data may not be totally un-understandable. When I compare the results for the interest rate responses between my time samples, the tendency to move in opposite direction become more obvious. With pre-IT policy, nominal interest rates fall by more. There is less loss in output in the IT sample, but more deflation in the pre-IT sample. Taken together, these observations do not offer very convincing evidence, however.

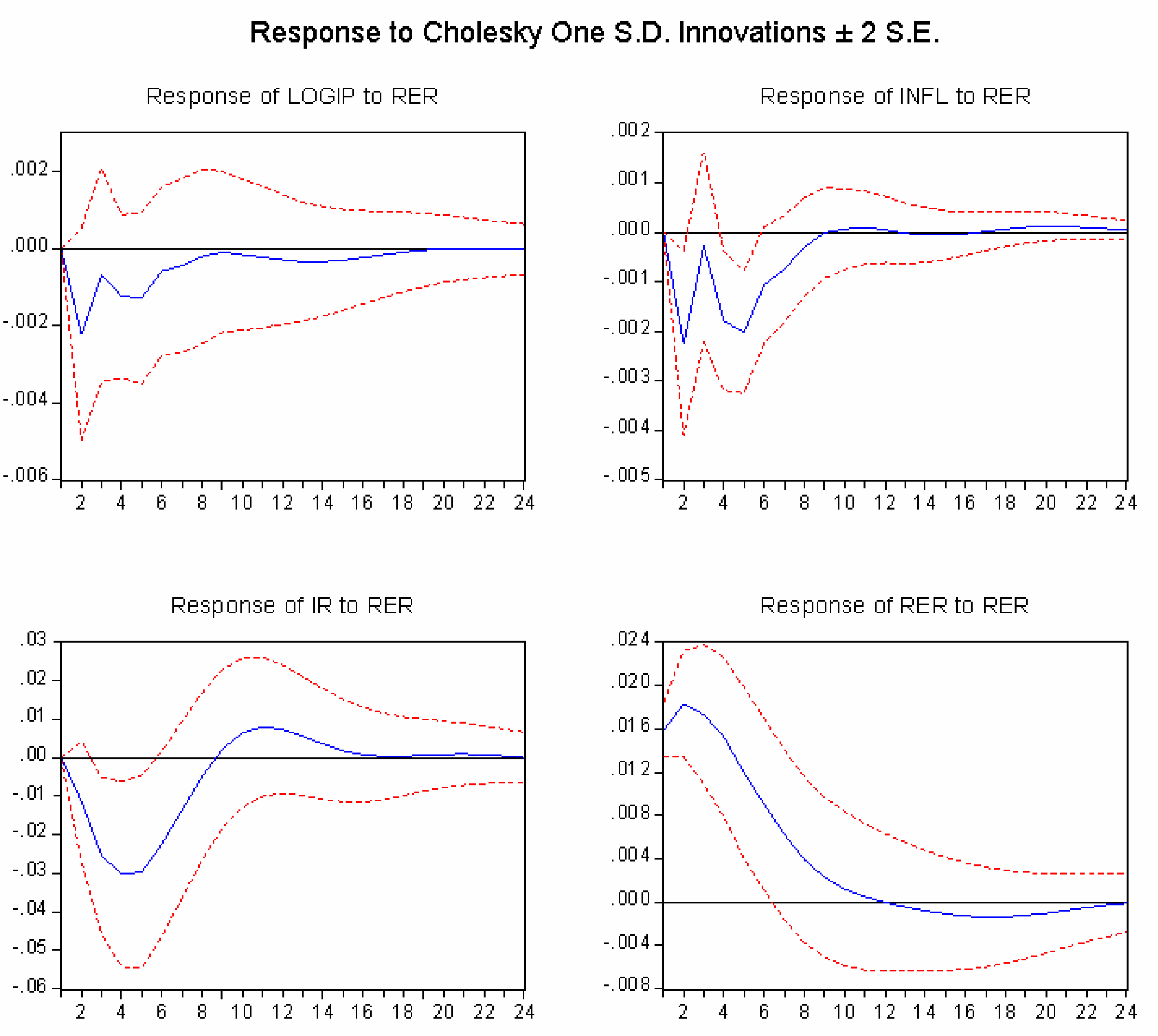

Fig.5. Pre-IT sample real exchange rate shock

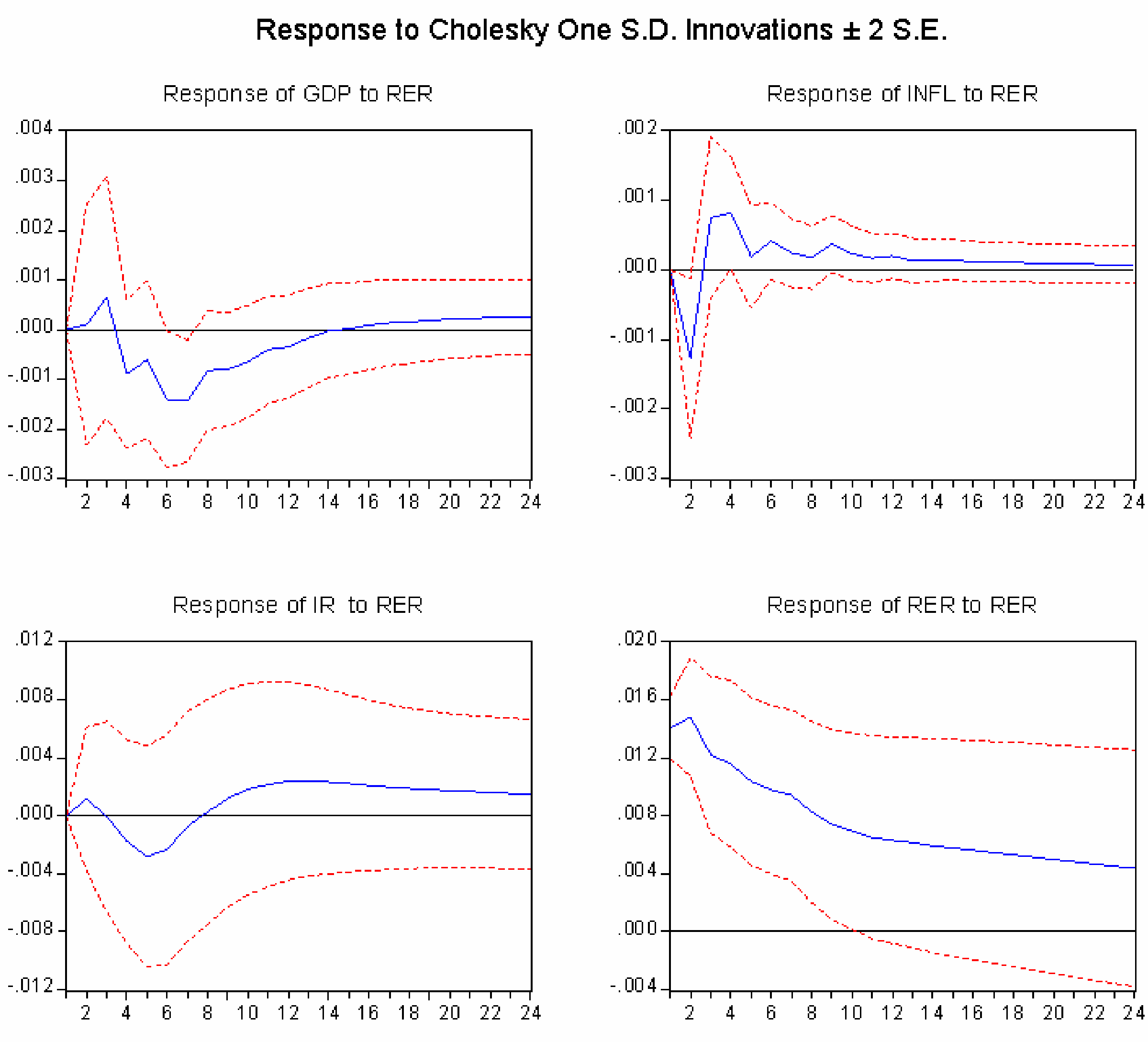

Fig.6. IT sample real exchange rate shock

4.2.4 Nominal exchange rate shocks

When I analyze the **nominal exchange rate shocks**, output rises on impact, reproducing the *capital controls* type of response; nominal exchange rates come down slowly. Interest rates only rise but do not fall on impact and the reverse in policy follows rather fast. In the SVAR using nominal exchange rates instead of real exchange rates, there is inflation under exchange rate shocks, reflecting the different nature of the 2 shock variables: nominal versus real rates. Output volatility is captured in the IT sample though only at positive values: relatively, the output gains remain bigger for the pre-IT period. Inflation is strong and volatile but dies quickly, similarly to the *flexible CPI-IT* results. Nominal exchange rates stay depreciated for the 2 coming years and do not show signs of reversing to the initial state: this is what happens roughly under *strict IT*. Nominal rates change steady state decreasing as below the pre-shock levels after a slight increase.

Given the lower initial reaction of prices to exchange rate shocks, I am led to conclude that the pass-through from exchange rates to inflation decreased: this is a dynamic effect of IT that justifies the assumption that unfavorable initial conditions may change in response to the implementation of IT and that welfare gains are endogenous to the time period for which IT has been in place.

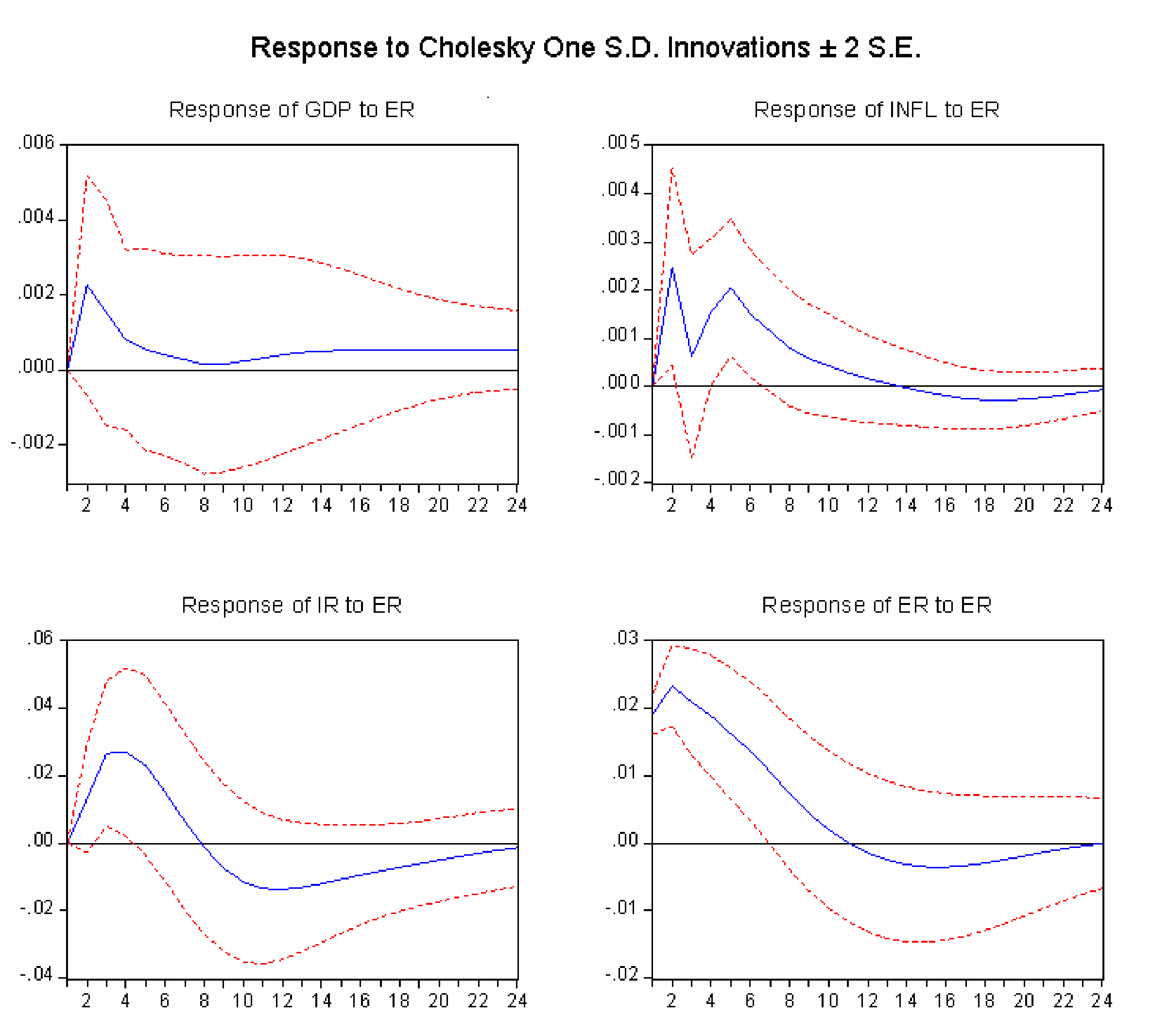

Fig.7- IT sample exchange rate shock

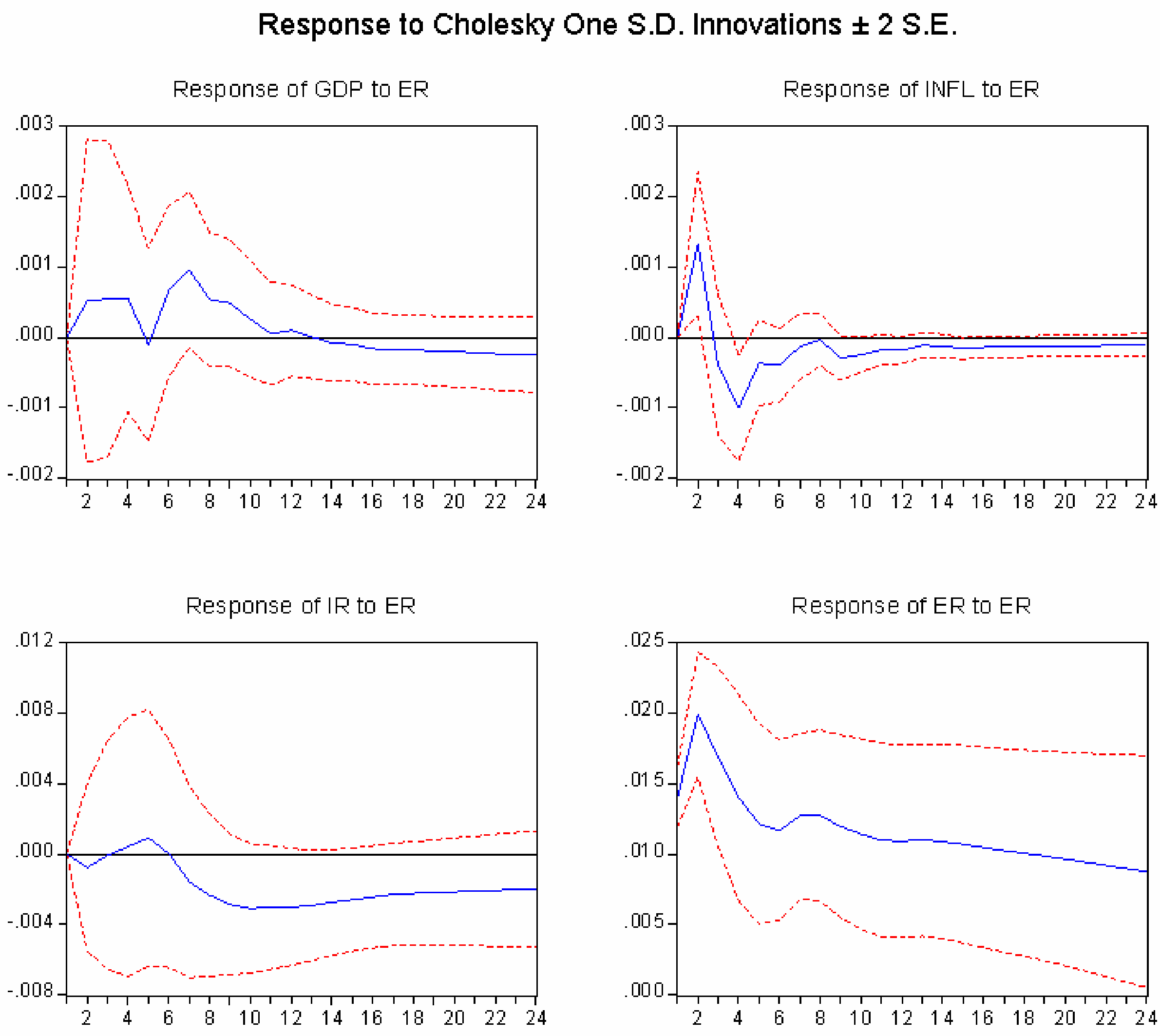

Fig.8- IT sample exchange rate shock

4.2.5. Foreign output shocks

Output depresses on impact in the IT sample, which is somehow puzzling. But then foreign demand spills over into domestic output gains. There is little impact on inflation which is consistent with all the regimes. Though all the regimes predict no major shift in interest rates the data shows an important spike in the rates which is associated with the even more puzzling depreciation. Higher interest rates become necessary with depreciation to keep track on inflation dynamics. The behavior of the variables is atypical under such shocks though they are mutually consistent. In the pre-IT sample output behaves more intuitively and is less volatile. The exchange rates appreciate more notably after the 8 month: this is in line with the relative pattern of the currency in *capital controls versus IT regimes*. However inflation is more volatile: subsequent deflation is generated by appreciation. Again the results are somewhat puzzling.

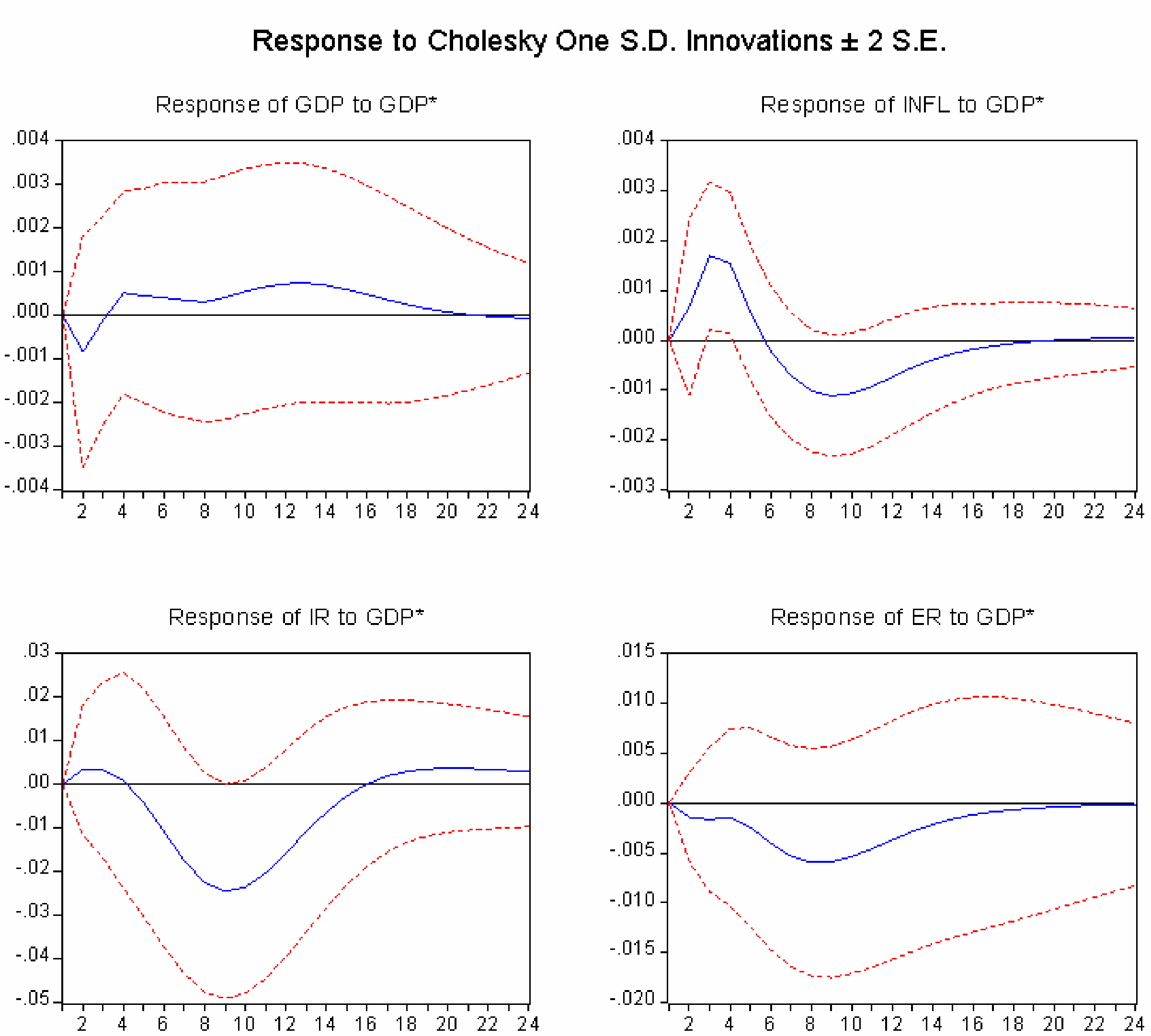

Fig.9. Pre-IT sample foreign output shock

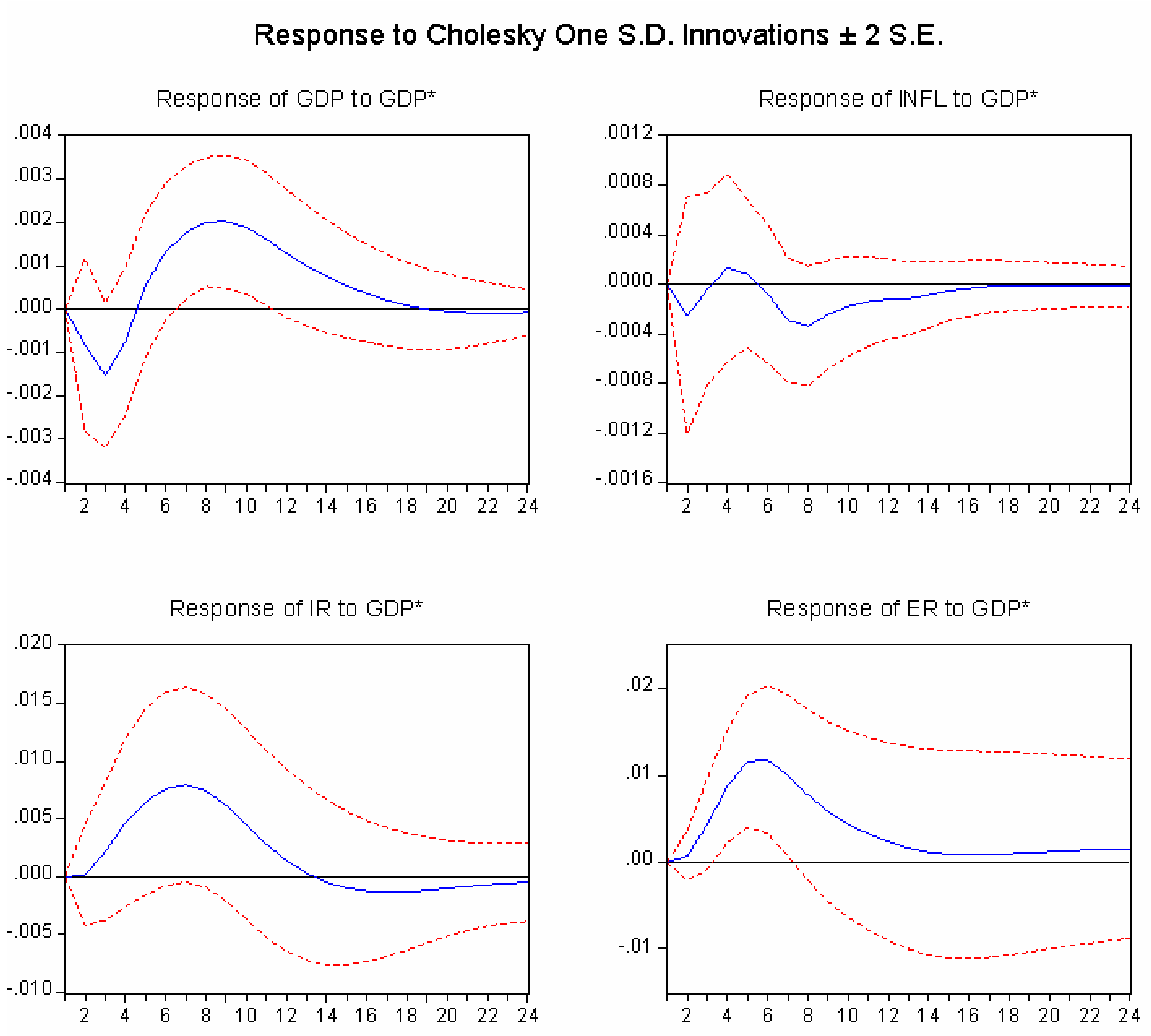

Fig.10.IT sample foreign output shocks

4.2.6 Positive capital account shocks

Interest rates do react strongly to buffer such shocks in the IT sample. Exchange rates depreciate but not strongly. The impact is deflationary and prices exhibit volatility. Again, nominal exchange rates do change steady state as in the case of *strict IT*. Estimating the non-IT sample responses, I find a large initial appreciation followed in the next year by steady state appreciation. After the initial fall, interest rates rise steeply, stay high for a few months and decline before appreciation. Deflation shows up again.

In relative terms, there is more output gain under capital controls which is confirmed by the simulation results. Interest rates are more smoothed on the initial down-turn under IT, though it takes them less than in the pre-IT sample to return to the steady state. However in the pre-IT sample, interest rates behave more cyclically moving in large swings.

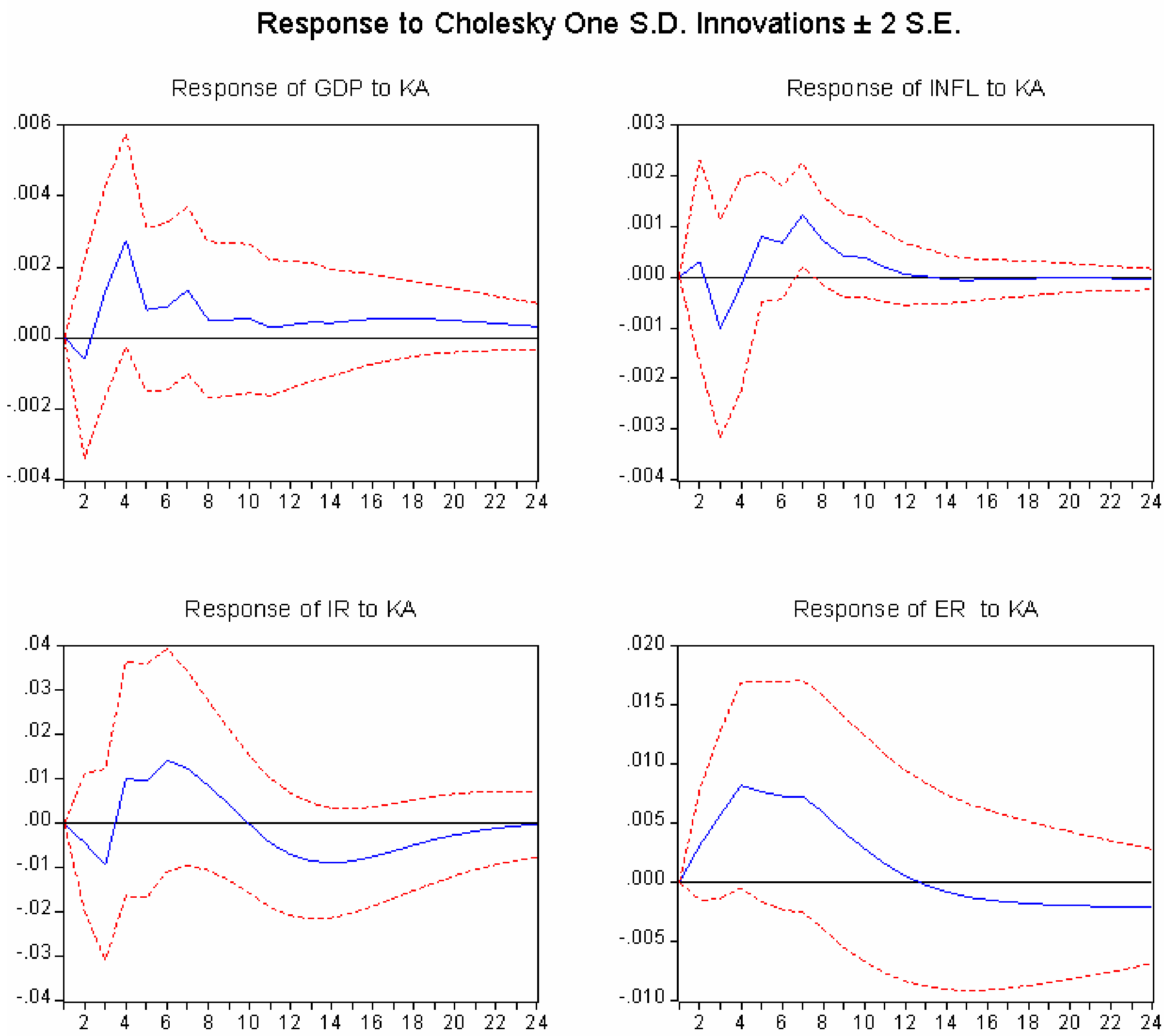

Fig. 11 Pre-IT sample capital account shocks

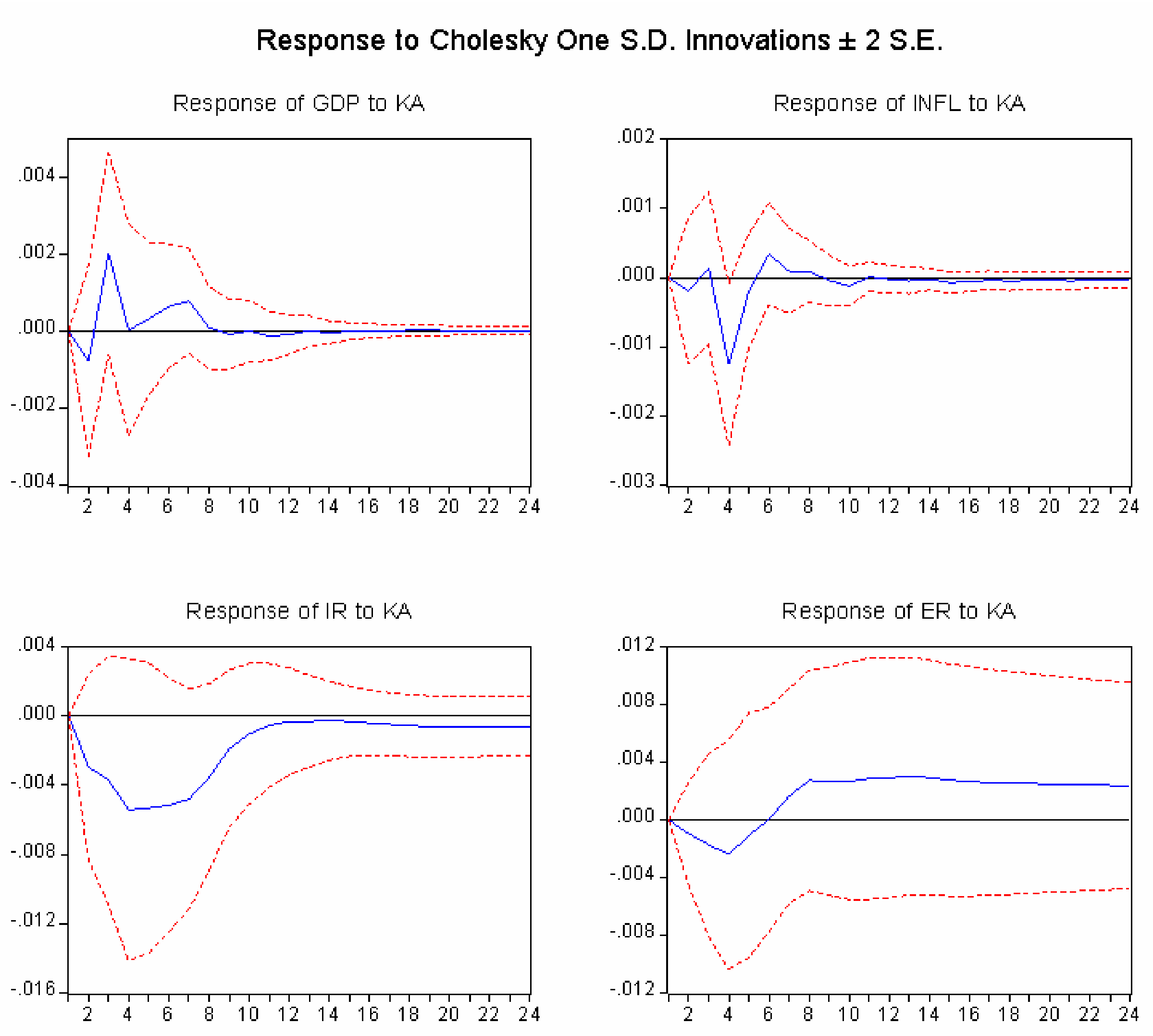

Fig.12. IT sample capital account shocks

All in all I find some similarities in the data that confirm an incipient shift towards the fully fledged inflation targeting behavior. There are however puzzling reactions of the economy which are more likely explained by anomalies characteristic to the Romanian transmission mechanism.

According to Leiderman et al (2006), interest rates should not be very important for inflation before IT: this is confirmed by the data where I find an inflation puzzle. However on the IT sample prices react initially by a decrease.

4.3 Variance decompositions

I will proceed by analyzing and comparing the variance decomposition between the two samples

a. Output decomposition

With IT, interest rates and exchange rates fail to explain so much volatility of output anymore. By contrast inflation and foreign monetary policy shocks account for more of the volatility in output . Looking at the standard errors of GDP across the samples one can detect in general less output volatility in the 2000-2007 sample.

Table 1.

1997 2004 sample
Variance Decomposition of GDP

Period	S.E.	GDP	INFL	IR	ER	IR^*
3	0.013875	90.08938	0.487953	5.150814	3.903487	0.368365
6	0.016675	80.8565	1.431756	13.05145	3.107564	1.552729
9	0.018034	77.15578	1.357219	17.06714	2.697008	1.722854
24	0.019622	71.70972	1.151251	20.52941	3.278471	3.331154

Table 2.

2000 2007 sample
Variance Decomposition of GDP:

Period	S.E.	GDP	INFL	IR	ER	IR^*
3	0.011024	89.00367	9.240023	0.897854	0.471987	0.386471
6	0.011786	78.0969	14.49046	2.840506	0.963843	3.60829
9	0.012268	72.12567	13.57788	3.632341	1.860444	8.803668
24	0.012591	68.91975	13.03423	3.67147	2.065052	12.3095

b. Inflation decomposition

European interest rates and exchange rate shocks matter less for inflation dynamics since IT was adopted: this is a piece of evidence which shows that the pass-through decreased with IT; Inflation is less persistent: passed shocks to inflation explain less of the variance of today's inflation. Evidence in table 3 and 4 proves that volatility of inflation decreased after the switch to IT. I do not find compelling proof in favor of a better transmission of signals from the interest rates to inflation in the variance decompositions results

Table 3.

1997 2004 sample
Variance Decomposition of INFL:

Period	S.E.	GDP	INFL	IR	ER	IR*
3	0.009414	0.427321	79.79291	7.723835	7.37904	4.676892
6	0.01004	1.828087	70.90194	7.400911	15.28866	4.580408
9	0.010313	1.897012	68.45591	7.182122	16.63671	5.828244
24	0.01053	3.066337	65.80101	8.228616	16.63798	6.266062

Table.4

2000 2007 sample
Variance Decomposition of INFL:

Period	S.E.	GDP	INFL	IR	ER	IR*
3	0.005047	1.582959	83.63488	7.173404	7.563106	0.04565
6	0.00529	2.688614	77.92814	7.51834	11.4842	0.380701
9	0.005358	2.792433	76.72897	7.708845	11.55888	1.210867
24	0.005434	3.194849	75.41856	7.762275	12.26494	1.359376

c. Interest rate decomposition

The percentage of variation in interest rates which is due to innovations in the inflation rate should increase with IT, because the relative importance of inflation shocks as a source of interest variance should grow as the inflation targeters place more weight on inflation stabilization. The inspection of the variance decomposition graphs confirms this hypothesis: while inflation volatility made up only 5% of interest rate variance before IT with IT its contribution rose to 20%. Interest rates respond less to exchange rate dynamics which implies a shift in the preferences of the Central Bank. The relative weight between inflation and GDP increased. Reaction in the IT sample to exchange rate shocks is delayed while the reaction to inflation shocks is strong and rapid. The policy rule is less backward looking since maximum response of interest rates is achieved at closer lags in inflation. Overall, volatility of interest rates also decreased, which favors the assumption that IT changed the behavior of the central bank. With less intervention in the foreign markets, the national bank does induce so much variation in the official interest rate(this explanation does not hold however if for instance the stability of the interest rate was market-induced)

Table.5

1997 2004 sample
Variance Decomposition of IR:

Period	S.E.	GDP	INFL	IR	ER	IR*
3	0.115256	0.484144	3.373421	87.1176	6.668452	2.356385
6	0.137401	1.801105	3.273791	79.86924	12.60194	2.453929
9	0.143468	3.353262	4.921359	73.88336	12.03724	5.804772
24	0.154443	5.690165	4.49935	65.11596	15.51027	9.184254

Table.6

2000 2007 sample
Variance Decomposition of IR:

Period	S.E.	GDP	INFL	IR	ER	IR*
3	0.035111	3.229103	12.89638	78.37445	0.046139	5.453932
6	0.045524	3.819542	21.05027	57.27349	0.07804	17.77865
9	0.047453	5.442097	20.91612	53.23712	0.784734	19.61993
24	0.049718	7.276091	20.78788	49.28446	4.462066	18.1895

d. Exchange rates decomposition:

Output shocks decreased their intensity on exchange rate volatility: the exchange would fluctuate more under the previous regime to accommodate foreign monetary shocks. The previous exchange rate regime placed more weight on output than on inflation: exchange rates were more volatile in response to output variation before 2005. The relative volatility of the currency in response to output and inflation shocks reversed after 2005, which is the normal tendency under free float (exchange rates as a nominal variable should have a volatility more synchronized with prices than with real variables).

Table.7

1997 2004 sample
Variance Decomposition of ER:

Period	S.E.	GDP	INFL	IR	ER	IR*
3	0.038776	4.543046	1.872327	2.654666	89.57685	1.353114
6	0.052763	11.29363	3.612774	6.433251	77.38055	1.279794
9	0.060939	21.11824	3.59059	9.838046	63.02925	2.42388
24	0.076658	35.45182	2.661479	12.48826	41.15297	8.245464

Table.8

2000 2007 sample
Variance Decomposition of ER_SA:

Period	S.E.	GDP	INFL	IR	ER	IR*
3	0.032519	12.47737	1.90538	0.882828	83.17949	1.554931
6	0.045171	18.15153	9.110049	2.49139	66.70641	3.540616
9	0.055597	19.54206	13.05398	5.741003	59.14281	2.520146
24	0.083915	22.39267	19.62535	8.550897	48.14118	1.289907

4.4. Additional evidence

4.4.1. Interest rate shocks

Turning back to the impulse responses, some other features become obvious. Interest rates should become less volatile with IT and be better in transmitting the monetary signals. They are not used so much as a buffering device anymore (they are more smoothed). With post-IT data interest rate shocks die slowly after 10 months. In the pre-IT sample interest rates which are 4 times bigger in magnitude die after 8 months.

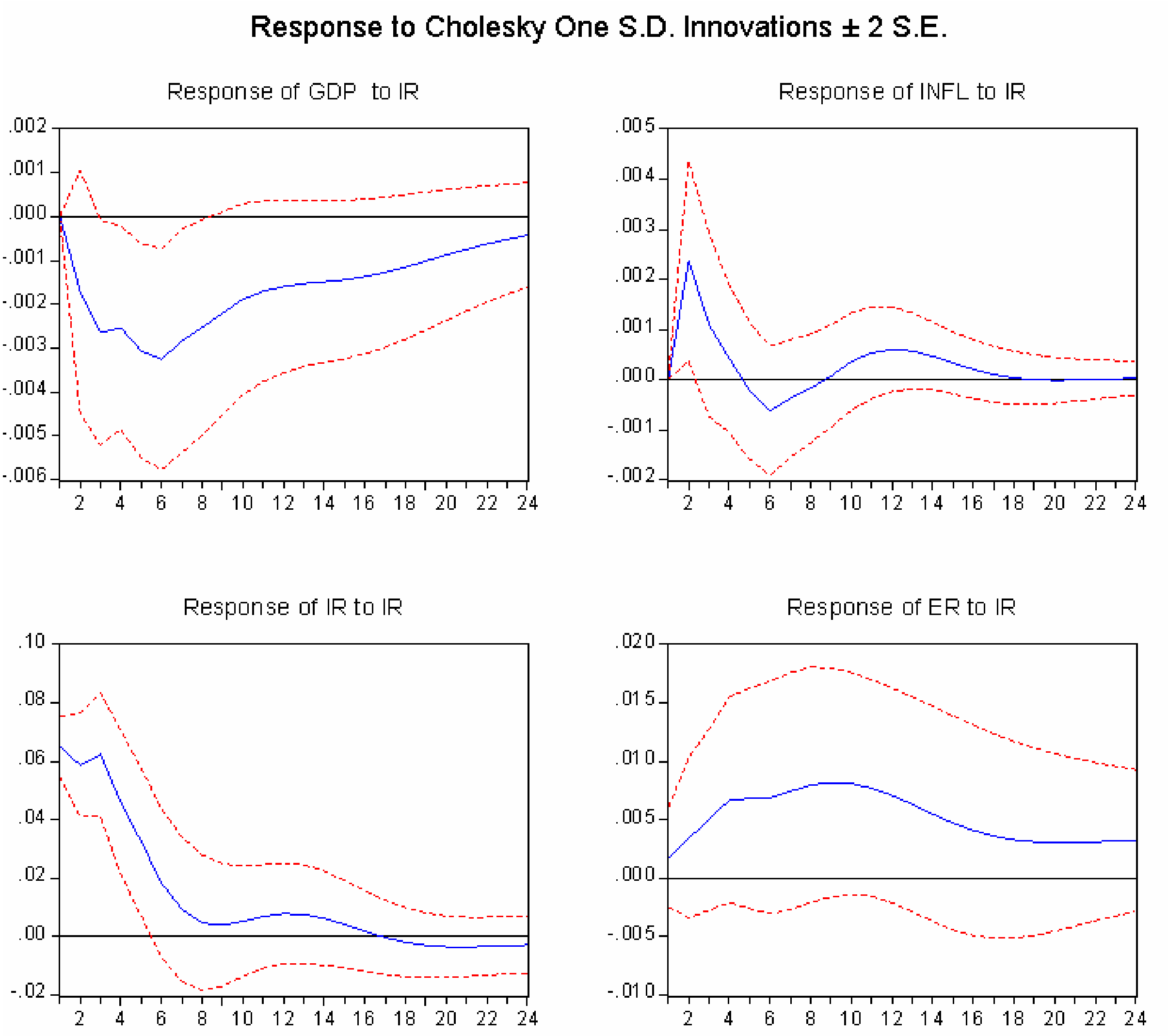

Fig.13. Pre-IT sample interest rate shocks

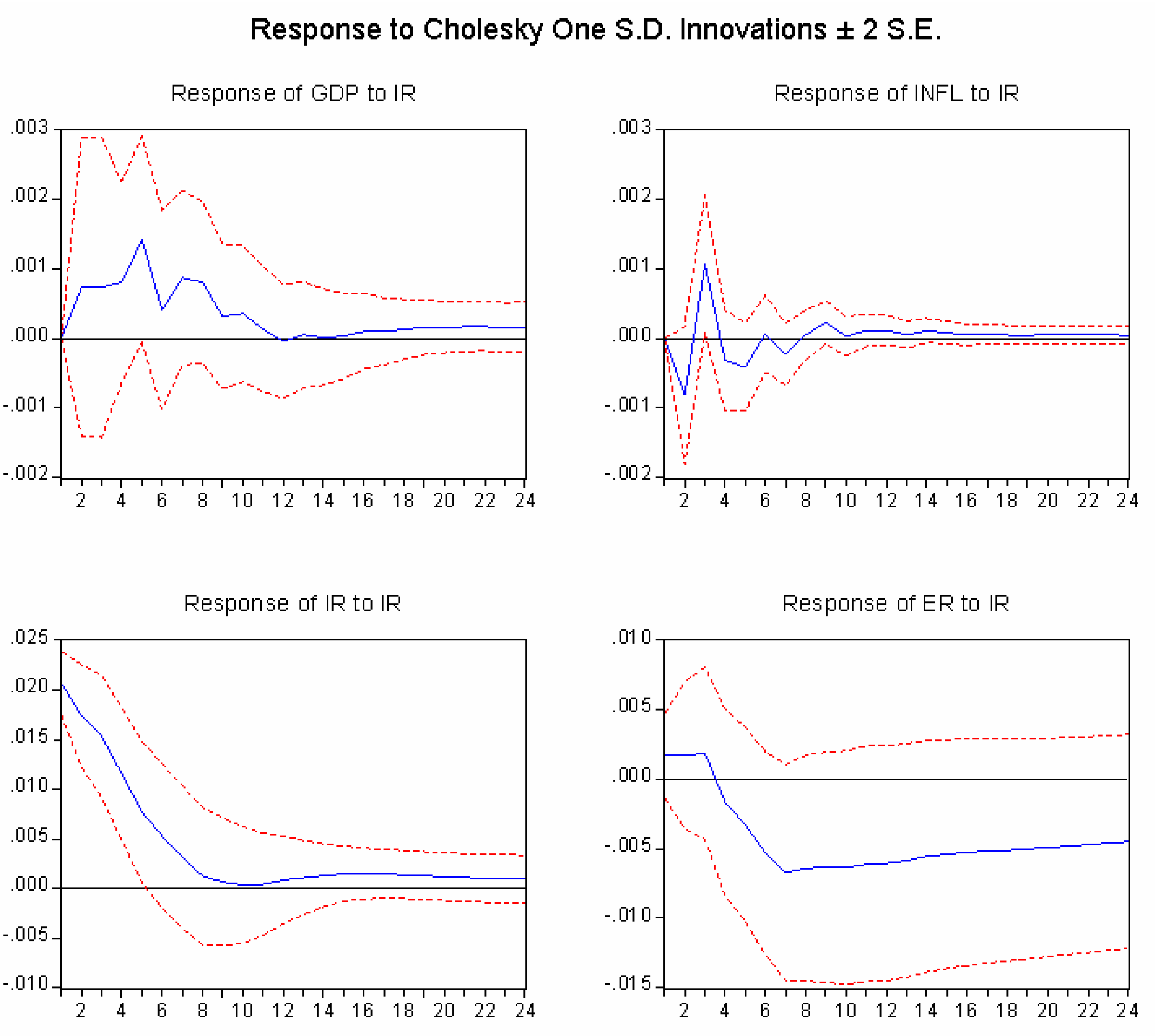

Fig.14. IT sample interest rate shocks

4.4.2. Inflation shocks

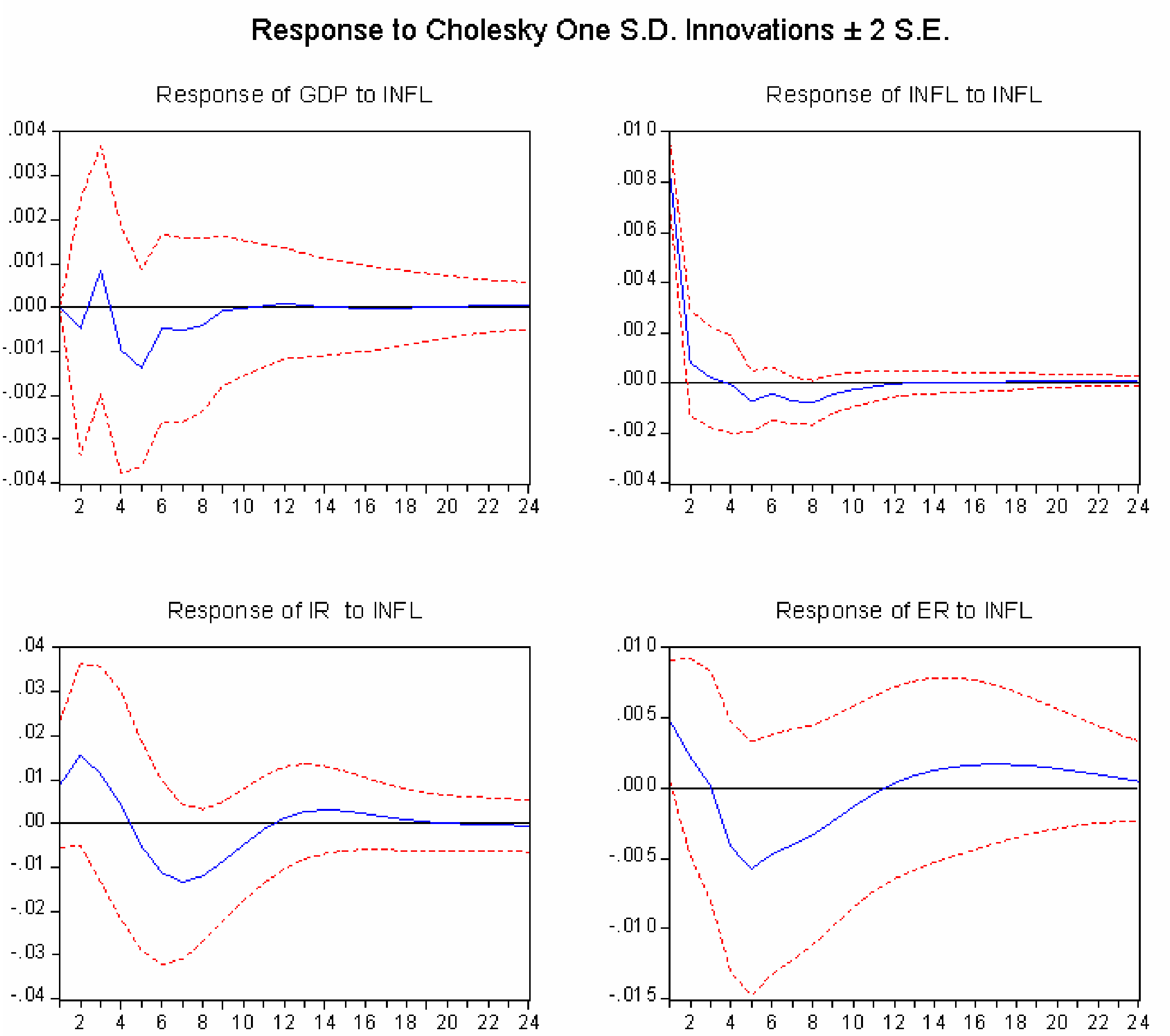

Fig.15 Pre-IT inflation shocks

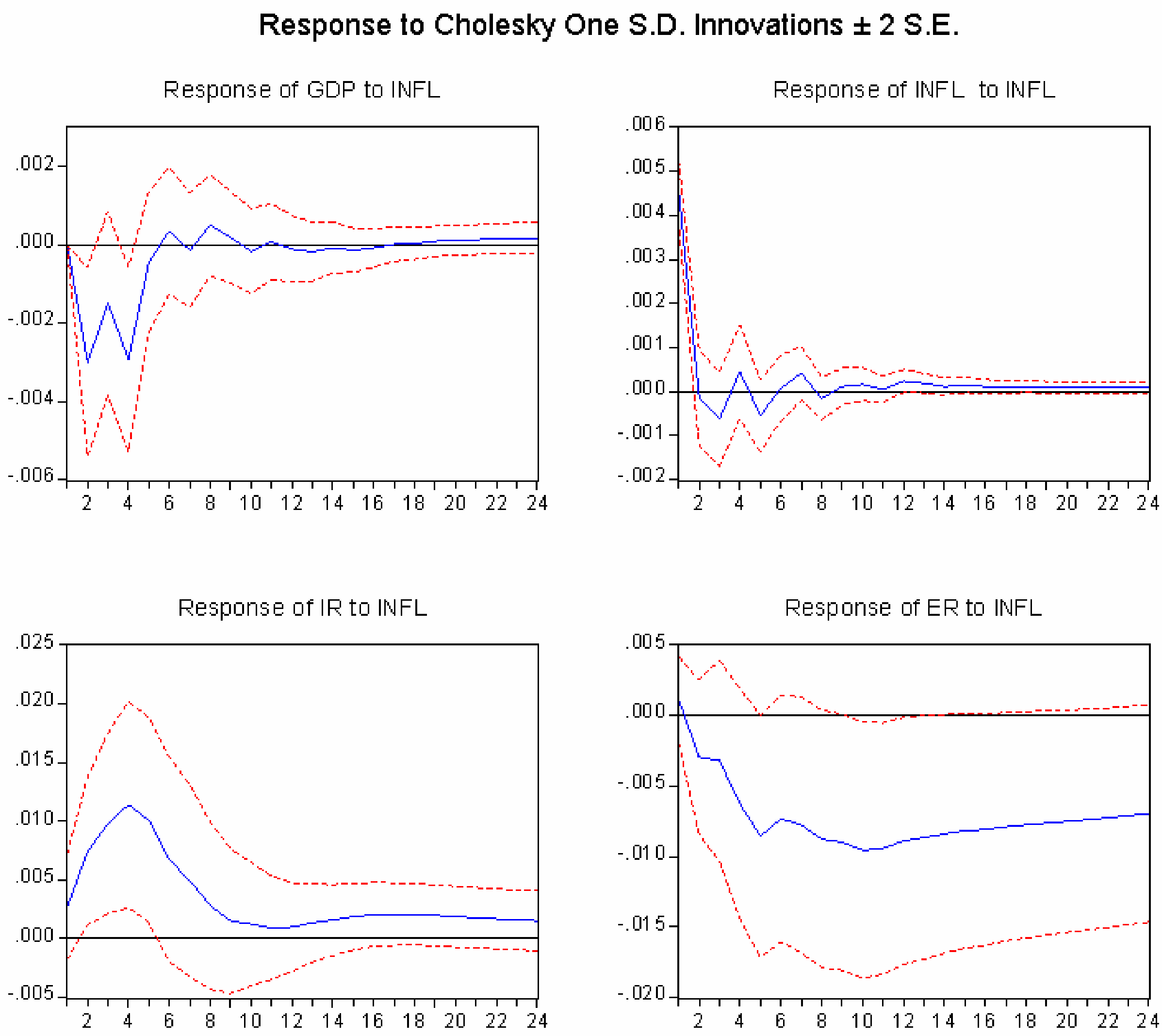

Fig.16.IT sample inflation shocks

Inflation targeting should render inflation unforecastable: that is one should be able to read in the data less persistence (at best, zero persistence). The impulse response of inflation to inflation shocks shows an immediate fall of inflation to the initial level. In contrast, with pre-IT data the first inflation shock dies in month four.

Neumann and von Hagen (2002) look at the interest rate reaction to inflation shocks and compares pre with after IT data: when I assess the estimated reaction functions for Romania, I find on pre-IT data a reaction of 0.01 of interest rates to a 0.008 standard deviation in inflation, which is almost 1.25. The post IT evidence shows that interest rates react with 0.025 to 0.045 standard deviation in inflation (which also says that standard deviation of inflation decreased on the post-IT sample) which adds up to 0.5445: obviously this new piece of evidence supports the hypothesis that inflation targeting is working in Romania.

CONCLUSION

In the current thesis I explored from an empirical perspective the effects of inflation targeting in Romania. By comparing the results obtained from a structural VAR with the results coming from simulations performed on a DSGE model specific to small open economies I was able to identify some common patterns between the two sets of reaction functions. Of course the comparison cannot be taken to extremes. However further evidence derived from variance decompositions confirms the successfulness of the IT implementation in Romania.

The economy is still undergoing important changes as it heads towards the Euro adoption. Complying with the Maastricht criteria will likely shift the focus of the bank towards the exchange rate parity again and which will impose additional challenges to policy making. In this light, it is understandable why the current governor of NBR is skeptical about rushing towards the Euro: IT takes time before it comes fully in effect. Changing gear so quickly would only complicate the tasks of a young inflation targeter like Romania

And yet, there are plenty of reasons to believe that the IT regime in Romania has not passed the validation tests. A truly effective regime is only to be proven "through fire". The Romanian economy engaged in direct inflation targeting in a favorable economic environment, enjoying increased investor confidence due to the promise of European integration. The crucial question is: would the monetary policy prove as effective under more drastic conditions?

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APPENDIX 1 - DATA SOURCES

SERIES	SOURCE
Monthly CPI	Romanian National Institute of Statistics, www.insse.ro
Interest rate BUBOR 3m	National Bank of Romania, www.bnro.ro
Exchange rate ROL vs Euro	National Bank of Romania, www.bnro.ro
Capital Inflows	National Bank of Romania, www.bnro.ro
Real exchange rate	International Financial Statistics, IMF
EU25 Industrial Production	Eurostat, www.eurostat.eu
3 month Euro Area interest rate	Eurostat, www.eurostat.eu

APPENDIX 2 - VAR STABILITY CONDITION CHECKS

Roots of Characteristic Polynomial-2000m01 2007m02
Endogenous variables: GDP INFL IR RER IR*
Exogenous variables: C T - Lag specification: 1 3

Root	Modulus
0.955955	0.955955
0.891017	0.891017
0.826265	0.826265
0.667351 - 0.333026i	0.745831
0.667351 + 0.333026i	0.745831
-0.443456 - 0.586185i	0.735028
-0.443456 + 0.586185i	0.735028
0.265840 - 0.585601i	0.643117
0.265840 + 0.585601i	0.643117
-0.350093 - 0.033958i	0.351736
-0.350093 + 0.033958i	0.351736
0.319400	0.319400
0.160980 - 0.242370i	0.290960
0.160980 + 0.242370i	0.290960
0.156915	0.156915

No root lies outside the unit circle.
VAR satisfies the stability condition.

Roots of Characteristic Polynomial-2000m01 2007m02
Endogenous variables: GDP INFL IR RER GDP*
Exogenous variables: C T - Lag specification: 1 3

Root	Modulus
0.996622	0.996622
0.772744 - 0.124197i	0.782661
0.772744 + 0.124197i	0.782661
-0.448269 - 0.595561i	0.745411
-0.448269 + 0.595561i	0.745411
0.718453	0.718453
0.594482 - 0.364884i	0.697531
0.594482 + 0.364884i	0.697531
0.328009 - 0.505105i	0.602263
0.328009 + 0.505105i	0.602263
0.126370 - 0.500247i	0.515962
0.126370 + 0.500247i	0.515962
-0.480082	0.480082
0.337123	0.337123
-0.291773	0.291773

No root lies outside the unit circle.
VAR satisfies the stability condition.

Roots of Characteristic Polynomial-2000m01 2007m02
Endogenous variables: GDP INFL IR RER KA
Exogenous variables: C T - Lag specification: 1 3-

Root	Modulus
0.972200	0.972200
-0.467290 – 0.603358i	0.763151
-0.467290 + 0.603358i	0.763151
0.689234 – 0.184927i	0.713611
0.689234 + 0.184927i	0.713611
0.358893 – 0.609061i	0.706937
0.358893 + 0.609061i	0.706937
0.657324	0.657324
-0.015779 – 0.608363i	0.608568
-0.015779 + 0.608363i	0.608568
0.508604	0.508604
-0.398215 – 0.033330i	0.399608
-0.398215 + 0.033330i	0.399608
-0.077041 – 0.296121i	0.305979
-0.077041 + 0.296121i	0.305979

No root lies outside the unit circle.
VAR satisfies the stability condition.

Roots of Characteristic Polynomial-1997m05 2004m05
Endogenous variables: GDP INFL IR RER KA
Exogenous variables: C T - Lag specification: 1 3

Root	Modulus
0.899451 - 0.188656i	0.919023
0.899451 + 0.188656i	0.919023
0.890251	0.890251
0.713624 - 0.426144i	0.831178
0.713624 + 0.426144i	0.831178
-0.351718 - 0.618493i	0.711505
-0.351718 + 0.618493i	0.711505
-0.430147 - 0.438355i	0.614151
-0.430147 + 0.438355i	0.614151
0.048884 - 0.569052i	0.571148
0.048884 + 0.569052i	0.571148
0.328546 - 0.423079i	0.535666
0.328546 + 0.423079i	0.535666
-0.498554 - 0.103300i	0.509143
-0.498554 + 0.103300i	0.509143

No root lies outside the unit circle
VAR satisfies the stability condition.

Roots of Characteristic Polynomial-1997m05 2004m05

Endogenous variables: GDP INFL IR RER IR*

Exogenous variables: C T Lag specification: 1 3

Root	Modulus
0.925171 - 0.093992i	0.929934
0.925171 + 0.093992i	0.929934
0.817461 - 0.189069i	0.839040
0.817461 + 0.189069i	0.839040
0.707977 - 0.433541i	0.830174
0.707977 + 0.433541i	0.830174
-0.257227 - 0.543935i	0.601690
-0.257227 + 0.543935i	0.601690
0.580002	0.580002
-0.356020 - 0.416796i	0.548151
-0.356020 + 0.416796i	0.548151
0.107389 - 0.507215i	0.518459
0.107389 + 0.507215i	0.518459
-0.443876	0.443876
-0.362763	0.362763

No root lies outside the unit circle.
VAR satisfies the stability condition.

Roots of Characteristic Polynomial-1997m05 2004m05

MODEL 2: Endogenous variables: GDP INFL IR RER GDP*

Exogenous variables: C T - Lag specification: 1 3

Root	Modulus
0.924832 - 0.149645i	0.936860
0.924832 + 0.149645i	0.936860
0.892194	0.892194
0.708778 - 0.433680i	0.830930
0.708778 + 0.433680i	0.830930
0.606707 - 0.395519i	0.724244
0.606707 + 0.395519i	0.724244
-0.278136 - 0.574679i	0.638448
-0.278136 + 0.574679i	0.638448
0.552167	0.552167
-0.543886	0.543886
-0.340686 - 0.388831i	0.516969
-0.340686 + 0.388831i	0.516969
0.132815 - 0.450315i	0.469492
0.132815 + 0.450315i	0.469492

No root lies outside the unit circle
VAR satisfies the stability condition.

CONT APPENDIX 2

APPENDIX 3 - RESIDUAL AUTOCORRELATION TESTS

MODEL 2 VAR Residual Serial Correlation LM Tests : GDP INFL IR RER GDP*
H0: no serial correlation at lag order h
Sample: 1997M05 2004M05
Included observations: 82

Lags	LM-Stat	Prob
1	55.01361	0.0005
2	51.82090	0.0013
3	34.05675	0.1067
4	33.64584	0.1157

Probs from chi-square with 25 df.

MODEL 3: VAR Residual Serial Correlation LM Tests: GDP INFL IR RER KA
H0: no serial correlation at lag order h
Sample: 2000M01 2007M02
Included observations: 86

Lags	LM-Stat	Prob
1	47.47587	0.0043
2	60.12923	0.0001
3	33.84665	0.1112
4	34.45436	0.0985

Probs from chi-square with 25 df.

MODEL 3: VAR Residual Serial Correlation LM Tests: GDP INFL IR RER KA
H0: no serial correlation at lag order h
Sample: 1997M05 2004M05
Included observations: 82

Lags	LM-Stat	Prob
1	31.24352	0.1811
2	32.72092	0.1382
3	44.95679	0.0085
4	26.01061	0.4070

Probs from chi-square with 25 df.

MODEL 2: VAR Residual Serial Correlation LM Tests: GDP INFL IR RER GDP*
H0: no serial correlation at lag order h
Sample: 2000M01 2007M02
Included observations: 86

Lags	LM-Stat	Prob
1	68.45229	0.0000
2	68.30652	0.0000
3	53.07424	0.0009
4	35.45581	0.0803

MODEL 1: VAR Residual Serial Correlation LM Tests: GDP INFL IR RER IR*
H0: no serial correlation at lag order h
Sample: 2000M01 2007M02
Included observations: 86

Lags	LM-Stat	Prob
1	59.34396	0.0001
2	58.75307	0.0002
3	38.24934	0.0437

APPENDIX 4 - LAG LENGTH CRITERIA

VAR Lag Order Selection Criteria
MODEL 2: Endogenous variables: GDP INFL IR RER GDP*
Exogenous variables: C T
Sample: 2000M01 2007M02
Included observations: 86

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1214.798	NA	4.67e-19	-28.01857	-27.73318	-27.90371
1	1563.250	640.1775	2.53e-22	-35.54069	-34.54182	-35.13869
2	1626.935	109.5980	1.04e-22	-36.44035	-34.72801*	-35.75121
3	1661.856	56.03591	8.38e-23	-36.67107	-34.24526	-35.69479
4	1714.034	77.66120	4.60e-23	-37.30313	-34.16384	-36.03971*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR Lag Order Selection Criteria
MODEL 1: Endogenous variables: GDP INFL IR RER IR*
Exogenous variables: C T
Sample: 2000M01 2007M02
Included observations: 86

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1192.065	NA	7.92e-19	-27.48990	-27.20451	-27.37504
1	1547.393	652.8112	3.66e-22	-35.17193	-34.17307*	-34.76994
2	1594.184	80.52382	2.22e-22	-35.67870	-33.96636	-34.98956*
3	1616.419	35.68010	2.41e-22	-35.61440	-33.18860	-34.63813
4	1661.798	67.54050	1.55e-22	-36.08833	-32.94905	-34.82491

VAR Lag Order Selection Criteria
MODEL 3: Endogenous variables: GDP INFL IR RER KA
Exogenous variables: C T
Sample: 2000M01 2007M02
Included observations: 86

Lag	LogL	LR	FPE	AIC	SC	HQ
0	909.0984	NA	5.71e-16	-20.90926	-20.62388	-20.79441
1	1124.628	395.9727	6.81e-18	-25.34018	-24.34132*	-24.93819*
2	1146.398	37.46577	7.40e-18	-25.26508	-23.55274	-24.57594

3	1170.320	38.38519	7.72e-18	-25.23999	-22.81418	-24.26372
4	1204.468	50.82570	6.44e-18	-25.45275	-22.31347	-24.18933

VAR Lag Order Selection Criteria
MODEL 3: Endogenous variables: GDP INFL IR RER KA
Exogenous variables: C T
Sample: 1997M05 2004M05
Included observations: 77

Lag	LogL	LR	FPE	AIC	SC	HQ
0	769.8811	NA	1.84e-15	-19.73717	-19.43278	-19.61542
1	933.5970	297.6652	5.04e-17	-23.34018	-22.27481*	-22.91404*
2	960.3045	45.09073	4.87e-17	-23.38453	-21.55819	-22.65401
3	994.0049	52.52007	3.98e-17*	-23.61052*	-21.02320	-22.57561
4	1009.084	21.54172	5.38e-17	-23.35283	-20.00454	-22.01355

VAR Lag Order Selection Criteria
MODEL 1: Endogenous variables: GDP INFL IR RER IR*
Exogenous variables: C T
Sample: 1997M05 2004M05
Included observations: 77

Lag	LogL	LR	FPE	AIC	SC	HQ
0	952.4907	NA	1.61e-17	-24.48028	-24.17589	-24.35853
1	1231.339	506.9973	2.21e-20	-31.07375	-30.00838*	-30.64761
2	1269.609	64.61099	1.58e-20	-31.41841	-29.59207	-30.68789*
3	1298.146	44.47273	1.48e-20	-31.51027	-28.92296	-30.47537
4	1331.196	47.21503	1.25e-20	-31.71938	-28.37108	-30.38009

VAR Lag Order Selection Criteria
MODEL 2: Endogenous variables: GDP INFL IR RER GDP*
Exogenous variables: C T
Sample: 1997M05 2004M05
Included observations: 77

Lag	LogL	LR	FPE	AIC	SC	HQ
0	957.7069	NA	1.40e-17	-24.61576	-24.31137	-24.49401
1	1265.960	560.4597	8.97e-21	-31.97298	-30.90761	-31.54684
2	1329.835	107.8422	3.30e-21	-32.98274	-31.15640*	-32.25222
3	1369.024	61.07372	2.34e-21	-33.35128	-30.76397	-32.31638*
4	1404.748	51.03420	1.85e-21	-33.62983	-30.28153	-32.29054

CONT APPENDIX 4

APPENDIX 5 - COINTEGRATION TESTS

Sample (adjusted): 1997M08 2004M05
Included observations: 82 after adjustments
Trend assumption: Linear deterministic trend
MODEL 2: Series: GDP INFL IR RER GDP*
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.432747	118.8335	69.81889	0.0000
At most 1 *	0.329674	72.34363	47.85613	0.0001
At most 2 *	0.218338	39.54441	29.79707	0.0028
At most 3 *	0.187053	19.34510	15.49471	0.0125
At most 4	0.028416	2.363822	3.841466	0.1242

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Sample (adjusted): 1997M08 2004M05
Included observations: 82 after adjustments
Trend assumption: Linear deterministic trend
MODEL 1: Series: GDP INFL IR RER IR*
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.448280	114.8110	69.81889	0.0000
At most 1 *	0.306403	66.04442	47.85613	0.0004
At most 2 *	0.267822	36.04353	29.79707	0.0084
At most 3	0.117729	10.48151	15.49471	0.2455
At most 4	0.002564	0.210555	3.841466	0.6463

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Sample (adjusted): 1997M08 2004M05
Included observations: 82 after adjustments
Trend assumption: Linear deterministic trend
MODEL 3: Series: GDP INFL IR RER KA
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.396221	121.5866	69.81889	0.0000
At most 1 *	0.340364	80.21373	47.85613	0.0000
At most 2 *	0.269910	46.09625	29.79707	0.0003
At most 3 *	0.200383	20.30012	15.49471	0.0087
At most 4	0.023655	1.963035	3.841466	0.1612

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Sample: 2000M01 2007M02
Included observations: 86
Trend assumption: Linear deterministic trend
MODEL 3. Series: GDP INFL IR RER KA
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.465606	104.2465	69.81889	0.0000
At most 1 *	0.301504	50.35705	47.85613	0.0285
At most 2	0.140858	19.49809	29.79707	0.4576
At most 3	0.067261	6.441525	15.49471	0.6433
At most 4	0.005257	0.453332	3.841466	0.5008

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Sample: 2000M01 2007M02
Included observations: 86
Trend assumption: Linear deterministic trend
MODEL 1:Series: GDP INFL IR RER IR^*
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.457791	102.6446	69.81889	0.0000
At most 1 *	0.354716	50.00375	47.85613	0.0310
At most 2	0.070171	12.33019	29.79707	0.9198
At most 3	0.068089	6.073260	15.49471	0.6869
At most 4	0.000101	0.008674	3.841466	0.9254

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Sample: 2000M01 2007M02
Included observations: 86
Trend assumption: Linear deterministic trend
MODEL 2. Series: GDP INFL IR RER GDP*
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.482059	103.5028	69.81889	0.0000
At most 1	0.301256	46.92394	47.85613	0.0610
At most 2	0.086723	16.09539	29.79707	0.7055
At most 3	0.062523	8.293854	15.49471	0.4345
At most 4	0.031374	2.741400	3.841466	0.0978

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

CONT APPENDIX 5

APPENDIX 6 - CHOW BREAKPOINT TEST

Chow Breakpoint Test: 2005M01 MODEL 1 , ER equation

F-statistic	0.644952	Probability	0.839319
Log likelihood ratio	16.45373	Probability	0.491928

Chow Forecast Test: Forecast from 2005M01 to 2007M02: MODEL 1, ER equation

F-statistic	0.408969	Probability	0.991226
Log likelihood ratio	19.00326	Probability	0.836292

Chow Breakpoint Test: 2005M01 MODEL 1 RER

F-statistic	0.879779	Probability	0.599029
Log likelihood ratio	21.74043	Probability	0.194909

Chow Forecast Test: Forecast from 2005M01 to 2007M02: MODEL 1 RER

F-statistic	0.706631	Probability	0.825401
Log likelihood ratio	30.59538	Probability	0.243683

Chow Breakpoint Test: 2005M01 MODEL 1 IR eq (with RER)

F-statistic	0.182413	Probability	0.999819
Log likelihood ratio	4.981508	Probability	0.997823

Chow Breakpoint Test: 2005M01 MODEL 1 IR eq (with ER)

F-statistic	0.245380	Probability	0.998745
Log likelihood ratio	6.636193	Probability	0.987789

Chow Forecast Test: Forecast from 2005M01 to 2007M02 MODEL 1 IR eq (with ER)

F-statistic	0.139975	Probability	0.999999
Log likelihood ratio	6.987052	Probability	0.999925

APPENDIX 7 - UNIT ROOT TESTS

Tests for industrial production

ADF TEST :Null Hypothesis: **LOGIP** has a unit root

Exogenous: Constant

Lag Length: 12 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.247346	0.9744
Test critical values:	1% level	3.493747	
	5% level	2.889200	
	10% level	2.581596	

PP TEST: Null Hypothesis: **LOGIP** has a unit root

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		3.000532	0.0377
Test critical values:	1% level	3.487046	
	5% level	2.886290	
	10% level	2.580046	

PP TEST Null Hypothesis: **D(LOGIP)** has a unit root

Exogenous: Constant

Bandwidth: 36 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-16.98812	0.0000
Test critical values:	1% level	-3.487550	
	5% level	-2.886509	
	10% level	-2.580163	

ADF TEST Null Hypothesis**: D(LOGIP)** has a unit root

Exogenous: Constant

Lag Length: 12 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.900810	0.0487
Test critical values:	1% level	-3.494378	
	5% level	-2.889474	
	10% level	-2.581741	

CONT APPENDIX 7

Tests for inflation

ADF TEST Null Hypothesis: **INFL** has a unit root

Exogenous: Constant

Lag Length: 4 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.969009	0.3001
Test critical values:	1% level	-3.489117	
	5% level	-2.887190	
	10% level	-2.580525	

PP TEST Null Hypothesis: **INFL** has a unit root

Exogenous: Constant

Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.192951	0.0010
Test critical values:	1% level	-3.487046	
	5% level	-2.886290	
	10% level	-2.580046	

ADF TEST Null Hypothesis: **D(INFL)** has a unit root

Exogenous: Constant

Lag Length: 11 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.306881	0.0000
Test critical values:	1% level	-3.493747	
	5% level	-2.889200	
	10% level	-2.581596	

PP TEST Null Hypothesis: **D(INFL)** has a unit root

Exogenous: Constant

Bandwidth: 41 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-37.71160	0.0001
Test critical values:	1% level	-3.487550	
	5% level	-2.886509	
	10% level	-2.580163	

CONT APPENDIX 7

Tests for interest rates

ADF TEST Null Hypothesis**: IR** has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.492931	0.5338

ADF TEST Null Hypothesis: **D(IR**) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.469982	0.0000
Test critical values:	1% level	-3.487550	
	5% level	-2.886509	
	10% level	-2.580163	
Test critical values:	1% level	-3.487550	
	5% level	-2.886509	
	10% level	-2.580163	

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PP TEST Null: **IR** has unit root

Exogenous: Constant

Bandwidth: 0 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.282960	0.1792
Test critical values:	1% level	-3.487046	
	5% level	-2.886290	
	10% level	-2.580046	

PP TEST Null Hypothesis**: D(IR)** has a unit root

Exogenous: Constant

Bandwidth: 5 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.395717	0.0000
Test critical values:	1% level	-3.487550	
	5% level	-2.886509	
	10% level	-2.580163	

CONT APPENDIX 7

Tests for exchange rates

ADF TEST Null Hypothesis**: LOGER** has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.108238	0.0287
Test critical values:	1% level	-3.487550	
	5% level	-2.886509	
	10% level	-2.580163	

PP TEST Null Hypothesis**: LOGER** has a unit root

Exogenous: Constant

Bandwidth: 4 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.333447	0.0156
Test critical values:	1% level	-3.487046	
	5% level	-2.886290	
	10% level	-2.580046	

Tests for real exchange rate

PP TEST Null Hypothesis**: LOGRER** has a unit root

Exogenous: Constant

Bandwidth: 6 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.300492	0.6277
Test critical values:	1% level	-3.487046	
	5% level	-2.886290	
	10% level	-2.580046	

ADF TEST Null Hypothesis**: LOGRER** has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.213301	0.6671
Test critical values:	1% level	-3.487550	
	5% level	-2.886509	
	10% level	-2.580163	

PP TEST Null Hypothesis: **D(LOGRER)** has a unit root

Exogenous: Constant

Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.077833	0.0000
Test critical values:	1% level	-3.487550	
	5% level	-2.886509	
	10% level	-2.580163	

ADF TEST Null Hypothesis: **D(LOGRER**) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.110374	0.0000
Test critical values:	1% level	-3.487550	
	5% level	-2.886509	
	10% level	-2.580163	

CONT APPENDIX 7

Tests for EU 25 production

ADF TEST Null Hypothesis**: IPSAEU** has a unit root

Exogenous: Constant

Lag Length: 6 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.100100	0.9644
Test critical values:	1% level	-3.490210	
	5% level	-2.887665	
	10% level	-2.580778	

PP TEST Null Hypothesis: **D(IPSAEU**) has a unit root

Exogenous: Constant

Bandwidth: 8 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.159138	0.0251
Test critical values:	1% level	-3.487550	
	5% level	-2.886509	
	10% level	-2.580163	

ADF TEST Null Hypothesis: **D(IPSAEU)** has a unit root

Exogenous: Constant

Lag Length: 5 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.010743	0.0369
Test critical values:	1% level	-3.490210	
	5% level	-2.887665	
	10% level	-2.580778	

PP TEST Null Hypothesis**: IPSAEU** has a unit root

Exogenous: Constant

Bandwidth: 8 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.665438	0.8502
Test critical values:	1% level	-3.487046	
	5% level	-2.886290	
	10% level	-2.580046	

Tests for Euro interest rates

ADF TEST Null Hypothesis: **IREU** has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.613413	0.4725
Test critical values:	1% level	-3.487550	
	5% level	-2.886509	
	10% level	-2.580163	

PP TEST Null Hypothesis: **IREU** has a unit root

Exogenous: Constant

Bandwidth: 8 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.680129	0.4387
Test critical values:	1% level	-3.487046	
	5% level	-2.886290	
	10% level	-2.580046	

CONT APPENDIX 7

ADF TEST Null Hypothesis: **D(IREU)** has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.715058	0.0000
Test critical values:	1% level	-3.487550	
	5% level	-2.886509	
	10% level	-2.580163	

PP TEST Null Hypothesis: **KA** has a unit root

Exogenous: Constant

Bandwidth: 5 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.662096	0.4478
Test critical values:	1% level	-3.487046	
	5% level	-2.886290	
	10% level	-2.580046	

Tests for capital account

ADF TEST Null Hypothesis**: KA** has a unit root

Exogenous: Constant

Lag Length: 5 (Automatic based on SIC, MAXLAG=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.657131	0.9996
Test critical values:	1% level	-3.489659	
	5% level	-2.887425	
	10% level	-2.580651	

PP TEST Null Hypothesis: **D(KA)** has a unit root

Exogenous: Constant

Bandwidth: 25 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-25.16132	0.0000
Test critical values:	1% level	-3.487550	
	5% level	-2.886509	
	10% level	-2.580163	

PP TEST Null Hypothesis: **D(IREU)** has a unit root

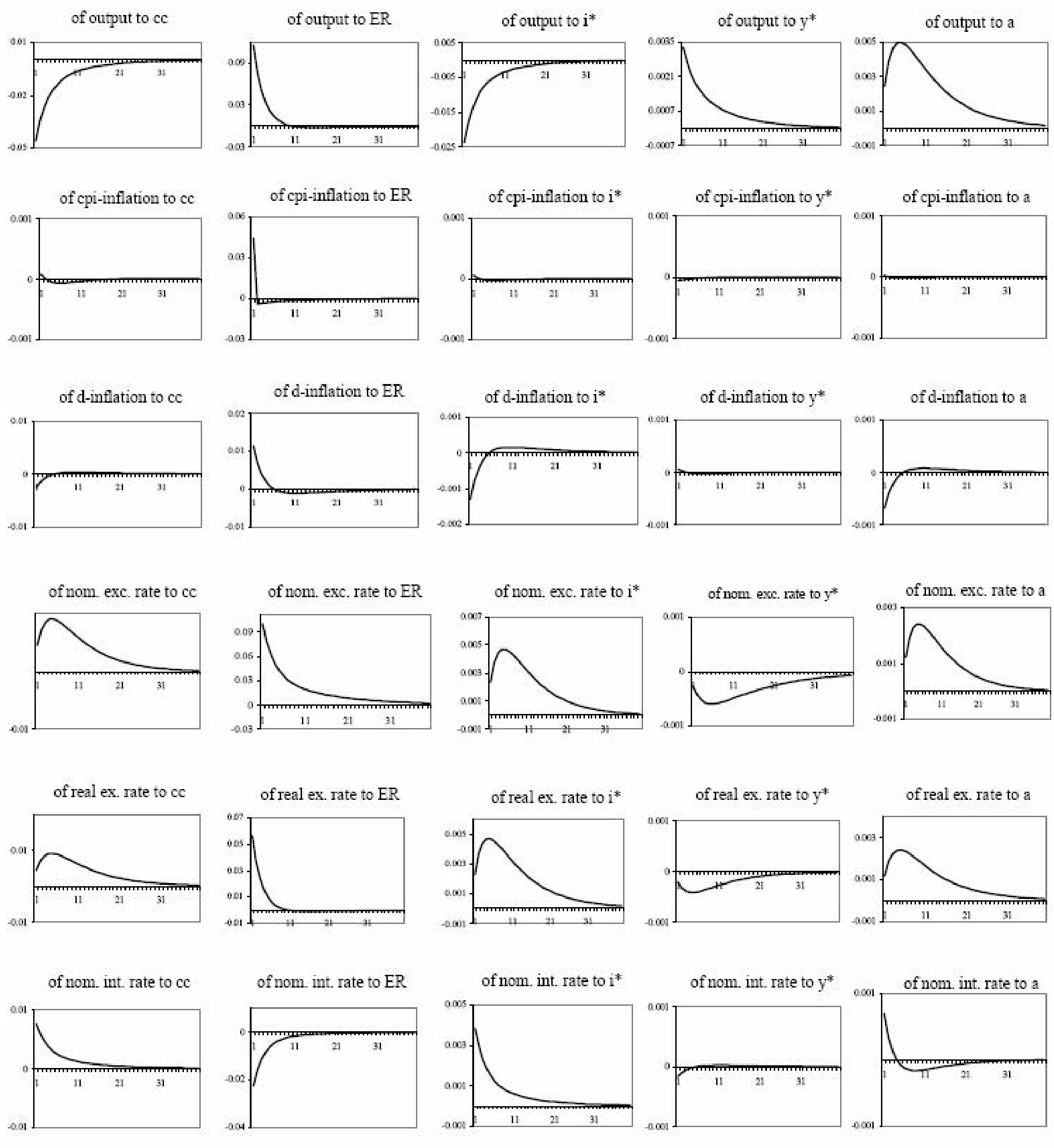
Exogenous: Constant

Bandwidth: 6 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.931160	0.0000
Test critical values:	1% level	-3.487550	
	5% level	-2.886509	
	10% level	-2.580163	

APPENDIX 8 - BENCHMARK IMPULSE RESPONSES

Figure 2. Capital Controls and an Exchange Rate Rule

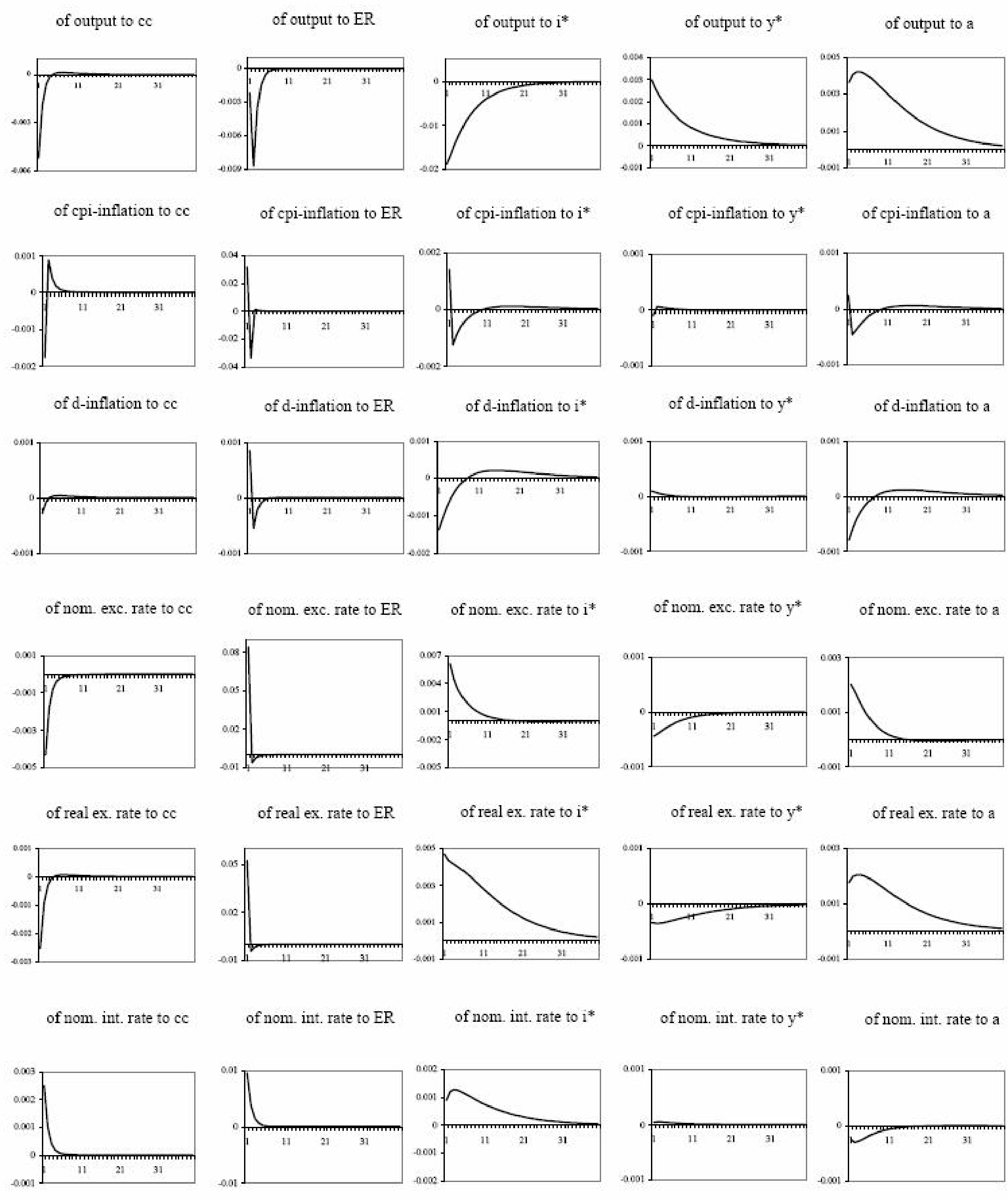


Note: *cc* stands for capital controls; *d-inflation* is domestic-goods inflation.

Source: Berkmen and Gueorguiev (2004)

CONT APPENDIX 8

Figure 3. Free Capital Mobility and Flexible CPI Inflation Targeting

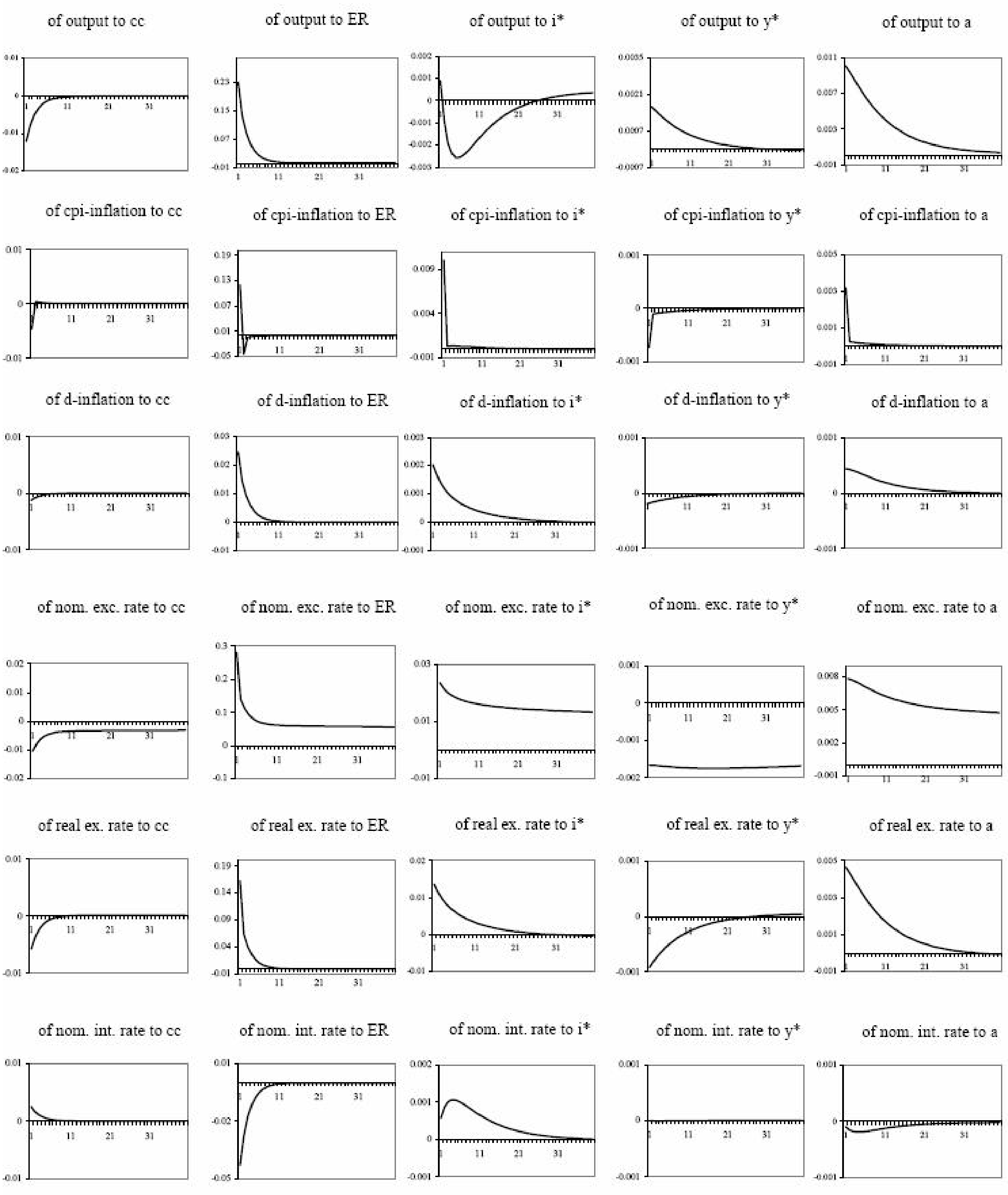


Note: *cc* stands for capital controls; *d-inflation* is domestic-goods inflation.

Source: Berkmen and Gueorguiev (2004)

CONT APPENDIX 8

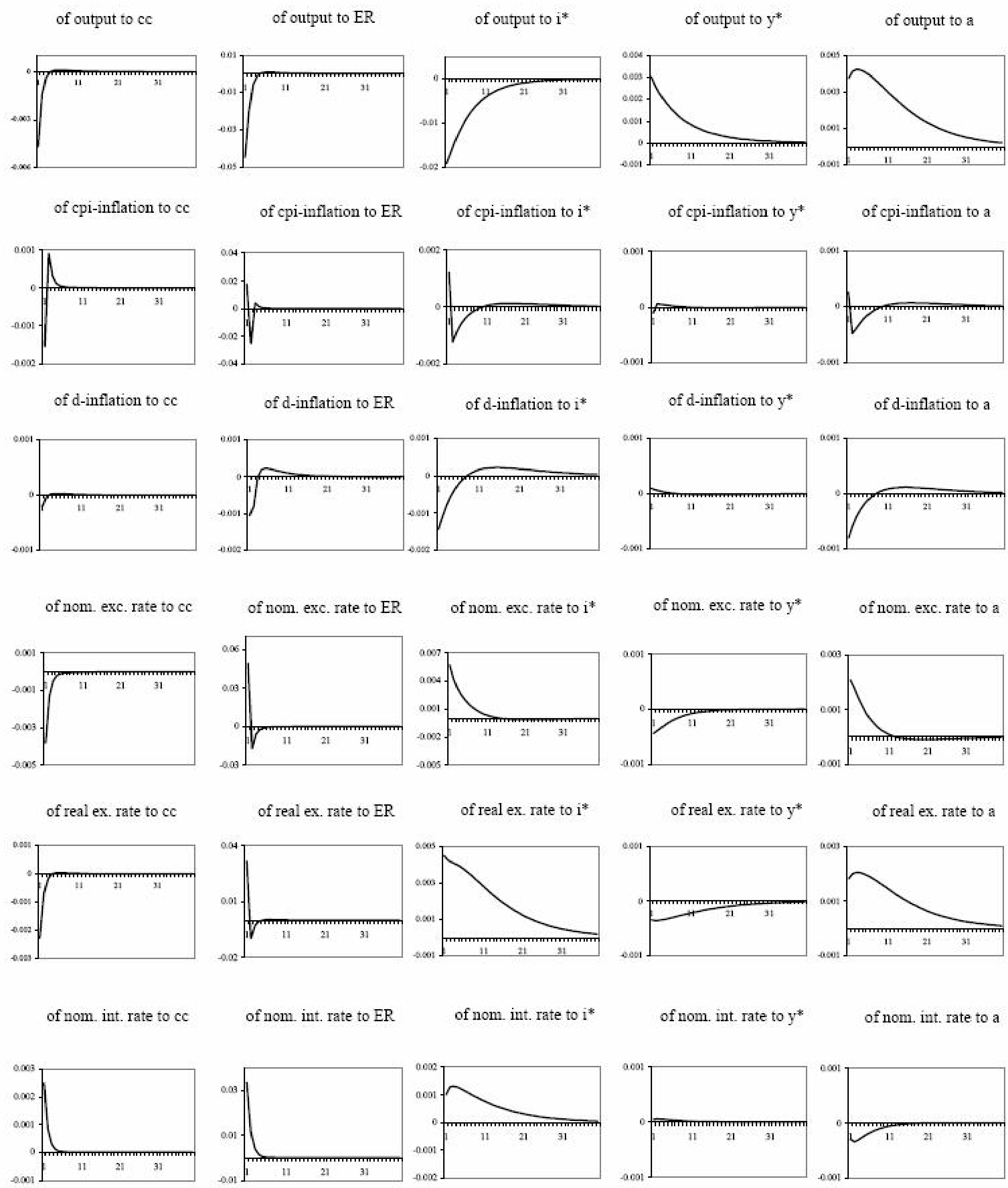
Figure 4. Free Capital Mobility and Stricter Inflation Targeting (Free-Floating Exchange Rate)



Note: *cc* stands for capital controls; *d-inflation* is domestic-goods inflation.

Source: Berkmen and Gueorguiev (2004)

Figure 5. Free Capital Mobility and Flexible Domestic Inflation Targeting



Note: *cc* stands for capital controls; *d-inflation* is domestic-goods inflation.

Source: Berkmen and Gueorguiev (2004)