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ON THE LINKAGE BETWEEN MONETARY  
POLICY AND MENA STOCK MARKETS

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# **On the Linkage between Monetary Policy and MENA Stock Markets**

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## Abstract

Relatively little empirical evidence is available that estimates the relationship between asset price movements and monetary policy measures. This paper, which is the first study that focuses on the linkage between monetary policy and stock market prices, aims at analyzing the interaction between monetary policy and asset markets in eight MENA countries. The countries considered in this study are: Bahrain, Egypt, Jordan, Morocco, Oman, Saudi Arabia, Tunisia, and Turkey. To this end, VAR methodology is used. The nature of the relationship between asset price movements and monetary policy is currently a hotly debated topic in macroeconomics. The chief findings put forward by this study are the following: (i) In Bahrain, Oman, Jordan and Saudi Arabia monetary policy seems to have a significant impact on stock market returns. (ii) The monetary policies of Tunisia, Morocco and to a less extent those of Egypt do not significantly impact on equity prices. (iii) Better still, monetary policies' reactions to stock market price movements are far from being homogenous across countries. While Saudi Arabian and Jordanian monetary authorities respond vigorously to an increase in stock market returns, the other countries do not seem to exhibit any reaction. The paper attempts to provide some explanations.

## ملخص

لا يتوفر من الأدلة التجريبية إلا النزر القليل نسبيا إذا أردنا تقييم العلاقة بين تحركات أسعار الأصول وإجراءات السياسة النقدية. وتهدف هذه الدراسة، وهي أول دراسة تركز على العلاقة بين السياسة النقدية وأسعار سوق الأسهم، إلى تحليل التفاعل بين السياسة النقدية وأسواق الأصول في ثماني دول من منطقة الشرق الأوسط وشمال أفريقيا، وهي البحرين ومصر والأردن والمغرب وعمان والسعودية و تونس وتركيا. ولتحقيق هذا الهدف، تم استخدام طريقة إعادة بيع القيمة المضافة (VAR). وتعتبر طبيعة العلاقة بين تحركات أسعار الأصول والسياسة النقدية موضوعا جدليا ساخنا في الاقتصاد الكلي في الوقت الراهن. وأما النتائج الأساسية التي تطرحها هذه الدراسة فهي: (1) في البحرين وعمان والأردن والسعودية، تبدو السياسة النقدية ذات تأثير ذات بال على عائدات سوق الأسهم، (2) لا تؤثر السياسات النقدية في كل من تونس والمغرب، وبدرجة أقل في مصر، تأثيرا ذات بال على أسعار الأسهم. (3) ولحسن الحظ أننا نجد ردود فعل السياسات النقدية بالنسبة لتحركات أسعار الأسهم أبعد ما تكون عن التجانس، فبينما تستجيب السلطات النقدية في كل من السعودية والأردن للزيادة في عائدات سوق الأسهم، لا تبدي الدول الأخرى أي رد فعل. وتحاول هذه الورقة طرح بعض التفسيرات.

## 1. Introduction

There is a considerable amount of interest among economists and financiers in understanding the interaction between asset markets and monetary policy. This interest revival has been triggered by the large swings in asset prices and economic activity witnessed in some developed countries (USA, Japan, etc.). This area of research, which is shared by monetary as well as financial economists, encompasses a two-sided research program. The first side focuses on whether monetary policy decisions have any effects on real stock prices. The second side seeks to assess the reaction of monetary authority to stock market movements. Economists who are traditionally interested in this second topic aim at knowing whether equity is a good hedge for inflation. Their focus is on the monetary policy reaction to movements in broad equity price indexes, likely reflecting the expected endogenous response of monetary policy to the impact of stock price movements to aggregate demand (Rigobon and Sack, 2004). Although these two research lines are interrelated, the one that focuses on the impact of monetary policy on stock markets seems more attractive to monetary economists whose interest is directed to two aspects. The first seeks to appreciate the contribution of stock markets in propagating monetary impulses to the real economy (the so-called stock market channel). The second attempts to understand how monetary policy might bring about asset price booms or transform a boom caused by real phenomenon into a bubble.

The linkage between monetary policy decisions and stock markets performance is an important topic for several reasons. There is a wide consensus that having reliable estimates of the reaction of asset prices to the policy instrument is important since it makes it easier for economists and central bankers to understand the function and assess the effectiveness, of the stock market's channel for monetary policy transmission. Better still, availability of such estimates helps to formulate effective policy decisions. While economists agree that monetary policy should take stock prices into account as large swings in stock prices, either related or unrelated to fundamentals, may have a destabilizing impact on the economy, they nonetheless disagree on the ways they should do it. Bernanke and Gertler (1999) suggest that monetary policy should react to the stock market behavior indirectly; more specifically, they recommend that price stability should be the overriding long-run goal of monetary policy in order to avoid stock market volatility. Besides, other economists argue that a central bank concerned with price stability should be preemptive and take asset prices directly and explicitly into account, in addition to other economic indicators, when making monetary policy decisions (Alchian and Klein, 1973; Cecchetti et al., 2000; Goodhart, 1999). Their aim has been to suggest a strategy that should dampen the variability of output and inflation, thereby avoiding large asset price misalignments, boom and bust investment cycles, inflation and employment instability.

Empirical analyses of the effects of monetary policy have to a large extent been addressed in terms of vector autoregressive (VAR) models, initiated by Sims (1980). Yet, studies that use VAR models to identify the interdependence have found only small effects of interaction between monetary policy and asset prices.<sup>1</sup> In this study we analyze the interaction between asset prices and monetary policy in the MENA countries using a VAR model that takes full account of the potential simultaneity of interdependence. Using a sample of eight MENA countries, this study tries to understand whether there is an interaction between asset markets and monetary policy. The nature of the relationship between asset price movements and monetary policy is currently a hotly debated topic in macroeconomics. Relatively little empirical evidence is available that estimates the relationship between asset price movements

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<sup>1</sup> See for instance Thorbecke (1997) and Neri (2004) among others.

and monetary policy measures in the MENA regions and this is the first study that addresses this relationship for some MENA countries.

In sum, the response of stock markets in MENA region is far from being homogenous across countries. In some countries stock market returns depict an upward tendency while in other countries it declines or does not react at all. Another important finding that should be emphasized is that the Saudi Arabian monetary authority reacts strongly to a rise in stock market returns. This could be taken as a preemptive reaction to avoid large assets misalignments and booms. Again, in Saudi Arabia a monetary tightening appears to be effective in mastering inflation. Most countries' monetary authorities, except Saudi Arabia and Turkey, do not react to stock market dynamics. This could be an indication that the stock market dynamics do not have a significant impact on key macroeconomic variables such as inflation.

Section 2 presents the institutional framework of MENA stock markets. Section 3 gives a brief description of the empirical models. Section 4 presents the identification scheme used for the VAR study in identifying the relationship between the monetary policy and the stock market. Section 5 presents and discusses the empirical results. Section 6 offers concluding remarks.

## **2. Monetary Policy and Stock Markets in MENA Region**

### ***2.1. MENA Stock Markets: The Institutional Framework***

By and large, the development of stock markets in the MENA region followed the same path as that of the banking sector. Due to the governments' (belated) recognition of the importance of the capital market for economic development, the reform agenda of the 1990s included plans to revitalize stock markets in some countries and to establish stock markets in others. Many of MENA countries issued new capital market laws, aimed at encouraging private investment, increasing investors' protection and enhancing the banks' roles in stimulating capital markets through the establishment of mutual funds. Specifically, their core provisions included establishing a new legal framework to govern specialized capital market companies, strengthening financial disclosure, giving foreign investors full access to the market and increasing investor's rights through provisions which prohibit unfair market practices.

The security markets in the region are generally underdeveloped with a limited number of listed companies, low free-float of shares and thin trading. However, security markets also incorporate bond markets. The advantage of creating a bond market is that the Ministry of Finance relies upon bonds to finance the country's medium- and long-term needs and reduce the cost of public debt. In addition to being policy tools, government bonds serve other general market purposes such as being indicators for the risk free rate in the country, and serve as benchmarks in pricing corporate debt. MENA countries, however, has fallen behind in developing these markets. With the financial liberalization policies, it was expected that bond markets in the region would gain more momentum. However, for several reasons, such as the difficulty of having longer-term maturities, the relative scarcity of large private corporations, the underdevelopment of pension funds and other forms of contractual savings and high transaction costs, bond markets did not experience any noticeable progress until now.

We see then that the equity markets in the MENA region developed at a much faster rate than the lagging bond markets, the development of which needs to be speeded up. One crucial impetus to developing bond markets is having viable non-banks and contractual savings financial institutions. In the MENA region, these underdeveloped institutions have been

hampered by highly conservative regulations (investments in mostly government bonds, for example). The gradual development of bond markets hinges on reforming these institutions.

Overall, the issuance of stocks and bonds is still a fairly minor method of raising funds in the MENA region. However, after September 11, 2001, the regional stock markets seem to have benefited from intra-regional financial flows. With a temporary pullback from US financial markets, MENA investors have increasingly sought returns in markets closer to home which has supported a sharp rise in regional real estate and equity prices.

Back again to the equity markets in the region, we can observe significant changes in these markets when we compare several market indicators between 2000 and 2005. In Table 1, Panel A presents some key financial market indicators in order to compare market performances among the major MENA markets at year-end 2000. Turkey leads the region in terms of market capitalization (\$69.6 billion) followed by Saudi Arabia (\$67.2 billion). These numbers prove to be substantial particularly when compared to the smallest markets, Oman and Tunisia, with \$2.82 billion and \$3.46 billion, respectively. The figures are corroborated to a large extent when we look at the turnover ratio. Turkey has the highest turnover ratio (206.2 percent) followed by Egypt (34.7 percent) and Saudi Arabia (27.1 percent). However, in comparison to each country's GDP, the apparent size completely changes. Bahrain is the leader according to this measure with a market capitalization of 83.1 percent of GDP, followed by Jordan with 58.4 percent. Nevertheless, this financial measure is probably sensitive to the limited number of transactions on these stock exchanges since some of them are only open for a few hours each day. In terms of number of listed companies, Egypt leads with 1,076 listed companies. However, most of these listed companies are not actively traded (they are closed or family-owned companies). Turkey stands second position with 315 companies.

As seen from Panel B, the picture changes dramatically in 2005 where stock market capitalization exceeded GDP in several countries, with the Gulf countries dominating the MENA stock markets. Saudi Arabia has the biggest stock market in terms of market capitalization as the total value of listed companies increased around ten-fold from \$67.6 billion in 2000 to \$646.1 billion in 2005. Turkey followed with market capitalization of \$161.5 billion, or more than two-fold increase compared with the 2000 figure. In terms of market liquidity, Saudi Arabia still leads the region with a turnover ratio of 231.7 percent, followed by Turkey (155 percent) and Jordan (85 percent).

Growth in the region's stock markets was particularly intense in 2005 when the region was home to eight of the top ten performing bourses in the world, and prices in Egypt, Dubai, Lebanon, and Saudi Arabia more than doubled. This strong performance, however, contrasts with generally lackluster gains in industrial countries, and exceeds the average of emerging markets as measured by Morgan Stanley's index (MSCI) which only grew by 30 percent.

Despite the above-mentioned substantial progress in the last few years, stock markets in most MENA countries are limited by several structural and regulatory weaknesses. Markets are characterized by relatively small numbers of listed firms (except few countries such as Egypt, Israel, Iran and Turkey), large institutional holdings, and therefore narrow "free floats". Reflecting the underlying economic structure, sectoral diversification is low and vulnerability to oil price shocks is high. Regional cross listing facilitates contagion. Although a broad range of legal, regulatory, and supervisory changes has increased market transparency in recent years, significant deficiencies remain in market oversight. Stock markets in several MENA countries (particularly, the Gulf countries) need to improve liquidity and open their operations to foreign investors. Most recently, in March 2006, the Saudi authorities lifted the restriction that limited foreign residents to dealing only in mutual investment funds.

Although we cannot deny the notable progress of the capital markets in the MENA region since the financial liberalization policies of the 1990s; they do not, as yet, represent a solid vehicle for real investment opportunities. For example, several stock markets in the region are in need of more transparency, through the promotion of timely disclosure and dissemination of information to the public. In addition, many of these markets are inefficient. Correctly pricing risk is necessary for stock markets to realize their role in securing investments and, consequently, enhancing economic growth. Being of the same mind, Singh (1997) indicates that stock markets in many developing countries are not able to price risk accurately and suffer from excessive volatility, lack of transparency, and insider trading. As the MENA stock markets make progress in building their capital market institutional and legal framework—contract compliance, bankruptcy laws and tax reforms—they should develop into healthy investment opportunities.

## ***2.2. MENA Monetary Policies Description***

### *2.2.1 Bahrain, Oman and Saudi Arabia*

These countries have officially followed a peg-to-the-US dollar regime since the early eighties. This policy has been guided by the broad objectives of minimizing exchange risks for the private sector and ensuring stable exchange rates among Gulf Council Countries (GCC) member countries. Bahrain, Oman and Saudi Arabia, like other GCC countries, target exchange rates for reasons that have little to do with the conduct of monetary policy. Indeed, a peg encourages integration of the domestic economy with its neighbors (the other GCC countries). In addition, these countries consider the exchange rate peg as a pre-step for carrying out the currency union. The US dollar is the unit of account used in pricing petroleum. With countries highly dependent on oil revenues, a stable relationship helps fiscal authorities plan better. These three country's imports from the US are large, and finally dollar-denominated instruments constitute a large portion of the countries' external investments. Under a fixed exchange rate regime and a free capital movement, the control of the domestic monetary policy is lost. In the light of the exchange rate peg, Bahrain, Oman and Saudi Arabia cannot afford to use the monetary policy as a stabilization tool, and consequently, they make use of the fiscal policy as a substitutable stabilization tool mainly through a fiscal transfer system not afforded elsewhere in the MENA region. A pegged regime prevents Bahrain, Oman and Saudi Arabia from pursuing an independent monetary policy. They have no choice but to adopt the US's monetary policy. The benefit of doing so is acknowledged seeing that these countries are still underdeveloped in terms of political, monetary and policy-making institutions.

### *2.1.2 Egypt*

The Egyptian monetary authority chose to target the exchange rate as did most MENA countries. This policy focused on using the exchange rate as the anchor for the country's economic program. A severe macroeconomic crisis<sup>2</sup> prompted policymakers to embark on a series of monetary and financial reforms. By the end of 1999, the Egyptian monetary authority was prompted to adopt a crawling peg. This strategy was adopted to introduce some flexibility to the exchange rate regime. Besides that, the Central Bank of Egypt (CBE) started to pursue a tight monetary policy aiming at stabilizing the economy and reducing inflation rates. The monetary authority occasionally intervenes in the market to maintain the exchange

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<sup>2</sup> Indeed, by 1990–91 inflation was running at 24 percent, the budget deficit was 18 percent of GDP, the CBE only had enough foreign exchange reserves to cover three weeks of imports, foreign debt had risen to 151 percent of GDP, and the GDP grew only at 3.6 percent.

rate within the bands specified in the policy. By 2003, exchange rate stability was replaced by price stability, and inflation became the CBE's primary target. By 2006, Egypt still had not explicitly stated a nominal anchor, but rather monitored various indicators in conducting monetary policy. The CBE intended to put in place a formal inflation targeting framework to anchor monetary policy once the fundamental prerequisites were met. During the transition period, the CBE intended to meet its inflation objectives by steering short term interest rates, keeping in view the developments in credit and money supply, as well as a host of other factors that may influence the underlying rate of inflation. To regulate the money supply and control price rises, the CBE introduced corridor rates for overnight deposit and lending in 2004. The Egyptian monetary authority established an interbank market for foreign exchange that was a prerequisite for Egypt's transition to a unified flexible exchange rate system.

### *2.2.3 Jordan*

The Jordanian monetary policy's aim is preserving the stability of its currency with a primary objective of maintaining a pegged exchange rate with the US dollar. Official interest rates have moved and continue to move in reaction to changes in US interest rates in preserving the stability of international reserves. Prior to mid-1995 the Central Bank of Jordan (CBJ) used an intermediate monetary aggregate target (M2) to support its monetary policy objective. This framework had worked well for Jordan until 1995, when the money multiplier's volatility increased, resulting in significant errors in forecasting the reserve money level. It seems that the preoccupation of the central bank's policymakers with preserving confidence in the local economy – through stable demand for the local currency (Dinar) and through comfortable levels of reserves – was the primary concern.

Since mid-1995, the CBJ adopted an accommodating policy and used the CD what is this auction rate as the operating target to achieve exchange rate stability. Thanks to imperfect asset substitutability, the CBJ had some independence in setting the interest rate spread. It targeted the interest rate through varying its offering of auctioned CDs. By targeting the CD rate, the CBJ attempted to influence bank deposit and lending rates to induce changes in the demand for the local currency. It goes without saying that the effectiveness of such a policy depends heavily on the transmission of the monetary policy stance, through CD rates, to bank rates, which would in turn affect the demand for local currency, the level of foreign exchange and ultimately the ability to maintain the peg.

### *2.2.4 Morocco*

Since the beginning of the 1990s, the role of Moroccan monetary policy has been reshaped. Credit restrictions were relaxed and the new monetary policy was based on indirect control instrument. The primary objective of the Moroccan monetary policy, as defined by the new 2005 Bank Al-Maghrib (BAM) statutes, was the maintenance of price stability. The monetary policy, sought to ensure that the rate of growth in means of payments, was in line with ensuring that the productive sector enjoyed adequate funding. The Moroccan monetary authority first started to carry out a monetary targeting strategy with announced growth rates of M3 (and recently of M1) as the main operational targets. The practice of such monetary policy implementation required the existence of rather strict capital account restrictions. The Moroccan monetary authority officially adopted a fixed exchange rate regime in the early 1990s. Despite their official target of preserving the stability of the currency, price stability also represented one of the main policy-making elements. The Moroccan monetary policy framework still remained an informal quantitative framework. Since the beginning of the 1990s, Moroccan monetary authority decided to pursue an exchange rate policy of pegging the local currency (Dirham) to an undisclosed basket of currencies. On the other hand,



restrictions on capital movements were maintained. These restrictions, which were applied to residents, were more concerned with capital outflows than inflows. The capital account restrictions allowed the authorities to maintain the pegged exchange rate in combination with an independent monetary policy.

#### *2.2.5 Tunisia.*

The objectives of the Tunisian monetary policy include preserving the value of the currency as well as supporting the economic policies of the government. To this purpose, the monetary authority decided to carry out a stability-oriented monetary policy strategy at the end of 1980s. The target for growth in the intermediary monetary target was derived by inserting forecasts for the rates of change in prices and output as well as in the velocity of the intermediary target. Commitment to this target intended to make credible the commitment to price stability. Targeting the broad money growth (M2 since 1988 and M3 since January 2003), in addition to pursuing a highly managed exchange rate regime, represented the core of the current monetary framework. The Central Bank of Tunisia (BCT) derived the ancillary target for the monetary base, from the growth target for broad money, by assuming a stable multiplier. Considering the projected path of broad money on the one hand, and having at its disposal an estimate of the required increases in net domestic credit on the other hand, the BCT derived the credit expansion to the public sector deemed consistent with these projections. The amount of credit expansion was estimated based on a separate assessment of the private sector credit needs. Finally, the BCT determined the amounts of liquidity to be distributed through the refinancing facilities by taking into account the projected net international reserves as well as the credit requirements of the agricultural sector. These amounts needed to be fine-tuned on a weekly basis in light of the supposed financing needs of the commercial banks. By 2006, Tunisia still maintained relatively strict control on capital account transactions.

#### *2.1.6 Turkey*

Following the collapse of the currency peg system introduced in 2000, the Turkish monetary authority decided to move to another monetary strategy that allows for containing future uncertainties and influencing expectations. In 2002, the Central Bank of Turkey (CBT) decided to move toward a monetary targeting strategy along with carrying out at the same time a monetary policy focused on ‘future inflation’. This monetary strategy was nothing more than an ‘implicit inflation targeting’. The core of formal inflation targeting was included in this framework. Given that the main aim of the CBT was to achieve price stability, short-term interest rates (the main policy tool of the CBT) were changed based purely on inflation outlook. Secondly, whenever a decision was taken on interest rates, the rationale behind that decision was explained to the public in press releases. It was only in December 2005 when the Turkish monetary authority moved to formal inflation targeting.

### **3. Empirical Models**

Different empirical approaches have been used in the literature in order to assess the linkage between monetary policy and stock markets. They can be classified into four classes. The first class encompasses studies that opt for monetary policy rules such as Taylor’s rule or forward-looking rules (Hayford and Malliaris, 2002, 2004).

The second class includes studies that make use of autoregressive models methodology (Ehrmann et al., 2005; Lastrapes, 1998; Neri, 2004; Sourial, 2002; Thorbecke, 1997). The chief advantage of such methodology is that it allows the investigator not only to assess the

impact of the monetary policy decisions on price movements of equity market, but also to enlighten policymakers about the reaction of the monetary authorities to changes in the stock market. This approach has often been used to check whether the stock market channel is operative or not (Cossola and Marana, 2004). However, it becomes less attractive when it is a question of appraising the relationship between the monetary instruments and the different asset prices. Better still, this approach is very demanding in terms of data since it functions better when high frequency data is used, and also when all the required variables are considered. Otherwise, the inference will be fragile.

The third class focuses on single equation conditional models (Ehrmann and Fratzscher, 2004; He, 2005). This approach favors the impact of monetary policy changes on the stock market and neglects the effect of other variables, including news about the economic outlook which could have an impact on both monetary instruments (short-run interest rate) and asset prices. This approach has been carried out especially when assessing the reaction of stock prices to money supply announcements (Cornell, 1983; Jensen and Johnson, 1995; Lyngge, 1981; Pearce and Roley, 1983). Though it seems to be appealing, this approach suffers from a serious drawback. Specifically, it implicitly assumes that causality acts in one direction, and consequently, it favors only a one side-impact. Thus, short-term interest rates (when used as a measure of monetary policy stance) are simultaneously influenced by movements in asset prices, resulting in a difficult endogeneity problem. Such considerations complicate the identification of the responsiveness of asset prices under previously used methods. The kind of model often considered under this heading is of the following form (Thorbecke, 1997):

$$\Delta s_t = \beta_0 + \beta_1 \Delta r_t + \Gamma' X_t + \varepsilon_t \quad (1)$$

where  $\Delta s$  is the change in the stock index and  $\Delta r$  is the amount by which the central bank changed the funds rate. The coefficient  $\beta_1$  should be negative if news of expansionary (contractionary) monetary policy is an event that increases (decreases) future cash flows or decreases (increases) the discount factors at which those cash flows are capitalized.  $X$  is a vector of additional economic variables that are deemed to have an effect on stock prices. Rather than considering the direct impact of a monetary policy instrument, some economists consider the impact of money surprise (Ehrmann and Fratzscher, 2004; Sellin, 2001). Furthermore, the majority of these studies focus on the influence of the monetary policy (measured by a short interest rate or by a monetary surprise term) on asset prices, and not the stock market as summarized by the stock market index (Rigobon and Sack, 2004).

Finally, the last class attempts to bypass the drawbacks of the single equation condition models. It makes use of the simultaneous equations approach (Bohl et al., 2006; Rigobon and Sack, 2003, 2004). These authors consider the following two-equation system in order to model the simultaneous relationship between monetary policy and the price of a given asset:

$$\Delta r_t = \alpha_0 + \alpha_1 \Delta s_t + \Theta' Z_t + \xi_t \quad (2)$$

$$\Delta s_t = \beta_0 + \beta_1 \Delta r_t + \Gamma' X_t + \varepsilon_t \quad (3)$$

where  $r$  stands for a short-run interest rate measuring the stance of the monetary policy (a discount rate or an (interbank) money market rate),  $s$  is the asset price,  $Z$  is a vector of variables to which monetary authorities might react (such as inflation, world interest rates, etc.), and  $X$  is a set of variables that could have an effect on stock prices. Equation (2) represents a monetary policy reaction function that captures the expected response of policy to a set of variables  $Z$  and to the asset price. Equation (3) represents the asset price equation

which allows the asset price to be affected by the interest rate as well as macroeconomic variables included in the vector  $X$ .

#### 4. Data and Econometric Methodology

As far as MENA countries are concerned and according to our knowledge, no work has been done in order to evaluate the linkage between monetary policy and stock markets in the region. Sourial (2002), which was concerned with a single country case namely Egypt, is an exception. The aim is to check whether there is any significant relationship between monetary policy and asset pricing in some MENA countries. To this purpose, VAR models will be conducted for these countries into a comparative perspective because of the disparities in monetary policies across these countries.

##### 4.1. Data Issue

The empirical study required deciding on the measures of the monetary policy instruments and the stock market returns. As for the first issue, many measures have been suggested in the literature. Reserve money (B), M1 aggregate and central bank interest rate (R)<sup>3</sup> are considered proxies of the monetary policy. Monthly series for these three variables and inflation rate (inf) were extracted from the IFS database. The stock exchange return (S), also observed monthly, comes from the Emerging Market Data Base (EMDB). In addition, inflation rate is considered as a control variable. Except for the interest rate and inflation, the reserve money, M1 aggregate and stock exchange return are expressed in log differences.

The countries that have to be considered in the first step estimates are Bahrain, Egypt, Jordan, Morocco, Oman, Saudi Arabia, Tunisia, and Turkey. The remaining countries have not been involved because of lack of data (no interest rate measures are available). Of course, data was not available for a uniform period for each country. Consequently, it is expected that the number of monthly observations will vary across these countries. The number of time observations ranges from 61 monthly observations for Bahrain to 189 observations for Jordan and Turkey. For most other countries the periods of observations cover mainly the nineties up to 2005.<sup>4</sup>

##### 4.2. Econometric Modeling

With the variables to be considered for estimation, and in order to avoid endogeneity problems, we constitute a VAR model of order  $p$ . In comparison with macroeconomic structural models, the VAR modeling initially developed by Sims (1980) makes a few assumptions about the underlying structure of the economy. It focus on the statistical representation of the past interaction between economic variables, letting the data determine the model. It permits putting into a unique vector all of the engaged variables in an endogenous manner. Each variable could have an instantaneous or/and lagged impact on the other endogenous variables in the system. Such statistical specification represents simultaneously correlations between the considered variables. Formally, the economy is described by a linear dynamic structural system of the following form:<sup>5</sup>

$$Y_t = \Psi_0 Y_t + \Psi_1 Y_{t-1} + \dots + \Psi_p Y_{t-p} + \varepsilon_t \quad t = 1, \dots, T \quad (4)$$

<sup>3</sup> In Saudi Arabia, we use the deposit interest rate instead of the central bank interest rate.

<sup>4</sup> See Annex A1.

<sup>5</sup> For reasons of simplicity, we have dropped the deterministic components (intercept, seasonal components, trends, etc.) from the VAR representations.

$Y_t$  is a (3×1) vector containing the 3 variables which reflect a monetary indicator, a measure of stock returns, and a control variable, that is the inflation rate.  $\Psi_0$  is a matrix of impact multipliers, and  $\Psi_i, i = 1, \dots, p$ , are (3×3) matrices of autoregressive parameters.  $\varepsilon_t$  is a (3×1) vector of structural errors which is assumed to be independently and normally distributed with zero mean and of variance-covariance matrix equal to the identity matrix. The VAR approach contributes to the estimation of Equation (4) in the reduced form defined as follows:

$$Y_t = \Phi_1 Y_{t-1} + \dots + \Phi_p Y_{t-p} + u_t \quad t = 1, \dots, T \quad (5)$$

where  $u_t$  is a (3×1) vector of residuals with variance-covariance matrix  $\Omega = E(u_t u_t')$ .

Defining  $\Phi_0 = (I - \Psi_0)^{-1}$  implies that  $\Phi_i = \Phi_0 \Psi_i$ , for  $i = 1, \dots, p$ . On the other hand, structural shocks and the reduced-form residuals are related by the following relationship:

$$u_t = \Phi_0 \varepsilon_t \quad (6)$$

so that:

$$\Omega = \Phi_0 \Phi_0' \quad (7)$$

Estimation of Equation (5) could be conducted either by OLS or maximum likelihood procedures because results are asymptotically equivalent (Lütkepohl, 1993). Economists are often interested in the impulse response functions (IRFs) analysis and forecast error decomposition variance (FDEV). They constitute useful tools to explore the dynamic structure of the system. After a suitable identification of the monetary policy shocks, it is possible to generate IRFs that give a mapping of the adjustment path in time for each variable in response to these shocks. The results of this analysis considerably depend on the chosen identification strategy. To get IRFs, Equations (4) and (5) have to be expressed in their respective moving average (MA) forms as follows:

$$Y_t = (I - \Psi(L))^{-1} \varepsilon_t \quad (8)$$

and:

$$Y_t = (I - \Phi(L))^{-1} u_t \quad (9)$$

The impulse response to structural shocks can be obtained from Equations (6), (8) and (9) as follows:

$$(I - \Psi(L))^{-1} = (I - \Phi(L))^{-1} \Phi_0 \quad (10)$$

While the elements  $\Phi_i$ , for  $i = 1, \dots, p$ , can be obtained directly from the regression, not all of the  $n^2$  elements<sup>6</sup> of  $\Phi_0$  are identified without the imposition of further assumptions. These so called identifying assumptions are necessary to retrieve the structural shocks  $\varepsilon_t$  from the reduced-form residuals  $u_t$ . The variance-covariance matrix obtained from the estimation provides, through Equation (7),  $n(n+1)/2$  restrictions on  $\Phi_0$ , leaving  $n(n-1)/2$  additional restrictions required for full identification. There are four general approaches that have been used in the literature to obtain identification, namely (i) restrictions on the contemporaneous effects of shocks through  $\Phi_0$ ; (ii) restrictions on the contemporaneous relations of variables

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<sup>6</sup> In the empirical study,  $n=3$ .

through  $\Psi_0$ ; (iii) long-run restrictions through  $\Psi(1)$  or  $\Phi(1)$ ; and (iv) some combinations of these three identification schemes.

This paper adopts the standard and widely used recursive identification scheme which corresponds to assuming that  $\Phi_0$  is lower triangular and is implemented through the Choleski decomposition of matrix  $\Omega$ . Such assumption imposes a recursive form on the contemporaneous correlations in the system. This implies that the first variable responds only to its own shock, the second variable responds to the first variable as well as to a shock to the second variable, and so on. Finally, the last variable in the system reacts without delay to all shocks, but disturbances to this variable have no contemporaneous effect on the other variables. This recursive scheme entails that the order of the variables has important implications for the identification of shocks. In this paper, the ordering was chosen on the basis of the speed with which the variables respond to shocks. Inflation ( $\pi$ ) is assumed to be the least responsive (that is the most exogenous), followed respectively by the stock prices ( $s$ ). At the end, we put the monetary instruments ( $r$ ).<sup>7</sup> By putting the monetary instrument (let's say the interest rate) in the last position, we implicitly suppose that the monetary authority responds to all other variables contemporaneously. In contrast, the interest rate has no immediate impact on the other variables; its impact is perceptible with a time lag. In other words, the central bank's reaction function includes all the contemporaneously variables. Concretely, the order chosen is encompassed in the following form:

$$\pi_t = E_{t-1}(\pi_t) + \varepsilon_t^\pi \quad (11)$$

$$s_t = E_{t-1}(s_t) + \rho\varepsilon_t^\pi + \varepsilon_t^s \quad (12)$$

$$r_t = E_{t-1}(r_t) + \gamma_1\varepsilon_t^\pi + \gamma_2\varepsilon_t^s + \varepsilon_t^r \quad (13)$$

where  $\varepsilon_t^j$ ,  $j = \pi, s, r$ , stand for the structural shocks.  $E_{t-1}(\cdot)$  is the expectation of a variable based on the information set at the end of period  $t-1$ . According to this picture, the monetary policy does not have any contemporaneous effect, which may be rationalized by assuming the existence of time dependent rules, convex adjustment costs, menu costs or building and delivery lags.

Inference and testing in VAR models depend tightly on the correct specification of the lag length. Many approaches have been used in the economic literature. The most widely used techniques are information criteria and likelihood ratio (LR) test. The LR test contributes in the comparison between two different lags according to the following hypotheses:

$$\begin{cases} H_0 : p = p_0 \\ H_1 : p = p_1 \quad p_1 > p_0 \end{cases} \quad (14)$$

This test will be conducted using the following statistic test:

$$LR = 2(\hat{L}_1 - \hat{L}_0) \equiv T(\log|\hat{\Omega}_0| - \log|\hat{\Omega}_1|) \quad (15)$$

$\hat{L}_0$  and  $\hat{L}_1$  are the estimated log-likelihoods obtained after estimation of  $\text{VAR}(p_0)$  and  $\text{VAR}(p_1)$ , respectively.  $|\hat{\Omega}|$  stands for the determinant of the appropriate covariance matrix. On the other hand and from the same estimations, the estimated matrices of variance-covariance of residuals are also calculated as follows:

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<sup>7</sup> Throughout this paper, we assume that the central bank monetary instrument could be either the reserve money, M1 aggregate or a short interest rate.

$$\hat{\Omega}_i = \frac{1}{T} \sum_{t=1}^T \hat{u}_t(p_i) \hat{u}_t'(p_i) \quad i = 0,1 \quad (16)$$

The LR statistic has the chi-squared distribution with  $q = n^2(p_1 - p_0)$  degrees of freedom which are equal to the number of restrictions in the system under the null hypothesis.  $n$  is the number of endogenous variables.<sup>8</sup> An alternative approach to select the appropriate lag length is based on information theory which proposes a series of information criteria. Many studies have analyzed the behavior of these criteria in finite sample as well as asymptotically (Lütkepohl, 1985). It turned out that there is no specific criterion that could be considered preferable in all situations. It has been shown for instance that when it comes to VAR models with a relatively moderate sample size, and when data frequency is monthly, the criterion of Akaike (AIC) is recommended (Ivanov and Kilian, 2005). It is determined by the following statistic (Lütkepohl, 1993, Chap. 4):

$$AIC = T \log|\hat{\Omega}| + 2n \quad (17)$$

Besides, in order to assure a relevance of the lag length choice, we run Ljung-Box test LB for residual serial correlation up to 16 lags (Hosking, 1980; Lütkepohl, 1993). If  $p$  is the dimension of the VAR and  $k$  its lag order, then it has been demonstrated (Lütkepohl, 1993, p.151) that the overall significance of the residual autocorrelation up to lag  $h$  has an approximate asymptotic chi-squared distribution defined as follows:

$$LB(h) \rightarrow \chi_{p^2(h-k)}^2 \quad (18)$$

## 5. Results and Discussion

Before estimating the VAR models and computing the IRFs, optimal lag lengths have been computed using the AIC criterion information. A maximum lag length of 7 has been fixed for all the countries. This value has been decided with reference to studies that make use of similar models, data and data frequencies. These studies do not consider more than 12 lags in selecting the order of a VAR model for monthly post-war data and most studies end up using 6 lags (Kim, 2003; Crosby and Otto, 2003). For the monthly data considered in this paper, a lag length of 12 has not been considered because such a practice may have favored any information criterion that tends to over-fit asymptotically such as AIC (Lütkepohl, 1985). The methodology we followed permitted to obtain optimal lags which differ from one country to another (see Table 2). As seen from Table 2, the LB test could not reject the null of no serial correlation in all cases.

The unexpected changes in the interest rate represent surprising changes that can be the results of a drastic shift in monetary policy. Changes in the target and procedure of monetary policy are examples for drastic policy changes. If these changes essentially differ from the past, that is, they cannot be effectively explained by past changes in the interest rate, responses from the stock market could be significant. The responses to unexpected changes of monetary policy can be both positive and negative. They can be either positive if changes are perceived favorable to businesses or negative if changes are perceived unfavorable. The monetary policy literature argues that monetary policy impacts on asset prices. Thus, a restrictive monetary policy (a rise in the interest rate) brings down equity prices because of

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<sup>8</sup> In the empirical study,  $n=3$ . When the estimation of a VAR model is conducted over a sample with a low size, Sims (1980) suggests a slight correction replacing  $T$  in Equation (16) by  $T - n(1 + p_1)$  where  $(1 + p_1)$  is the number of estimated parameters in each equation of VAR model specification (Equation (5)).

the following reasons: firstly because the income flow which the share price measures is now discounted at a higher rate of long-term interest than before; secondly since demand for bonds increases at the expense of equities when bond yield grows up, and thirdly because higher interest rates may bring about an increase in corporate financial expenses, thereby reducing their profits. Falling equity prices reduce the wealth of individuals, which in turn reduces their propensity and ability to borrow, and thereby their ability to spend. A fall in share prices also reduces the market value of firms relative to the replacement cost of capital, making it relatively more expensive to issue new equity to finance new investments.

The above explanations are not in contradiction with what happens in Bahrain, Jordan, Saudi Arabia, and to a lesser extent Oman. Indeed, the monetary policy in these countries appears to be effective in influencing the stock market prices. The IRFs are reported in Figures 1 through 8. These results display the response of each variable in the system to one-standard deviation shock in the monetary policy variables. We are most interested in the impact of an unanticipated monetary policy shock on inflation and stock market returns. The solid lines in the figures represent the IRFs, while the broken lines correspond to the 95 upper and lower confidence bands about the point estimate of the IRFs. A response can be considered significant if both bands, as well as the point estimated, lie on the same side of the zero line.

Consider first the finding when the interest rate is used as the monetary policy instrument. Figures 1.a through 8.a display the response of the variables included in the VAR system to one standard point increase in the interest rate shock. For Bahrain, Jordan, Oman and Saudi Arabia, the IRFs indicate that subsequent to a positive shock in interest rate, the country stock prices decreases significantly after 3 months for Bahrain, 8 months for Saudi Arabia, 12 months for Oman and 15 months for Jordan, respectively. Besides, the aggregate impacts of interest rate shocks were quite impressive in Jordan and Oman (0.2 and 0.1, respectively), whereas they did not cross 0.01 in Bahrain and Saudi Arabia. Furthermore, these findings indicate that stock returns remain below the pre-shock level for over 20 months for Oman, Jordan and Saudi Arabia, but with a declining trend for Saudi Arabia and the effect of interest shock disappears in Bahrain after 12 months. Surprisingly, we notice that following the interest rate shock, the stock returns increase during the first three months in Jordan and Saudi Arabia, and subsequently decrease gradually to below pre-shock level.

Next, we investigate a positive shock of  $M1^9$  on stock returns. For Bahrain, Egypt and Tunisia, the IRFs indicate that an unanticipated increase in money supply causes a rise in stock returns by 0.4, 1.2 and 0.5, respectively. However, the results show that the increase takes place after 1 month in Egypt, but needs 2 months and even 10 months in Tunisia to show up. Furthermore, the positive effects disappear in Bahrain and Egypt just one month after their occurrence (the 3<sup>rd</sup> and 11<sup>th</sup> months, respectively). In Egypt, the impact disappears after 3 months, reappears after 8 month with a slightly milder effect, and vanishes again after the 9<sup>th</sup> month. Surprisingly in Morocco, stock returns decreased slightly during the 1<sup>st</sup> month, but recover rapidly until they reach their pre-shock levels in the 2<sup>nd</sup> month.

To sum up, the results indicate that only Bahraini stock returns respond to both interest rate and M1 shocks as predicted. Omani, Jordanian and Saudi Arabian stock returns react negatively as expected to a positive shock in interest rate with different patterns. Egyptian and Tunisian stock returns are positively impacted by a positive innovation in M1, but not to an unanticipated increase in interest rate. Finally, stock returns react negatively and surprisingly to an innovation in M1 but with no long lasting effect, and the reaction of the Turkish stock returns to a tight or expansive monetary policy appears to be totally absent.

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9 Money Base did not provide any significant results when used as a measure for the monetary policy shock, so we focus our comments on M1.

On the other hand, it should be of interest to assess the reaction of monetary authorities to stock price movements (booming market and bubble initiation). Jordan and Saudi Arabia react to a positive innovation in stock returns by increasing, with 8 months delay, their interest rates by 0.5 and 0.3, respectively. The reaction to prevent large assets misalignments and booms is strengthening gradually in Jordan to reach 1 after 20 months whereas it decreases in Saudi Arabia to reach 0.2 after 20 months. Surprisingly in Turkey, the monetary authorities respond by decreasing the interest rate following a positive shock on stock returns by 0.6 after the first month, but the effect dies away after 5 months. Overall, these findings show that the Saudi Arabian Monetary Authority (SMA) and BOJ are interested in what happens in their respective stock markets. Such interests reside in the fear that one small event, whether “rational” or not would trigger a financial crisis. SMA and BOJ seem to respond vigorously to unexpected movements in stock market prices. Both Saudi Arabian and Jordanian monetary policy makers care about their financial systems stability; they worry that the probability that one small event can have disastrous consequences for the stability of the financial systems is sufficiently high to warrant the monitoring, and response, to movements in the stock market.<sup>10</sup> For the remaining countries (Bahrain, Morocco, Oman and Tunisia), monetary authorities are non responsive to bubbles surging from booming markets. Indeed and unlike the Fed, the monetary authorities of Bahrain, Oman, Morocco and Tunisia do not seem to react to unexpected rises in their stock market prices. This attitude is not surprising especially if monetary authorities either find it fruitless to respond to transitory events in stock market or deem it possible to stem output volatility and inflation skidding without reacting to equity price movements. Again, the lack of reaction in the cases of Bahrain and Oman is understandable, seeing that the hands of monetary policy makers in these countries are tied by the pegging regime they had ascribed to. In Tunisia and Morocco, the inertia of the authorities could be explained by the small size of their stock exchanges relative to the economy as a whole, that even a huge surge of stock indexes will increase inflation only slightly.

## 6. Conclusion

The nature of the relationship between asset prices movements and monetary policy is currently a hotly debated topic in macroeconomics. An important number of theoretical and empirical studies have been devoted to the relation between monetary policy and stock markets. As surprising as it may appear, there is no single theoretical study on the linkage between monetary policy and stock market prices so far. Relatively little empirical evidence is available that estimates the relationship between asset price movements and monetary policy measures. This theme is still unexplored. For instance, the issue of whether central banks should react to stock market movements is still an open issue. The theoretical literature has mixed views on this subject. For instance, Bernanke and Gertler (2001) argue that under an inflation targeting regime, monetary policymakers do not benefit from responding to assets prices; because under such a regime, the aim is to stabilize inflation and output even when stock markets are volatile. More specifically, Bernanke and Gertler (1999) take the position that reactions to equity price movements are warranted only to the extent that they convey information regarding expected inflation. Bullard and Shaling (2002) show that including equity prices in the monetary authorities’ reaction function degrades economic performance; better still, these authors argue that taking into consideration equity prices does not help to achieve optimal monetary policy. Besides, other economists (Cecchetti et al.,

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<sup>10</sup> It is worth noting that Saudi Arabia is the biggest stock market in the region has witnessed a stock market crisis during March 2006 which propagates quickly to some other GCC countries.



2000) argue that explicit reaction to asset price movements can help the monetary authorities curtail output volatility.

Our study attempts to shed light on this issue for an unexplored region, namely the MENA region. Using a sample of eight MENA countries, this study aims to understand whether there is an interaction between equity markets and monetary policy. From a comparative perspective, promising results reflect a significant effect of an appropriate monetary policy on stock markets development especially in Bahrain, Egypt, Morocco, Saudi Arabia and Tunisia. On the other hand, the responsiveness of stock markets differs across these MENA countries. In some countries, stock market returns depict an upward tendency while in other countries they decline or do not react at all.

What implications do these results have for our broader understanding and for the practice of monetary policy? We will briefly discuss the role of the stock market in the transmission of monetary policy changes to the economy. Bahraini, Jordanian, Saudi Arabian and, to a lesser extent, Omani monetary policies seem to affect prices in their respective stock markets both sensibly and quickly, and monetary policy is considered an efficient tool whether to control prices (interest rate hikes) or to spur the economy by allowing consumers to enjoy a capital gain in their stock portfolios of the day. Meanwhile it can be effective in reducing the amount of economic and financial risk they must face (interest rate decrease). Why do these countries, and not others in our sample, enjoy strong links between their monetary policy and stock market prices? First, these countries have pegged their currencies to the US dollar and they endorse the US monetary policy. Besides, the stock markets of these two countries are relatively the biggest in the region using market capitalization over GDP. Paradoxically, the monetary policies reactions of the MENA countries to stock market prices movements, appears to be heterogeneous. While Saudi Arabia and Jordan respond significantly to unexpected events in their respective stock markets, the other countries do not exhibit significant reactions.

In a nutshell, what we could propose for the lagging countries in matters of relationship between their monetary policies and stock market returns is to peg their currencies and to further develop their stock markets. It would be also of interest to develop Treasury fund futures because they could be considered of benefit not only to investors such as banks, which want to protect themselves against changes in the cost of reserves, but also to policymakers, because futures allow the observer to infer, from the prices of futures contracts, the values of the discount rate that market participants anticipate at various future dates.

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## Annex A1:

### Sample Descriptions and Tables

#### *Sample Description:*

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Bahrain	[1998:12-2003:12]
Egypt	[1995:12-2005:09]
Jordan	[1990:01-2005:09]
Morocco	[1995:12-2005:07]
Oman	[1999:06-2005:06]
Saudi Arabia	[1998:01-2005:08]
Tunisia	[1996:01-2005:10]
Turkey	[1990:02-2005:10]

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**Table 1- Equity Markets in Selected MENA Countries (Selected Indicators: 2000 and 2005)**

<b>Panel A. 2000</b>					
<b>Country</b>	<b>Number of listed companies</b>	<b>Market Capitalization (\$billions)</b>	<b>Market Capitalization (% GDP)</b>	<b>Value Traded (% GDP)</b>	<b>Turnover Ratio (%)</b>
Bahrain	42	6.62	83.1	3.1	3.6
Egypt	1076	28.74	28.1	10.9	34.7
Jordan	163	4.94	58.4	4.9	7.7
Morocco	53	10.89	32.7	3.3	9.2
Oman	131	3.46	17.4	2.8	14.2
Saudi Arabia	75	67.17	35.6	9.2	27.1
Tunisia	44	2.82	14.5	3.2	23.3
Turkey	315	69.65	35	89.9	206.2
<b>Panel A. 2005</b>					
<b>Country</b>	<b>Number of listed companies</b>	<b>Market Capitalization (\$billions)</b>	<b>Market Capitalization (% GDP)</b>	<b>Value Traded (% GDP)</b>	<b>Turnover Ratio (%)</b>
Bahrain	47	17.36	133.6	5.5	4.6
Egypt	744	79.67	89.2	28.4	43
Jordan	201	37.63	292.7	185.1	85
Morocco	56	27.21	52.6	8	15.9
Oman	96	15.26	40	-	29.8
Saudi Arabia	77	646.1	208.6	356.2	231.7
Tunisia	46	2.87	10	1.6	16.5
Turkey	302	161.53	44.5	55.4	154.9

Sources: Arab Monetary Fund (AMF), Emerging Markets Database (EMDB), Federation of Euro-Asian Stock Exchanges (FEAS), International Financial Statistics (IFS) and World Development Indicators (WDI).

**Table 2- VAR Lag Selection, Serial Correlation and Granger Non-Causality Tests**

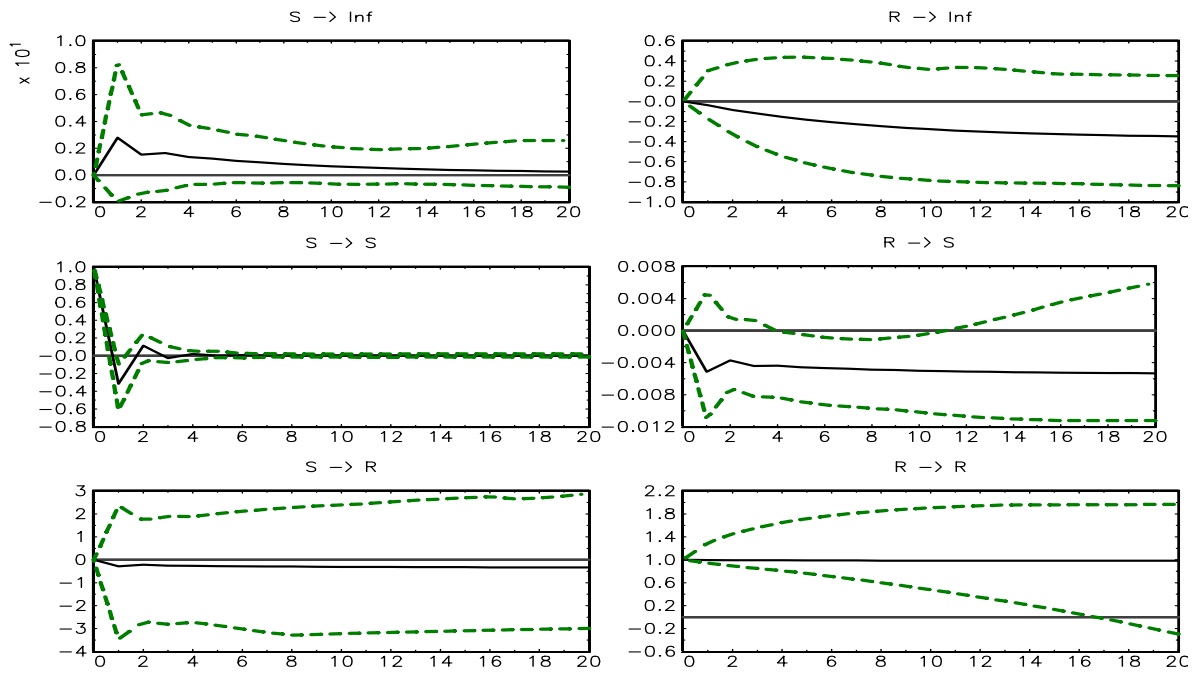
Country	Model	Optimal lag	LB Statistics	Causality
		length	p-value	p-value
Bahrain	Model 1: [inf, S, R]	1	0.05	0.11
	Model 2: [inf, S, ΔB]	1	0.01	0.97
	Model 3: [inf, S, ΔM1]	4	0.01	0.54
Egypt	Model 1: [inf, S, R]	2	0.06	0.59
	Model 2: [inf, S, ΔB]	6	0.06	0.10
	Model 3: [inf, S, ΔM1]	9	0.00	0.10
Jordan	Model 1: [inf, S, R]	1	0.00	0.00
	Model 2: [inf, S, ΔB]	6	0.01	0.99
	Model 3: [inf, S, ΔM1]	1	0.01	0.91
Morocco	Model 1: [inf, S, R]	1	0.05	0.91
	Model 2: [inf, S, ΔB]	1	0.06	0.49
	Model 3: [inf, S, ΔM1]	1	0.06	0.50
Oman	Model 1: [inf, S, R]	5	0.12	0.13
	Model 2: [inf, S, ΔB]	6	0.01	0.53
	Model 3: [inf, S, ΔM1]	1	0.00	0.81
Saudi Arabia	Model 1: [inf, S, R]	2	0.00	0.00
	Model 2: [inf, S, ΔB]	1	0.00	0.93
	Model 3: [inf, S, ΔM1]	1	0.02	0.87
Tunisia	Model 1: [inf, S, R]	10	0.00	0.71
	Model 2: [inf, S, ΔB]	1	0.06	0.43
	Model 3: [inf, S, ΔM1]	1	0.03	0.49
Turkey	Model 1: [inf, S, R]	4	0.02	0.00
	Model 2: [inf, S, ΔB]	2	0.00	0.00
	Model 3: [inf, S, ΔM1]	2	0.00	0.00

The second column gives VAR specification for each country. The third column indicates, for each specification the optimal lag length according to AIC criterion information. The fourth column reports the p-value relative to the LB test of the null hypothesis of the absence of serial correlation. The null is rejected at  $\alpha$ -percent risk level

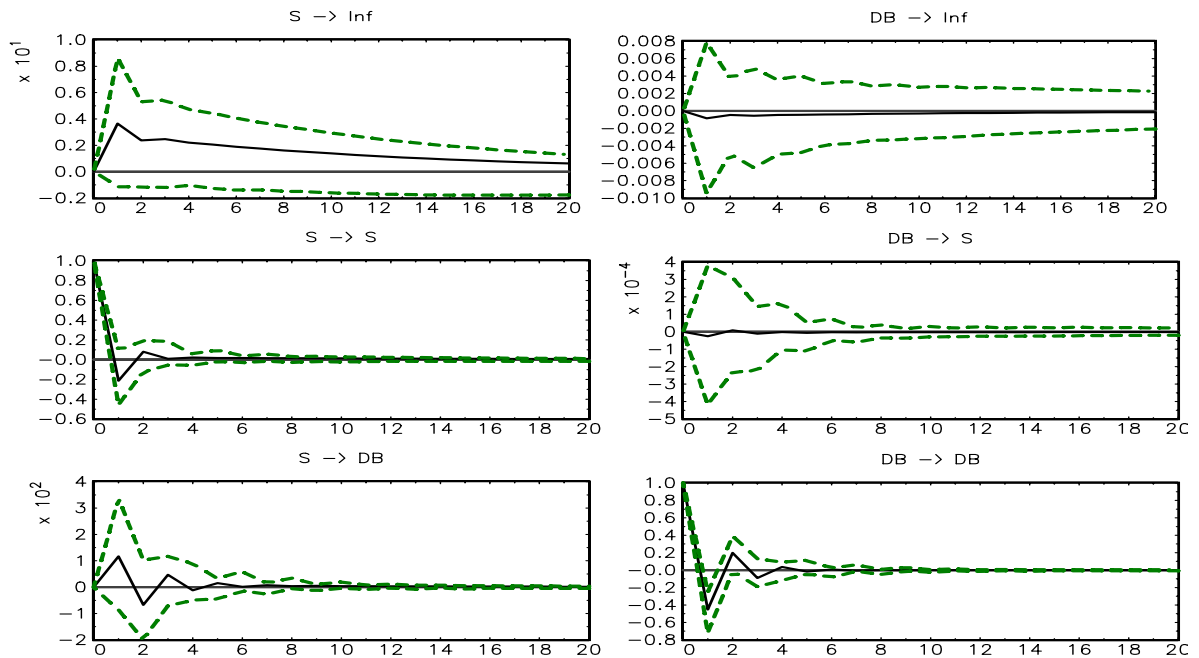
if the corresponding p-value is lower than  $\alpha$ . In the last column, results of causality test are given. The null hypothesis “x does not Granger cause inf and S” is rejected at  $\alpha$ -percent risk level if the corresponding p-value is lower than  $\alpha$  where  $x \in \{R, \Delta B, \Delta M1\}$ .



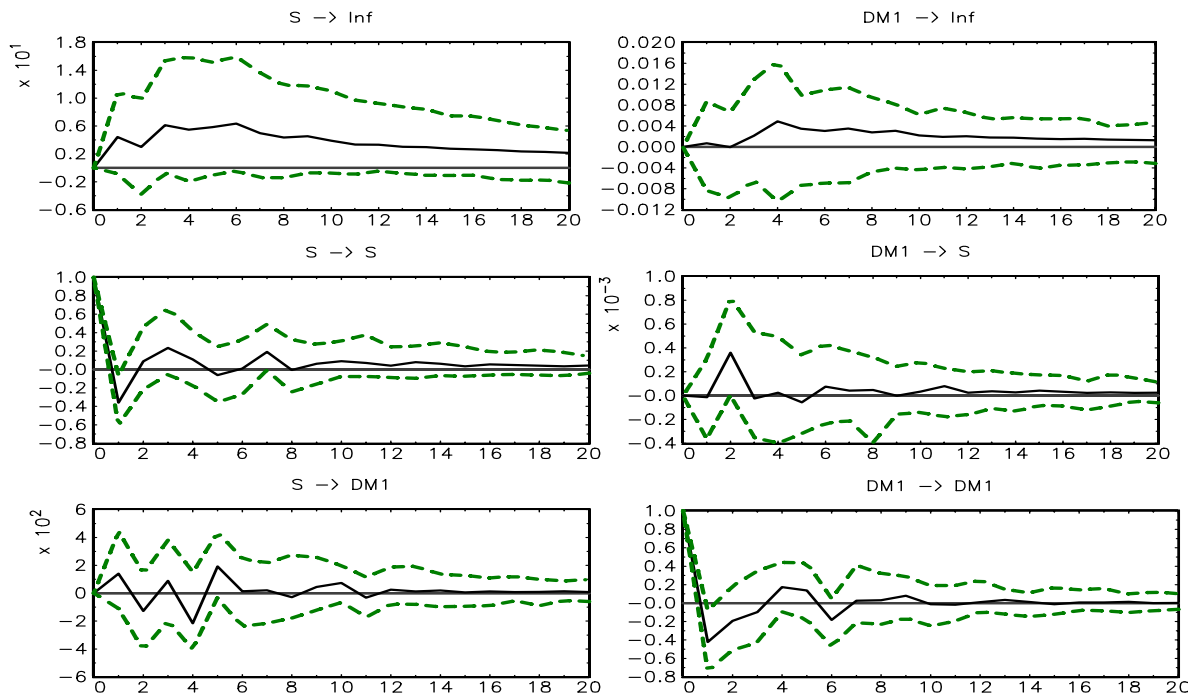
**Figure 1.a- Impulse Response Functions for Bahrain over the Period [1998:12-2003:12]**



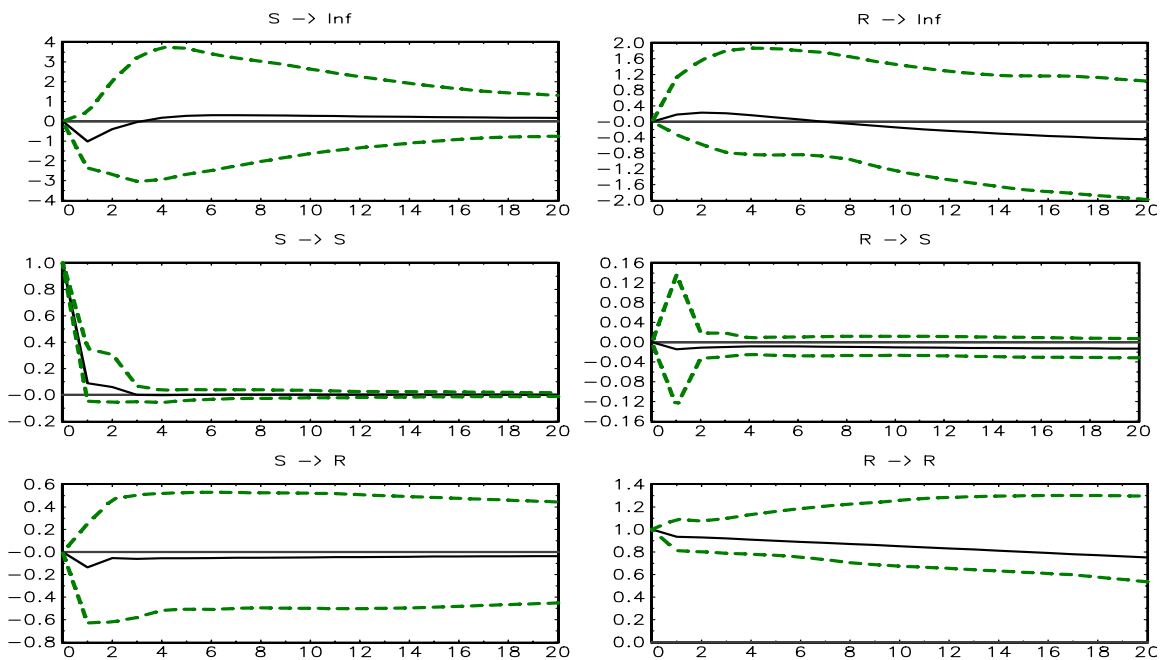
**Figure 1.b- Impulse Response Functions for Bahrain over the Period [1998:12-2003:12]**



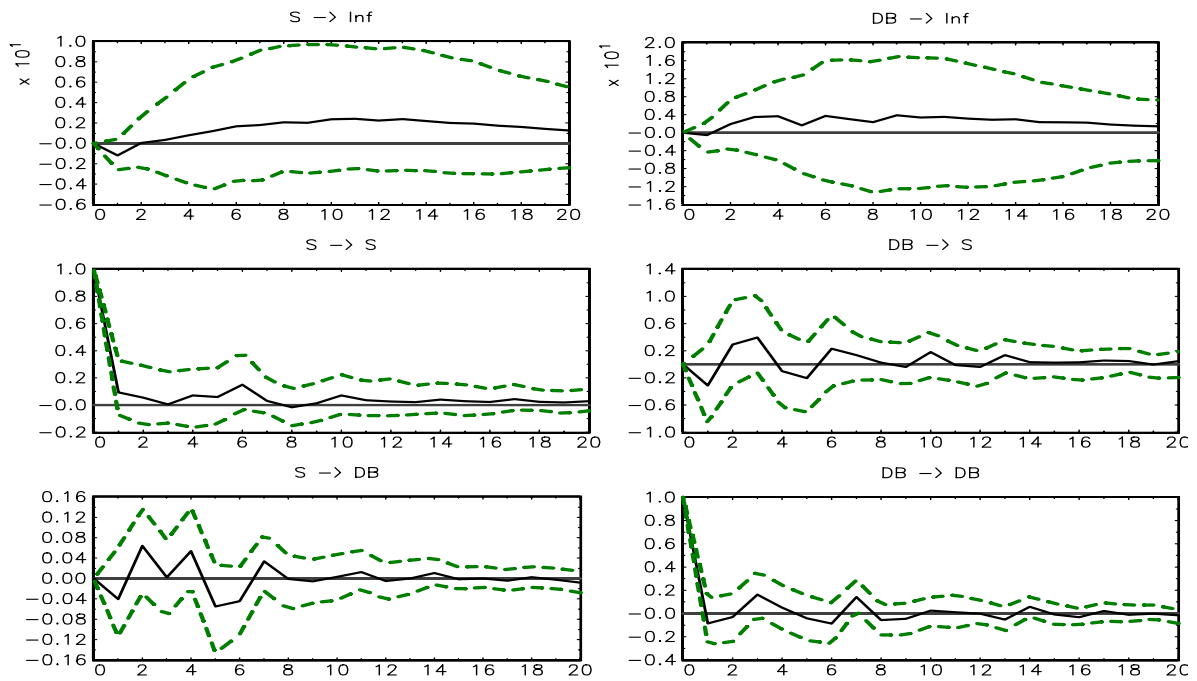
**Figure 1.c- Impulse Response Functions for Bahrain over the Period [1998:12-2003:12]**



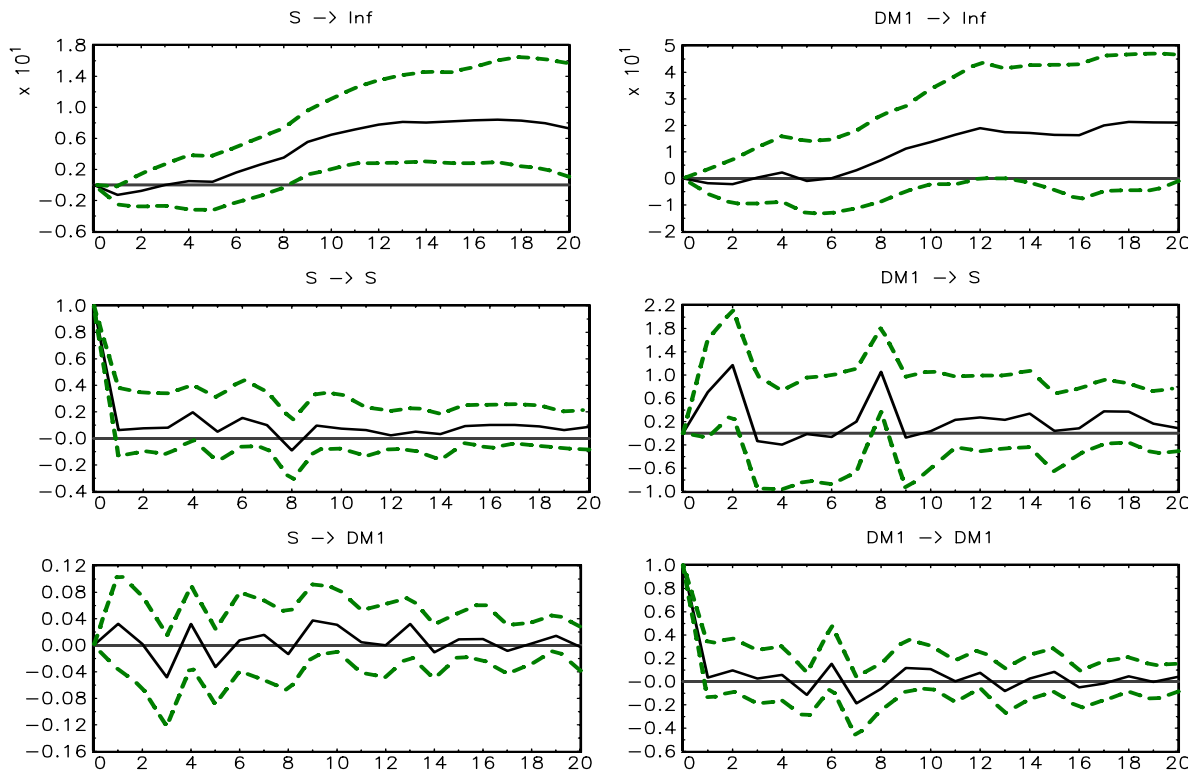
**Figure 2.a- Impulse Response Functions for Egypt over the Period [1995:12-2005:09]**



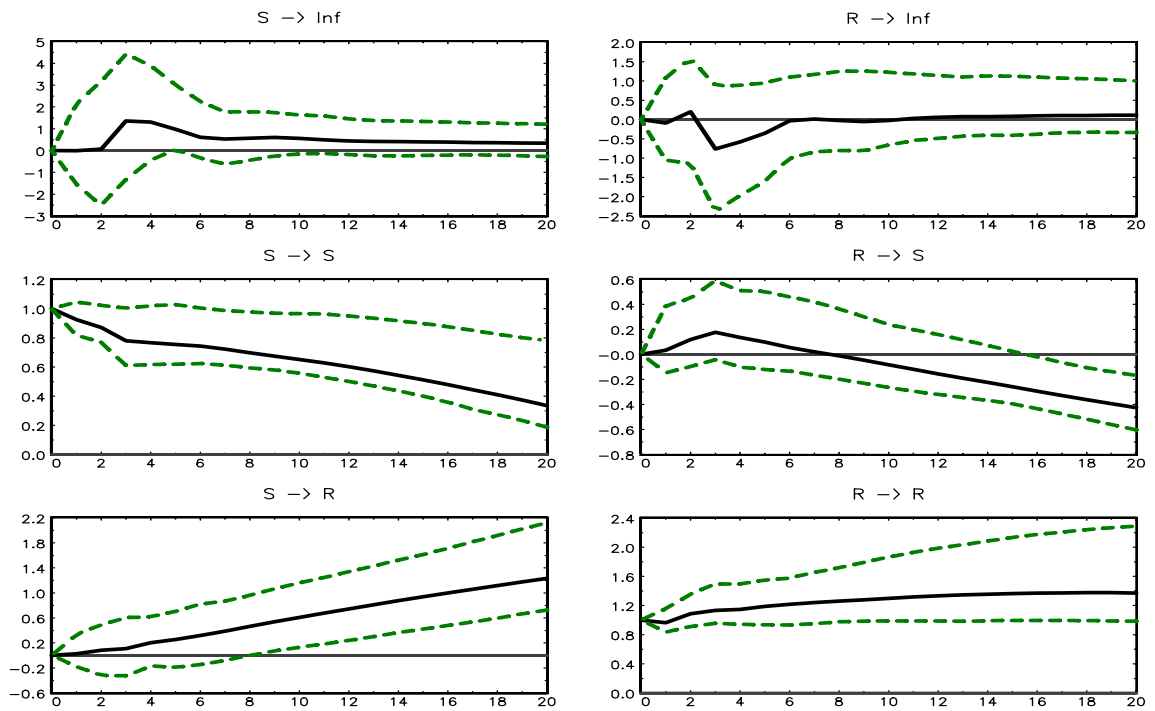
**Figure 2.b- Impulse Response Functions for Egypt over the Period [1995:12-2005:09]**



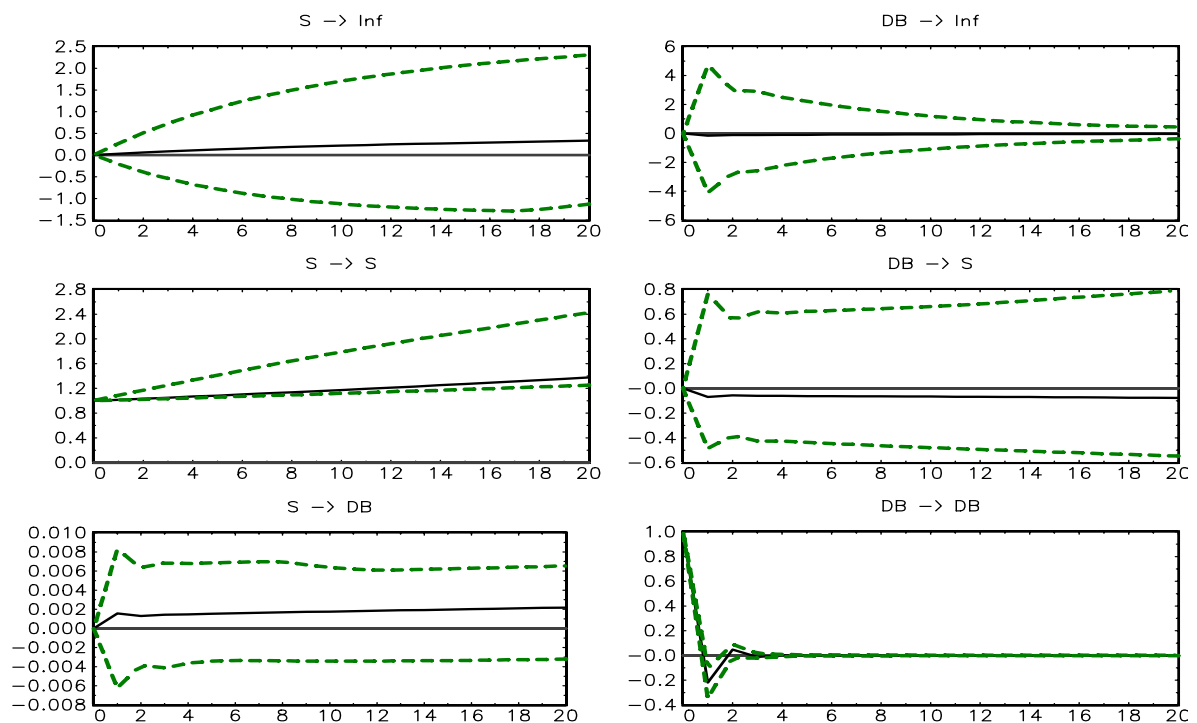
**Figure 2.c- Impulse Response Functions for Egypt over the Period [1995:12-2005:09]**



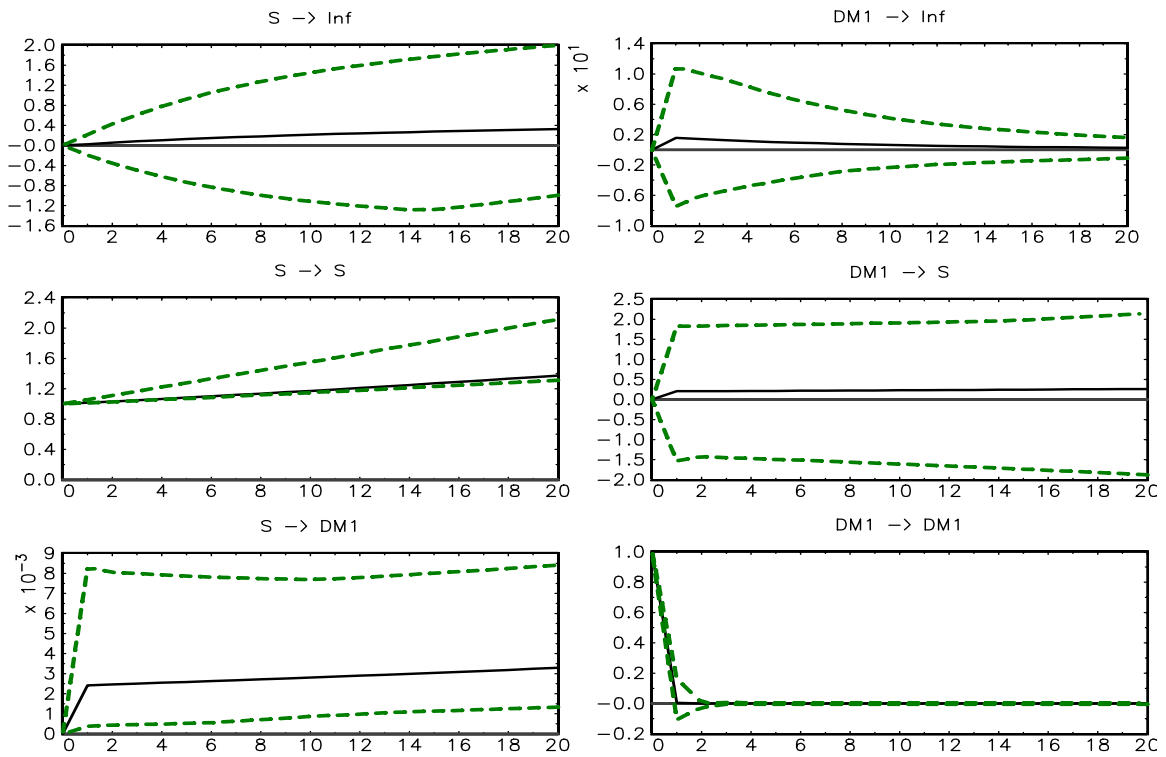
**Figure 3.a- Impulse Response Functions for Jordan over the Period [1990:01-2005:09]**



**Figure 3.b- Impulse Response Functions for Jordan over the Period [1990:01-2005:09]**



**Figure 3.c- Impulse Response Functions for Jordan over the Period [1990:01-2005:09]**



**Figure 4.a- Impulse Response Functions for Morocco over the Period [1995:12-2005:07]**

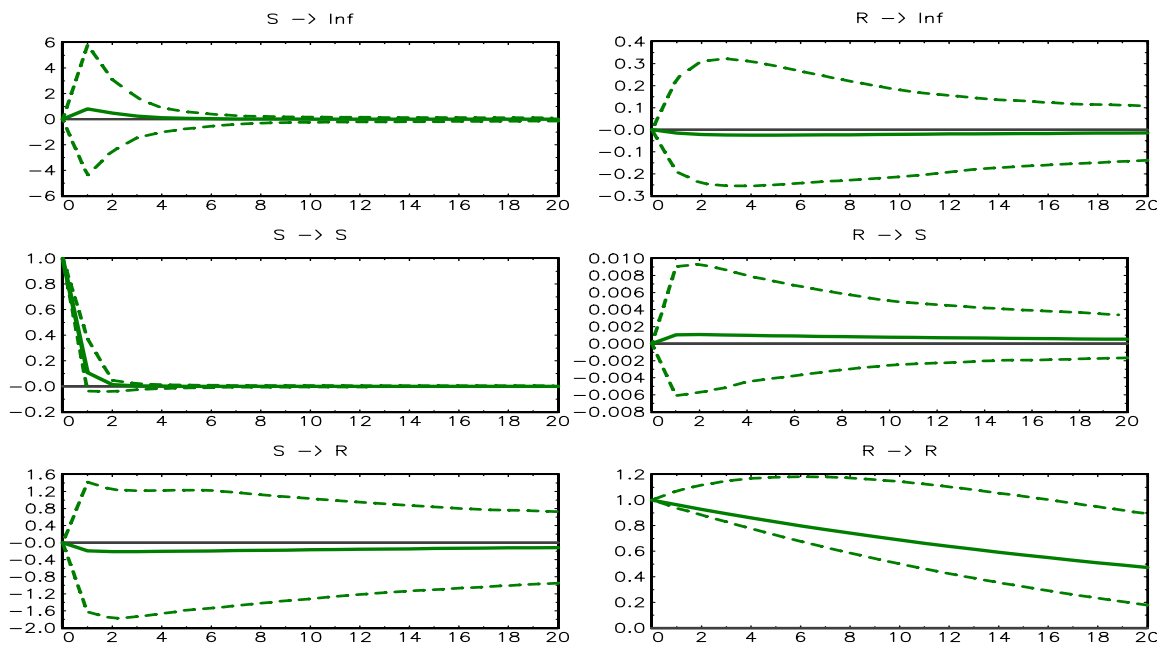


Figure 4.b- Impulse Response Functions for Morocco over the Period [1995:12-2005:07]

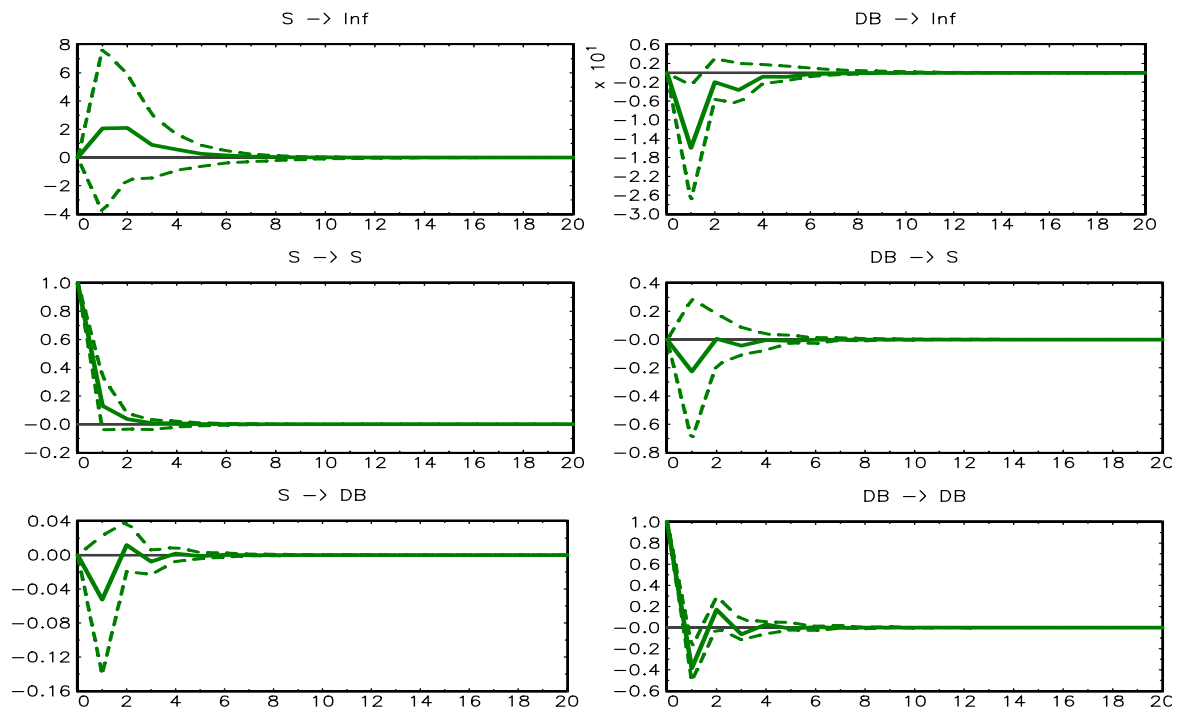
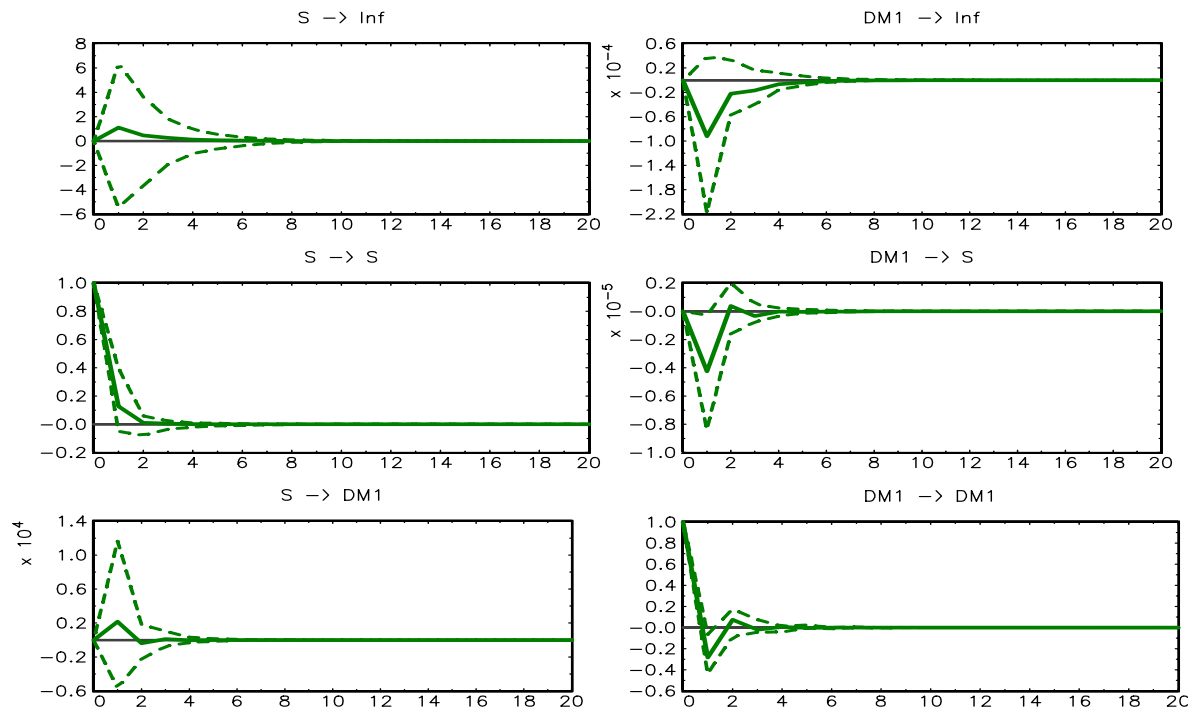
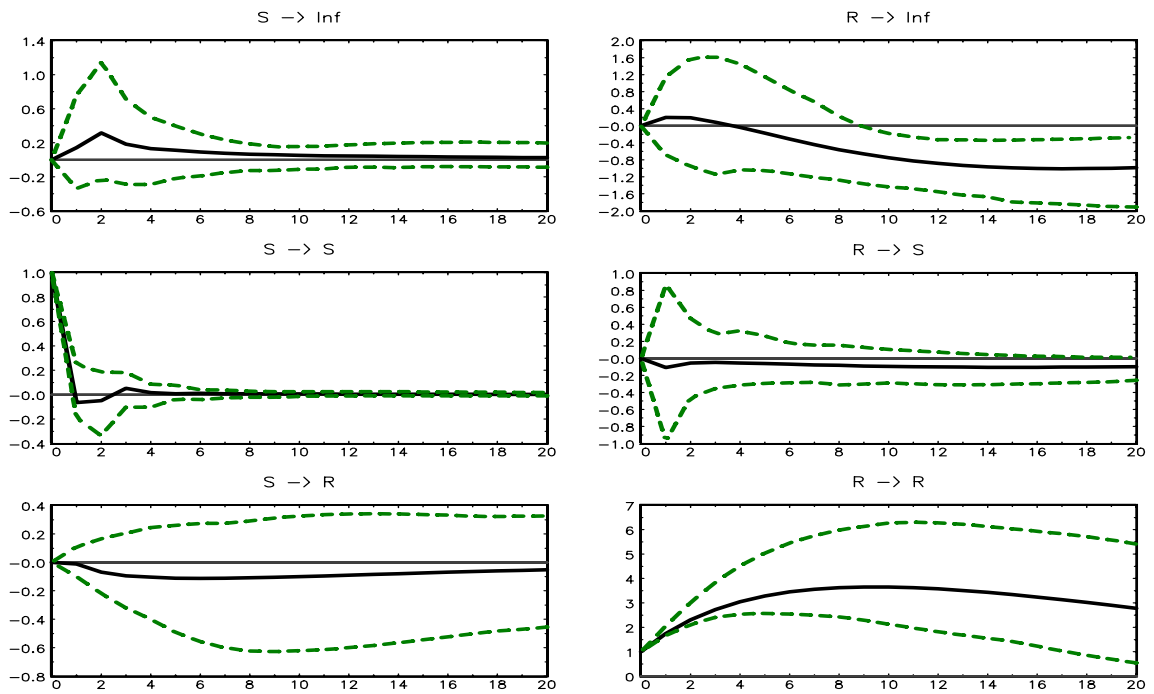


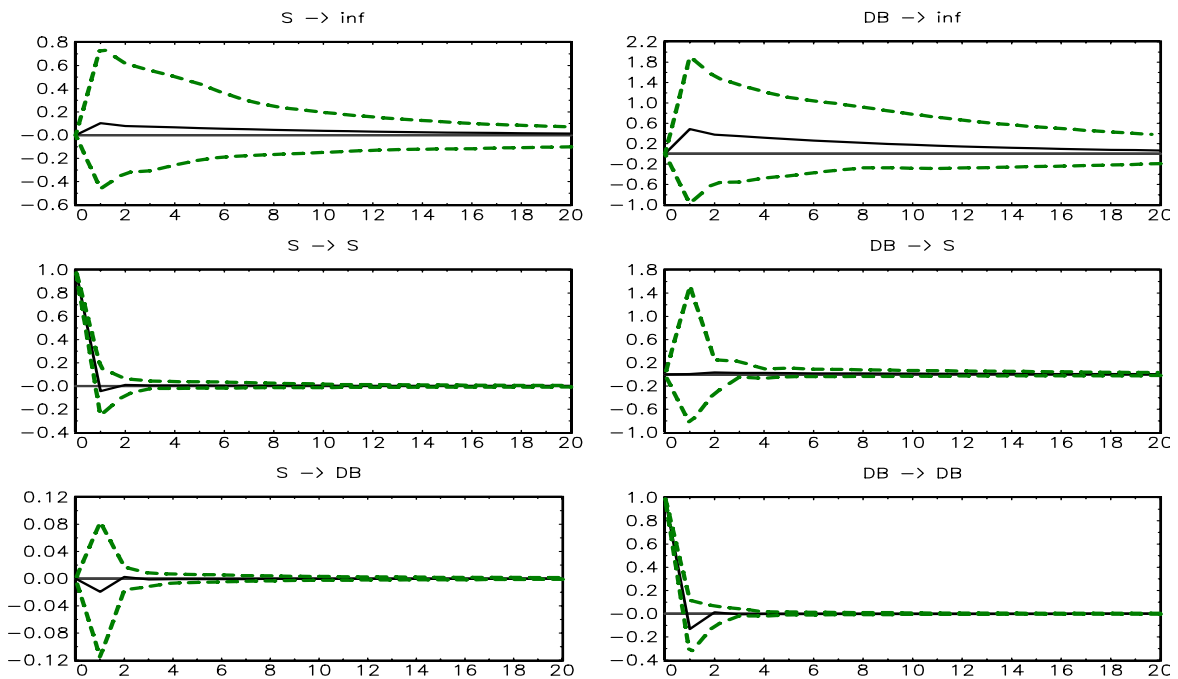
Figure 4.c- Impulse Response Functions for Morocco over the Period [1995:12-2005:07]



**Figure 5.a- Impulse Response Functions for Oman over the Period [1999:06-2005:06]**

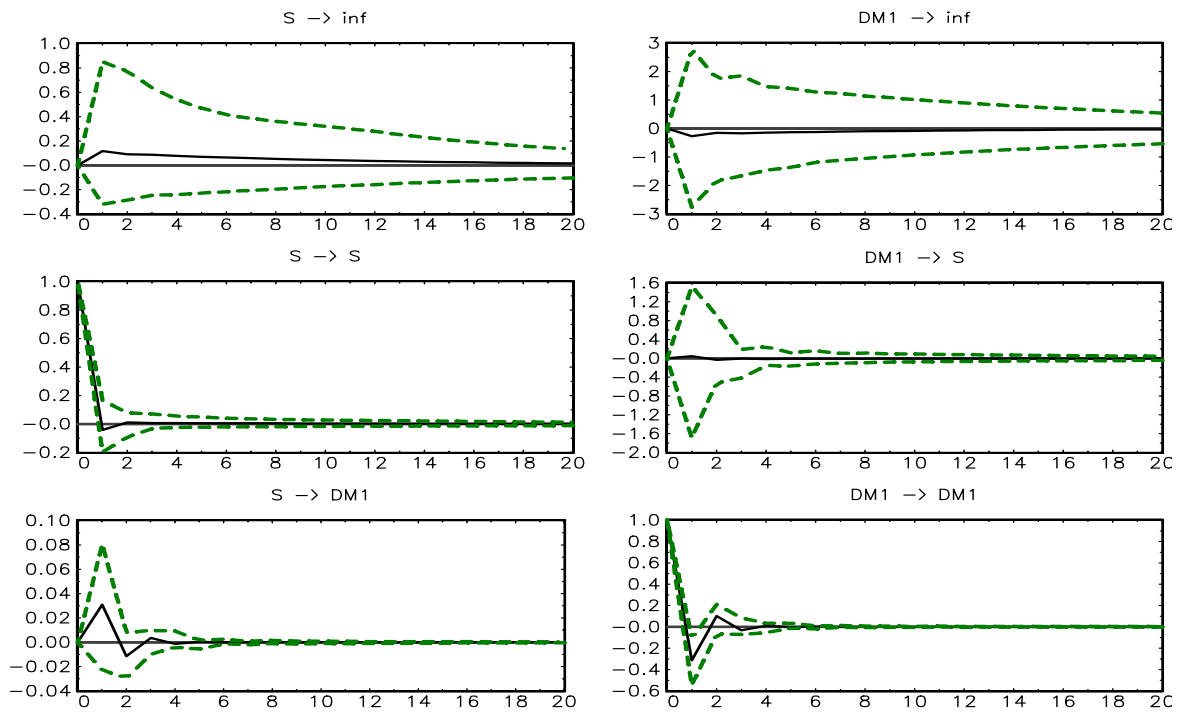


**Figure 5.b- Impulse Response Functions for Oman over the Period [1999:06-2005:06]**

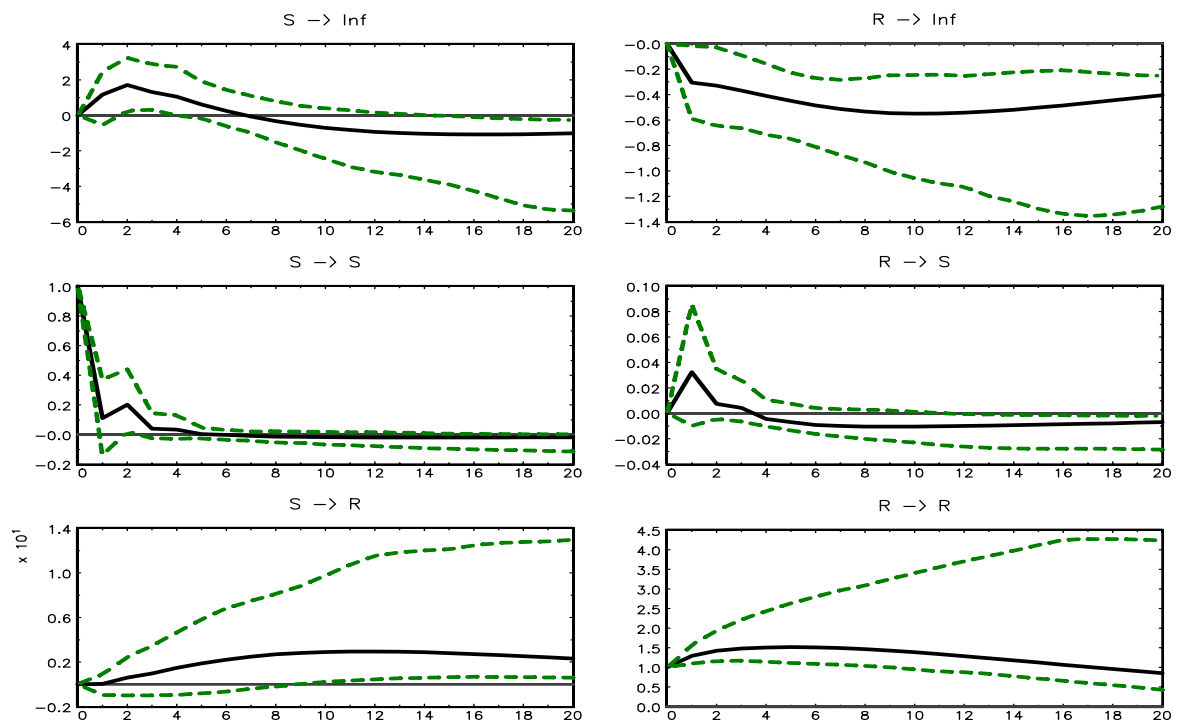




**Figure 5.c- Impulse Response Functions for Oman over the Period [1999:06-2005:06]**



**Figure 6.a- Impulse Response Functions for Saudi Arabia over the Period [1998:01-2005:08]**



**Figure 6.b- Impulse Response Functions for Saudi Arabia over the Period [1998:01-2005:08]**

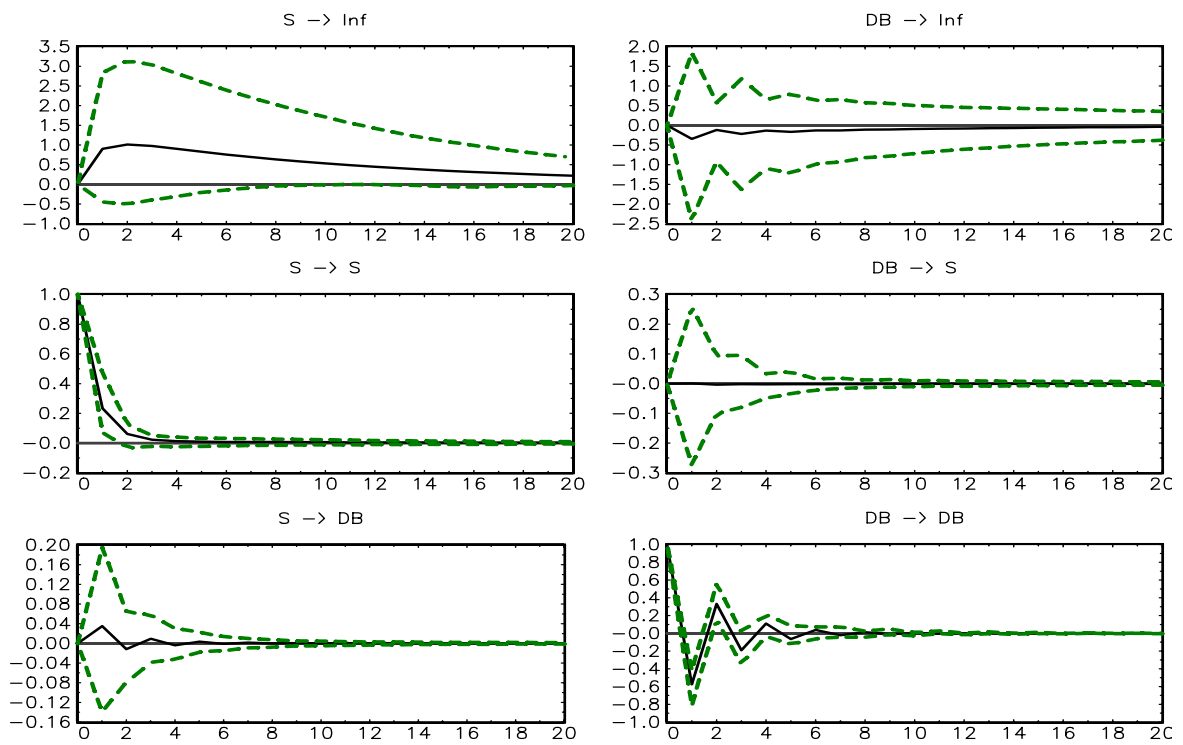
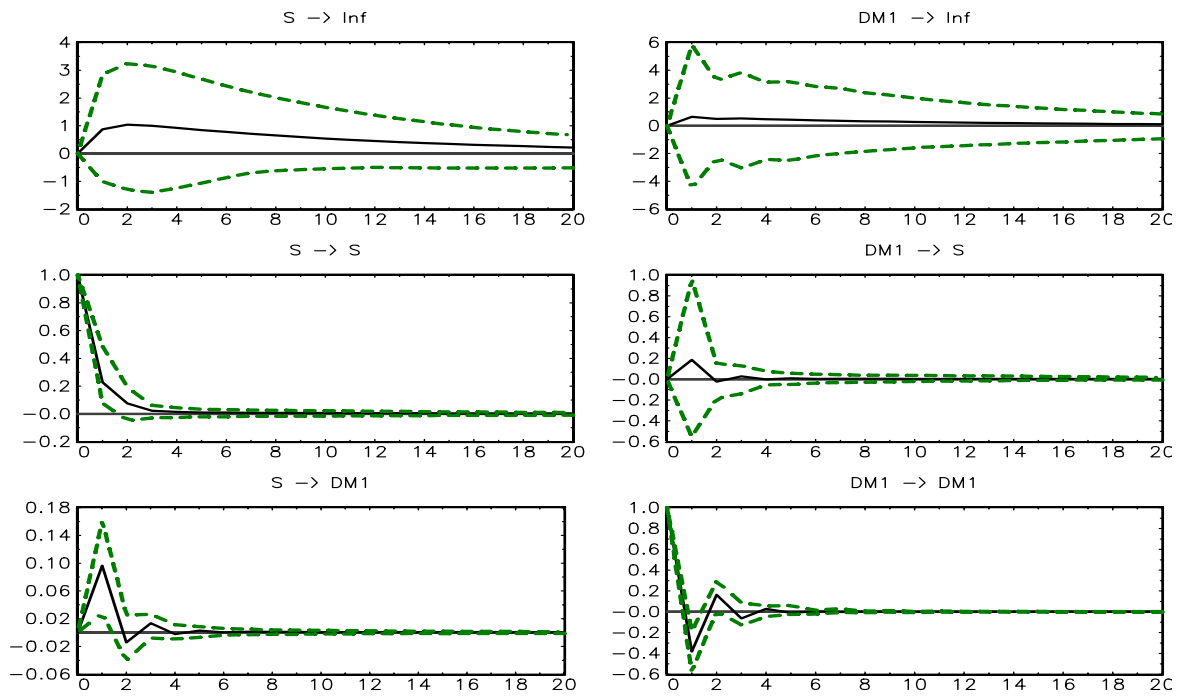
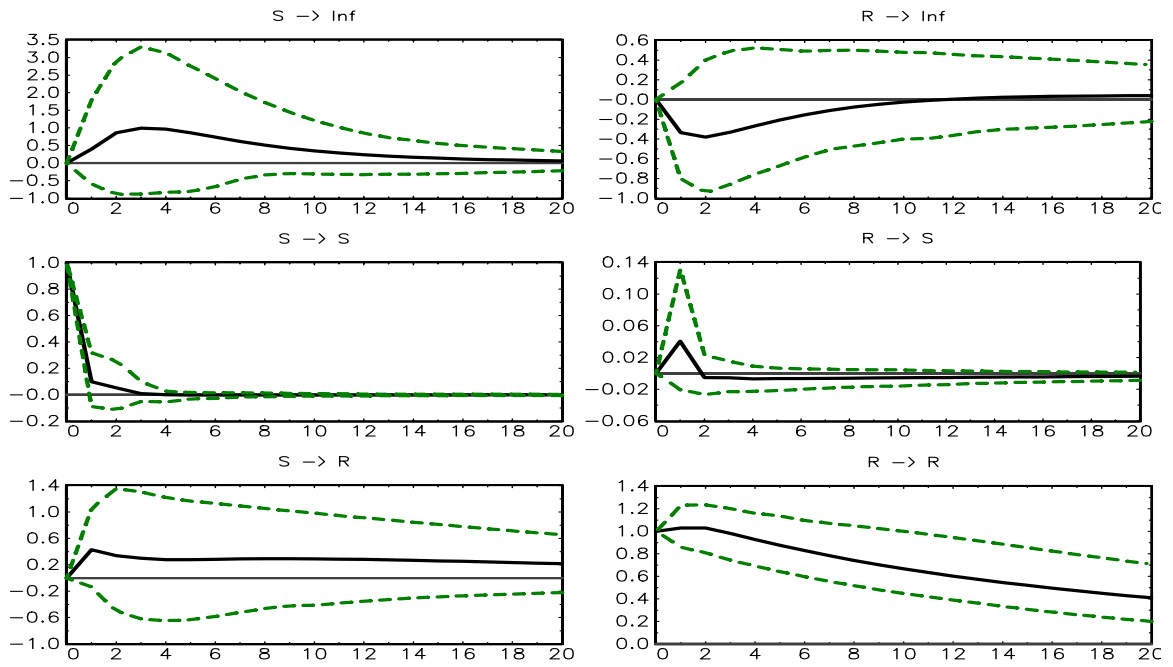


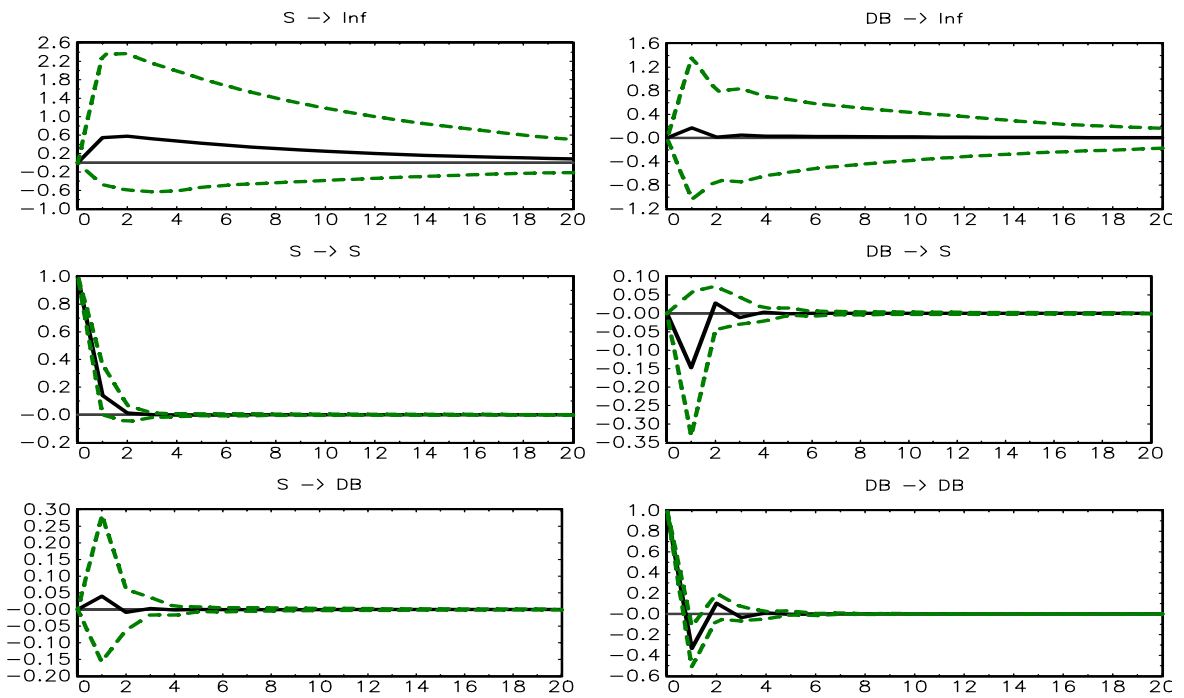
Figure 6.c- Impulse Response Functions for Saudi Arabia over the Period [1998:01-2005:08]



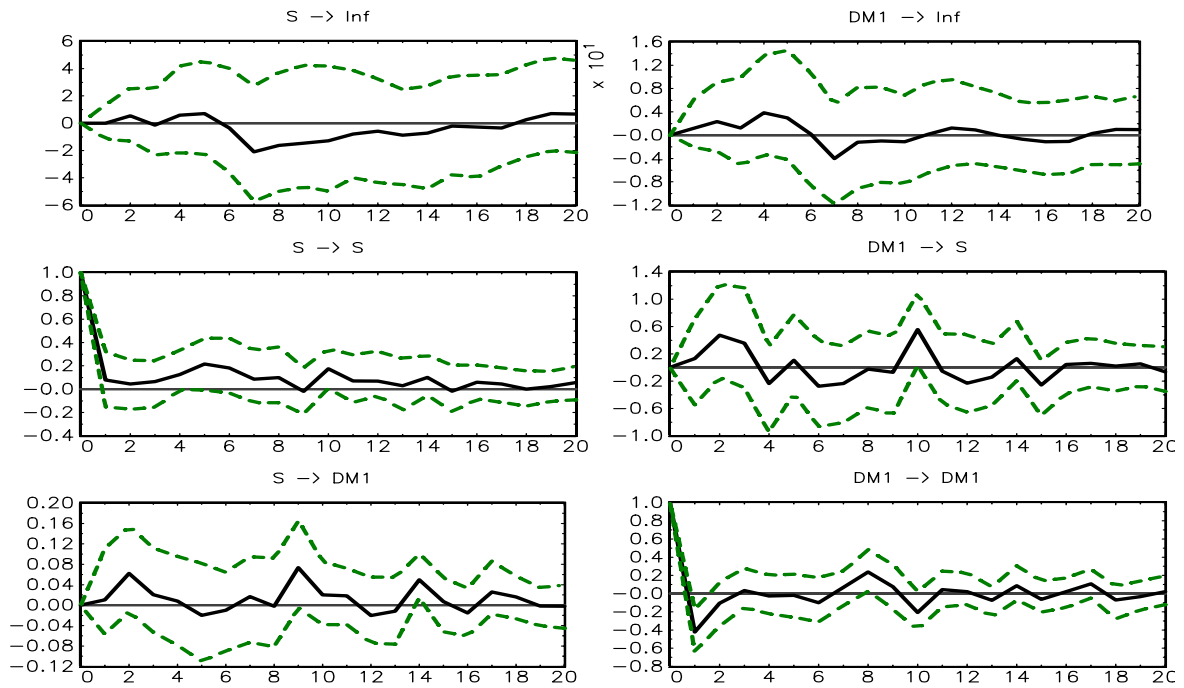
**Figure 7.a- Impulse Response Functions for Tunisia over the Period [1996:01-2005:10]**



**Figure 7.b- Impulse Response Functions for Tunisia over the Period [1996:01-2005:10]**



**Figure 7.c- Impulse Response Functions for Tunisia over the Period [1996:01-2005:10]**



**Figure 8.a- Impulse Response Functions for Turkey over the Period [1990:02-2005:10]**

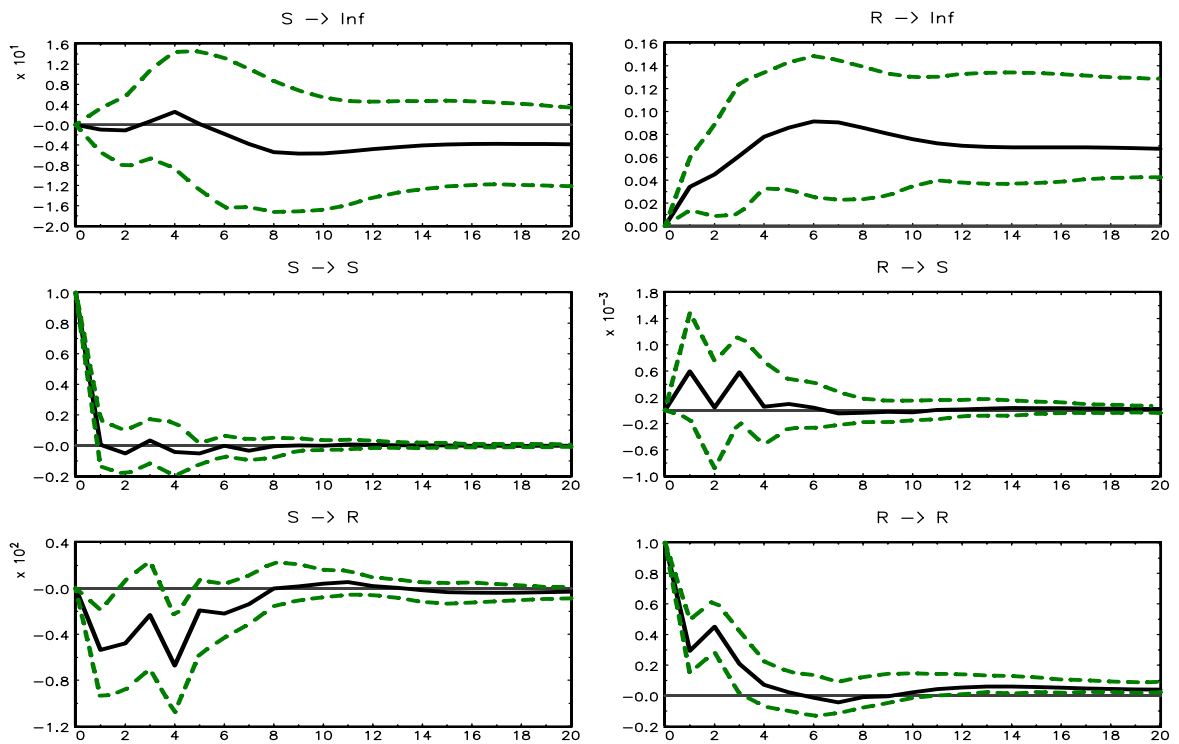


Figure 8.b- Impulse Response Functions for Turkey over the Period [1990:02-2005:10]

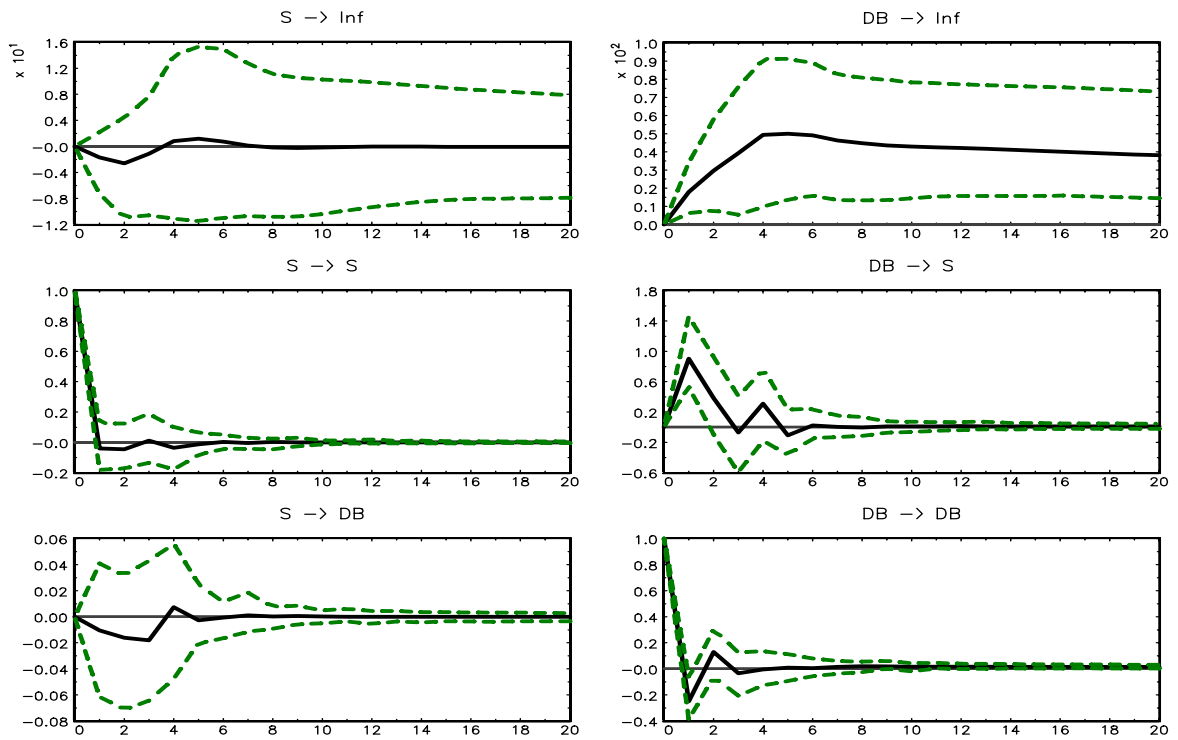


Figure 8.c- Impulse Response Functions for Turkey over the Period [1990:02-2005:10]

