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ON THE LINKAGE BETWEEN MONETARY POLICY AND MENA STOCK MARKETS

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Abstract

Using a sample of eight MENA region 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 and monetary policy measures. From a comparative perspective, promising results reflect a significant effect of an appropriate monetary policy on stock market development especially in Bahrain, Egypt, Morocco, Saudi Arabia and Tunisia using a VAR methodology. On the other hand, the responsiveness of stock markets differs across these MENA countries. In some countries stock market return depicts an upward tendency while in other countries it declines or do react at all.

ملخص

تسعى هذه الدراسة إلى توضيح هل هناك تفاعل بين أسواق الأصول والسياسة النقدية باستخدام عينة من ثماني دول في منطقة الشرق الأوسط وشمال أفريقيا؛ علما بأن ثمة نقاشا مستمرا في أروقة اقتصاديات السوق الكلي حول طبيعة العلاقة بين أسعار الأصول والسياسة النقدية. ويذكر أنه لا يتوفر لدينا إلا النزر اليسير من الأدلة التجريبية التي تقييم العلاقة بين تحركات أسعار الأصول ومقاييس السياسة النقدية. ومن منظور مقارن، نجد أن ثمة نتائج واعدة تعكس تأثيرا ذا بال للسياسة النقدية المناسبة على تطور سعر الأسهم خاصة في البحرين ومصر والمغرب والسعودية وتونس باستخدام طريقة إعادة بيع القيمة المضافة. وعلى الجانب الآخر، نلاحظ اختلافا في مدى استجابة أسواق الأسهم بهذه الدول؛ حيث تتخذ عوائد سوق الأسهم منحى تصاعديا في بعضها بينما تنخفض أو تتلاشى تماما في البعض الآخر.

1. Introduction

It is commonly accepted that monetary policy impact on private-sector decision-making. If prices are not fully flexible in the short run, as assumed by the New Keynesian theory framework, the central bank can temporarily influence the real interest rate and therefore have an effect on real output in addition to nominal prices. For the financial markets, where information is rapidly available and prices depend greatly on agent expectations, we would expect that a large part of the interdependence is simultaneous. The relationship between monetary policy and asset pricing is crucial topic for several reasons. From the perspective of monetary policymakers, having reliable estimates of the reaction of asset prices to the policy instrument is a critical step in elaborating effective policy decisions. Much of the transmission of monetary policy comes through the influence of short-term interest rates on other asset prices, as it is the movements in these other asset prices— including longer-term interest rates and stock prices—that determine private borrowing costs and changes in wealth, which in turn influence real economic activity.

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, see for instance Thorbecke (1997) and Neri (2004) among others. 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 region 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 and monetary policy measures and it is the first study to study this relationship in a panel of MENA countries.

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

Section 2 gives a brief survey of theoretical, methodological and empirical arguments regarding the interaction between asset prices and monetary policy. Section 3 describes the monetary policy instrument and the stock market. Section 4 presents the institutional framework of MENA stock markets. Section 5 gives a brief description of the empirical models. Section 6 the identification scheme used for the VAR study in identifying the relationship between the monetary policy and the stock market. Section 7 presents and discusses our empirical results.

2. Monetary Policy and Asset Markets: An Overview

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 two-side 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 area 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 has seemed 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 cause an asset prices booms or transform a boom caused by real phenomenon into a bubble.

It is worth noting that booms in asset prices tend to be associated with relatively long economic expansions boosting investors' over-confidence towards economic fundamentals, future companies' productivity and expectations of future profits growth. Thus, a trend of over-borrowing, over-investment, and over-consumption are realized and transformed into wealth effect. In some cases, however, asset prices may rise without corresponding improvements in the fundamentals during the period of low and stable inflation, especially when monetary and credit aggregates are growing faster than nominal output. In emerging markets, periods of equity price increases have usually been associated with large capital inflows and increasing of domestic market integration with other world capital markets. Empirical evidence has nonetheless suggested that prolonged rises in equity prices is due to monetary conditions has been tightening significantly. This shift in the monetary policy could be intentionally by the central bank due to the inflationary pressures or intentionally due to vulnerable capital flows. Consequently, monetarist economists have also addressed how monetary authorities should respond to asset prices booms, and monetary policy has been cited as both a possible cause of asset prices booms and a tool for defusing those booms before they can cause macroeconomic instability. Indeed, the monetary policy could be considered as a precautionary means that might dampen excessive asset prices volatility. It goes without saying that the monetary policy objective should not stabilize systematically this volatility as the latter may generate profits and liquidity (Shiller, 2000; and Sourial, 2002). The challenging issue for monetary authorities is therefore when they should intervene so that they will not trigger any turbulence in the financial market that could cause a disrupting in the financial sector or/and in real economy. Although, the answer to this question is far from being trivial, a partial response is put forward by the literature studying whether assets are over- or under-evaluated.

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 to assess the effectiveness, of stock markets 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 takes directly and explicitly into account asset prices, as well as other economic indicators, when making monetary policy decisions (Alchian and Klein, 1973; Cecchetti et al.; 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 and boom, and bust investment cycles, inflation and employment instability.[1]

3. The Monetary Policy Instrument and the Stock Market

Whatever the central bankers' beliefs about how to take stock prices into account, a deep understanding of the linkage between monetary instruments and some stock markets relevant measure is necessary. The choice and the effectiveness of the monetary instrument depend on the degree of development of markets as well as on the monetary strategy carried out. Much of the transmission of monetary policy changes come through the influence of short-term interest rates (or money supply) changes on other asset prices (stock prices, bonds, exchange rates, etc.), as it is the movements in these other asset prices, including longer-term interest rates and stock prices, that determine private borrowing costs and changes in wealth, which in turn influence real economic activity (Mishkin, 1995). Monetary policy affects macroeconomic variables, and ultimately inflation, through many channels.[2] One of them is *the stock market channel* which has gained an interest revival during the last decade. The functioning of this channel is as follows: an expansionary monetary policy can boost equity prices by making equity relatively more attractive to bonds. This monetary easing can also improve the earnings outlook for firms. When equity prices rise, they can propagate monetary impulses according to two ways. First, increases in stock prices translate into higher financial wealth of households and therefore higher consumption. Second, higher equity prices increase the market value of firms relative to the replacement cost of capital (the Tobin's q). Tobin (1969, 1978) has constituted significant contributions according to the formulation and understanding of the stock market channel.[3] The Tobin's chief idea maintains that an easing or tightening of the monetary policy can affect stock prices through expected future earnings as well as through the rate at which they are discounted. Thus, an altered monetary policy stance will induce changes in investors' financial wealth, which should have an effect on private consumption expenditure. Companies' cost of capital will also change, which should affect real investment spending. The resulting shift in real activity will ultimately have an impact on inflation.[4] Tobin recognizes however that the relationship between monetary policy and equity prices is not enough understood since its effect is far from being homogenous across firms, and since it is difficult to properly identify monetary policy shocks. The

[1] The recent world wide stock markets volatility has brought economists' attention to the importance of understanding the possible role of central banks in either preventing or/and reducing the disruptive effects of financial shocks on the economy.

[2] Most of the literature on the transmission of monetary policy has focused on the money (or interest rates) channel (Walsh, 1998). This channel works through the money and bond markets. A shift in the stance of monetary policy leads to changes in markets interest rates which in turn affect real activity and inflation.

[3] The absence of the role of asset prices in the transmission of monetary shocks is not surprising since share ownership is far from being pervasive in Tunisia, and that firms' reliance on equity financing has not been very significant compared to bank credit. The role of asset prices in the transmission mechanism might increase into the future in line with the continued developments in capital markets that both increases investment opportunities for households as well as financing options for firms.

[4] For instance, an expansionary monetary policy, which may result from an increase in inflation, lowers the present value of future inflows and, consequently, depresses markets.

literature on credit channel has put forward a significant insight (Bernanke and Blinder, 1992; Bernanke and Gertler, 1989; Kashyap et al., 1993; Thorbecke, 1997).

The literature on the credit channel of monetary policy transmission has shown that a tightening monetary policy has a particular strong impact on firms which are highly bank-dependent borrowers mainly small firms since they cannot be financed in the financial market, as banks reduce their overall supply of credit (Bernanke and Blinder, 1992). This strand of literature has shown also that a tight monetary policy weakens the firms' balance sheets since the present value of collateral falls in relation with rising interest rates. This impact can be stronger for some firms than for others. This argument as well as the above one rest on information asymmetries—firms for which less information is publicly available may find it more difficult to access bank loans when credit conditions become tighter. Indeed, banks tend to reduce credit lines first to those customers about whom they have the least information. Thus, if a credit channel is operative for firms that are quoted on stock markets, one would expect that their stock prices respond to monetary policy in a heterogeneous fashion with the prices of firms that are subject to relatively larger informational asymmetries reacting more strongly. The reasons is that their expected future earnings are affected more since these firms will find it harder to access funds following a monetary tightening, which should lead to a constraint of the supply for their goods.

4. MENA Stock Markets: The Institutional Framework

By and large, the development of the 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 the MENA countries issued new capital market laws, aimed at encouraging private investment, increasing investors' protection, and enhancing the banks' role in simulating capital markets through the establishment of mutual funds. Specifically, their core provisions included the establishment of a new legal framework to govern specialized capital market companies, strengthening of financial disclosure, giving foreign investors full access to the market, and increasing investor's rights through provisions prohibiting unfair market practices.

The security markets in the region are generally underdeveloped, with 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 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 stock and bonds is still a fairly minor method of raising funds in the MENA region. However, after September 11, 2001, the regional stock market seems 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 if we compare several market indicators between 2000 and 2005. 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 ($69.5 billion) followed by Saudi Arabia ($67.9 billion) and Israel ($66.8 billion). These numbers prove to be substantial particularly when compared to the smallest market, Lebanon, which has only $1.58 billion. The figures are corroborated to a large extent when we look at the turnover ratio. Turkey has the highest turnover ratio (238 percent) followed by Israel (42.7 percent), and Saudi Arabia (25.6 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 value of 101.4 percent of GDP, followed by Jordan with 65.2 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 is the leading market with 1,075 listed companies. However, most of these listed companies are not actively traded (they are closed or family-owned companies), followed by Israel and Turkey with 664 and 315 companies, respectively.

As seen from Panel B, the picture changed dramatically in 2005 as we can observe that 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 $67.9 billion in 2000 to $646 billion in 2005. The UAE followed with market capitalization of $231.4 billion, a 21-fold increase compared with the 2000 figure. Also, Kuwait comes fourth after Turkey with around $124 billion. In terms of market liquidity, Saudi Arabia still leads the region with a turnover ratio of 171 percent, followed by Turkey (117 percent), Jordan (63.3 percent), and the UAE (60.8 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 lacklustre 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 can not 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.

5. 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 the studies having recourse to 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 been often used to check whether the stock market channel is operative or not (Cassola and Morana, 2004). However, it becomes less attractive when it is 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; it functions better when high frequency data are 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 Johonson, 1995; Lynge, 1981; Pearce and Roley, 1983). Although, it seems to be appealing, this approach suffers from a serious drawback. It assumes implicitly 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 type of model often considered under this heading is of the following form (Thorbecke, 1997):

$$\Delta p_t = \beta_0 + \beta_1 \Delta r_t + \Gamma' X_t + \varepsilon_t \qquad (1)$$

where Δp is the change in the stock index and Δr is the amount by which the central bank changed the funds rate. The coefficient β_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 model. 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:

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

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

where r stands for a short-run interest rate measuring the stance of the monetary policy (a discount rate or a (interbank) money market rate), p is the asset price, Z is a vector of variable 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 and also by macroeconomic variables included in the vector X.

6. Data and Econometric Methodology

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

6.1. 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 and interest rate on deposits are considered as proxies of the monetary policy. Monthly series for these two variables were extracted from the IFS database. The stock exchange index also observed monthly and comes from the Emerging Market Data Base (EMDB). Finally, inflation rate is considered as a control variable. Series are taken from the IFS database.

The countries that have to be considered in the first step estimates comprise the following countries: 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 were not available for a uniform period for each country. Consequently, it is expected that the number of monthly observations will vary across our sample countries. The number of time observations ranges from 61 monthly observations for

Bahrain to 189 observations for Jordan and Turkey. For the most other countries, the periods of observations cover mainly the nineties to go until 2005.[5]

6.2. 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), permits to put into a unique vector the whole 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.

A general representation of a VAR(p) model is defined by the following relationship:

$$Y_t = \mu + \Phi_1 Y_{t-1} + \cdots + \Phi_p Y_{t-p} + \varepsilon_t \quad t = 1, \cdots, T \tag{4}$$

Here, Y_t is a (3x1) vector containing the 3 variables which reflect a monetary indicator, a measure of stock returns, and a control variable, that is the inflation rate. $\Phi_i, i = 1, \cdots, p,$ are (3x3) matrices of autoregressive parameters. They are defined without any restriction related to economic theory. μ is a (3x1) vector containing constants.[6] ε_t is an error vector of order (3x1) which is assumed to be independent multivariate normally distributed with zero mean and of variances and contemporaneous covariances matrix of order (3x3) named Ω. Estimation of this system could be conducted either by OLS or maximum likelihood procedures because results are asymptotically equivalent.

Before going to interpretation of estimation results, it is important to determine the optimal lag length in order to assure efficiency of statistical results. A likelihood ratio test is recommended which consists in the comparison between two different lags according to the following hypotheses:

$$\begin{cases} H_0 : p = p_0 \\ H_1 : p = p_1 \qquad p_1 > p_0 \end{cases} \tag{5}$$

This test will be conducted using the following test statistic:

$$LR = 2\left(\hat{L}_1 - \hat{L}_0\right) \equiv T\left(\log\left|\hat{\Omega}_0\right| - \log\left|\hat{\Omega}_1\right|\right) \tag{6}$$

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

$$\hat{\Omega}_i = \frac{1}{T}\sum_{t=1}^{T} \hat{\varepsilon}_t(p_i)\hat{\varepsilon}'_t(p_i) \qquad i = 0,1 \tag{7}$$

[5] See Annex A1.

[6] In some empirical modeling, the constant term is dropped out in order to have a vector Y_t with a null mean.

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.[7]

In order to reinforce the results of the precedent test, an alternative test is used which is based on the well known criteria of Akaike. It is determined by the following statistic:

$$AIC = T\log\left|\hat{\Omega}\right| + 2N \qquad (8)$$

where N is the total number of parameters estimated in the system.

7. Results and Discussion

The preliminary tests of optimal lag using the likelihood ratio statistic and the criterion of Akaike provide optimal lags which differ from one country to the other ranging from 1 for Tunisia and Jordan, and 4 for Bahrain and Saudi Arabia.

The unexpected changes in the interest rate represent surprising changes that can be 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 both positive and negative. They can be positive if changes are perceived favorable to businesses; they can be negative if changes are perceived unfavorable.

Under the hypothesis that the interest rate considered is a good measure of the stance of the monetary policy, a monetary tightening of one standard deviation of the rate seems to have a significant impact on stock market return in the case of Bahrain, Egypt, and Saudi Arabia. The impulse response functions of stock markets in Morocco and Tunisia depict the same pattern: right after the interest rate hike, the stock returns increase and then get back to the baseline. Overall, the stock market responses are negligible in these countries (see Figure 1 and Figure 2). Stock markets response in Bahrain and Saudi Arabia appears to be more pronounced (see Figure 6 and Figure 7). Indeed, following a monetary contraction the variables measuring stock market return show a clear downward tendency. This tendency becomes statistically significant after 2 years in the case of Bahrain and after three years in Saudi Arabia. For the remaining countries, the stock markets do not exhibit any reaction.

In sum, the response of stock market in MENA region is far from being homogenous countries. In some countries stock market return depicts an upward tendency while in other countries it declines or do react at all.

Another important finding that should be emphasized is that the Saudi Arabian monetary authority reacts strongly to the stock market return rise. This could be understood as a preemptive reaction to avoid large assets misalignments and boom. Again, in Saudi Arabia a monetary tightening appears to be effective in mastering the inflation as it stands from the left upper graphic in figure 7. Most countries' monetary authorities, except Saudi Arabia and Turkey, do not react to the stock market dynamics. This could be understood seeing that in these countries the stock market dynamics do not have a significant impact on key macroeconomic variable such as inflation.

[7] 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 (6) by $T - (1 + p_1)$ where $(1 + p_1)$ is the number of estimated parameters in each equation of VAR(1) specification.

Using a sample of eight MENA region 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 and monetary policy measures.

From a comparative perspective, promising results reflect a significant effect of an appropriate monetary policy on stock market 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 return depicts an upward tendency while in other countries it declines or do react at all.

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Annex A1: Sample descriptions and tables

Sample Description

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]

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

Panel A. 2000

Country	Number of listed companies	Market Capitalization ($billions)	Market Capitalization (% GDP)	Value Traded (% GDP)	Turnover Ratio (%)
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

Panel A. 2005

Country	Number of listed companies	Market Capitalization ($billions)	Market Capitalization (% GDP)	Value Traded (% GDP)	Turnover Ratio (%)
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 length	LB Statistics p-value	Causality 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 forth 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 α-percent risk level if the corresponding p-value is lower than α. In the last column, results of causality test are given. The null hypothesis "x does not Granger cause inf and S" is rejected at α-percent risk level if the corresponding p-value is lower than α where $x \in \{R, \Delta B, \Delta M1\}$.

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

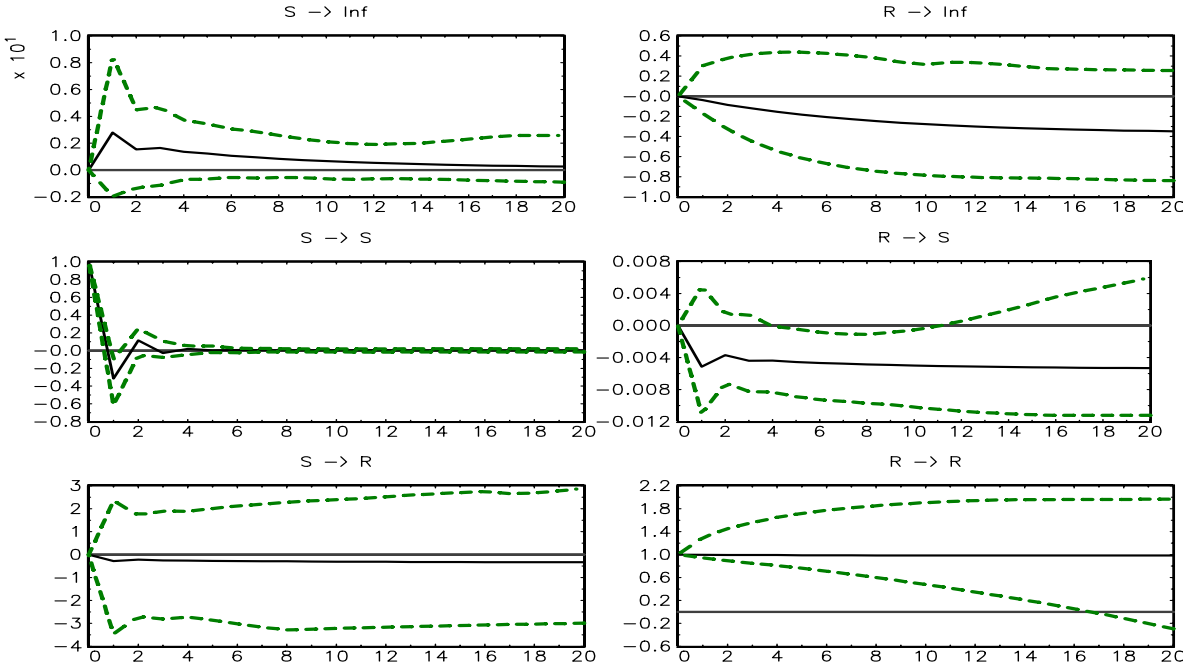

Figure 1.b- Impulse Response Functions for Bahrain over the period [1998:12-2003:12]

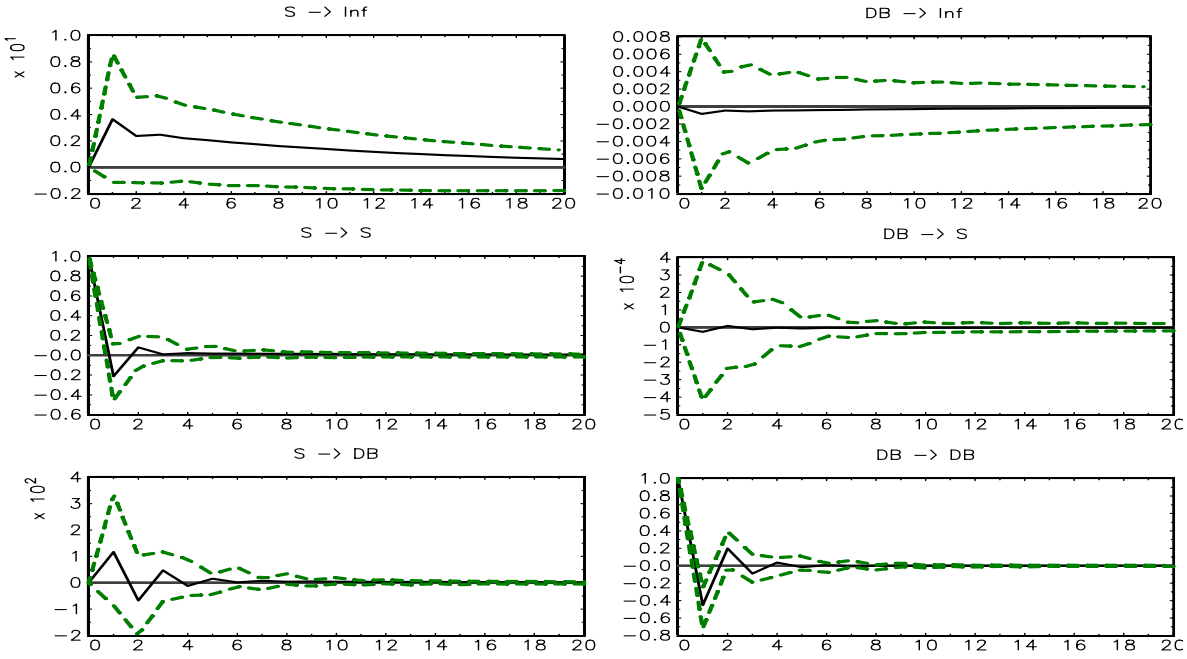

Figure 1.c- Impulse Response Functions for Bahrain over the period [1998:12-2003:12]

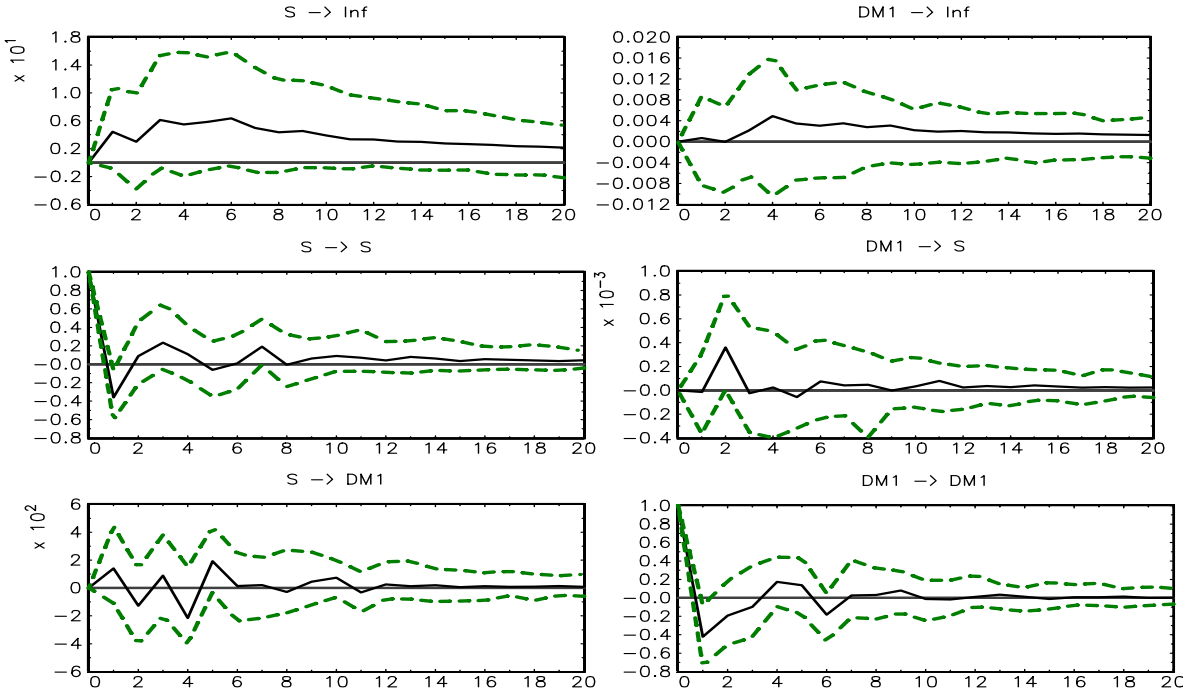

Figure 2.a- Impulse Response Functions for Egypt over the period [1995:12-2005:09]

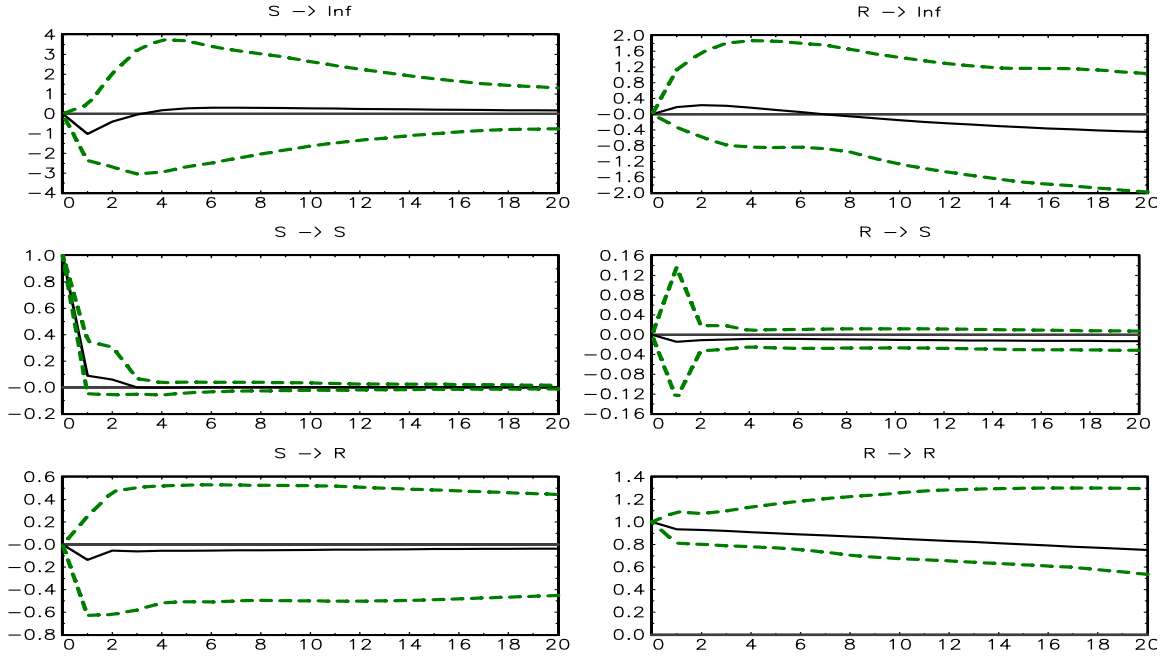

Figure 2.b- Impulse Response Functions for Egypt over the period [1995:12-2005:09]

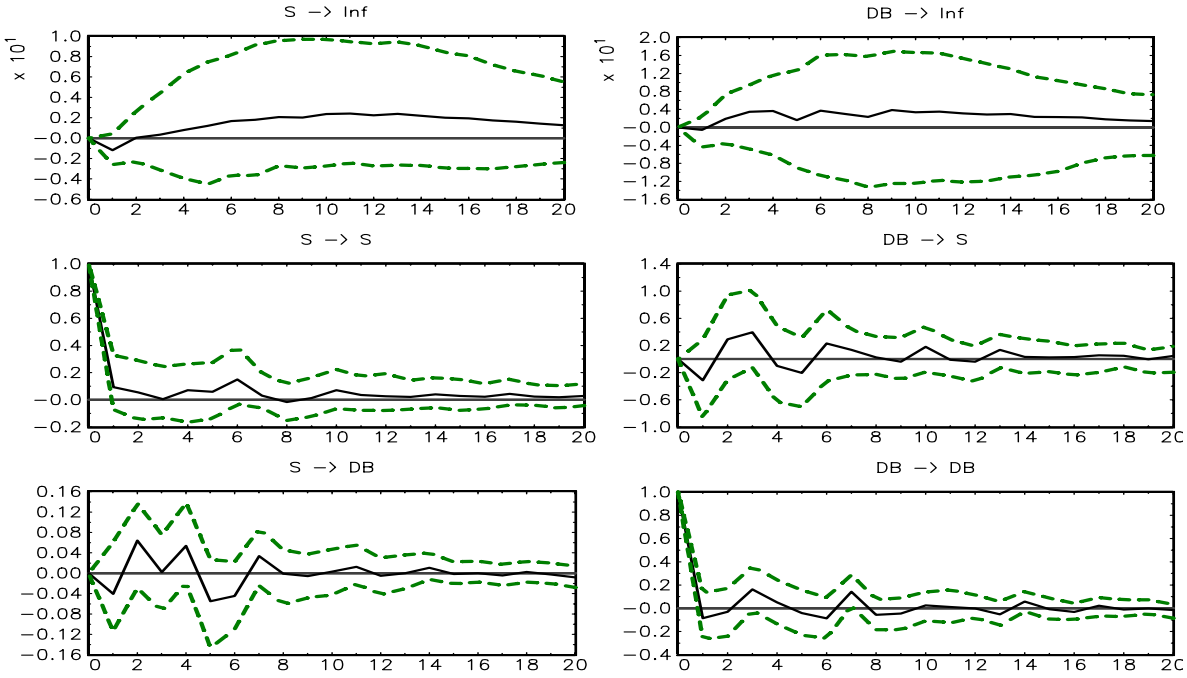

Figure 2.c- Impulse Response Functions for Egypt over the period [1995:12-2005:09]

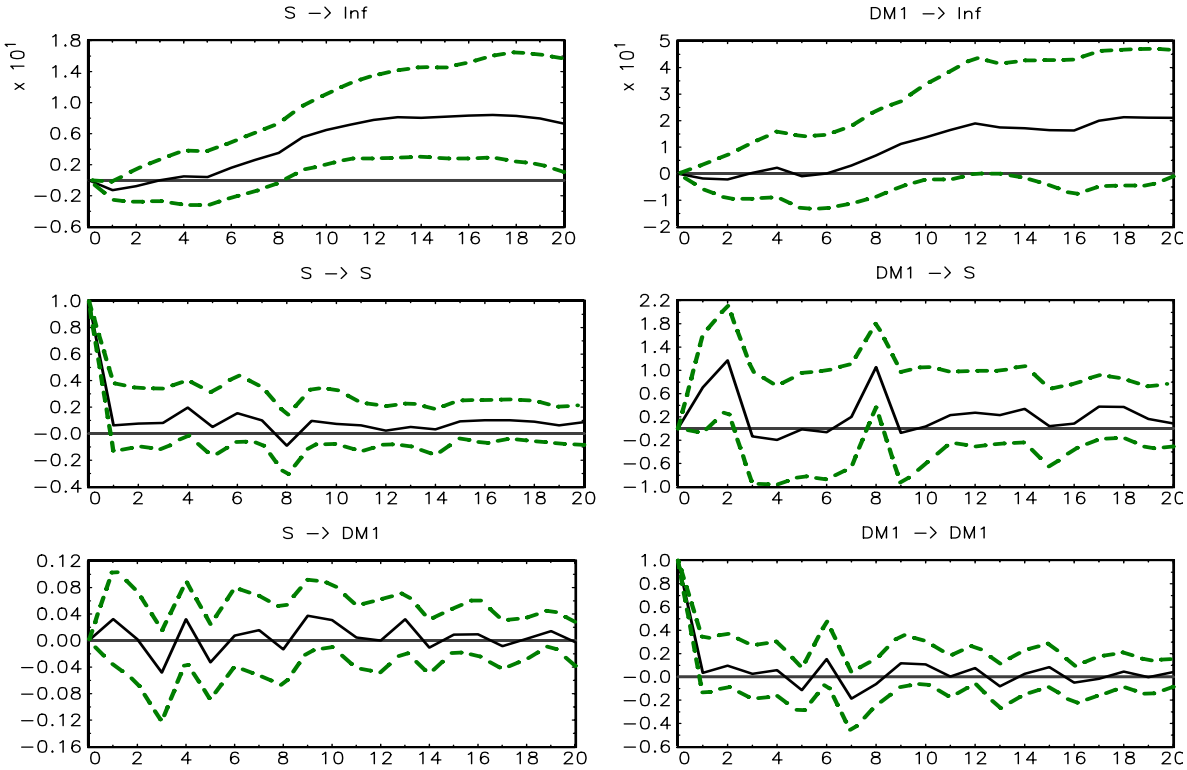

Figure 3.a- Impulse Response Functions for Jordan over the period [1990:01-2005:09]

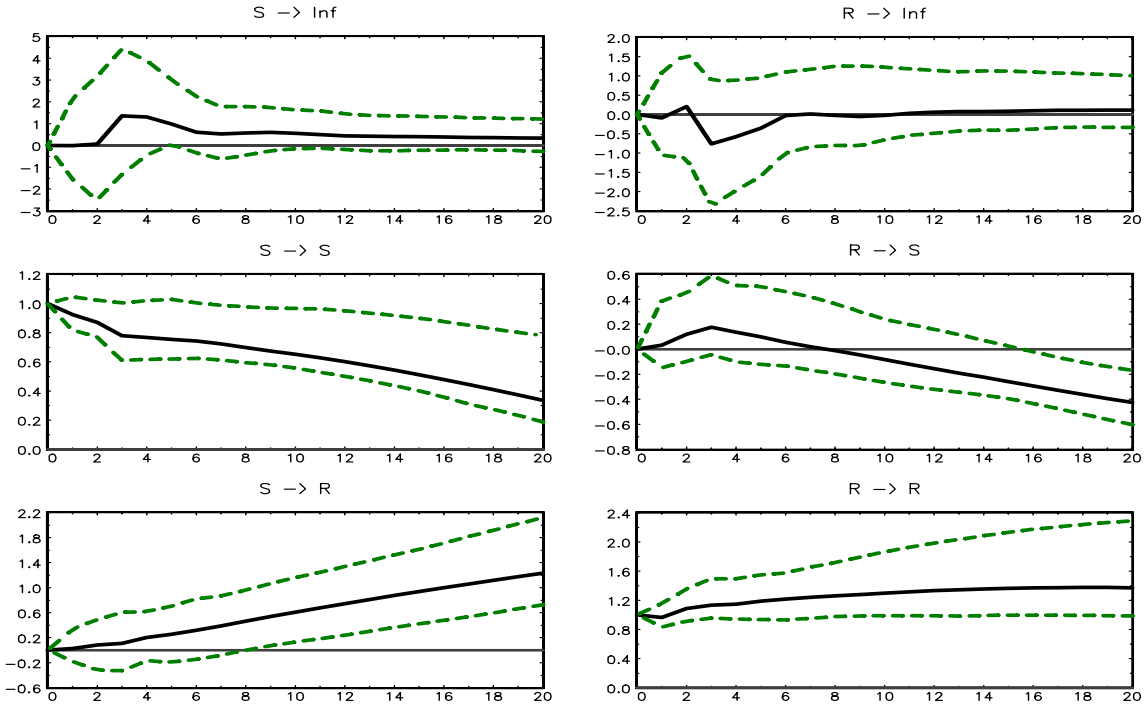

Figure 3.b- Impulse Response Functions for Jordan over the period [1990:01-2005:09]

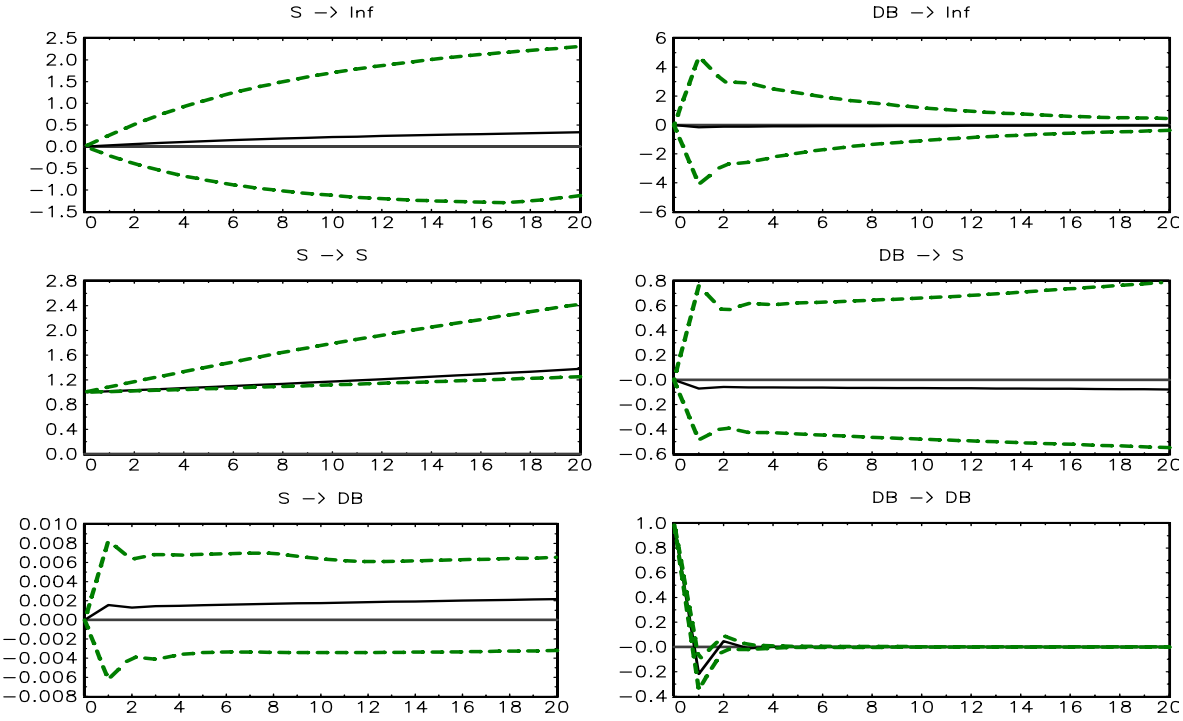

Figure 3.c- Impulse Response Functions for Jordan over the period [1990:01-2005:09]

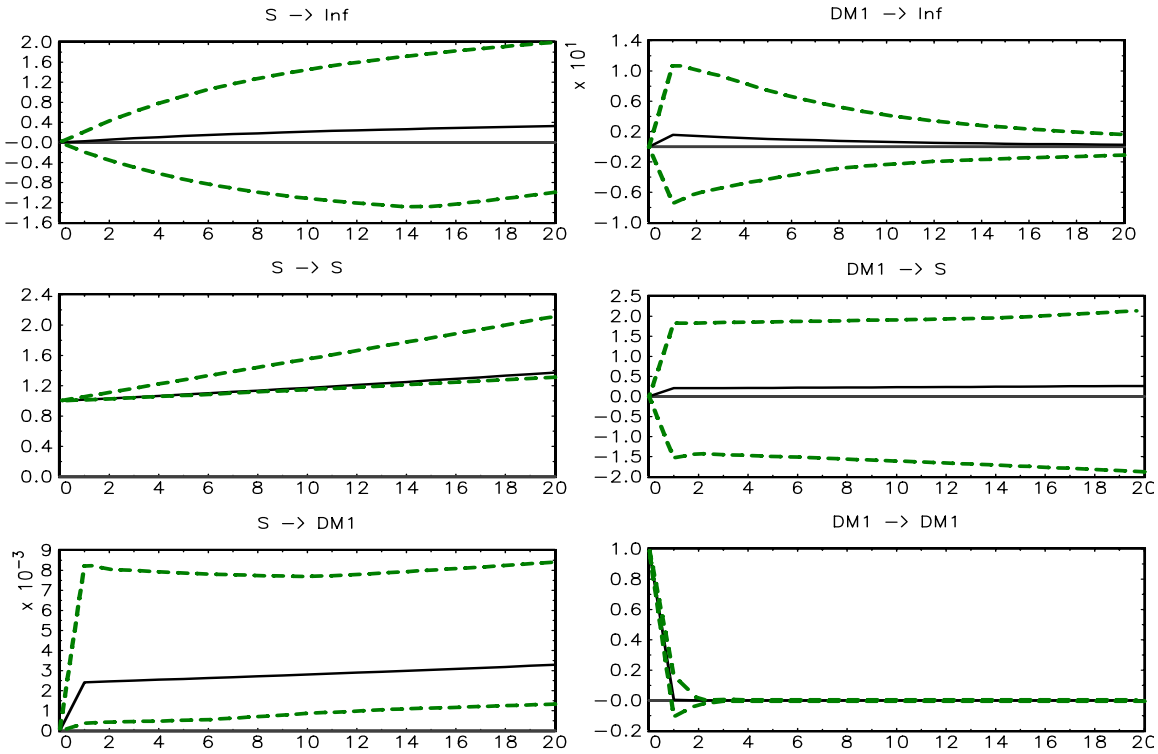

Figure 4.a- Impulse Response Functions for Morocco over the period [1995:12-2005:07]

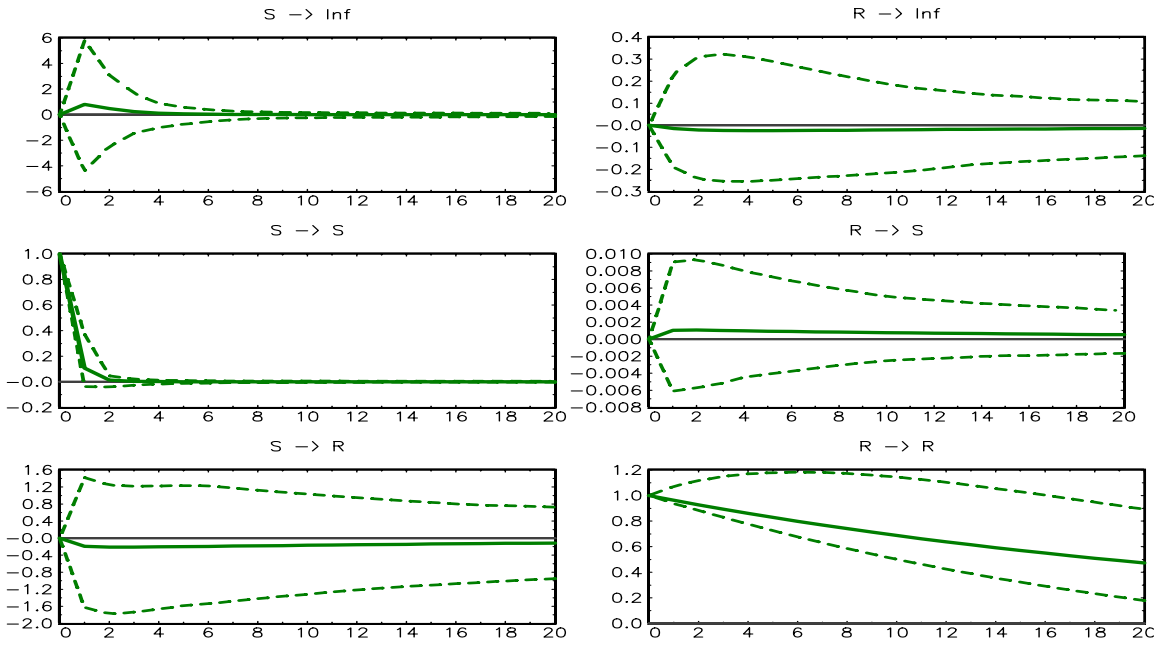

Figure 4.b- Impulse Response Functions for Morocco over the period [1995:12-2005:07]

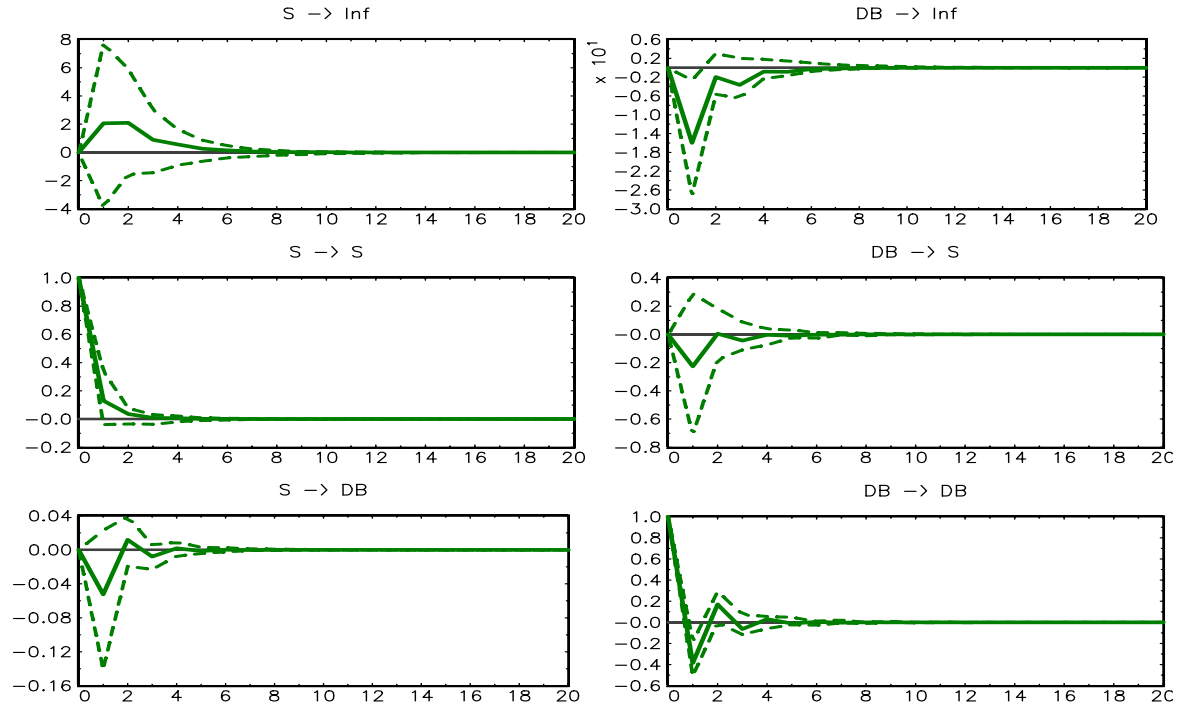

Figure 4.c- Impulse Response Functions for Morocco over the period [1995:12-2005:07]

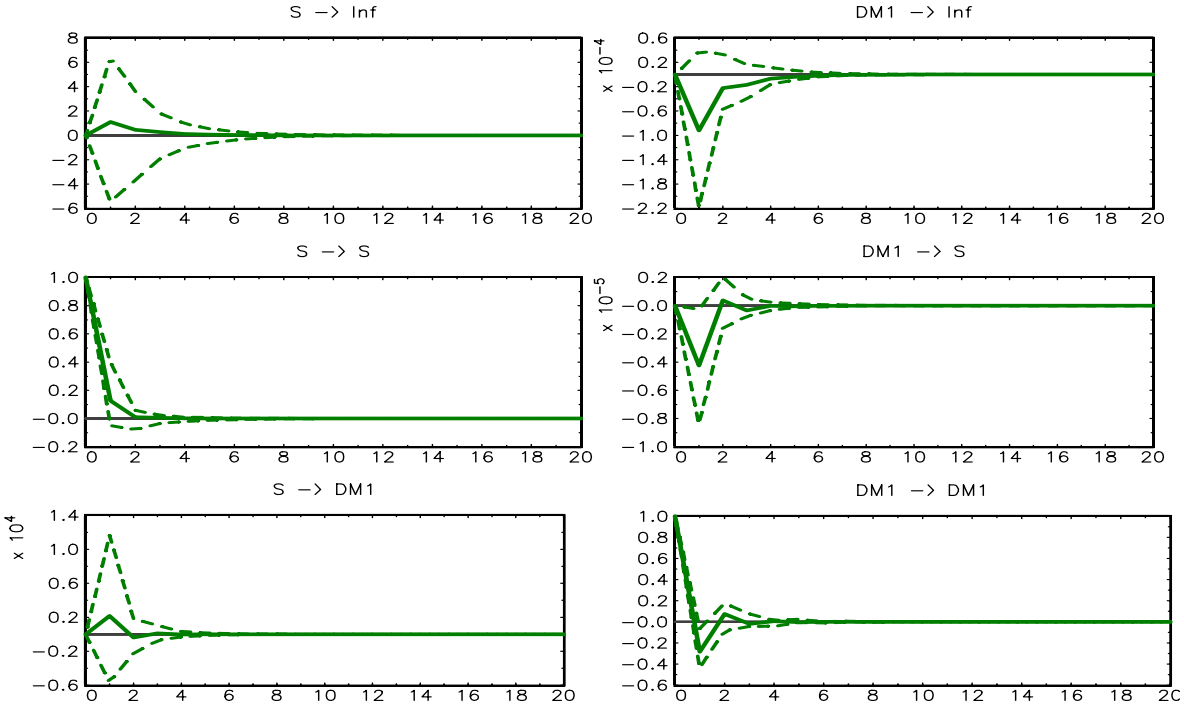

Figure 5.a- Impulse Response Functions for Oman over the period [1999:06-2005:06]

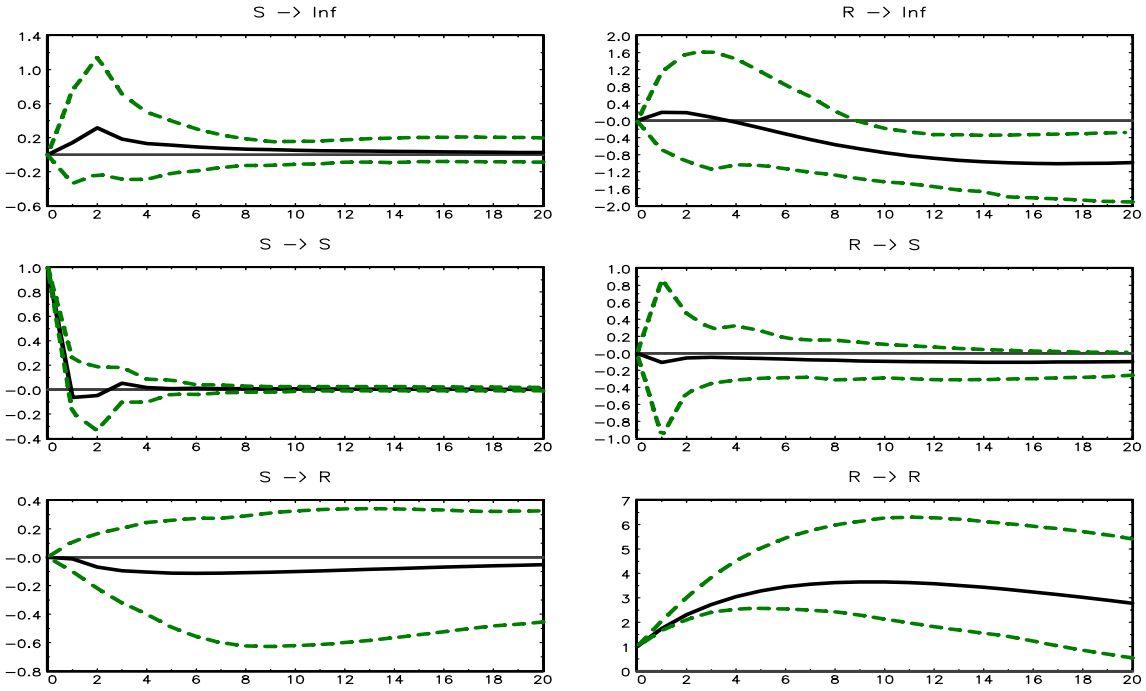

Figure 5.b- Impulse Response Functions for Oman over the period [1999:06-2005:06]

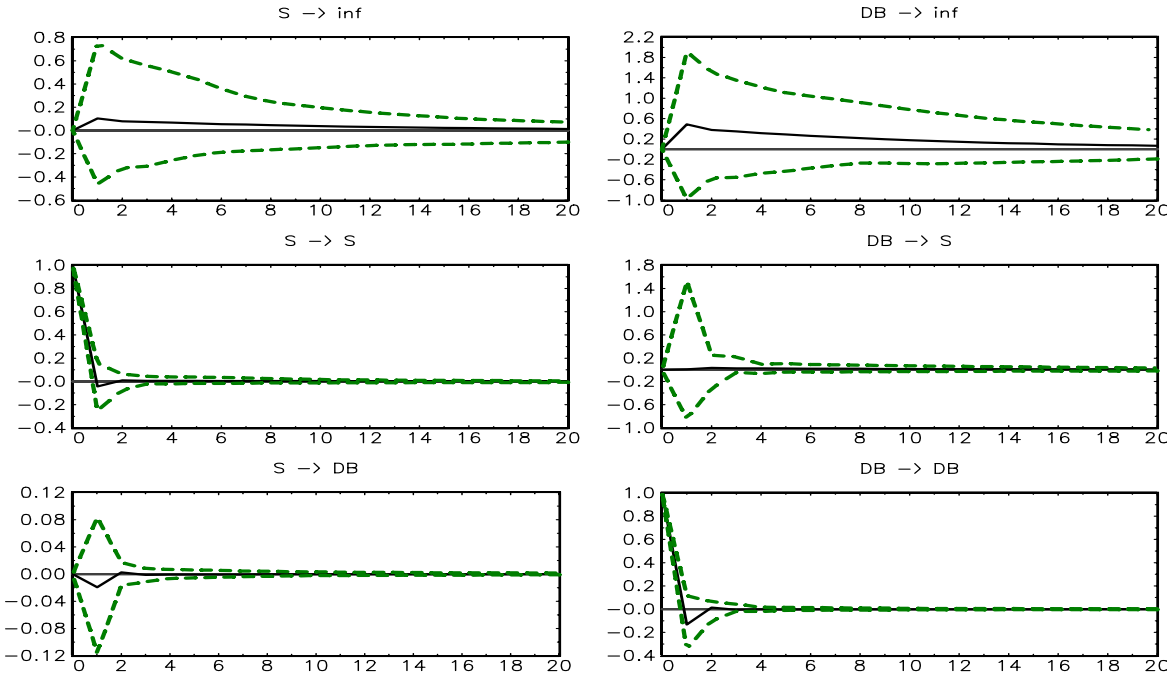

Figure 5.c- Impulse Response Functions for Oman over the period [1999:06-2005:06]

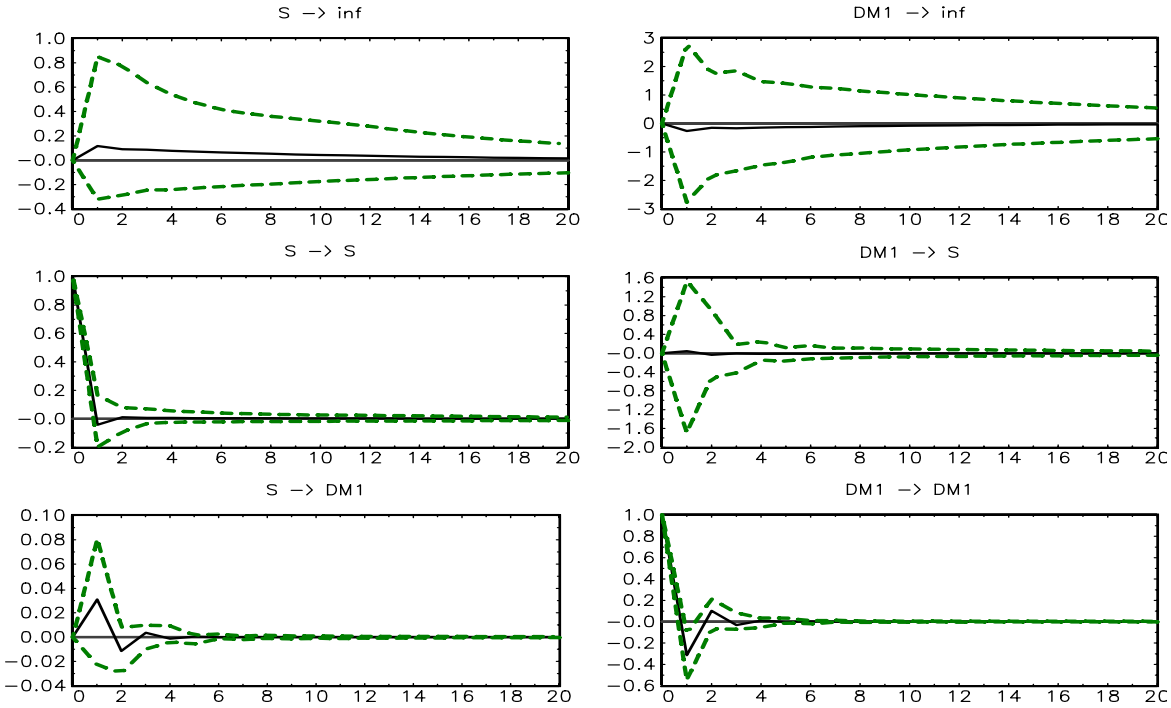

Figure 6.a- Impulse Response Functions for Saudi Arabia over the period [1998:01-2005:08]

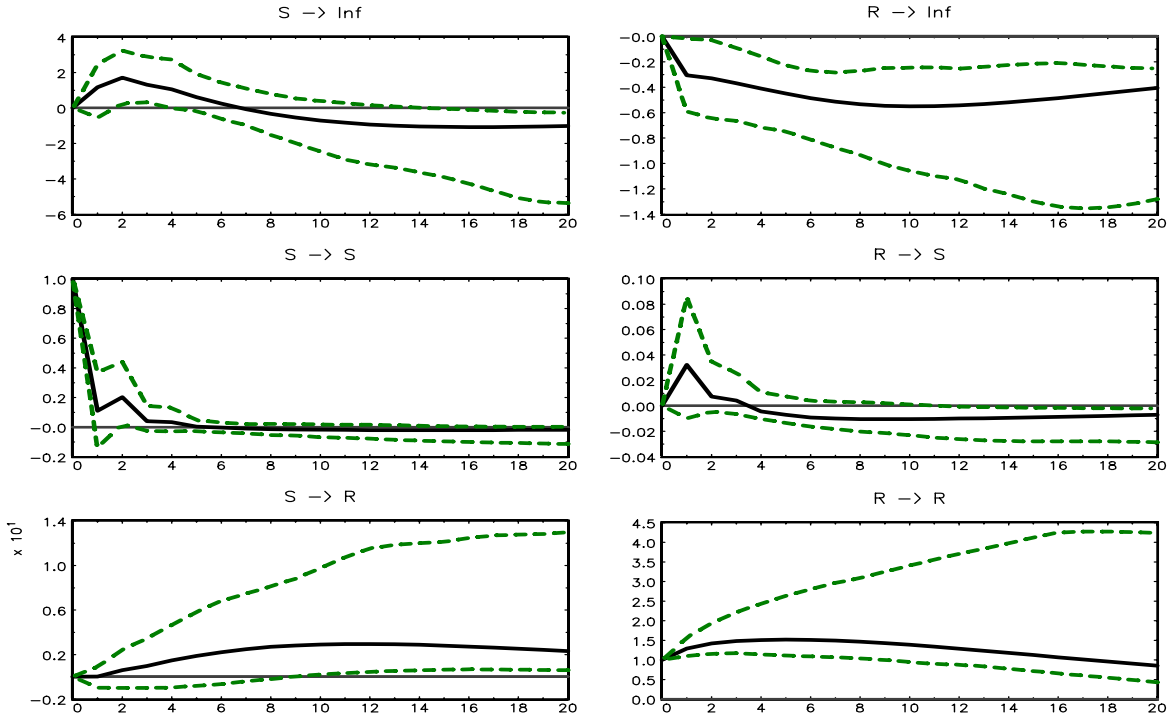

Figure 6.b- Impulse Response Functions for Saudi Arabia over the period [1998:01-2005:08]

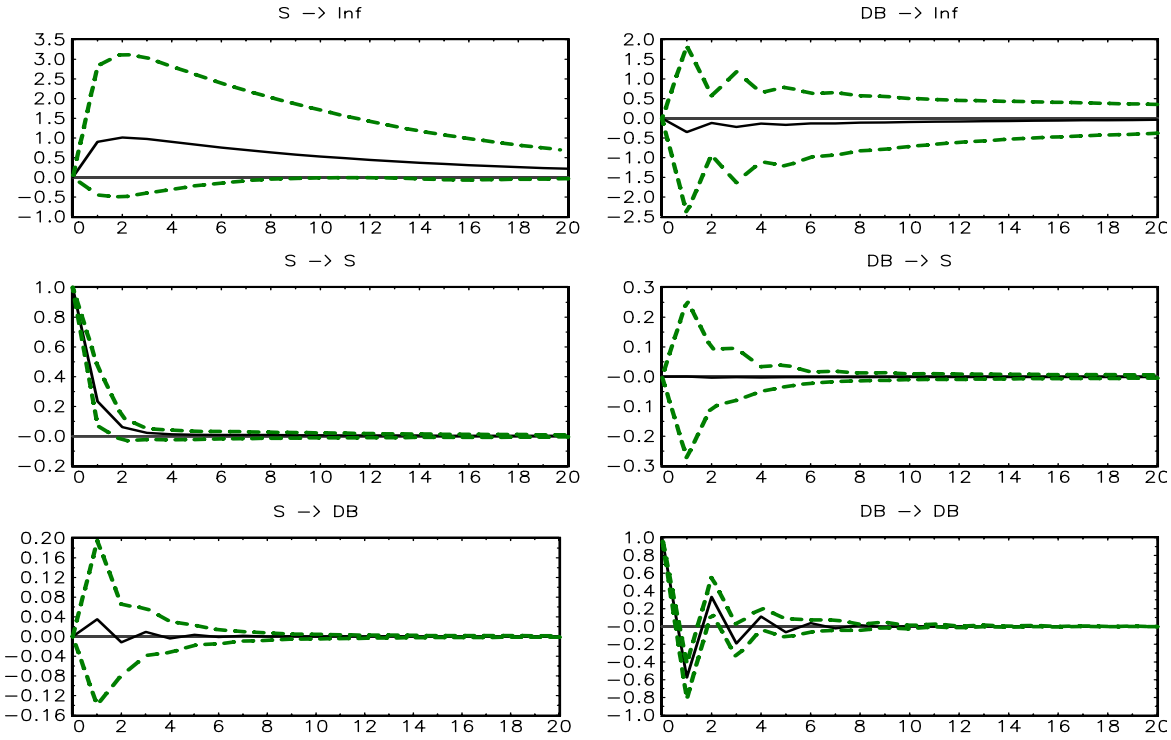

Figure 6.c- Impulse Response Functions for Saudi Arabia over the period [1998:01-2005:08]

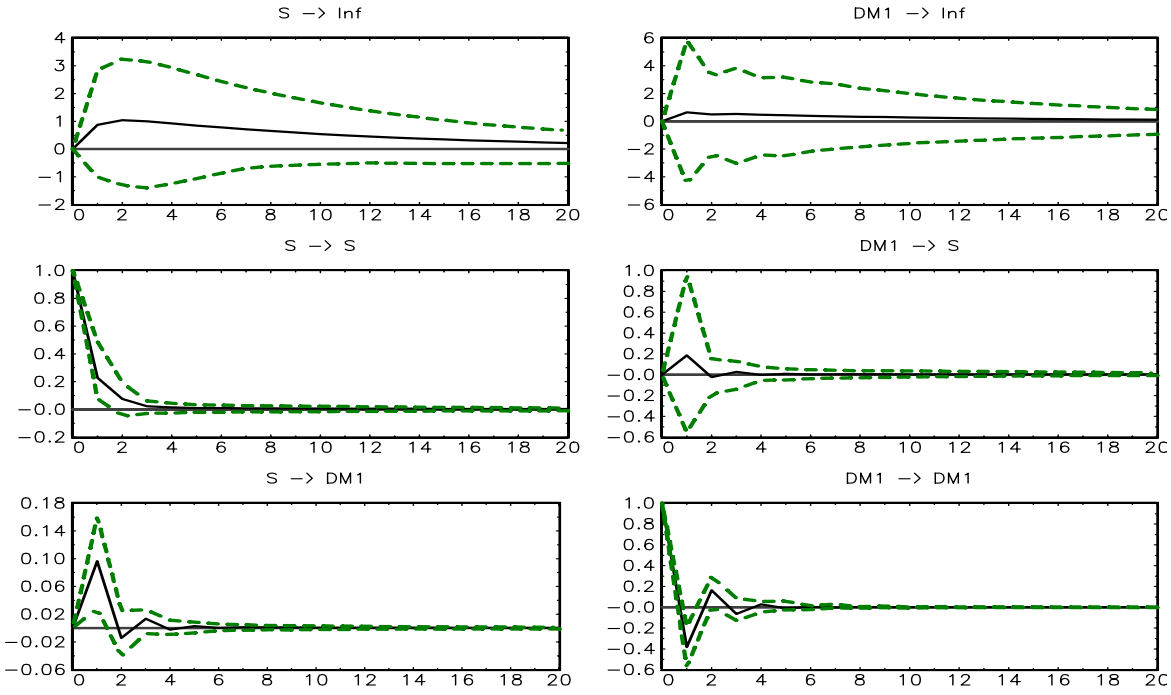

Figure 7.a- Impulse Response Functions for Tunisia over the Period [1996:01-2005:10]

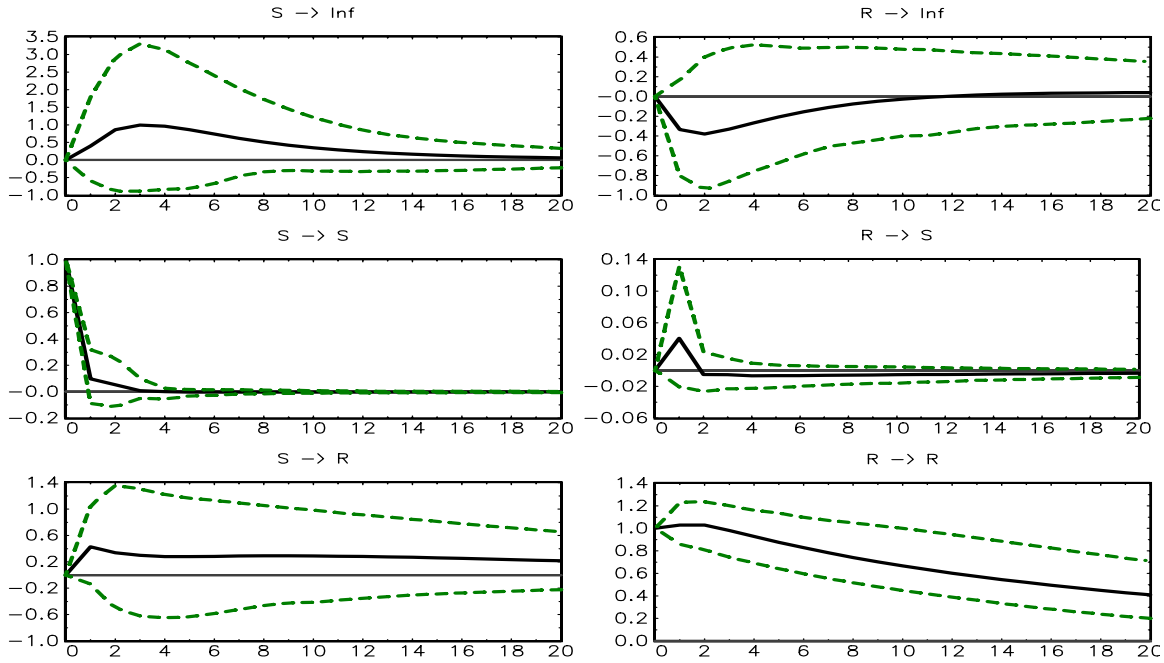

Figure 7.b- Impulse Response Functions for Tunisia over the period [1996:01-2005:10]

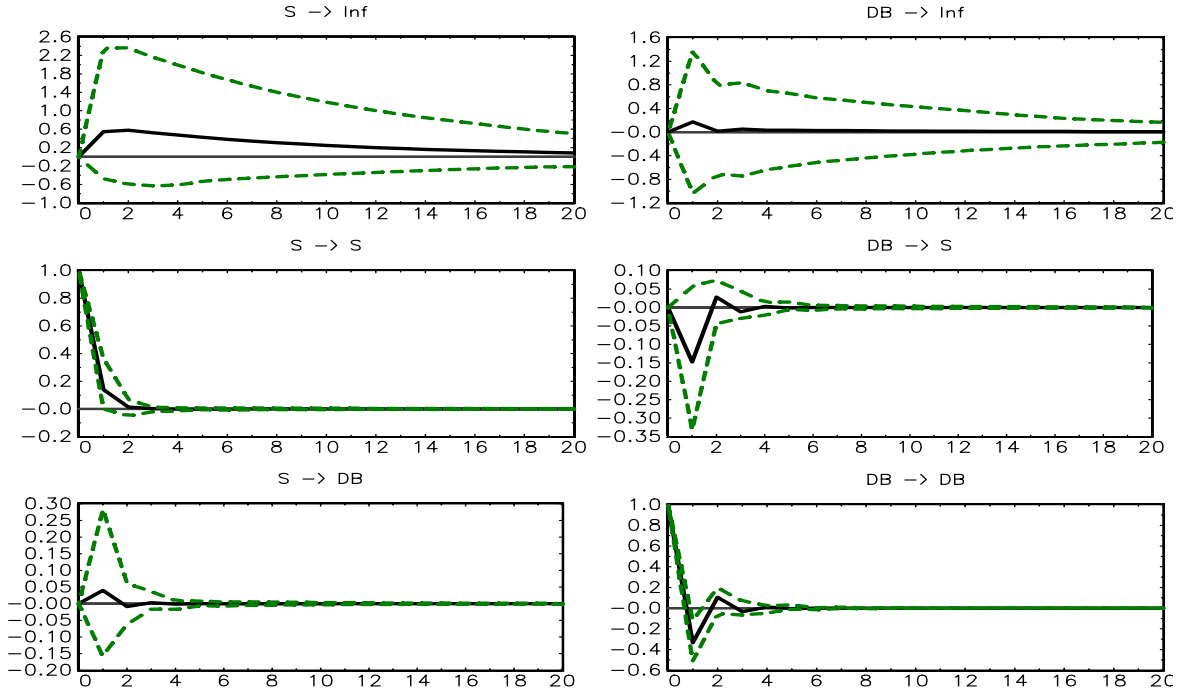

Figure 7.c- Impulse Response Functions for Tunisia over the period [1996:01-2005:10]

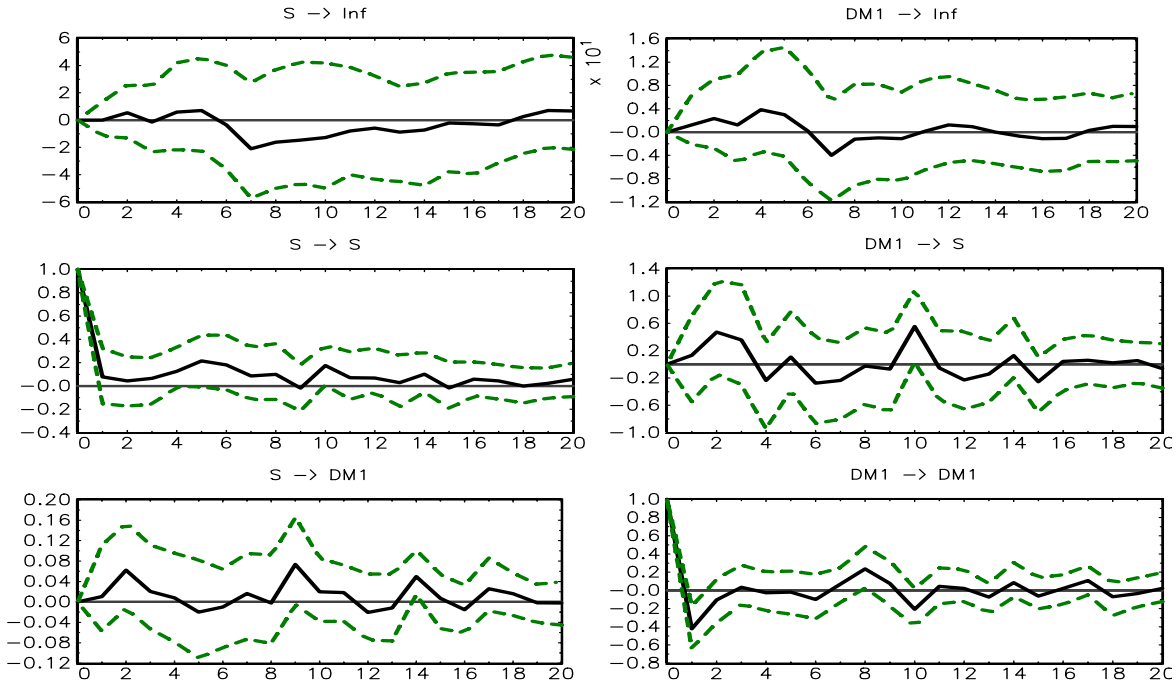

Figure 8.a- Impulse Response Functions for Turkey over the period [1990:02-2005:10]

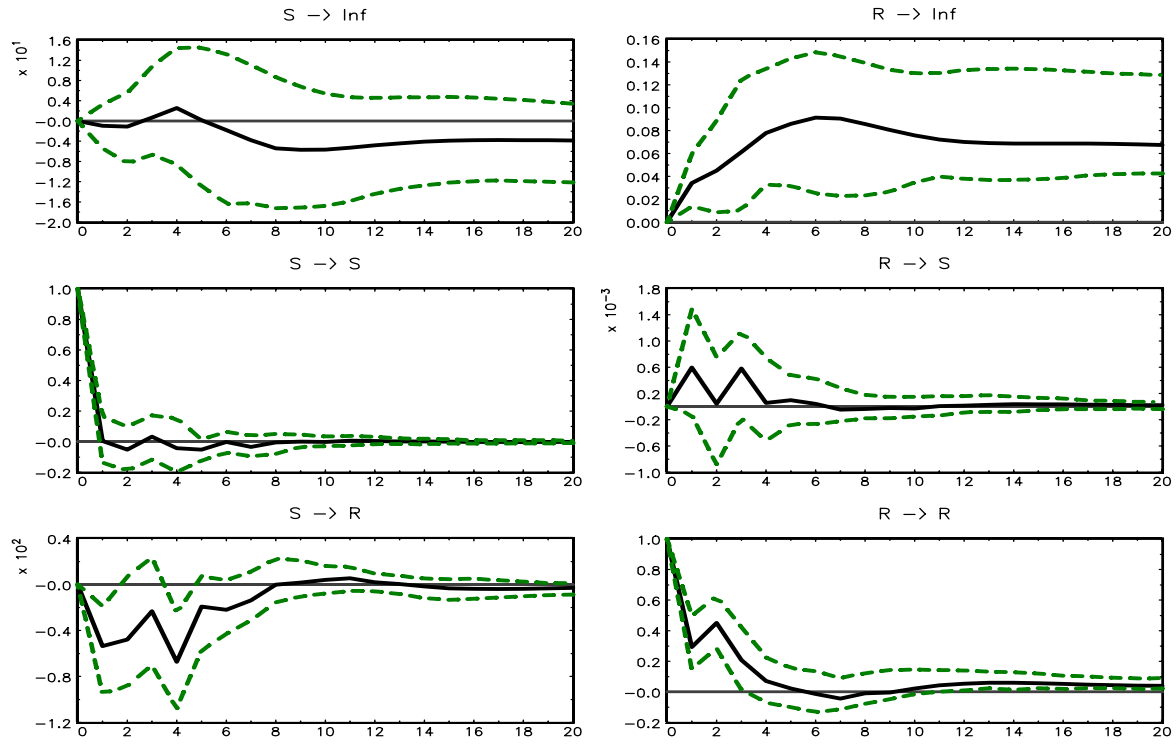

Figure 8.b- Impulse Response Functions for Turkey over the period [1990:02-2005:10]

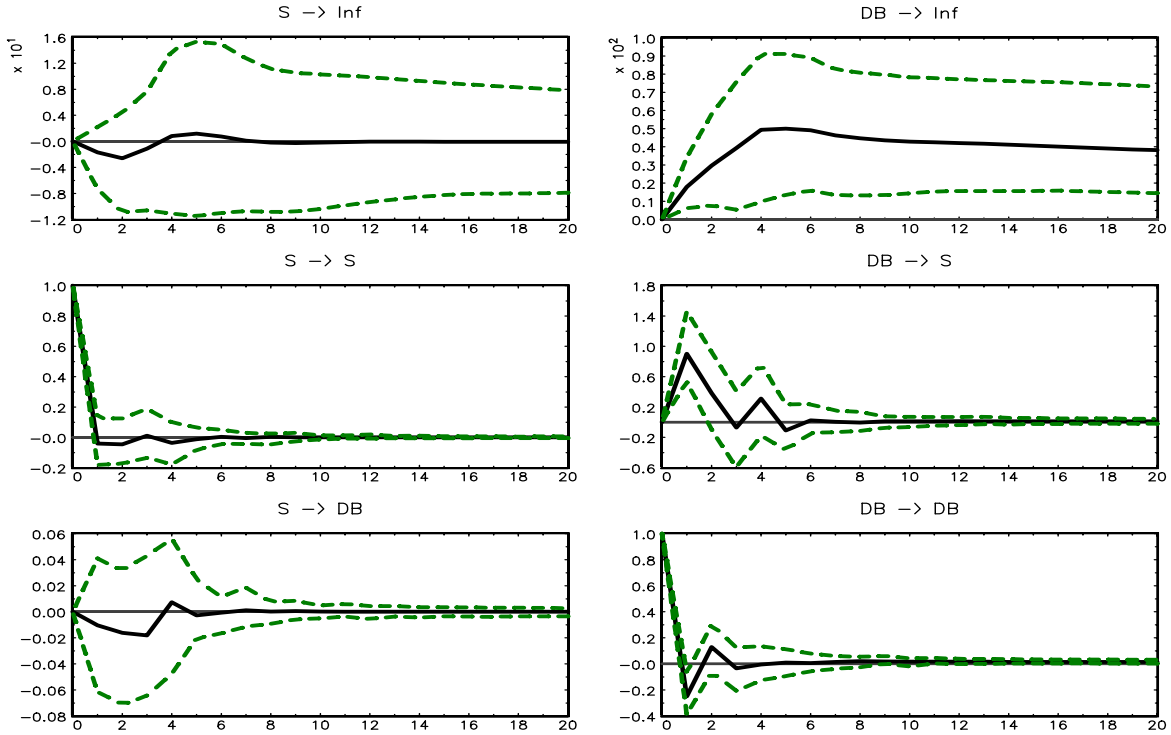

Figure 8.c- Impulse Response Functions for Turkey over the period [1990:02-2005:10]