



Monetary and Exchange Rate Policies in Tunisia: Towards Inflation Targeting and Floating Exchange Rate

RABHI ABDESSALEM BEN LTAIEF

(Degree)

博士（経済学）

(Date of Degree)

2010-09-25

(Date of Publication)

2011-06-17

(Resource Type)

doctoral thesis

(Report Number)

甲5083

(URL)

<https://hdl.handle.net/20.500.14094/D1005083>

※ 当コンテンツは神戸大学の学術成果です。無断複製・不正使用等を禁じます。著作権法で認められている範囲内で、適切にご利用ください。



博 士 論 文

Monetary and Exchange Rate Policies in Tunisia:
Towards Inflation Targeting and Floating Exchange Rate

チュニジアの通貨と為替レート政策
インフレターゲット政策と変動為替相場に向かって

平成 22 年 6 月

神戸大学大学院経済学研究科

総合経済政策専攻

指導教員 地主 敏樹

Rabhi Abdessalem Ben Ltaief

Acknowledgement

I would like to acknowledge the contribution of the following individuals to the development of my dissertation:

- My supervisor, Prof. Jinushi Toshiki, was very patient and kind in his comments and guidance. He was also always ready to help and support me whenever I had administrative problems.
- Miyao sensei, and Fujita sensei, gave me a very useful comments and suggestions to improve the content of my dissertation during the mid-term evaluation session.
- Kitano sensei never hesitates to be a member in the committee which will evaluate it.
- Ida san, Hanabusa san, Umino san, and other peer researchers were ready always to help and support me during the development of the dissertation and presentations.
- My family members and other friends never stop encouraging me.

In short, my sincere thanks go for each one contributed to the development of this dissertation.

Executive Summary

Over the past years, the Tunisian economy has shown great resilience in a difficult external environment, posting sustained growth and maintaining macroeconomic stability thanks to a prudent monetary and fiscal policy mix use. As for monetary policy, the stability-oriented monetary policy strategy has been the framework adopted by the central bank of Tunisia (CBT) since 1987. Till early 2000, the growth rate of the money aggregate M2 was the main target, with base money as the operating target. Starting from the early 2000, CBT switched to target M3 money supply growth instead of M2 money supply growth, with base money as the operating target. The overall, monetary policy design and formulation did not really change. As for exchange rate policy, CBT followed a constant real effective exchange rate rule during the 90's. Since 2000, the CBT has reduced its intervention in the foreign exchange market and allowed for more flexibility in the exchange rate by adopting a managed float exchange rate.

Restrictions on capital flows, and the absence of strong external and internal shocks over the last two decades have made it easier for the monetary authorities to pursue such monetary and exchange rate policies to achieve multiple objectives, even if some of these objectives overlap or contradict each others.

The currently conducted monetary and exchange rate policies have served well, but their limitations are beginning to emerge in the context of increased regional and global integration, a more sophisticated market-based monetary policy, and the need to relax capital controls to diversify external financing sources and maximize the benefit of foreign capital for investment and growth.

Monetary authorities in Tunisia seem to be aware of the coming challenges. Currently, they are attempting to move from the ongoing broad money targeting framework, with base money as the operating target to inflation targeting policy. They are also attempting to move from the ongoing managed float exchange rate regime to a floating exchange rate regime.

Before attempting for these new policy frameworks, question about the reaction of the real variables to monetary and exchange rate shocks have to be answered. To answer this question, we estimated vector autoregressive (VAR) model over two different periods; the first lasts from 1993M1 to 2000M1, and the second from 2000M1 to 2008M1. We found that in the first period, neither monetary policy shock, nor exchange rate shock has an effect on output and price. In the second period, while monetary policy shock has an impact on output and not on price, the exchange rate shock has small impact on output and large impact on price.

The small impact of exchange rate shock on Tunisian output over both periods raises the

question about the impact of exchange rate on Tunisian trade balance. Again VAR frame work was estimated over both periods to answer this question. We found that real exchange rate shock (appreciation) has a modest impact on trade balances, and there is no evidence of J-curve shape for both periods. This lends further robustness for our previous finding about the small impact of exchange rate shock on output. The marginal effect of exchange rate shock on Tunisian trade balance could be explained by the fact that exports and imports respond with the same sign to an exchange rate shock. Since Tunisia is major importer of intermediate products, which it processes into finished products for export, the demand for these products seems to follow the trend of exports. Thus, some part of trade balance worsening due to real exchange rate shock seems to be offset by the decrease in the demand for foreign intermediate goods.

Knowing the source of real exchange rate fluctuation helps policy makers to understand the effectiveness of promoting competitiveness through currency devaluation, and helps them to efficiently conduct monetary and exchange rate policies. To identify the source of real exchange rate fluctuation in Tunisia, we estimated two different SVAR models. The first is a bivariate model; the second is a trivariate model. The bivariate model is similar to the one developed by Lastrapes (1992). It is a simple two variables model consisting of real effective exchange rate and nominal effective exchange rate. The trivariate model hinges on Clarida and Gali (1994). It is estimated using the following three variables: real effective exchange and relative output to reflect real shocks, and relative price level to reflect nominal shocks. The trivariate model is also re-estimated after substituting the relative price level variable by the nominal effective exchange rate variable (NEER). Thus, it is re-estimated using the following three variables: real effective exchange rate and relative output to reflect real shocks, and nominal effective exchange rate to reflect nominal shocks. From the estimation results, we concluded that, nominal shocks are major source of real exchange rate fluctuations in the first period, while real shocks are major source of real exchange rate fluctuations in the second period. In addition, we concluded that the share of real shocks in real exchange rate fluctuations is almost balanced between demand shocks and supply shocks in the first period, while almost all the share of real shocks in real exchange rate fluctuations is output shock in the second period. The same interpretation goes for the nominal exchange rate.

Our estimation results are logical and in accordance with the economic and financial situation characterizing each period. For instance, the policy of the Central Bank of Tunisia (CBT) in the first period was driven by the fear of financial system instability and by the government needs and development strategy. In addition, during this period, financial sector was inefficient and weak. The inefficiency of the financial system emerges from the fact that CBT has maintained considerable influence on credit extended to the private sector, through commercial banks' dependence on central bank refinancing. CBT used its power not only to keep credit growth and inflation in check, but also to promote credit to certain sectors regarded by the authorities as

priority sectors, such as tourism, housing, and agriculture. As a result, there was bad allocation of credit, and the overall level of non-performing loans reached high level, especially for public banks. Last but not least, during this period most of the price of the consumer basket were controlled and administrated.

In the second period, number of measures have been adopted to promote good governance, and to strengthen legal framework for banks; the assignment of the monetary policy was also modified to mainly preserve price stability; In this period, administrated price share in consumer price index continued to decrease and a significant trade openness to foreign and neighboring countries was seen. These factors may explain why results are more significant and robust for the second period compared to the first period.

As for the way forwards we can outline the following:

- CBT has to look for a target that provides real guidance to economic agents regarding expectations over the economy, such as inflation targeting.
- For monetary policy to effectively control inflation, the share of administered prices should be reduced significantly through price liberalization.
- The existence of a sound financial system is the most crucial condition for inflation targeting. To this end a set of institutional and/or economic preconditions have to be fulfilled: central bank independence, accountability and transparency, the existence of a sound financial system, Fiscal discipline and a flexible exchange rate regime are necessary before inflation targeting can even be attempted.
- Inflation targeting also requires a flexible exchange rate regime and, more generally, the absence of any other targeted nominal variable.
- Policy maker should be aware that with the ongoing trend of trade liberalization and the overall degree of openness of the economy, the real exchange rate shock will generate a larger trade balance worsening.
- Since large share of real exchange rate variation is due to real disturbance, to improve the degree of competitiveness of the economy, policy maker should attempts to improve productivity rather than devaluating nominal exchange rate.

Table of content

Acknowledgement	1
Executive Summary	2

Chapter 1

Economic Policies in Tunisia: Achievements and Challenges

1. Introduction.....	8
2. Economic development.....	8
3. Inflation, monetary and exchange rate policies.....	9
3.1. Inflation trend and price characteristics in Tunisia.....	9
3.2. Monetary policy in Tunisia.....	10
3.2.1 Monetary policy in Tunisia before 2000.....	10
3.2.2. Monetary policy in Tunisia after 2000.....	12
3.3. Exchange rate policy in Tunisia.	13
3.3.1 Exchange rate policy in Tunisia before 2000.....	13
3.3.2. Exchange rate policy in Tunisia after 2000.....	13
3.4. Banking sector.....	14
4. Fiscal policy and external position.....	16
4.1. Fiscal policy.....	16
4.2. External position.....	16
4.2.1. Trade liberalization.....	16
4.2.2. Openness to foreign investment.....	18
5. Summary and recommendations.....	19

Chapter 2

Effects of Monetary Policy and Exchange Rate Shocks on Tunisia's Economic Variables

1. Introduction.....	21
2. Methodology and model identification strategy.....	22
2.1. Model.....	22
2.2. Data.....	23
3. Empirical results.....	24
3.1 Interpretation of the impulse responses of the benchmark model over both periods.....	24
3.1.1. Output response to monetary policy shock.....	25
3.1.2. Output response to exchange rate shock.....	25
3.1.3. Price response to monetary policy shock.....	26
3.1.4. Price response to exchange rate shock.....	26
3.1.5. Other findings.....	26
3.2. Interpretation of the variance decomposition of the benchmark model over	

both periods.....	27
3.2.1. Variance decomposition of output.....	27
3.2.2. Variance decomposition of price.....	27
4. Preliminary concluding and robustness check.....	28
4.1. Over-identifying restriction test.....	28
4.2. Changing order of variables (including cpi in the first place).....	28
4.3. Using Real Effective Exchange Rate (reer) instead of nominal effective exchange rate (e).....	29
5. Summary of findings and concluding remarks	29

Chapter 3

Effect of Exchange Rate Shock on Tunisian Trade Balance

1. Introduction.....	40
2. Review of theoretical and empirical findings concerning the effects of exchange rate changes on the trade balance.....	41
3. Methodology and model identification strategy.....	44
4. Estimation and empirical results.....	45
4.1 Unit root test.....	45
4.2. Estimation of unrestricted VAR based on unit root test result.....	45
4.3. Benchmark model: recursive VAR where all variables are estimated in level form.....	46
4.3.1. Methodology and model specification.....	46
4.3.2. Interpretation of the impulse responses of the benchmark model over both periods.....	48
4.3.3. Interpretation of the variance decomposition.....	49
4.3.4. Robustness check.....	49
5. Summary of findings and concluding remarks.....	51

Chapter 4

Source of Real Exchange Rate Fluctuation in Tunisia

1. Introduction.....	61
2. Review of theoretical and empirical findings concerning the source of real exchange rate fluctuation.....	62
3. Models' specifications, estimation results and interpretations	68
3.1. Bivariate model specification, estimation results and interpretations	
3.1.1 Specification and identification scheme.....	68
3.1.2 Estimation results and interpretations.....	69

3.2. Trivariate model specifications, estimation results and interpretations.....	72
3.2.1 Model specification and identification scheme	72
3.2.2 Estimation results and interpretations.....	74
3.3. Re-estimation of the above trivariate SVAR model: substituting relative price by nominal effective exchange rate.....	75
4. Conclusion.....	76
General Conclusion.....	86
References.....	89
Appendix.....	94

Chapter 1

Economic Policies in Tunisia: Achievements and Challenges

1. Introduction

Tunisia is a small and politically stable country, lying on the North African coast, and has the most diversified economy in the region. With a population of only 10.4¹ million (CIA 2010), it has one of the highest standards of living in the entire African continent.

Since 1986, Tunisia has implemented several programs of multi-sectoral reforms aimed to liberalize prices, reduce tariffs, and reorient Tunisia toward a market economy. In addition, outward orientation has been a key component of Tunisia's development strategy, notably through the association agreement with the European Union, signed in 1995.

This chapter will give sight about the economic reforms and development in Tunisia over last two decades. It will mainly outline the monetary and exchange rate policies which have been conducted so far, and shed light on the fiscal and trade policies of the country. Based on the findings, it will raise some questions which will be answered in the next chapters.

The rest of this chapter is organized as follows: In section 2 we outline the Tunisian economic development; In section 3 we outline the achievement and challenges in term of inflation, monetary and exchange rate policies. In section 4 we shed light on Tunisian fiscal policies and external position. In the last section, we raise several questions and give a framework on how to answer them in the next chapters .

2. Economic development in Tunisia

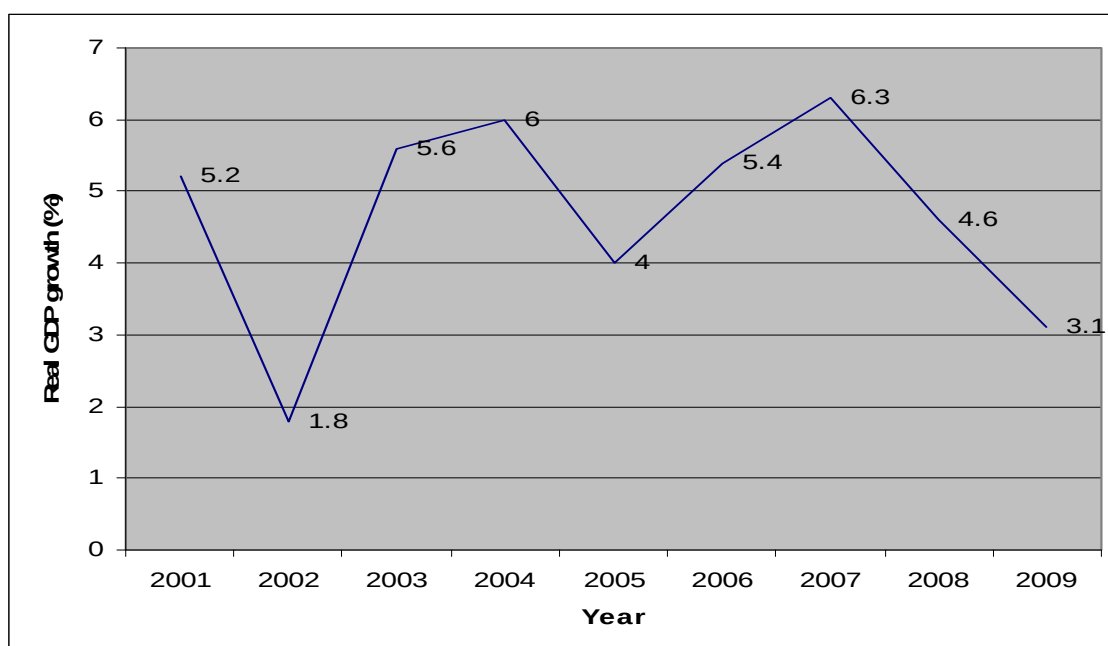
Over the past two decades, Tunisia has undergone a structural transformation in various fields of economic activity. It has notably achieved unprecedented rates of growth, thanks to structural reforms aimed at rehabilitating economic profitability and putting in place market mechanisms. Accordingly, the government's efforts have focused on developing a legal and legislative arsenal relating to the liberalization of investment, price and foreign trade. In this regard, a modern infrastructure was put in place, an effective administrative reform was introduced, and the roles between the public and the private sectors was reallocated through withdrawal of the State from the competitive sectors to which the private sector's contribution may be more efficient and

¹ Estimated by CIA staffs for July 2010

of better quality.

It is in this way that Tunisia has managed, progressively and consistently, to achieve average rates of growth of almost 4.6% annually at constant prices over the period 1990-2009. It also succeeded, thanks to the reforms adopted, in preserving the overall balances of the economy, particularly debt control whose indicators were brought down to reasonable levels. The foreign debt ratio was reduced to 42.6% and the debt service ratio to 7.8% in 2009 against 58% and 26.3% respectively in 1986.

Fig.1: Real GDP growth



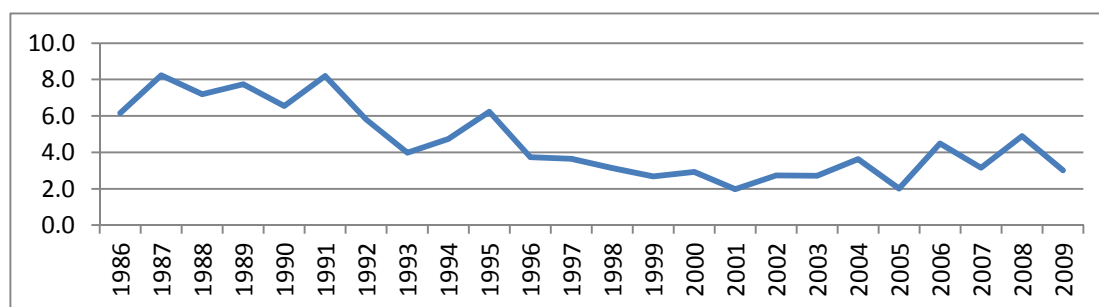
Source: Author, based on data taken from ([BCT](#) 2010).

3. Inflation, monetary and exchange rate policies

3.1. Inflation trend and price characteristics in Tunisia

Following the structural adjustment plan in 1983-84, inflation in Tunisia followed a long-term decreasing trend. As depicted in figure 2, the inflation rate declined from about 8% in early 1990s to about 2% in 2001 and 2005. Between 2000 and 2009, the average rate of inflation was around 3 %. Prudent monetary and fiscal policies, combined with structural reforms, played a key role in achieving this low level. Tunisia outperforms a number of other Middle Eastern countries in term of low inflation and it compares favorably to its trading partners and competitors.

Fig.2. Inflation trend in Tunisia



Source: Author, based on data taken from BCT 2010.

Despite the ongoing price liberalization in Tunisia, administered prices remain important. Prices of about one third of the consumer basket were still administered in 2008 (AfDB 2009). Level of administrated prices of some selected items from consumer basket are reported in table 1.

Table1: Level of administrated prices of some selected items from consumer basket

Selected items from consumer basket	Percentage of administrated prices
Tobacco, telecommunication, common transport, and care and treatment	100%
Energy	97%
Coffee and tea	87%
Cereals	71%
Sugar	59%
Education	57%

Source: Abdelahk senhadji et al. 2007

3.2. Monetary policy in Tunisia

3.2.1 Monetary policy in Tunisia before 2000

The 1958 Tunisian Law (Law 58-90), creating the Central Bank of Tunisia (CBT) assign multiple objective to CBT. It states that CBT is fully owned by the government and that its mission is to control money supply and credit, to supervise all banks and all of Tunisia's financial system, to defend the value of the national currency, the Tunisian Dinar (TND) and insure its stability and also to support the government's economic policy. Towards these ends, many measures have been implemented; the most important of them concerns the conduct of monetary policy. The stability-oriented monetary policy strategy becomes the framework adopted by the CBT since 1987. Till early 2000, the growth rate of the aggregate M2 has been the main target, with base money as the operating target. The CBT has developed a notion of the appropriate growth of the money supply according to the following three steps procedure:

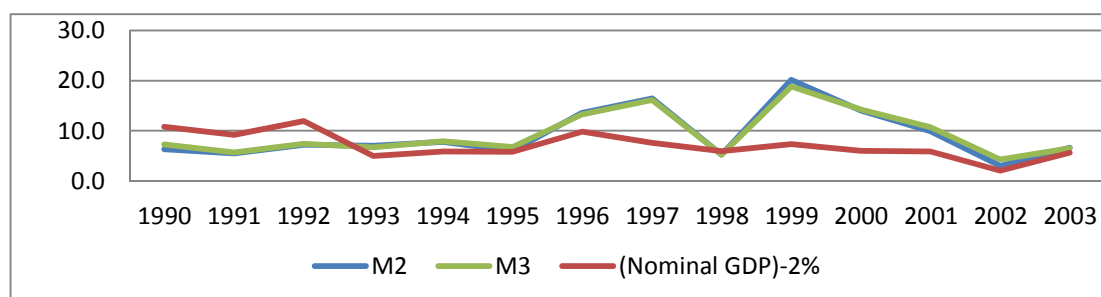
-First, the growth of the aggregate M2 is set at 2% below the projected growth of the nominal GDP.

-Second, under the presumption of a roughly constant multiplier, the amount of the base money supply consistent with the target M2 is calculated.

-Third, taking into account projected net international reserves and the credit requirement of the agriculture sector; the CBT determines the quantity of liquidity to be distributed through the refinancing facilities. These amounts need to be fine-tuned on a weekly basis in the light of the supposed financing needs of the commercial banks.

Boughrara Adel (2004) reported that in practice, targets have often been missed; the gap between M2 targets and observed values exceeded the 2% level in more than 60% of the time during the period 1987-2000. He claimed that this gap even exceeded 8% during the years 1988, 1996 and 1999. After 1996, as a result of the contingency linked to the huge arrears accumulated by public enterprises, CBT had to allow an increase in money supply. Consequently M2 grew well beyond its target in 1996, 1997 and 1999 (Fig. 3), and CBT had frequently tried to partly drain the excess liquidity out of the system and to stabilize the money market rate. The oversupply of money was mainly due to: (i) the take-over of the banks' claims on two main public firms, (ii) the increase in net foreign assets due to several Euromarkets issues by Tunisian banks; and (iii) the elimination of the reserve requirements related to mandatory loans to priority activities, thus contributing to the reduction of the expansion of bank credit to the economy. CBT policy was driven by the fear of financial system instability and by the government needs and development strategy. Consequently, banks had to supply credits to priority sectors, and CBT often had to meet requests for liquidity indirectly put forward by the government through commercial banks. Also as a result of the fear of instability and to facilitate the financing of the fiscal deficit, CBT preferred to maintain stable interest rates. Stability of the interest rates is obtained through the coordination between fiscal and monetary policy. The coordination process shows that monetary policy is adapted to fiscal needs, which is a sign of fiscal dominance.

Fig.3: Annual growth of monetary aggregates M2, M3 and the nominal GDP.



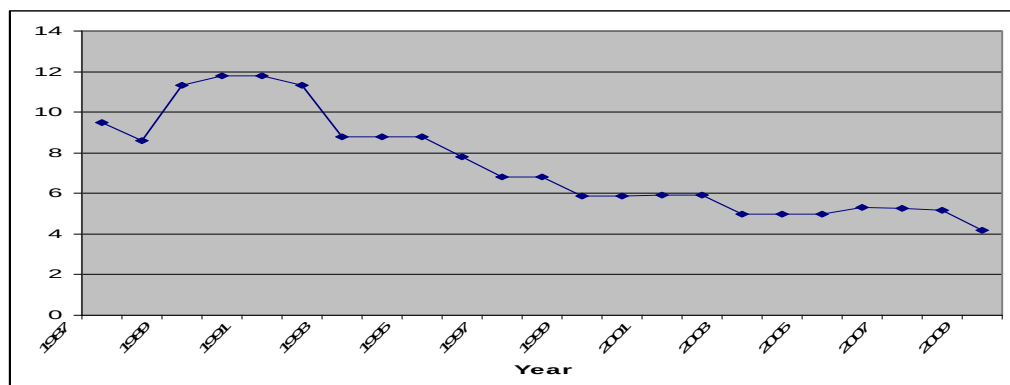
Source: Author based on data taken from (BCT 2010, and IFS 2008)

3.2.2 Monetary policy in Tunisia after 2000

Since early 2000, CBT switched to target M3 money supply growth instead of M2 money supply growth, with base money as the operating target. The overall, monetary policy design and formulation did not really change. The targeted M3 money supply growth rate is set to be in line with the expected expansion of nominal GDP growth. Within this framework, CBT has controlled the expansion of credit to the economy. Restrictions on capital flows have made it easier for the monetary authorities to pursue such a monetary policy. The monetary and credit aggregates had grown beyond the target level in 2000 and 2001. In addition, there was a strong domestic demand pressure that contributed to a deterioration of Tunisia's external accounts, in early 2000. These two factors drive CBT to tighten its monetary policy stance. The tighter policy was implemented through new rules concerning refinancing opportunities for the banking sector and new indirect monetary policy instruments. Liquidity demands of the banking sector are no longer automatically satisfied, and banks have to compete for liquidity via auctions. The new instruments include the introduction of 3-month repo operations, new collateral rules as well as new marginal lending and depository facilities.

In 2006, the law 58-90 creating the CBT was modified by article 33 of law n°2006-26. The new article states that the main assignment of the monetary policy in Tunisia consists in preserving price stability. To ensure price stability, through the instruments put at its disposal, the CBT influences the money market interest rate considered as the main instrument for conducting the monetary policy to achieve the final target of price stability (CBT home page). However, This transformation of monetary policy framework requires some times as Chailloux et al (2009) claims “In the interim, monetary policy has been anchored on a monetary program: the BCT derives annual targets for M3 from the government’s financial program, as well as monthly targets for M3 and base money growth.”²

Fig.4. Money Market Interest Rate trend



Source: Author based on data taken from (BCT. 2010)

² Thus, in Chapter 2, to analyze the effect of monetary policy on Tunisian economic variable, we choose the estimation period up to early 2008.

Currently, monetary authorities in Tunisia are attempting to move from the ongoing broad money targeting framework, with base money as the operating target to inflation targeting policy.

3.3. Exchange rate policy in Tunisia

3.3.1 Exchange rate policy in Tunisia before 2000

Through the last decades, Tunisia has experienced several exchange rate policies. The quest for a reasonable exchange rate policy has been inspired in part by the different goals that policy makers have attempted to achieve with this policy.

In the early 70's, the authorities chose to peg their currency to the French Franc, given the importance of France as its principal trading partner. Following the demise of the Britton-Woods system of fixed exchange rate system in 1973, Tunisia decided to move away from a fixed value relative to the French Franc to peg to a basket that was first composed of three currencies (French Franc, Deutschmark and the U.S Dollar) and that was widened in the early 80's by including the Italian Lira.

Since 1985, the objectives of promoting Tunisia's exports and enhancing the external competitiveness perused by the Tunisian government, in conjunction with some other international considerations forced the authorities to widen even more the basket and to incorporate currencies like the Belgian Franc, Dutch Florin and the Spanish Peseta.

During the 90's, Tunisia made significant progress in opening the external sector. This strategy aimed at ensuring a competitive environment for domestic enterprises and products. In 1992, the authorities decided to follow a constant real effective exchange rate rule in an effort to index its nominal exchange rates to the domestic price level and to avoid losses in competitiveness. This rule is interpreted with some flexibility by CBT as it allows the real exchange rate to deviate from its target in order to smooth movements in the nominal rate. It is reported that this exchange rate policy combined with very prudent and sound monetary and fiscal policies helped the country not only to avoid currency and financial crises, but it also contributed to reduce inflation from 8% in 1991 to around 3% between 2000 and 2009, and to establish a credible commitment to macroeconomic stability (AfDB. 2009).

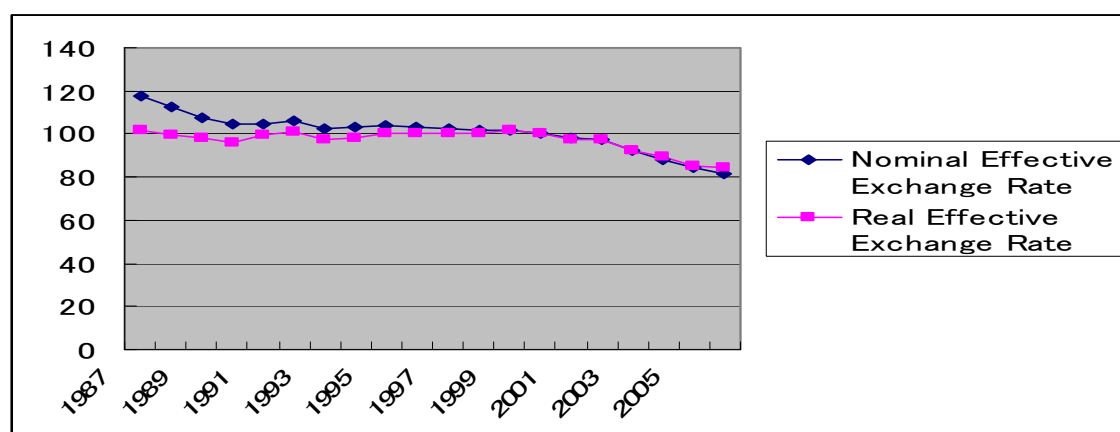
3.3.2 Exchange rate policy in Tunisia after 2000

Since 2000, the CBT has reduced its intervention in the foreign exchange market and allowed for more flexibility in the exchange rate by adopting a managed float exchange rate. The monetary authority attempts to influence the exchange rate without having a specific exchange

rate path or target. Indicators for managing the rate are broadly judgmental, and adjustments may not be automatic. Intervention may be direct or indirect. The Tunisian dinar (TND) exchange rate is determined on the interbank market. In this framework, local banks exchange the currencies among themselves or with their customers at freely-negotiated rates. The role of the Central Bank of Tunisia consists in its intervention to fine-tune liquidity on the market in case of imbalance between supply and demand for currencies on this market. The Central Bank of Tunisia publishes, for disclosure, the currencies' daily average exchanges rates applied on the interbank market over the previous day. This current regime is considered as an intermediate step toward a floating exchange rate regime.

Nominal effective exchange rate and real effective exchange rate have depreciated by about 20% since 2000 (fig.5). The latest estimations by IMF staffs suggest that real exchange rates appear in line with economics fundamentals (IMF 2010).

Fig.5. Nominal and real effective exchange rate trends



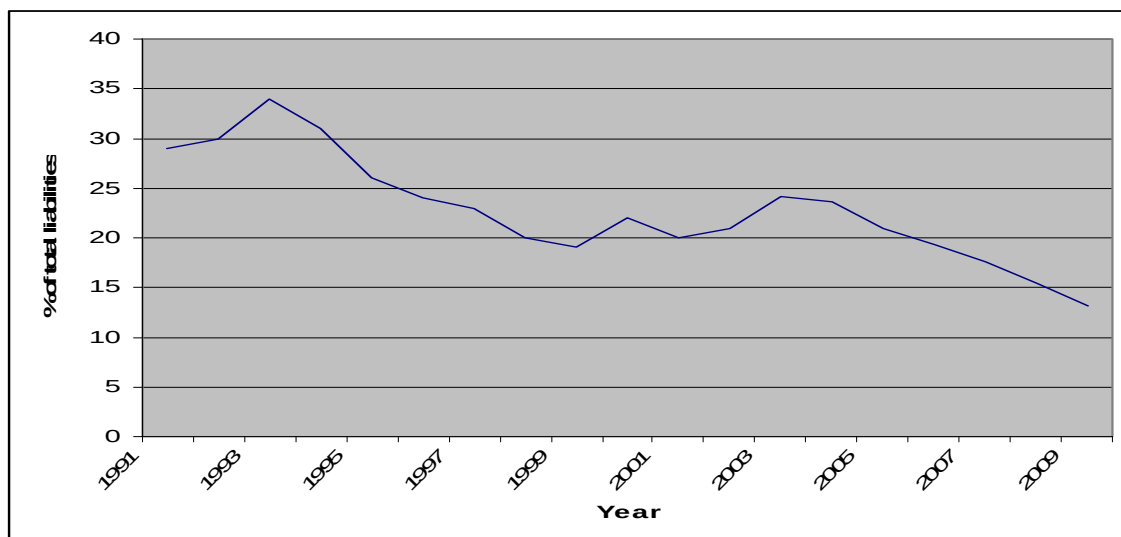
Source: Author, based on data taken from (IFS 2008)

3.4. Banking sector

The Tunisian banking system is a mixture of private and state-owned institutions. The government is the controlling shareholder in nine banks, which together account for more than two thirds of all credit and over half of total deposits, with varying types of financial instruments and services. The banks are strictly regulated by the CBT, which in recent years has increasingly insisted upon prudential norms for bank reserves and balance sheets, in compliance with international standards. The required minimum risk-weighted capital/asset ratio has been raised to 8%, consistent with the Basel Committee capital adequacy recommendations in 2008, thirteen of the country's fourteen banks conform to the ratio, compared with only two in 1993.

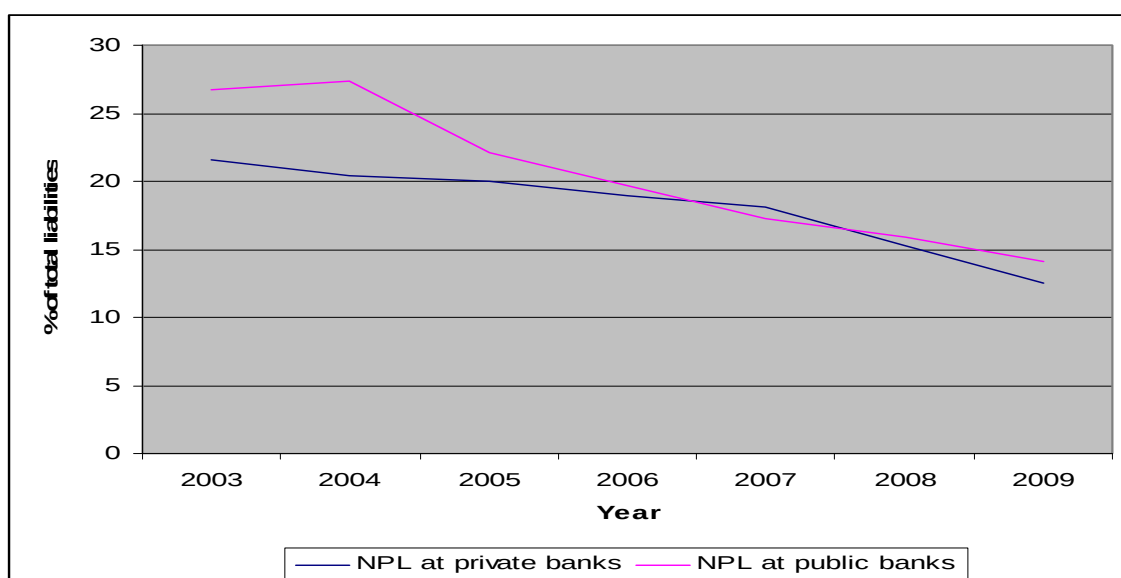
Despite the strict new requirements, many banks still have substantial amounts of non-performing or delinquent debt in their portfolios. Over the past years, the overall level of non-performing loans has been reduced from nearly 34% in the early 90s to less than 15% in 2009 (Fig.6). These rates remain quite high, especially for public banks (Fig.7).

Fig.6: Non Performing Loan in Tunisia (in % of total Banks liabilities)



Source: Author, based on data taken from (IMF 2010)

Fig.7: Private banks and public banks non performing loans



Source: Source: Author, based on data taken from (IMF 2010)

The inefficiency of the financial system emerges from the fact that CBT has maintained considerable influence on credit extended to the private sector, through commercial banks' dependence on central bank refinancing. CBT used its power not only to keep credit growth and inflation in check, but also to promote credit to certain sectors regarded by the authorities as priority sectors, such as tourism, housing, and agriculture. Another reason is the fact that Tunisian capital markets remain dominated by the banking system which is in turn fragmented and of limited size.

Number of measures have been adopted to promote good governance, and to strengthen legal framework for banks. Raising administrated interest rates to positive real levels was an important initial step in the banking system reform process, which was followed by a gradual liberalization of interest rates. The new regulations introduced by law 2001-65 represent significant enhancements to the transparency and prudential management of banks compared to the situation before 2001. However, they are not completely in line with the recommendations of the Basle Committee. Although CBT claims that the interest rates on all credit are determined freely by the banks, it continues to control credit indirectly and links all interest rates to its "Guiding rate", MMR.

Tunisian commitments under the WTO and its EU free trade agreement to begin liberalizing its banking sector will probably result in more stringent enforcement of reform measures over the coming years.

4. Fiscal policy and external position

4.1. Fiscal policy

It is true that compared to the fiscal imbalance observed in the mid eighties, Tunisia managed to significantly reduce its fiscal deficit and to keep public debt at an affordable level. By the mid nineties, the fiscal deficit was brought down to around 3%. The country also moved to more transparent and more market based debt management, and the development of the government debt market has helped the government manage its deficit. Government finance has increased in recent years especially in social infrastructure development. The situation was also influenced by the high international price of oil and food products, which weighted on the state subsidies for energy and basic product.

4.2. External position

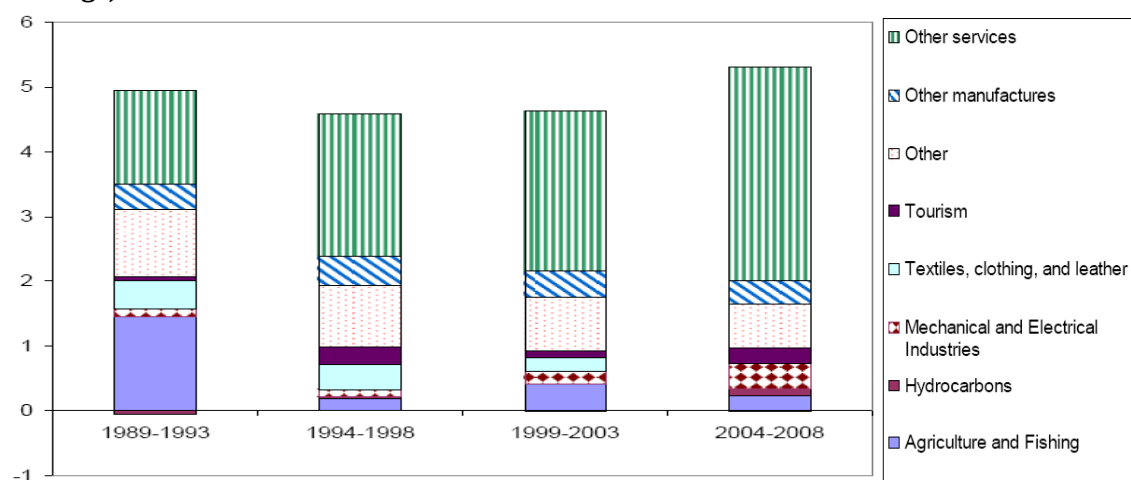
4.2.1. Trade liberalization

Tunisia has signed several regional preferential trade agreements, including the Association

Agreement with the European Union, the Agreement on the Greater Arab Free Trade Area (GAFTA), the Arab-Mediterranean Free Trade Agreement, the Free Trade Agreement with EFTA, the Maghreb Arab Union Agreement, and several other bilateral agreements. These agreements differ with respect to geographical coverage, trade liberalization programs, implementation periods, trade policy instruments and their objectives. Some of them overlap. Consequently, Tunisia's trading partners have market access which differs according to the agreement to which they are party and its degree of implementation.

Tunisia is a major exporter of consumer goods and a major importer of intermediate products which it processes into finished products for export. It is also dependent on the outside world for capital goods. Although energy is of relatively minor importance in Tunisia's foreign, the negative balance of trade in these products is highly sensitive to international price trends. The food balance is negative while imports of consumer goods are high. The evolution of sectoral contributions to GDP is given in fig.8

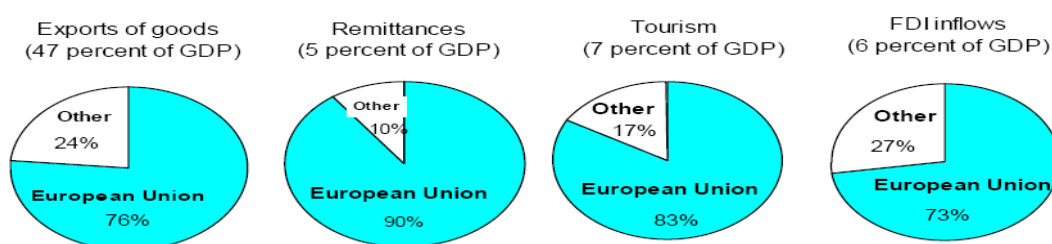
Fig.8: Evolution of sectoral contributions to GDP growth (in percentage points, period average)



Source: IMF 2010

Tunisia is the most advanced country among the Euro-Med partners as far as the introduction of a free trade area with the European Union is concerned. Tunisia started dismantling tariffs in 1996, before the EU-Tunisia Association Agreement become effective in 1998. Tariff dismantling has seen a speeding up of the country's integration into the European market. 80% of Tunisian exports go to the EU, and the EU represents 71% of Tunisia's imports. Total exports and imports of goods increased from 74% of GDP in 1995 to 98% of GDP in 2009, with a significant improvement in the import cover ratio which moved from 70% to 90%. FDI, in percentage of GDP, virtually doubled during the same period. The situation of trade between Tunisia and the EU as for 2008 is given in the fig.9 .

Fig.9: Main links between Tunisia and European Union, 2008



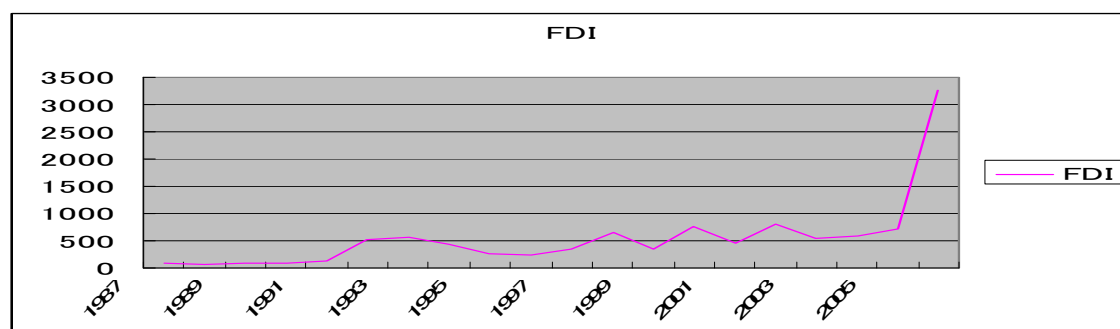
Source: IMF 2009

These trends reflect Tunisia's trade liberalization policy, particularly in the context of the Association Agreement with the EU that culminated in free trade in 2008, with zero tariffs on industrial products from the EU, down from an average of 19% in 1999. The tariff simplification program continues: the number of rates was reduced from 14% to 9% in two years and the maximum rate was reduced from 73% to 60%. The relaxation of customs formalities advances, with the average length of time spent by goods in customs declining from 11 days in 2005 to 7 days in 2007. Further simplification and reduction of multilateral customs tariffs are needed in order to prevent trade diversion and to enhance the geographical diversification of trade.

4.2.2. Openness to foreign investment

A large share of Tunisia's foreign direct investments (FDI) has come from a privatization program to sell off state-owned or state-controlled enterprises. The program began in 1987 with the sale of the smallest and least viable public sector enterprises, then it included major state assets. The Tunisian government also, actively encourages selected FDI, particularly for export-oriented industries. It screens potential FDI to minimize the impact of the investment on domestic competitors and employment. In 2008, total FDI in Tunisia was about \$15 billion. It has contributed to the creation of over 2,600 companies and approximately 250,000 new jobs (AfDB. 2009).

Fig.10: Total FDI inflow



Source: Author, based on data taken from (IFS 2008)

Manufacturing industries producing for export has long been the major generator of jobs in Tunisia and has attracted the bulk of FDI. Until recently the Government discouraged foreign investment in service sectors such as restaurants, real estate, and retail distribution but there are signs of relaxation of this policy. In particular, FDI in retail distribution is expanding rapidly. Furthermore, mega projects in real estate could substantially increase FDI. Two of such projects, originating from countries in the Gulf region, have already been established. According to IMF report, these projects may attract 20 billion US \$ in investment over the next 15-20 years (IMF 2006).

5. Conclusion of this chapter and framework for the next chapters

Over the past years, the Tunisian economy has shown great resilience in a difficult external environment, posting sustained growth and maintaining macroeconomic stability thanks to a prudent monetary and fiscal policy mix. As for monetary policy, the stability-oriented monetary policy strategy has been the framework adopted by the CBT since 1987. Till early 2000, the growth rate of the aggregate M2 was the main target, with base money as the operating target. Starting from the early 2000, CBT switched to target M3 money supply growth instead of M2 money supply growth, with base money as the operating target. The overall, monetary policy design and formulation did not really change. As for exchange rate policy, CBT followed a constant real effective exchange rate rule during the 90's. Since 2000, the CBT has reduced its intervention in the foreign exchange market and allowed for more flexibility in the exchange rate by adopting a managed float exchange rate.

Restrictions on capital flows, and the absence of strong external and internal shocks over the last two decades have made it easier for the monetary authorities to pursue such monetary and exchange rate policies to achieve multiple objectives. In addition, based on the inefficient financial system, CBT has maintained considerable influence on credit extended to the private sector, through commercial banks' dependence on central bank refinancing. CBT used its power not only to keep credit growth and inflation in check, but also to promote credit to certain sectors regarded by the authorities as priority sectors, such as tourism, housing, and agriculture. As a result, the overall level of non-performing loans is high, especially for public banks

Those monetary and exchange rate policies have served well, but their limitations are beginning to emerge in the context of increased regional and global integration. More sophisticated market-based monetary policy are required, and capital controls should be relaxed in order to diversify external financing sources and maximize the benefit of foreign capital for investment and growth. Tunisian commitments under the WTO and its EU free trade agreement to begin liberalizing its banking sector will probably result in more stringent enforcement of reform measures over the coming years.

Monetary authorities in Tunisia seem to be aware of the coming challenges. Currently, they are attempting to move from the ongoing broad money targeting framework, with base money as the operating target to inflation targeting policy. They are also attempting to move from the ongoing managed float exchange rate regime to a floating exchange rate regime.

Before attempting for these new policy frameworks, question about the reaction of the real variables to monetary and exchange rate shocks have to be answered; Before attempting to more trade and capital account liberalization, question of the effect of exchange rate shock on trade balance have to be answered; Answering the question of what is the source of real exchange rate fluctuation is also crucial, because it provides policy makers an idea how to conduct an exchange rate policy, and the effectiveness of promoting competitiveness through currency devaluation.

In the next three chapters, we will try to answer the above questions. To this end, we will use appropriate econometric tools to analyze, and compare, the estimation results of two different periods. The first period lasts from 1993M1 to 2000M1; the second period lasts from 2000M1 to 2008 M1. More precisely, in chapter 2 we will identify the effect of monetary and exchange rate shocks on Tunisia's economic variables. In chapter 3 we will identify the effect of exchange rate shock on Tunisian trade balance. In the last chapter, chapter 3, we will identify the source of real exchange rate fluctuation in Tunisia. Basic information about Tunisia will be given in the appendix.

Chapter 2

Effects of Monetary Policy and Exchange Rate Shocks on Tunisia's Economic Variables

1. Introduction

Tunisia has been undertaking reforms of its financial sector as part of broad macroeconomic adjustment programs and structural reforms since the ending of 1986. The objective was to move from controlled economy and an administratively managed financial system towards open and market oriented system with a reduced direct involvement of the state. Measures taken to reform the financial and banking system since 1987 included the development of non bank financial institutions and the capital market, eliminating progressively credit allocation controls by abolishing credit ceiling and preferential interest rates, improving banking supervision and introducing more market-based instruments of monetary policy and made them more flexible. Interest rates were progressively freed, but the Central bank of Tunisia (CBT) maintained a strong involvement in their determination. The main purpose of the monetary policy of the CBT becomes to preserve the value of the currency by keeping inflation rate as low as that of its partners and competitors. The intermediary objective is to match the money supply growth with economic activity growth. This policy amounted in the 1990s to a Constant Real Exchange Rate rule (CRER) and a Monetary Targeting Strategy (MTS).

As for monetary policy in Tunisia, since 2000, The CBT has made significant progress toward implementing a new broad monetary targeting framework, with base money as the operating target. This framework, an intermediate step toward inflation targeting, has been run in parallel for the past years with the existing framework, which focuses on maintaining private credit growth in line with nominal GDP growth. The objective of implementing inflation targeting in the future has taken on increased significance with the article 33 of law No 2006-26 which, defines price stability as the key objective of the BCT.

As for exchange rate policy, since 2000, the CBT has reduced its intervention in the foreign exchange market and allowed for more flexibility in the exchange rate. The current managed float is an intermediate step toward a floating exchange rate regime.

While these approaches have served well, their limitation are beginning to emerge in the context of increased regional and global integration, a more sophisticated market-based monetary policy, and the need to relax capital controls to diversify external financing sources and maximize the benefit of foreign capital for investment and growth. Further vulnerabilities are the high level of non-performing loan and the large share of administrated price in consumer basket. Although banking sector indicators improved significantly in recent year, in 2005, nonperforming loan

(NPLs) remain high (about 21%) and provisioning low (47% of NPLs). Despite price liberalization, administrated prices remain important. Price of about 32% of the basket is still administrated.

Given the ongoing domestic and global policies and economic changes, especially after 2000, we attempt to answer the question of what is the effect of monetary policy and exchange rate shock on Tunisia's economic variables before and after this year. Since the achievements and challenges in terms of economic and financial reforms were highlighted in the previous chapter, the rest of this chapter we will focus only on the analysis part. It is organized as follow: Section 2 introduces the methodology and model identification strategy. Section 3 reports the empirical results. Robustness of our estimation is checked in section 4; and last section is reserved for the conclusion.

2. Methodology and model identification strategy

Monetary policy making can consist of two parts. One is endogenous policy responses to the overall economic condition such as inflation, output, exchange rate, etc. This is often called “monetary policy rule”, which describes a guiding principle of monetary policy (Miyao, R. 2008). The other corresponds to exogenous policy actions that are not explained by policy rule (i.e., deviation from standard policy practices). In this work, using a recursive VAR, the second one is considered beside the exchange rate shock, to assess their effect on Tunisia's output and price.

2.1. Model

The vector autoregressive (VAR) framework has been widely used to analyze the effect of monetary policy shock. We used this framework to assess the effect of monetary policy shock (monetary easing) and exchange rate shocks (appreciation) on output and price in Tunisia. We used recursive VAR estimation with monthly data. We developed a simple four-variable model consisting of real output (y), price (cpi), nominal effective exchange rates (e), and narrowest money aggregate (m) as our benchmark. Consider the following system of equations:

$$\sum_{s=0}^p A_s X_{t-s} = A(L)X_t = \varepsilon_t, \quad (1)$$

Where $A(L) = A_0 - A_1L - A_2L_2 - \dots - A_pL_p$ is a p th-order lag polynomial,

$A_s (s = 0, 1, \dots, p)$ is a four by four coefficient matrix, $X_t = (y_t, cpi_t, e_t, m_t)'$ and

$\varepsilon_t = (\varepsilon_{yt}, \varepsilon_{cpit}, \varepsilon_{et}, \varepsilon_{mt})'$, a four by one vector of serially uncorrelated structural disturbance with a mean zero and covariance matrix Σ_ε .

As is widely known, the structural form of a model cannot be estimated without additional information; the sampling information contained in the reduced form of Eq.(1) is not sufficient to estimate all of the parameters in A_0 . Therefore, the need for identifying restrictions arises. In order to identify A_0 , two identifying restrictions are made. The covariance matrix of the structural disturbances are assumed to be orthogonalized, so that with the appropriate normalization, $\Sigma_\varepsilon = I$, and the matrix A_0 is assumed to be lower triangular. These two assumptions are also known as the Choleski factorization of the VAR. The structural model above can be recovered from a corresponding reduced-form VAR using Cholesky decomposition of the reduced-form covariance matrix.

For the empirical analysis at hand, the assumption that A_0 is lower triangular is critical. This 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 plus 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 ordering of the variables has important implications for the identification of the shocks. In this paper, the ordering was chosen on the basis of the speed with which the variables respond to shocks. The present ordering implies that, within a month, there are no contemporaneous effects of monetary and exchange rate variables on real economic activities as we use monthly data.

By putting the monetary aggregate in the last position, we indicate that monetary authorities care about the exchange rate stability. We assume that monetary policy respond to all other variables contemporaneously. This set of restriction just-identifies the structural model, so that we may not be able to test the validity of assumptions (Miyao R. 2008). To this end, we will add some short run restrictions and perform over-identification restriction test to test the validity of our identification scheme statistically.

2.2. Data

To assess the effect of monetary policy shock and exchange rate shocks on output and price, in Tunisia, we used recursive VAR estimation with monthly data over two periods. The first period

lasts from 1993M1 to 2000M1³, and the second period lasts from 2000M1 to 2008M1⁴. We developed a four-variable model, as benchmark, consisting of industrial production as proxy for real output variation (y), Consumer Price Index (cpi), The narrow measure of money supply that consist of money plus demand deposit known as M1 (m)⁵ to reflect monetary policy shock, and the nominal effective exchange rate (e) to reflect exchange rate shock.

All series are seasonally adjusted using X12, taken in logarithm, and estimated in their level form ⁶. The trends of the variables used in benchmark model over the first and second periods are plotted in figure 7 and 8 respectively given in the end of this chapter.

The lag length is set to 3 in the reduced form estimation.⁷

3. Empirical results

3.1. Interpretation of the impulse responses of the benchmark model over both periods

The impulse responses of variables to one standard-error innovation over both periods are given in the fig.1 and fig.2 given in the end of this chapter. Figure1 reports the impulse responses of variables to one standard-error innovation over the period lasting from 1993M1 to 2000M1. Figure2 reports the impulse responses of variables to one standard-error innovation over the period lasting from 2000M1 to 2008M1

(Insert fig.1 and fig.2 here)

In our benchmark model, shocks and responses are defined as follow:

- Monetary policy shock refers to an increase in the aggregate money M1 (easing of monetary policy). The response of all variables to this monetary policy shock is illustrated in the fourth column of both figures.

³ During which constant real effective exchange rate policy was been conducted

⁴ During which managed float exchange rate policy s conducted.

⁵ We used the interest rate as a policy variable, but results were not robust, this could be due to the fact that interest rates, stability, were considered as secondary goal rather than instrument during the ongoing financial reform.

⁶ IFS data code: 66zf, 64zf, 34zf, NE czf, respectively. All series are seasonally adjusted using X12, taken in logarithm, and estimated in their level form.

⁷ The Akaike Information criteria (AIC), Schwarz Information Criteria (SC), and the Hannan-Quin are the information criteria used for model selection such as determining the lag length of the VAR; the smaller the value of the criteria, the better is the model. All of them indicated that the best lag length is of order 2 as reported in table (a) and (b), but because we know that monetary policy affect real variable with lags, we took our model with 3 lags.

- Exchange rate shock refers to an increase in the nominal effective exchange rate (appreciation of the nominal exchange rate). The response of all variables to this nominal exchange rate shock is illustrated in the third column of both figures.

Our main target is to check the effect of monetary policy and exchange rate shock on output and prices during each period, and answer if there is any difference between them. Thus, we will focus on the four charts located in top-right of figures1 and figure2 and highlight any difference between them.

3.1.1. Output response to monetary policy shock

The output response to monetary policy shock (shock4 in fig.1 and fig.2) is given in the first line, forth column chart of both figure1 and figure2.

We observe that there is no response of output to monetary policy shock in the first period. However, in the second period output tend to increase as a response to a monetary policy shock. The finding could be attributed to a more sound banking system over the second period compared to the first period. Efforts to increase soundness and effectiveness of the financial and banking system become visible in the second period. Banking sector weakness constitutes a drag on growth by contributing to higher costs of capital and inefficient allocation of resources. An explanation could be as follow: after a monetary easing, that is not predicted, banks increase credit to the economy. These credits seem to be badly allocated especially in the first period when government use its power to promote credit to certain sectors regarded as priority sectors namely agriculture and housing sector.

Monetary authorities have adopted a number of measures recently aimed at improving the credit culture, promoting good governance, and strengthening the legal framework for banks. This seems to result in improvement in banking situation and thus could be behind the positive response of output to monetary policy shock. We do believe that further efforts in term of legislation and programs that enhance competitiveness between financial institutions and that curb non performing loan are needed. These efforts will enhance and strengthen more the overall financial system and especially banking systems. With the existence of a more sound and efficient financial system we may see a larger and more statistically significant positive response of output to a monetary policy shock.

3.1.2. Output response to exchange rate shock

The output response to exchange rate shock (shock 3 in fig.1 and fig.2) is given in the first line, third column chart of both figure1 and figure2.

We observe that there is no response of output to exchange rate shock in the first period.

However, a modest decrease takes place in the second period. This latter become statistically significant after one year.

The small effect of exchange rate shock on output raises the question about the effect of exchange rate shock on Tunisian trade balance?

We will try to answer this question in the next chapter and see if the response of trade balance to an exchange rate shock takes a J-curve shape?

3.1.3. Price response to monetary policy shock

The price response to monetary policy shock is given in the second line, forth column chart of both figure1 and figure2.

We observe that for both periods, price increases after a monetary policy shock. However, results are not statistically significant. This could be explained by the fact that large part of consumer basket price is controlled (about 32%).

3.1.4. Price response to exchange rate shock

The price response to exchange rate shock is given in the second line, third column chart of both figure1 and figure2.

We observe that while in the first period price increases after an exchange rate shock; in the second period it largely decreases. Furthermore, while the response in the first period is not statistically significant, it is significant in the second period. The decrease of price level due to exchange rate shock (appreciation) is standard implication of most of small open economy models in which the prices of traded goods return rapidly to world levels following an exchange rate appreciation.

3.1.5. Other findings

-Looking to the third line, third column in both figure1 and figure2, we can see that nominal exchange rate shock has more persistent effect on the nominal exchange rate itself in the second period compared to the first one. The persistency and variability of exchange rate has increased after moving to managed float exchange rate. This has to be taken in account when attempting to move for floating exchange rate.

-Looking to the chart giving the response of monetary aggregate to an exchange rate shock given in the forth line, third column in both charts. We can see that while an appreciation of nominal exchange rate has no effect on monetary policy variable in the first period, it has an immediate, significant decrease in the second period. In the first period, there was capital account restriction (inflow and outflow). The aim was to enable domestic saving to finance the

domestic investment. In order to curb unemployment rate, there was relaxation of capital account in the second period. As a result, in case of an appreciation shock, a capital outflow occurs. To curb with this capital outflow, Tunisian authorities seems to contract money supply.

3.2. Interpretation of the variance decomposition of the benchmark model over both periods

Because the share of every shock in the variation of each variable seems not to change after a period of two years, we report variation decomposition only over this period (24 months).

(Insert tables 3 and table 4 here)

Table3 reports the variance decomposition of all variables for the 1st period lasting from 1993M1 to 2000M1. Table4 reports the variance decomposition of all variables for the 2nd period lasting from 2000M1 to 2008M1.

The share of monetary policy shock in the variation of different variables is given in the sixth column. The share of exchange rate shock in the variation of different variables is given in the fifth column. Our main focus is to check the share of monetary policy and exchange rate shock on output and prices variation during the tow estimated periods and answer if there is any difference between them. Thus, we will try to analyze the fifth column and sixth column for the variance decomposition of output and price over both periods.

3.2.1. Variance decomposition of output

A monetary policy shock seems to have more impact on output in the second period compared with the first period. After two years period, while the share of monetary policy shock in output variance is below 3% in the first period, it accounts more than 11% in the second period.

An exchange rate shock seems to have no impact on output variation over both periods. Although the share in the second period is bigger than the first period, it is still below 6% (5.61%). This implies that both, monetary policy shock and exchange rate shock have no effect on output in the first period. In the second period, although the effect of monetary policy shock is larger than the exchange rate, both of them are small.

3.2.2. Variance decomposition of price

A monetary policy shock seems to have no impact on price in both periods. Its share is below 5% in the first period and negligible in the second one.

An exchange rate shock has no impact in the first period on price variation. The impact becomes clear in the second period. It's above 18% within a year and reaches almost 30% after 2 years period.

We can notice that monetary policy shock and exchange rate shock have not effect on price variation in the first period. In the second period, only exchange rate shock does have impact.

4. Preliminary concluding and robustness check

Our finding from the benchmark model could be summarized as follow:

In the first period, neither monetary policy shock, nor exchange rate shock has an effect on, both, output and price. In the second period, while monetary policy shock has an impact on output and not on price, the exchange rate shock has small impact on output and large impact on price.

Hereafter we will conduct a robustness check.

4.1. Over-identifying restriction test

The recursive identification scheme implied in our model implies that A_0 becomes lower triangular and the ordering in the VAR determines the degree of exogeneity of the variables. The assumption that A_0 is lower triangular is critical. This set of restrictions just-identifies the structural model, so that we may not be able to test the validity of assumptions. If the model is over-identified by adding some restriction, it is possible to test the validity of our identification scheme statistically. To this end, we further impose a short-run restriction that output does not affect the nominal effective exchange rate contemporaneously. This implies that the third-row, first column of A_0 matrix is set to be zero. Adding this restriction enables us to perform over-identifying restriction test. The chi-square statistics was 2.168619 with p-value equal 0.1409 for the first period and 0.216259 with p-value equal 0.6419 in the second period. These reported chi-square statistics indicate that the hypothesis that over-identifying restrictions are valid is not rejected by conventional significance levels. The restrictions including our just-identified assumptions are statistically plausible.

4.2. Changing order of variables (including cpi in the first place)

To check robustness of our benchmark results we changed the ordering of variables included in the benchmark model. Because a large part of consumer price basket is controlled prices, we thought that it will be better to include it in the first place giving that it will not respond to output variation within a period of one month. This assumption could be more acceptable in the first period then in the second one.

Figure3 reports the impulse responses of variables to one standard-error innovation over the period lasting from 1993M1 to 2000M1. Figure4 reports the impulse responses of variables to one standard-error innovation over the period lasting from 2000M1 to 2008M1. Innovation in Monetary policy variable is still reported in the forth column and the innovation in the exchange rate is in the third column.

(Insert fig.3 and fig.4 here)

Comparing figure 3 and figure 4 that report the impulse responses of the new model to figure 1 and figure 2 that report the impulse responses of the benchmark model, we don't notice any single change in any response to any innovations. Thus all our first interpretations still hold for the new estimation system.

4.3. Using Real Effective Exchange Rate (reer) instead of nominal effective exchange rate (e)

The trends of nominal effective exchange rate and real effective exchange rate over the first and second periods are given in figure 9 and 10 respectively given in the end of this chapter. Since the trend of nominal effective exchange rate and real effective exchange rate in Tunisia are quite similar, we opt to substitute the nominal effective exchange rate in the benchmark model (e) with the real effective exchange rate variable (reer).

Figure5 reports the impulse responses of variables to one standard-error innovation over the period lasting from 1993M1 to 2000M1. Figure6 reports the impulse responses of variables to one standard-error innovation over the period lasting from 2000M1 to 2008M1. Innovation in Monetary policy variable is still reported in the forth column and the innovation in the exchange rate is in the third column.

(Insert fig.5 and fig.6 here)

Comparing figure 5 to figure 1 and figure 6 to figure 2, we, don't notice any difference. Thus we hold our first interpretation.

5. Summary of findings and conclusion

The vector autoregressive (VAR) framework has been widely used to analyze the effect of monetary policy shock. We used this framework to assess the effect of monetary policy shock (monetary easing) and exchange rate shocks (appreciation) on output and price in Tunisia. We used recursive VAR to estimate a monthly data over two different periods. The first period lasts from 1993M1 to 2000M1, and the second period lasts from 2000M1 to 2008M1. We developed

a four-variable model, as benchmark, consisting of industrial production as proxy for real output variation, Consumer Price Index as proxy for price, The narrow measure of money supply that consist of money plus demand deposit known as M1 to reflect monetary policy shock, and the nominal effective exchange rate to reflect exchange rate shock.

We found that in the first period, neither monetary policy shock, nor exchange rate shock has an effect on, both, output and price. In the second period, while monetary policy shock have an impact on output and not on price, the exchange rate shock have small impact on output and large impact on price. Results are in accordance with the economic and financial status in which monetary and exchange rate were conducted.

In the first period, the CBT did not have any influence on a large part of the CPI basket. CBT targets also did not provide real guidance to economic agents regarding expectations over the economy. The first period was characterized by uncertain monetary policies and changing objectives. CBT policy was indeed driven more by the fear of financial system instability and by the government needs and development strategy. Furthermore, in practice, the system has not systematically operated according to the rules of the monetary targeting policy followed during this period, and the targets have often been missed; the gap between M2 (and later M3) targets and observed values exceeded the 2% level in more than 60% of the time during the period 1987-2002. This gap even exceeded 8% during the years 1988, 1996 and 1999. CBT derives its targets on the basis of its staff experience, which is not enough, and has always published its targets months late behind their schedule (Boughrara A. 2004). These factors mean that CBT targets did not provide real guidance to economic agents regarding expectations over the economy during the first period.

In the second period, targeting growth of broad money and pursuing a tightly managed exchange rate regime have represented the core of the monetary policy framework. The banking system has been modernized and improved; nevertheless, there is a consensus calling for further and deeper reforms. The required minimum risk-weighted capital/asset ratio has been raised to 8%, consistent with the Basel Committee capital adequacy recommendations (CBT 2008). Thirteen of the country's fourteen banks conform to the ratio, compared with only two in 1993. Controlled and administrated price share also decreased, nevertheless, there is consensus calling for full liberalization before implementing inflation targeting. These factors may explain somehow why the results of our estimation are more significant in the second period. Further effort in term of price liberalization and strengthening the financial system could result in better results. Results were plausible and maintained in robustness checking cases.

Since Tunisia is attempting to move to new policy framework in term of monetary and exchange rate policies, the following point could be raised:

- The share of administered prices should be reduced significantly through price liberalization.
- Deeper reforms and strengthening of the financial system, especially banking sector, is crucial. This sector, which so far has been shielded against foreign competition and against major external risks, is likely to face stronger shocks in the coming future. Moreover, many fundamental macroeconomic and institutional preconditions for more flexible interest rates, exchange rates and capital movements are yet to be fulfilled. This includes stable, well governed, transparent and accountable institutions and convertibility of the local currency.
- Since innovation in the narrow measure of money supply (M1) has no effect on price, policy maker should choose other aggregate variable (i.e., M2, M3), or the right interest rate to successfully implement inflation targeting policy.
- Since output does not respond to an exchange rate shock, this finding raises the question about the effect of exchange rate shock on trade balance. Thus, on export and import. Further investigation is needed. To this end we will check the effect of exchange rate on Tunisian trade balance in the next chapter and see if there is a J-curve shape response.

In general, we believe that it's better to focus on price stability and let the exchange rate to be flexible. This could attract more capital inflow that is crucial for boosting investment and thus alleviate the unemployment rate that is the main problem in Tunisia. By focusing only on price stability, it's easier for monetary policy to achieve credibility highly needed in changing world and financial turmoil. To this end, financial institution and banking strengthening is a prerequisite. Furthermore, policy mix has been so far helpful, but greater independence for monetary policy is needed.

Table. 1: Checking lag length for VAR estimated over 1993M1-2000M1

VAR Lag Order Selection Criteria						
Endogenous variables: Y CPI M E						
Exogenous variables: C						
Sample: 1993M01 2000M01						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	696.4392	NA	2.05e-12	-15.56043	-15.44858	-15.51535
1	1122.640	804.5143	2.04e-16	-24.77843	-24.21919*	-24.55302*
2	1143.212	36.98356	1.84e-16*	-24.88118*	-23.87454	-24.47543
3	1152.165	15.29014	2.17e-16	-24.72281	-23.26878	-24.13673
4	1157.066	7.929725	2.82e-16	-24.47340	-22.57197	-23.70698
5	1169.843	19.52433	3.08e-16	-24.40097	-22.05214	-23.45422
6	1189.862	28.79077*	2.89e-16	-24.49127	-21.69505	-23.36420
7	1202.559	17.12011	3.23e-16	-24.41706	-21.17344	-23.10965

Table. 2: Checking lag length for VAR estimated over 2000M1-2008M1

VAR Lag Order Selection Criteria						
Endogenous variables: Y CPI M E						
Exogenous variables: C						
Sample: 2000M01 2008M01						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	706.7207	NA	1.63e-12	-15.79148	-15.67963	-15.74639
1	1106.290	754.2438	2.94e-16	-24.41102	-23.85177*	-24.18560
2	1133.976	49.77232*	2.27e-16*	-24.67362*	-23.66698	-24.26787*
3	1146.302	21.05168	2.48e-16	-24.59107	-23.13703	-24.00499
4	1151.900	9.056300	3.16e-16	-24.35730	-22.45587	-23.59089
5	1162.304	15.89838	3.65e-16	-24.23155	-21.88272	-23.28480
6	1175.666	19.21740	3.97e-16	-24.17227	-21.37605	-23.04519
7	1181.944	8.465044	5.13e-16	-23.95380	-20.71019	-22.64639

Table. 3: Variance decomposition (in %) 1993 M1-2000M1

Variance Decomposition of Y:					
Period	S.E.	$\mathcal{E}_{yt}$	$\mathcal{E}_{cpit}$	$\mathcal{E}_{et}$	$\mathcal{E}_{mt}$
3	0.033701	93.38186	2.771565	1.430868	2.415703
6	0.036596	93.22946	2.901025	1.377393	2.492124
12	0.038896	91.32007	5.109571	1.307950	2.262413
24	0.043319	74.89344	20.73937	1.379332	2.987854
Variance Decomposition of CPI:					
Period	S.E.	$\mathcal{E}_{yt}$	$\mathcal{E}_{cpit}$	$\mathcal{E}_{et}$	$\mathcal{E}_{mt}$
3	0.006251	0.432892	99.40186	0.037955	0.127295
6	0.009061	0.224908	98.30232	0.860037	0.612733
12	0.012980	0.386030	95.21450	2.087344	2.312129
24	0.017836	0.747168	90.47014	3.027607	5.755086
Variance Decomposition of E:					
Period	S.E.	$\mathcal{E}_{yt}$	$\mathcal{E}_{cpit}$	$\mathcal{E}_{et}$	$\mathcal{E}_{mt}$
3	0.008745	2.906472	11.90713	84.75545	0.430952
6	0.009486	4.578318	13.84584	79.86538	1.710462
12	0.010080	7.501933	15.99232	72.28982	4.215933
24	0.010484	9.863468	15.87630	67.11067	7.149563
Variance Decomposition of M:					
Period	S.E.	$\mathcal{E}_{yt}$	$\mathcal{E}_{cpit}$	$\mathcal{E}_{et}$	$\mathcal{E}_{mt}$
3	0.026638	3.762586	0.920737	0.383183	94.93349
6	0.034245	5.310143	1.068415	0.236423	93.38502
12	0.043735	7.236255	2.247194	0.154586	90.36196
24	0.054986	7.992025	7.916452	0.214965	83.87656

Table. 4: Variance decomposition (in %) 2000M1-2008M1

Variance Decomposition of Y:					
Period	S.E.	$\mathcal{E}_{yt}$	$\mathcal{E}_{cpit}$	$\mathcal{E}_{et}$	$\mathcal{E}_{mt}$
3	0.028097	94.49803	2.401796	0.372626	2.727549
6	0.030432	93.46249	2.397395	0.638986	3.501132
12	0.032487	88.33896	2.360543	1.880507	7.419991
24	0.034458	80.72591	2.413997	5.616255	11.24384

Variance Decomposition of CPI:					
Period	S.E.	$\mathcal{E}_{yt}$	$\mathcal{E}_{cpit}$	$\mathcal{E}_{et}$	$\mathcal{E}_{mt}$
3	0.006068	0.121873	99.00276	0.560595	0.314776
6	0.008674	1.209845	92.63525	5.503844	0.651060
12	0.011289	4.753162	75.82906	18.66746	0.750313
24	0.015515	5.238668	65.06644	29.23144	0.463453
Variance Decomposition of E:					
Period	S.E.	$\mathcal{E}_{yt}$	$\mathcal{E}_{cpit}$	$\mathcal{E}_{et}$	$\mathcal{E}_{mt}$
3	0.013083	0.403372	3.947506	95.48445	0.164675
6	0.015000	1.289888	5.216165	91.29488	2.199068
12	0.019255	1.926340	27.69136	63.69223	6.690074
24	0.026071	1.305372	46.40499	43.36839	8.921255
Variance Decomposition of M:					
Period	S.E.	$\mathcal{E}_{yt}$	$\mathcal{E}_{cpit}$	$\mathcal{E}_{et}$	$\mathcal{E}_{mt}$
3	0.021009	2.670323	5.281473	14.72609	77.32212
6	0.026430	3.776590	4.388219	22.01629	69.81890
12	0.032688	5.070683	5.884414	32.49063	56.55428
24	0.042765	5.069391	20.80444	39.46600	34.66017

Table. 5: Over identifying restriction test results

period	Chi-square statistics	P-value
1993M1-2000M1	2.168619	0.1409
2000M1-2008M1	0.216259	0.6419

Fig.1: Impulse responses of variables to one standard-error innovation (benchmark VAR model estimated over 1993M1-2000M1)

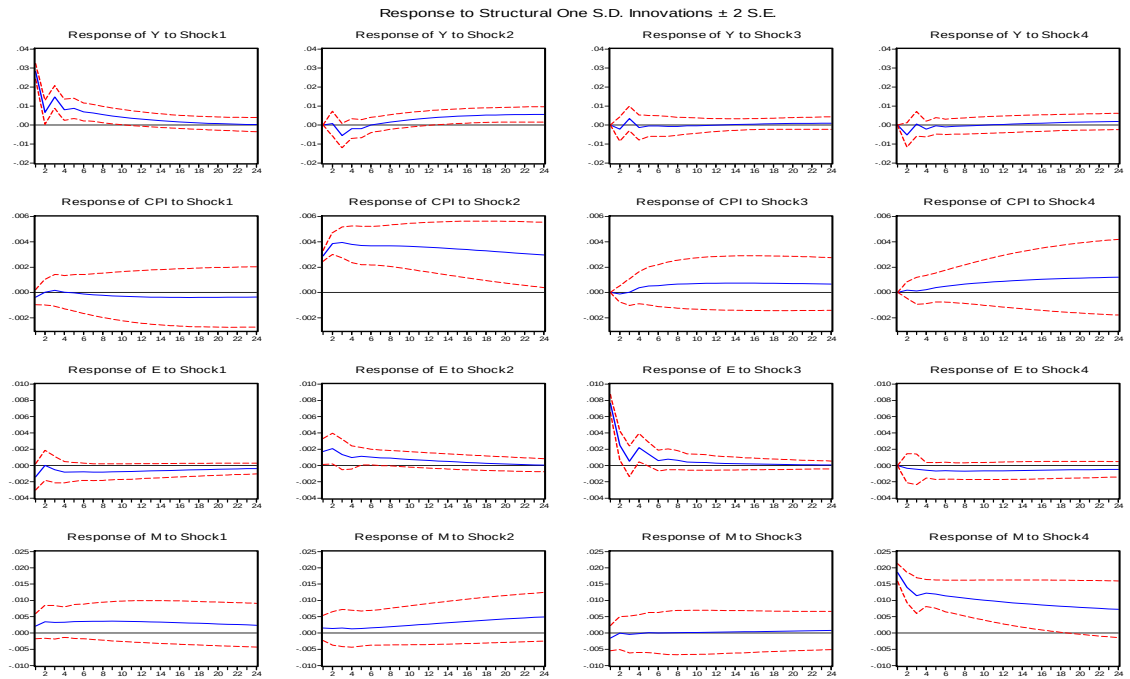


Fig.2: Impulse responses of variables to one standard-error innovation (benchmark VAR model estimated over 2000M1-2008M1)

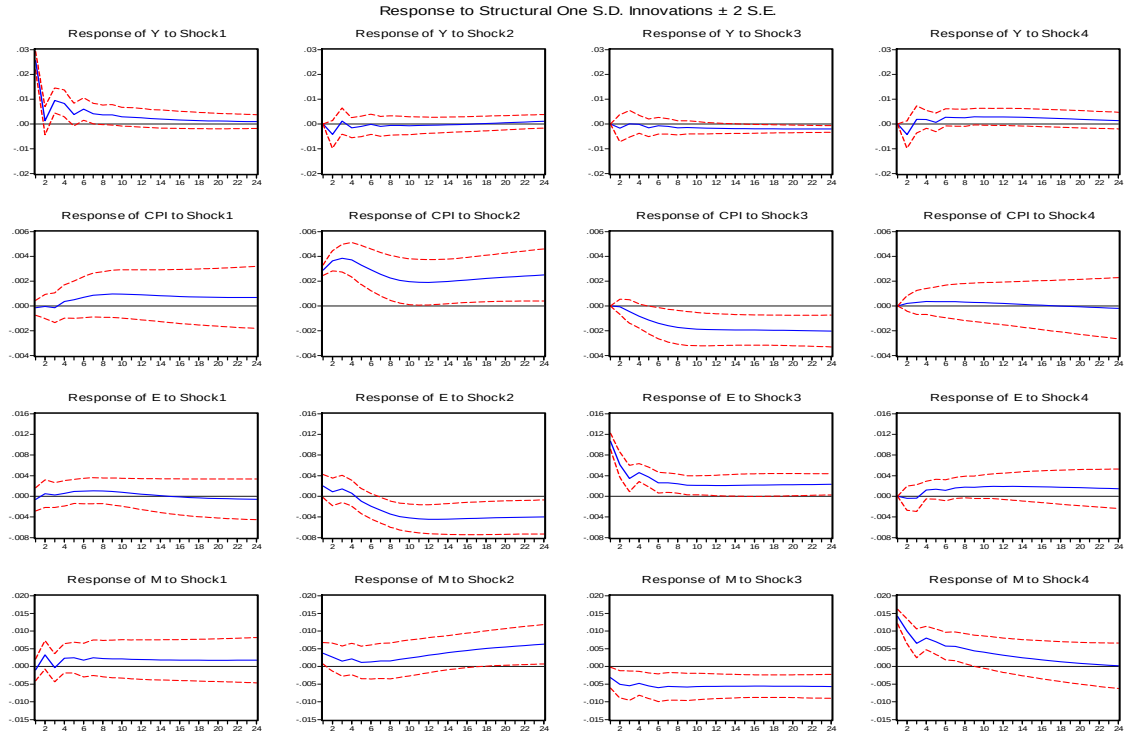


Fig.3: Impulse responses of variables to one standard-error innovation (CPI included in the first place in the variables ordering in the benchmark model estimated over 1993M1-2000M1)

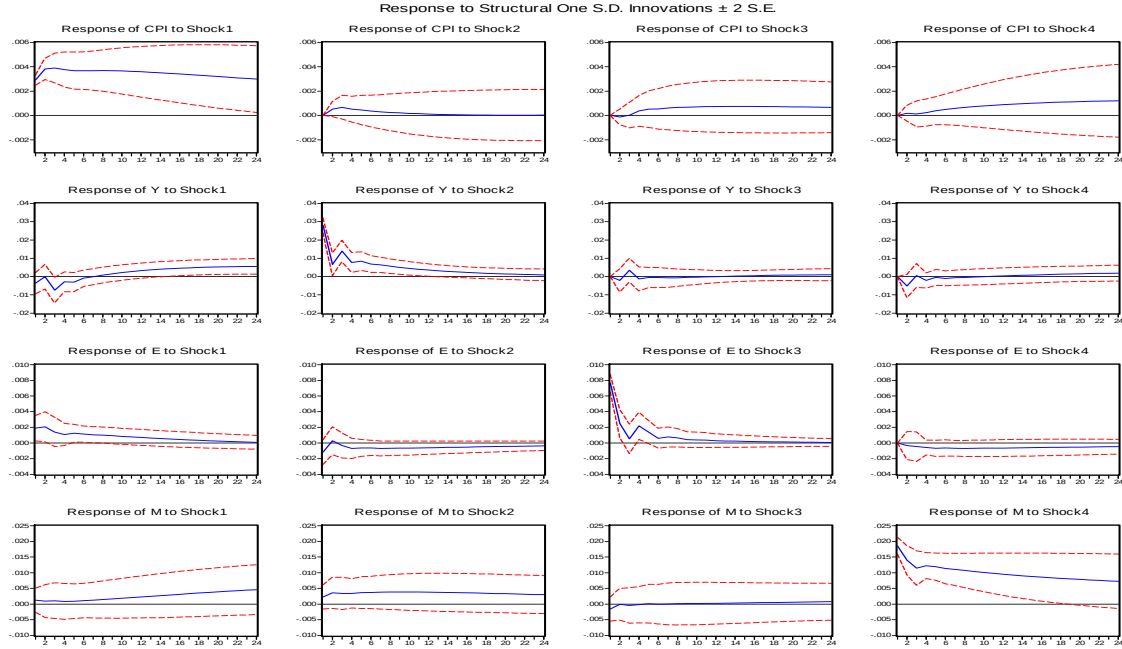


Fig.4: Impulse responses of variables to one standard-error innovation (CPI included in the first place in the variable ordering in the benchmark model estimated over 2000M1-2008M1)

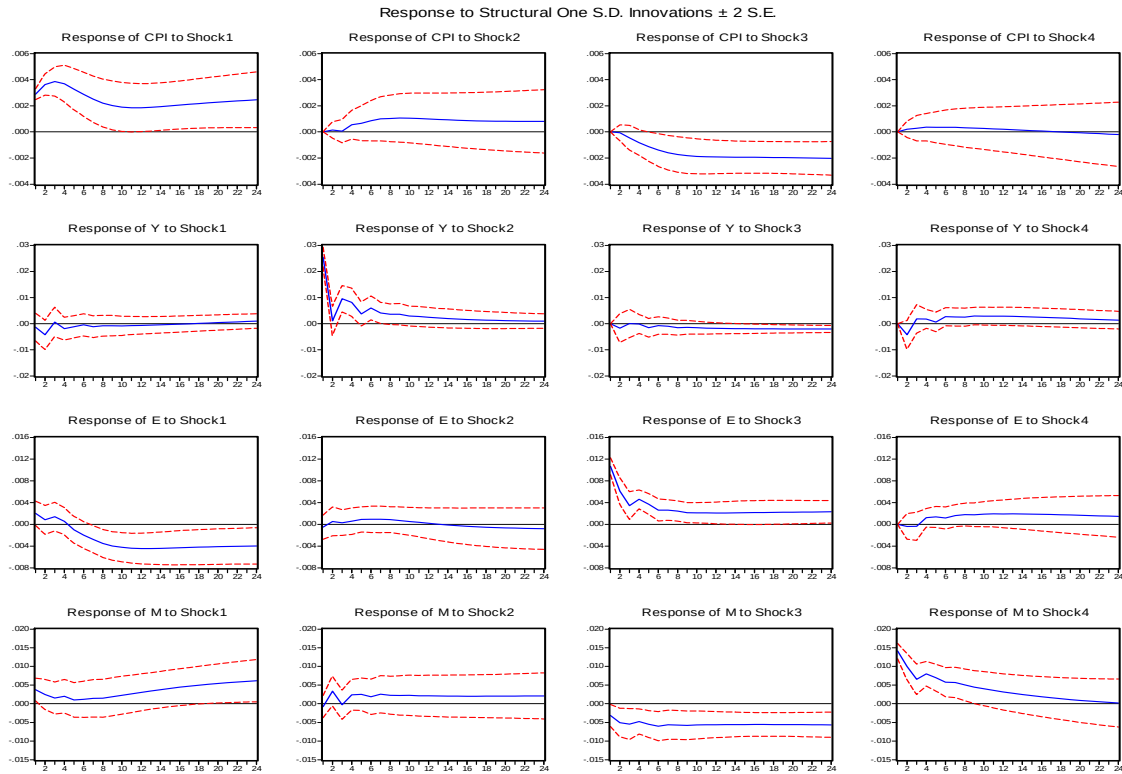


Fig.5: Impulse responses of variables to one standard-error innovation (REER included instead of NEER in the benchmark VAR model estimated over 1993M1-2000M1)

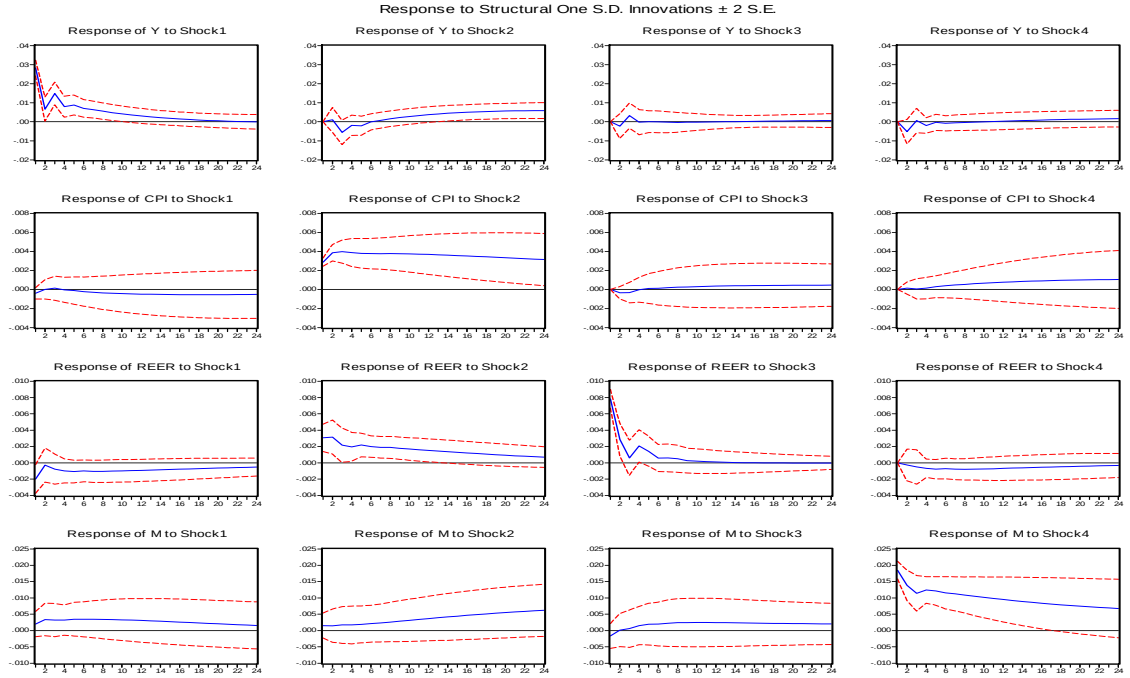


Fig.6: Impulse responses of variables to one standard-error innovation (REER included instead of NEER in the benchmark VAR model estimated over 2001M1-2008M1)

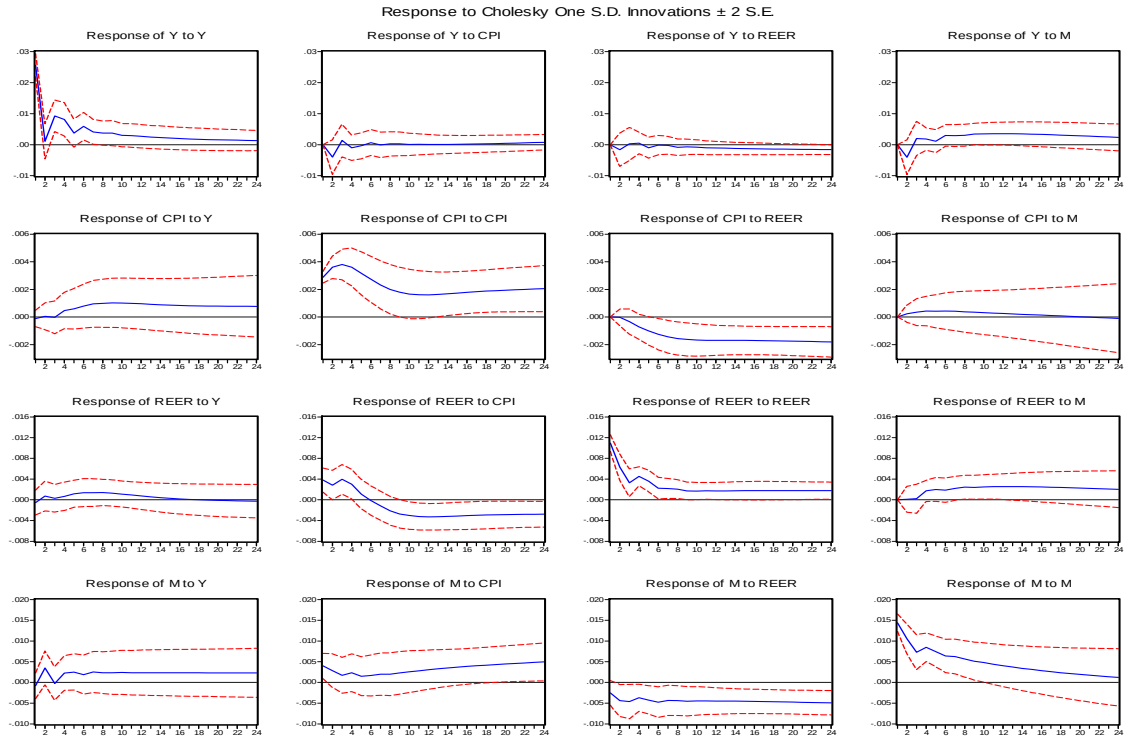


Fig.7: Plot of the variables used in benchmark model (from 1993M1 to 2000M1)

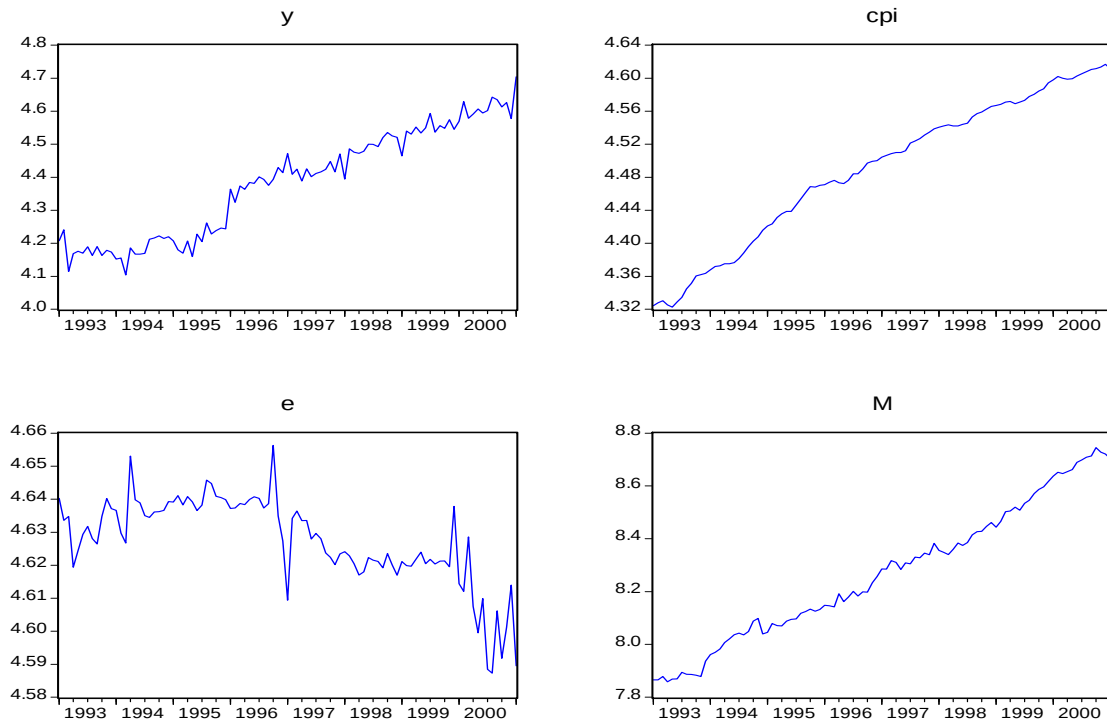


Fig.8: Plot of the variables used in benchmark model (from 2000M1 to 2008M1)

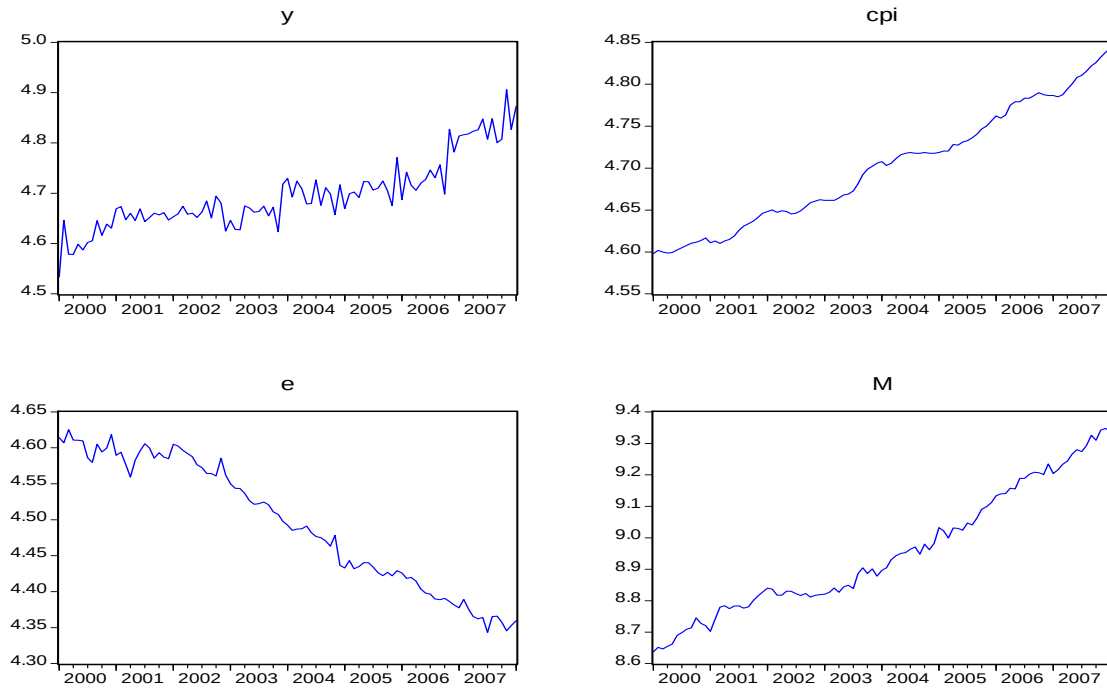


Fig.9: Plot of the trend of nominal effective exchange rate (e) and real effective exchange rate (reer) over the first period (from 1993M1 to 2000M1)

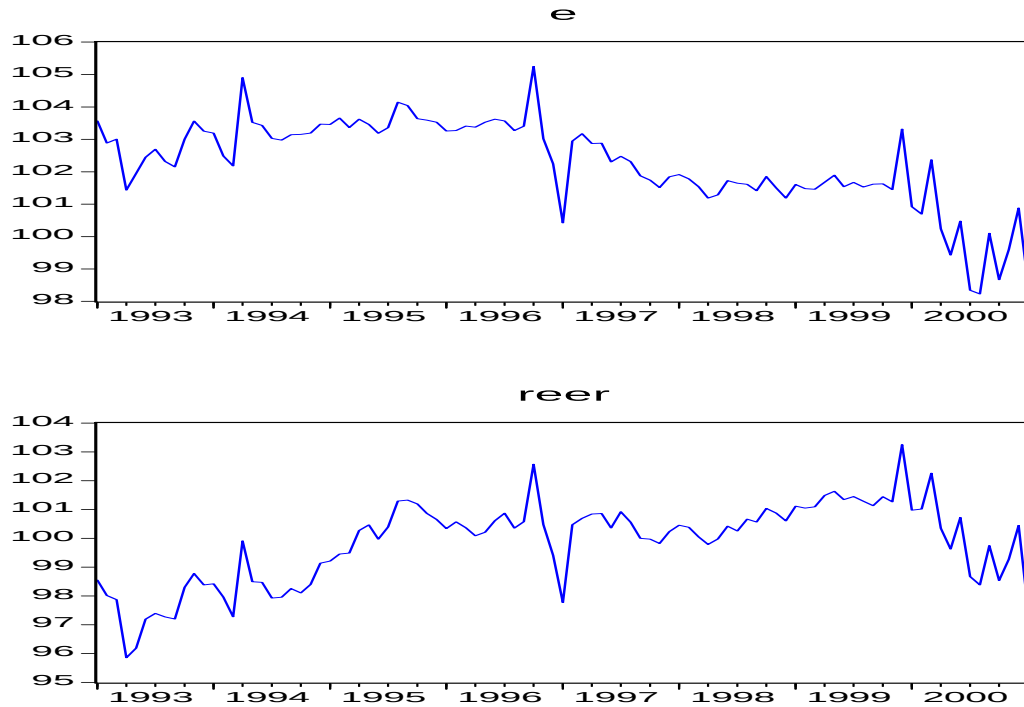
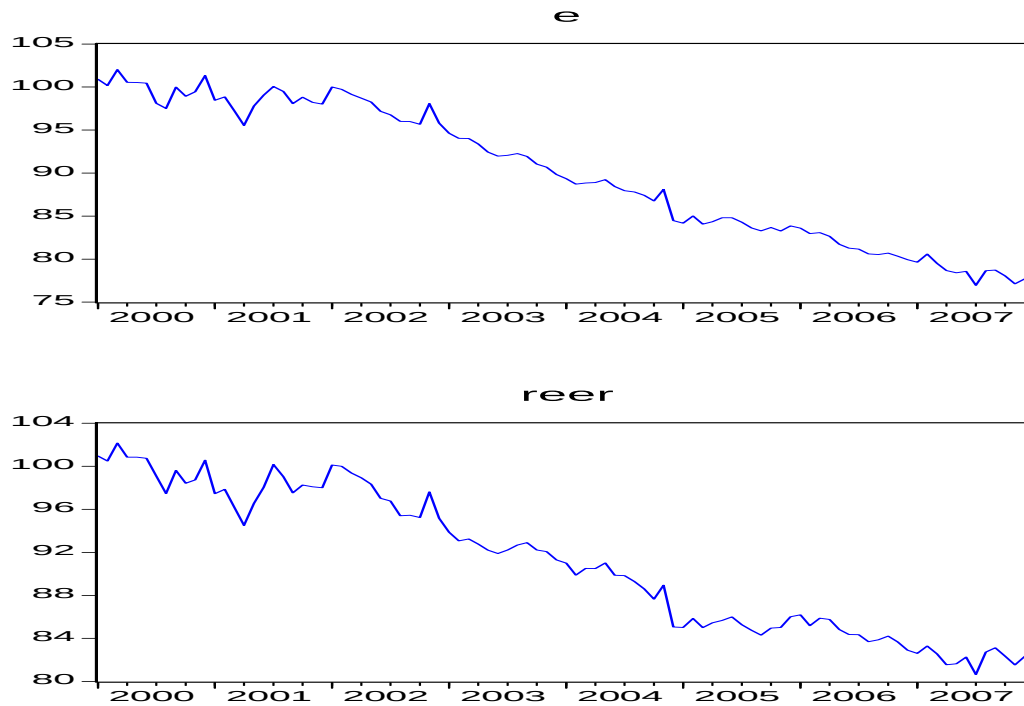


Fig.10: Plot of the trend of nominal effective exchange rate (e) and real effective exchange rate (reer) trend over the second period (from 2000M1 to 2008M1)



Chapter 3

Effect of Exchange Rate Shock on Tunisian Trade Balance

1. Introduction

Tunisia has recently signed several regional preferential trade agreements, including the Association Agreement with the European Union, the Agreement on the Greater Arab Free Trade Area (GAFTA), the Arab-Mediterranean Free Trade Agreement, the Free Trade Agreement with EFTA, the Maghreb Arab Union Agreement, and bilateral agreements (Tunisia information online). These agreements seem to have an impact on Tunisian economic variables and increase the vulnerability of financial system to external shocks. However from the previous chapter we found that exchange rate shock has a modest effect on output. This raises the question about the effect of exchange rate shock on Tunisian trade balance. We will try to answer this question in the current chapter.

A change in the exchange rate has two effects on trade flows: price effect and volume effect. The price effect implies that currency depreciation (appreciation) will cause imports to be more expensive (cheaper) and domestic exports to be cheaper (more expensive) for foreign buyers at least in the short run. Since the volume of goods imported and exported might not change drastically in the short run, the trade balance may initially deteriorate (improve). However, the volume of trade changes eventually in response to the depreciation. In other words, the price effect is generally believed to dominate the volume effect in the short run. In the long run, however, if the Marshall-Lerner condition holds, the volume effect takes over and reverses the effect, and the trade balance improves (deteriorates). Thus, in response to exchange rate depreciation (appreciation), the trade balance gauged in local currency worsens (improves) in the impact period, and then improves (worsens). The total effect when plotted over time with trade balance on the y-axis will yield a J-curve shape.

This conventional wisdom on the J-curve has been widely called into question. Overall the evidence suggests that the J-curve is not an empirical regularity. For some countries, the J-curve effect predominantly applies, for some it does not.

The objectives of this work are twofold: first, to examine the effects of exchange rate changes on the Tunisian trade balance; and secondly, to check the existence of a J-curve phenomenon.

Since the exchange rate policy and the regional integration of Tunisian economy are reviewed in the first chapter, they will not be reviewed here. Thus, the rest of the chapter will be organized as follows: Section 2 summarizes theoretical and empirical findings concerning the effects of

exchange rate changes on the trade balance. Section 3 outlines the methodology and the model identification strategy. Section 4 reports the empirical results. Last section is reserved for a summary of findings and concluding remarks.

2. Review of theoretical and empirical findings concerning the effects of exchange rate changes on the trade balance

There are several theories regarding the relationship between the exchange rate and the trade balance. The most conventional are the elasticity, absorption, and monetary approaches.

The elasticity approach put forward by Bickerdike (1920), Robinson (1947), Metzler (1948), commonly known as the *BRM model*, says that a nominal devaluation improves the trade balance in the long run, although the short run effects may be adverse (famous J-curve hypothesis). The effect of devaluation on trade balance depends on the elasticity of exports and imports. This is so called particular solution of the *BRM condition*, known as the *Marshall-Lerner condition* (Marshall (1923), Lerner (1944)). This condition states that for a positive effect of devaluation on the trade balance the absolute value of the sum of import and export demand elasticities must exceed unity. The BRM model and Marshall-Lerner conditions have become the underlying assumptions for those who focus on the exchange rate as the major determinant of the trade balance, and support the hypothesis that devaluation or depreciation increase exports by making exports relatively cheaper, and discourage imports by making imports relatively more expensive, thus improving trade balance.

The absorption approach, which emerged at the beginning of 1950s (Meade (1951), and Alexander (1952, 1959)) shifted attention towards balance of payments (trade balance) and macroeconomic effects of reducing domestic absorption relative to production. It states that the trade balance is affected by the rise of domestic and world incomes. Increase in home income would lower the trade balance due to increased demand for imports while a rise in foreign incomes is led to an increase in the demand for the country's exports. However, it was revealed in recent years that adverse trade balance response to the rise of domestic incomes is not so certain *a priori*, as a rise of domestic incomes can increase both the demand for the country's imports and the country's exports if the latter have been supply constrained. Moreover if the rise of domestic incomes stems from an increase in the production of import-substitute goods, imports may decline.

The monetarist approach (Mundell (1962), Dornbusch (1973) Frenkel and Rodriguez (1975) considers a balance of payments as essentially a monetary phenomenon. It posits that a deficit of the balance of payments as a result of excess demand for goods, services and assets in fact is determined by an excess supply or demand of the stock of money. This implies that devaluation

or depreciation decreases the real supply of money thus improving both the balance of payments and the trade balance.

The textbook explanation of J-curve goes as follows; following real depreciation, volumes of exports and imports would not change much as the export and import contracts are usually made several months in advance. But the real depreciation will make the predetermined level of imports to cost more in domestic currency units, thus value of imports rise where the value of exports do not change much, which will worsen the trade balance immediately after the real depreciation. However as time passes by both producers and consumers will be more responsive and quantities start to adjust to the change in relative price of domestic goods and hence trade balance start to improve. The response of the trade balance through time then forms the famous J shape. Of course implicit in this discussion is the assumption that in the short-run elasticities are sufficiently low and in the long-run elasticities are sufficiently large, or in the long-run Marshall-Lerner condition holds.

The short-run and long-run relationships between the trade balance and exchange rate have been subject to many empirical studies. Here a brief overview is provided of methodologies and results of the literature for developed and emerging economies. This will demonstrate that the variety of results, often for identical countries, may stem from empirical evidence being extracted from different time periods and different methodologies.

Developed countries, especially the United States, have received most of the attention in this field of research. In their seminal paper, Rose and Yellen (1989) employ disaggregated, bilateral trade data and do not find support for the J-curve effect nor evidence of a long-run relationship in the case of U.S. data for the period 1960 to 1985. Demirden and Pastine (1995) employ Sim's VAR methodology and demonstrate in a simple empirical example that feedback effects in a flexible exchange rate environment may be significant, resulting in a J-curve effect.

On the other side, Marwah and Lawrence (1996) find evidence of an S-curve for both Canada and the United States utilizing disaggregated data in OLS regression for the period 1977 to 1992. According to their results, the trade balance initially declines after depreciation, followed by a trade balance improvement - the typical J-curve effect. However, after several quarters there seems to be a tendency for the trade balance to worsen.

Furthermore, Bahmani-Oskooee and Alse (1994) tested 41 developed and less developed countries for the existence of cointegration and the J-curve effect applying the Engle-Granger two-step procedure. The results indicated that the trade balance and real effective exchange rate are co-integrated for only fourteen countries. In the countries exhibiting cointegration, there was some evidence of the J-curve effect. Gupta-Kapoor and Ramakrishnan (1999) analyzed the

impact of the yen appreciation on Japanese trade balance data with respect to seven major trading partners employing a VECM. The estimated impulse response function indicated the existence of a J-curve for Japan. Jung and Khosrow (1998) obtained similar results for Japan. In conclusion, evidence seems to suggest that the J-curve is an empirical phenomenon, i.e. it may or may not be found in a given country.

The preponderance of evidence, so far, suggests that the United States does not exhibit such short-run import and exports elasticities leading to a J-curve effect. Support for a stable long-run relationship between the U.S. trade balance and its determinants are mixed. Japan, on the other hand, is an example of trade elasticities that do result in the J-curve phenomenon.

Recently, an upsurge of research has occurred relating to less developed countries, predominantly emerging Asian markets. Baharumshah (2001) employs an unrestricted VAR model for the bilateral trade balances of Thailand and Malaysia with the United States and Japan for the period 1980 to 1996. He finds support for a stable and positive long-run relationship between trade balance and the exchange rate. The evidence on the short-run response of the trade balance supporting the J-curve effect is mixed. A delayed J-curve seems to apply to Thai data, whilst no support for the J-curve was found in Malaysian data. In addition, Bahmani-Oskooee and Kantipong (2001) tested on disaggregated data the J-curve between Thailand and her main trading partners Germany, Japan, Singapore, United Kingdom, and the United States for the period 1973 to 1997. They find evidence of the J-curve in bilateral trade with the U.S. and Japan only.

Upadhyaya and Dhakal (1997) test the effectiveness of devaluation on the trade balance for eight developing countries (Colombia, Cyprus, Greece, Guatemala, Mexico, Morocco, Singapore, and Thailand). Their empirical finding is contradictory to Baharumshah's findings regarding Thailand. They provide evidence that seems to suggest that only in the Mexican case devaluation improves the trade balance in the long-run. Bahmani-Oskooee (2001) investigated the long-run response of Middle Eastern countries' trade balances to devaluation by applying the Engle-Granger and Johansen-Juselius (1990) cointegration methodology. The evidence suggests that there exist a favorable long-run effect of a real depreciation on the trade balance for all six countries (Bahrain, Egypt, Jordan, Morocco, Syria, and Turkey). In the case of Morocco, this opposes the results obtained by Upadhyaya and Dhakal. Wilson (2001) examined the relationship between the real trade balance and the real exchange rate for bilateral merchandise trade between Singapore, Korea and Malaysia with respect to the United States and Japan. No evidence of a J-curve effect was found, with the exception of Korean trade with the United States. In the case of Turkey, Akbostanci (2002) finds support for a favorable long-run relationship between the exchange rate and the trade balance. The generalized impulse response function indicates in the short-run an S-shaped trade balance response to devaluation. This view

with respect to the positive long-run relationship is supported in Bahmani-Oskooee (2001). However, Kale (2001) obtains conflicting results, providing evidence of a negative long-run impact of devaluation on the trade balance. In the short-run Kale finds evidence of a delayed J-curve effect.

In the Tunisian case, Marial et al. (2006) examined the effect of exchange rate changes on the bilateral trade balance vis-à-vis the US and Japan, and attempted to check whether this effect produces a J-curve phenomenon. The study employs the Johansen cointegration and error-correction model on the annual data lasting from 1970 to 2003. In general, in cases of Tunisia/US, they observed some kind of delayed J-curve effects in which, following the currency devaluation, trade balances experience short-term improvement first that lasts for about one year. However, in cases of Tunisia/Japan, no clear evidence of the J-curve phenomenon was found.

Overall, the evidence suggests that the J-curve is not an empirical regularity. For some countries, the J-curve effect predominantly applies, for some it does not.

3. Methodology and model identification strategy

In most of the studies done so far on the J-curve, attention is paid only to the direct effect and not to the feedback effect. The effect of a depreciation of the exchange rate on the trade balance shows the direct effect of the depreciation. However, feedback effects arise from a one-time change in exchange rate which will have an impact not only on the balance of trade, but also on the future exchange rate, which will in turn affect the balance of trade and so on. Furthermore, there are additional feedback effects from other endogenous variables, such as domestic income and foreign income. These feedback effects (which could be linear or non-linear) have to be captured to analyze the dynamics of the J-curve. A vector autoregression (VAR) and the impulse response function will take these feedback effects of the exchange rate fluctuations into account.

Before estimating a VAR, we first carry out diagnostic tests for unit roots of the selected variables. If the series have unit roots in levels, then first differencing usually makes them stationary. If the variables are individually $I(1)$, then the existence of a stationary relationship among the variables implies that they are cointegrated. If a VAR in first difference is estimated, the model would still be misspecified because variables in levels contain useful information for forecasting beyond what is contained in a finite set of lagged changes in the variables alone (Hamilton, 1994: 573). On the other hand, a vector error correction (VEC) model which introduces the restrictions implied by the long run relationship would be appropriate.

Data

To assess the effect of real exchange rate shock on Tunisian trade balance, we estimated a VAR model with monthly data over two periods. The first period lasts from 1993M1 to 2000M1, and the second period lasts from 2000M1 to 2008M1. We developed a simple four-variable model, as benchmark, consisting of Euro Area industrial production as proxy for foreign output variation (y_f), Tunisian industrial production as proxy for domestic output variation (y), export/import ratio to reflect trade balance variation (Tb)⁸, and the real effective exchange rate (E) to reflect exchange rate shock. Data is taken from the IFS- CD⁹. Plot of the variables during first and second period are given in figures 8 and 9 respectively in the end of this chapter.

4. Estimation and empirical results

4.1 Unit root test

Both Augmented Dickey-Fuller (ADF) unit root test and Phillips-Perron unit root test were conducted on each variable to test for stationarity. The regressions were run with an intercept and time trend for level form, and only with intercept for first difference. Lags length were based on AIC, and SC criteria. As reported in Table 1 and table 2, the null hypothesis that there is a unit root in, both, “E” and “Tb” are rejected. These two variable are level stationary ($I(0)$). The other variables y_f , and y , become stationary upon their first difference.

4.2. Estimation of VAR based on unit root test result

Based on the unit root results, we included variables reflecting foreign and domestic incomes in their first difference form (“ dy_f ” and “ dy ” respectively). Trade balances (Tb) and real effective exchange rates were included in their level form (Tb and E respectively).

Fig.1 reports the impulse responses of the variables to one standard-error innovation over the period lasting from 1993M1 to 2000M1. Fig.2 reports the impulse responses of the variables to

⁸ The ratio of the value of export (line 70) and the value of import (line 71) is taken to express the trade balance. Taking the export-import ratio to represent trade balance is common in literature. One advantage is to allow one to take logs of trade balance, and then get growth rates (Brada, Kutan, and Zhou 1997). Another advantage of taking the export-import ratio is that it remains constant as units of measurement change. Indeed taking the difference between exports and imports to stand for trade balance demands the use of a deflator to reckon real trade balance. Yet this gauge is sensitive to alternative deflators. By contrast, the export-import ratio is able to represent either nominal or real trade balance (Bahmani-Oskoei 2001).

⁹ IFS data code: y_f (66czf), y (64zf), export (70zf)/import (71zf), Reer(RE czf), respectively. All series are seasonally adjusted using X12, taken in logarithm.

one standard-error innovation over the period lasting from 2000M1 to 2008M1

(Insert fig.1 and fig. 2 here)

In our study, real exchange rate shocks reflect an increase in the real effective exchange rate (appreciation). The response of all variables to this shock is illustrated in the last column of each figure. To assess the effect of this shock on trade balance during each period, and to check whether there is any different effect over both period, we will try to interpret the charts located in the third row, last column of fig.1 and fig.2.

The impact of exchange rate on trade balance variation seems to be marginal over both periods. It is of different sign; While in the first period, we observe that exchange rate shock (appreciation) slightly improved the trade balance, in the second period we observe that a similar shock generate a small deterioration of the trade balance.

For both periods, the response of Tunisian trade balance to real exchange rate appreciation is not consistent with the conventional wisdom of J-curve. This latter implies that in response to exchange rate appreciation, the trade balance gauged in local currency improve in the impact period, and then worsens. The total effect when plotted over time with trade balance on the y-axis will yield a J-curve. Thus we conclude that this phenomenon does not hold.

Because the other variables seem to have no effect on each others, we further estimated a recursive VAR which will be considered as our benchmark model. In this benchmark model all variables are estimated in their level form. Robustness check will also be carried.

4.3. Benchmark model: recursive VAR where all variables are estimated in level form

4.3.1. Methodology and model specification

We developed a four-variable model consisting of foreign output (yf), domestic output (y), Trade balance (Tb), and real effective exchange rate (E) where all variable are estimated in their level form.

Consider the following system of equations:

$$\sum_{s=0}^p A_s X_{t-s} = A(L)X_t = \varepsilon_t, \quad (1)$$

Where $A(L) = A_0 - A_1L - A_2L_2 - \dots - A_pL_p$ is a p th-order lag polynomial, $A_s (s = 0, 1, \dots, p)$ is a four by four coefficient matrix, $X_t = (yf_t, y_t, Tb_t, E_t)'$ and $\varepsilon_t = (\varepsilon_{yft}, \varepsilon_{yt}, \varepsilon_{Tbt}, \varepsilon_{Et})'$, a four by one vector of serially uncorrelated structural disturbance with a mean zero and covariance matrix Σ_ε .

As is widely known, the structural form of a model cannot be estimated without additional information; the sampling information contained in the reduced form of Eq.(1) is not sufficient to estimate all of the parameters in A_0 . Therefore, the need for identifying restrictions arises. In order to identify A_0 , two identifying restrictions are made. The covariance matrix of the structural disturbances are assumed to be orthogonalized, so that with the appropriate normalization, $\Sigma_\varepsilon = I$, and the matrix A_0 is assumed to be lower triangular. These two assumptions are also known as the Choleski factorization of the VAR.

The VAR model above can be recovered from a corresponding reduced-form VAR using Cholesky decomposition of the reduced-form covariance matrix. For the empirical analysis at hand, the assumption that A_0 is lower triangular is critical. This 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 plus 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 ordering of the variables has important implications for the identification of the shocks. In this paper, the ordering was chosen on the basis of the speed with which the variables respond to shocks.

Putting Tunisian output in the first place is logic since it has no effect on foreign output within a month. Since Tunisian authority are conducting an exchange rate targeting in the first period and managed float exchange rate in the second they care about exchange rate stability. Thus we put the exchange rate variable in the last place in the model. Putting the real exchange rate at last reflects that exchange rate reacts without delay to all other shocks, but disturbance to this exchange rate have no contemporaneous effect on the other variables. This set of restriction just-identifies the structural model, so that we may not be able to test the validity of assumptions. To this end, we will add some short run restrictions and perform over-identification restriction test to test the validity of our identification scheme statistically. Furthermore, as a robustness check we will change the ordering of the variables and see if the results holds.

The lag length is set to 3 in the reduced form estimation.¹⁰

4.3.2. Interpretation of the impulse responses of the benchmark model over both periods

Figure3 reports the impulse responses of variables to one standard-error innovation over the period lasting from 1993M1 to 2000M1. Figure4 reports the impulse responses of variables to one standard-error innovation over the period lasting from 2000M1 to 2008M1

In our benchmark model, real exchange rate shocks reflect an increase in the real effective exchange rate (appreciation). The responses of all variables to this shock are illustrated in the last column. To assess the effect of this shock on trade balance during each period, to check whether there is any difference between them, and to check if a J-curve phenomena holds, we will try to interpret the charts located in the third raw, last column of fig.3 and fig.4 and compare between them.

(Insert fig.3 and fig.4 here)

Similar to our previous finding, the impact of exchange rate on trade balance variation seems to be marginal for both periods, and of different sign. While in the first period exchange rate shock (appreciation) generate small improvement in trade balance, a similar shock in the second period generates small immediate deterioration of the trade balance.

As for the first period, price effect seems to dominate the volume effect in the short run. The price effect implies that currency appreciation will cause imports to be cheaper and domestic exports to be more expensive for foreign buyers at least in the short run. Since the volume of goods imported and exported might not change drastically in the short run, the trade balance may initially improve. In the long, it seems that volume effect does not take over and reverses the price effect. The reason behind this could be attributed to the level of trade restriction over this period.

As for the second period, it seems that the volume effect takes over the price effect even in the short run. This could be explained by the degree of trade liberalization undertaken by Tunisian government which signed several regional preferential trade agreements, including the Association Agreement with the European Union, the Agreement on the Greater Arab Free

¹⁰ The Akaike Information criteria (AIC), Schwarz Information Criteria (SC), and the Hannan-Quin are the information criteria used for model selection such as determining the lag length of the VAR; the smaller the value of the criteria, the better is the model. All of them indicated that the best lag length is of order 2 .

Trade Area (GAFTA), the Arab-Mediterranean Free Trade Agreement, the Free Trade Agreement with EFTA, the Maghreb Arab Union Agreement, and bilateral agreements (Tunisia information online). Given the location of Tunisia vis-à-vis its main trading partner with whom it sign free trade agreement it seems that in response to exchange rate appreciation, the trade balance gauged in local currency worsens even in the impact period.

For both periods, the response of Tunisian trade balance to real exchange rate appreciation is not consistent with the conventional wisdom of J-curve. This latter implies that in response to exchange rate appreciation, the trade balance gauged in local currency improve in the impact period, and then worsens. The total effect when plotted over time with trade balance on the y-axis will yield a J-curve. Thus we conclude that this phenomenon does not hold for the Tunisian case

4.3.3. Interpretation of the variance decomposition

Table3 reports the variance decomposition of all variables for the period lasting from 1993M1 to 2000M1. Table4 reports the variance decomposition of all variables for the period lasting from 2000M1 to 2008M1. Because the share of every shock in the variation of every variable seems not to change after a period of two years, we report variation decomposition only over 24 months period.

(Insert tables 3 and table 4 here)

The share of exchange rate shock in the variation of different variables is given in the last column. Our main focus is to check the share of exchange rate shock on trade balance variation during the tow estimated periods and answer if there is any difference between them. Thus, we will try to analyze the last column of trade balance variance decomposition (3rd component of each table) over both periods.

The share of exchange rate shock on trade balance variation seems to be very small, especially in the first period where it does not exceed 5%. This share increased to 14.36% over the second period. This could be attributed to the level of trade liberalization undertaken by Tunisian authorities. Further trade liberalization may result in a more large response of trade balance to exchange rate shock. Thus, while attempting to move towards floating exchange rate regime, Tunisian authorities have to take in account the effect of exchange rate shock on trade balance, given that an appreciation that is not expected have a persistent negative effect on trade balance.

4.3.4. Robustness check

Over-identifying restriction test

The recursive identification scheme implied in our model implies that A_0 becomes lower triangular and the ordering in the VAR determine the degree of exogeneity of the variables. The assumption that A_0 is lower triangular is critical. This set of restrictions just-identifies the structural model, so that we may not be able to test the validity of assumptions. If the model is over-identified by adding some restriction, it is possible to test the validity of our identification scheme statistically. To this end, we further impose a short-run restriction that foreign output does not affect the real effective exchange rate contemporaneously. This implies that the last row, first column of A_0 matrix is set to be zero. Adding this restriction enables us to perform over-identifying restriction test. As indicated in table 5, the chi-square statistics was 0.013845 with p-value equal 0.9063 for the first period and 0.304141 with p-value equal 0.5813 in the second period. These reported chi-square statistics indicate that the hypothesis that over-identifying restrictions are valid is not rejected by conventional significance levels. The restrictions including our just-identified assumptions are statistically plausible.

Trade balance is included in the bottom of the ordering

To check robustness of our benchmark results, we attempt, to change the ordering of variables included in the model. We assumed that trade balance could react within a month to exchange rate shock, given the location of and integration of Tunisia economy vis-à-vis its trading partners. To this end, we included the trade balance (Tb) in the bottom of the ordering. Figure5 reports the impulse responses of variables to one standard-error innovation over the period lasting from 1993M1 to 2000M1. Figure6 reports the impulse responses of variables to one standard-error innovation over the period lasting from 2000M1 to 2008M1.

(Insert fig.5 and fig.6 here)

Exchange rate shock now is given in the third column. The response of trade balance to exchange rate shock is given in the last row, third column chart in each figure. Comparing the charts of fig.5 to the one of fig.3 and the charts of fig.6 to the one of fig.4 we don't notice any change of the response of trade balance to real exchange rate shock. The other responses of other variables to different innovation are unchanged as well. Thus, all our previous interpretations still hold for the new estimation system.

Taking export value and import value separately

To check the effect of exchange rate on export (X) and import (M) separately, we included these variables instead of trade balance (Tb) in the benchmark model. The five variables are included in the following ordering: foreign output (yf), domestic output (y), import (M), export (X), and real effective exchange rate (E) and were estimated in their level form over both periods. Their

impulse responses to a one standard-error innovation over first and second period are given in fig.7 and fig.8 respectively. The exchange rate shock effect on each variable is given in the last column of each figure.

(Insert fig.7 and fig.8 here)

The export response to a real exchange rate shock is given in the fourth row, last column of fig.7 and fig.8. The import response to a real exchange rate shock is given in the third row last column of fig.7 and fig.8. We observe that exchange rate shock has immediate impact on both imports and exports value. Interestingly enough, we observe that export and import respond with the same sign to a real exchange rate shock over each period. While they respond by an increase in the first period, they respond by a decrease in the second period. The reason behind the sign of the response could be attributed to the type of imported goods. Tunisia is a major exporter of consumer goods and a major importer of intermediate products which it processes into finished products for export. Since export and import respond with a similar sign to a real exchange rate shock, then the total impact on trade balance is minimized.

5. Summary of finding and concluding remarks

To examine the effects of exchange rate shock (appreciation) on the Tunisian trade balance; and to check the existence of a J-curve phenomenon, we developed a four-variable VAR model. The estimation was carried on monthly data, over two periods. The first period lasts from 1993M1 to 2000M1, and the second period lasts from 2000M1 to 2008M1.

The effect of exchange rate shock on Tunisian trade balance seems to be marginal. We found that in the first period exchange rate shock generates a small improvement in the trade balance. However in the second period a similar shock generate a small immediate deterioration of the trade balance. The marginal effect of exchange rate shock on Tunisian trade balance could be explained by the fact that exports and imports respond with the same sign to an exchange rate shock. This latter finding is attributed to the type of Tunisian imported goods. Since Tunisia is major importer of intermediate products, which it processes into finished products for export, the demand for these products seems to follow the trend of exports. Thus, some part of trade balance worsening due to real exchange rate shock (appreciation) seems to be offset by the decrease in the demand for foreign intermediate goods.

Although there is a marginal response of trade balance to real exchange rate shock, we observed that: In the first period, the price effect seems to dominate the volume effect in the short run. In the long run, it seems that volume effect does not take over and reverses it as is widely recognized in macroeconomics. This latter fact could be attributed to several trade restrictions implemented by Tunisian authorities during this period. In the second period, it seems that the

volume effect dominates the price effect even in the short run. This could be explained by the degree of trade liberalization undertaken by Tunisian government which signed several regional preferential trade agreements.

For both periods, the response of Tunisian trade balance to real exchange rate appreciation is not consistent with the conventional wisdom of J-curve. This latter implies that in response to exchange rate appreciation, the trade balance gauged in local currency improve in the impact period, and then worsens. The total effect when plotted over time with trade balance on the y-axis will yield a J-curve. Thus we conclude that this phenomenon does not hold for Tunisian case.

Table. 1: Unit root test of variables over the first period(1993m1-2000M1)

Null Hypothesis: variable has a unit root

Variables	ADF	Philip-Perron
	Constant, linear trend	Constant, linear trend
	test statistic	test statistic
E	-4.469426*	-4.408624*
Tb	-7.056057*	-7.145238*
Yf	-2.358924	-1.337793
Y	-2.430067	-1.731549

* significant at 1% (null hypothesis is rejected)

(Test critical value 1%=-4.071006; 5%=-3.464198;10=-3.158586)

Table. 2: Unit root test of variables over the second period (2000M1-2008M1)

Null Hypothesis: variable has a unit root

Variables	ADF	Philip-Perron
	Constant, linear trend	Constant, linear trend
	test statistic	test statistic
E	-3.473283**	-3.383460***
Tb	-12.47859*	-12.37545*
Yf	-1.502486	-1.277702
Y	-1.280502	-1.354291

** significant at 5%

*** significant at 10%

Table. 3: Variance decomposition (in %) of variables included in the benchmark model estimated over 1993 M1-2000M1

Variance Decomposition of Yf:					
Period	S.E.	$\mathcal{E}_{yft}$	$\mathcal{E}_{yt}$	$\mathcal{E}_{Tbt}$	$\mathcal{E}_{et}$
3	0.013105	97.05703	0.158041	2.544897	0.240036
6	0.016950	94.76748	0.738377	4.341321	0.152826
12	0.022263	90.92899	3.122040	5.700188	0.248783
24	0.029862	82.78110	8.575741	7.515744	1.127410
Variance Decomposition of Y:					
Period	S.E.	$\mathcal{E}_{yft}$	$\mathcal{E}_{yt}$	$\mathcal{E}_{Tbt}$	$\mathcal{E}_{et}$
3	0.040136	1.392782	97.48827	0.301534	0.817412
6	0.049050	2.085166	93.22477	1.416580	3.273484
12	0.062694	6.131454	82.15916	4.595264	7.114117
24	0.081800	17.78007	65.03187	8.268731	8.919324
Variance Decomposition of Tb:					
Period	S.E.	$\mathcal{E}_{yft}$	$\mathcal{E}_{yt}$	$\mathcal{E}_{Tbt}$	$\mathcal{E}_{et}$
3	0.087886	0.021080	2.873786	95.21710	1.888036
6	0.089584	0.066547	3.096481	92.80215	4.034822
12	0.090349	0.186960	3.067850	91.90607	4.839125
24	0.090642	0.558107	3.075382	91.46284	4.903672
Variance Decomposition of E:					
Period	S.E.	$\mathcal{E}_{yft}$	$\mathcal{E}_{yt}$	$\mathcal{E}_{Tbt}$	$\mathcal{E}_{et}$
3	0.009150	0.192685	0.587659	5.421738	93.79792
6	0.010136	1.194442	0.617441	11.78371	86.40440
12	0.010782	4.517189	0.908475	14.32861	80.24573
24	0.011443	11.23160	2.195910	14.49724	72.07525

Table. 4: Variance decomposition (in %) of variables included in the benchmark model estimated over 2000M1-2008M1

Variance Decomposition of Yf:					
Period	S.E.	$\mathcal{E}_{yft}$	$\mathcal{E}_{yt}$	$\mathcal{E}_{Tbt}$	$\mathcal{E}_{et}$
3	0.010546	95.74651	1.397461	2.797909	0.058116
6	0.011750	90.69986	4.811647	3.989669	0.498821
12	0.013006	82.66835	9.899609	4.392572	3.039469
24	0.014451	72.11047	11.69344	3.951341	12.24475
Variance Decomposition of Y:					
Period	S.E.	$\mathcal{E}_{yft}$	$\mathcal{E}_{yt}$	$\mathcal{E}_{Tbt}$	$\mathcal{E}_{et}$
3	0.031484	4.506906	88.90974	5.724875	0.858476
6	0.036756	10.67740	79.89503	6.359485	3.068078
12	0.042677	15.50280	68.81576	5.814994	9.866453
24	0.050487	17.25398	53.15737	4.475875	25.11277
Variance Decomposition of Tb:					
Period	S.E.	$\mathcal{E}_{yft}$	$\mathcal{E}_{yt}$	$\mathcal{E}_{Tbt}$	$\mathcal{E}_{et}$
3	0.076370	8.945406	7.365928	81.49409	2.194578
6	0.078419	8.587615	9.239992	77.70508	4.467312
12	0.080268	8.336313	8.869627	74.19667	8.597385
24	0.083113	8.124987	8.289696	69.21967	14.36565
Variance Decomposition of E:					
Period	S.E.	$\mathcal{E}_{yft}$	$\mathcal{E}_{yt}$	$\mathcal{E}_{Tbt}$	$\mathcal{E}_{et}$
3	0.018236	0.983546	0.902483	1.166859	96.94711
6	0.024740	1.734103	0.517946	0.858903	96.88905
12	0.033185	2.723506	0.297546	0.657837	96.32111
24	0.043151	3.717165	0.225192	0.495868	95.56177

Table. 5: Over identifying restriction test results

period	Chi-square statistics	P-value
1993M1-2000M1	0.013845	0.9063
2000M1-2008M1	0.304141	0.5813

Fig.1: Impulse responses of variables to one standard-error innovation based on the unit root test (foreign and domestic income variables are estimated in their first difference, real exchange rate and trade balance are in level) ; VAR estimated over 1993M1-2000M1

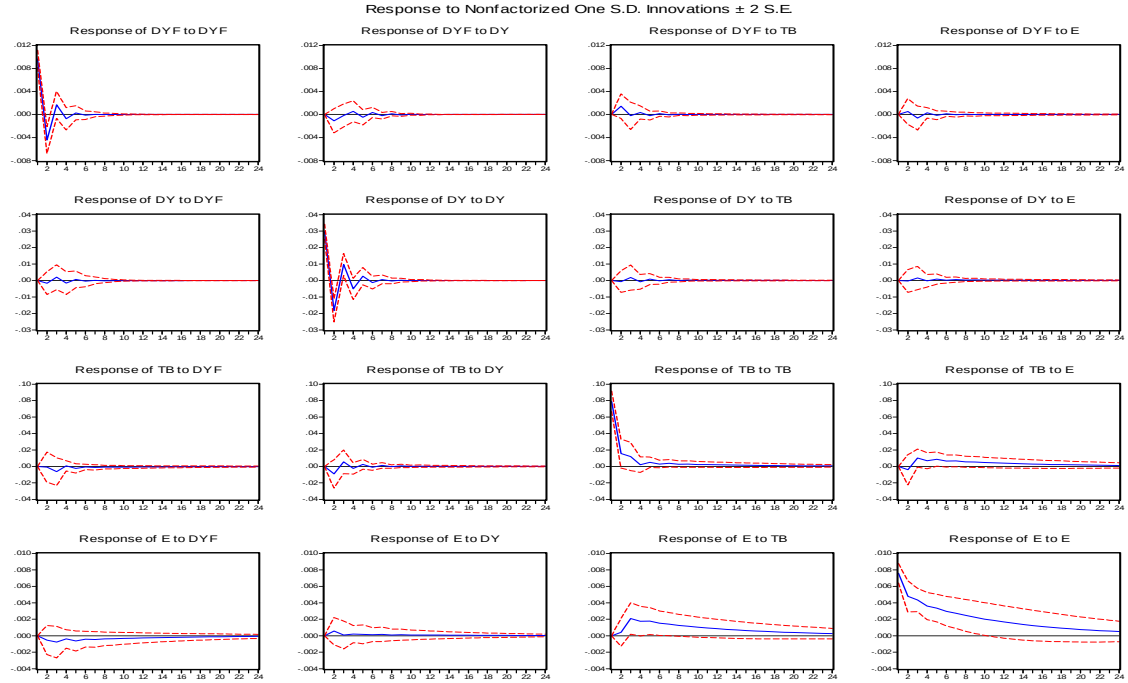


Fig.2: Impulse responses of variables to one standard-error innovation based on the unit root test (foreign and domestic income variables are estimated in their first difference, real exchange rate and trade balance are in level) ; VAR estimated over 2000M1-2008M1

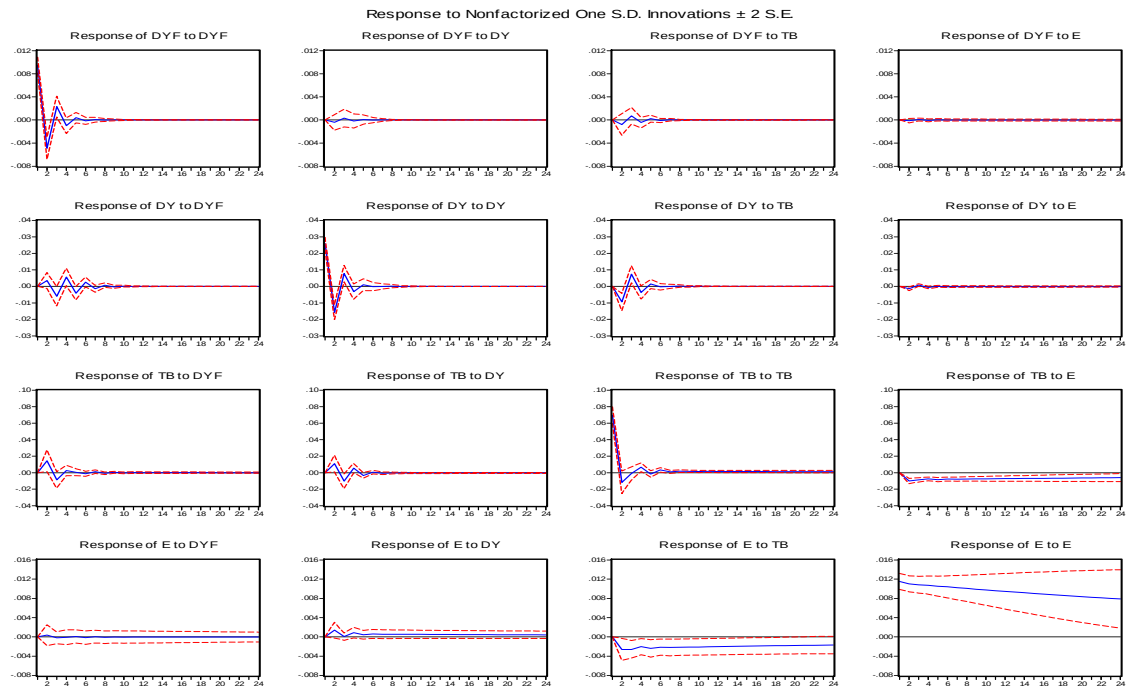


Fig.3: Impulse responses of variables to one standard-error innovation (*Benchmark model where all variable are estimated in level form*); VAR estimated over 1993M1-2000M1

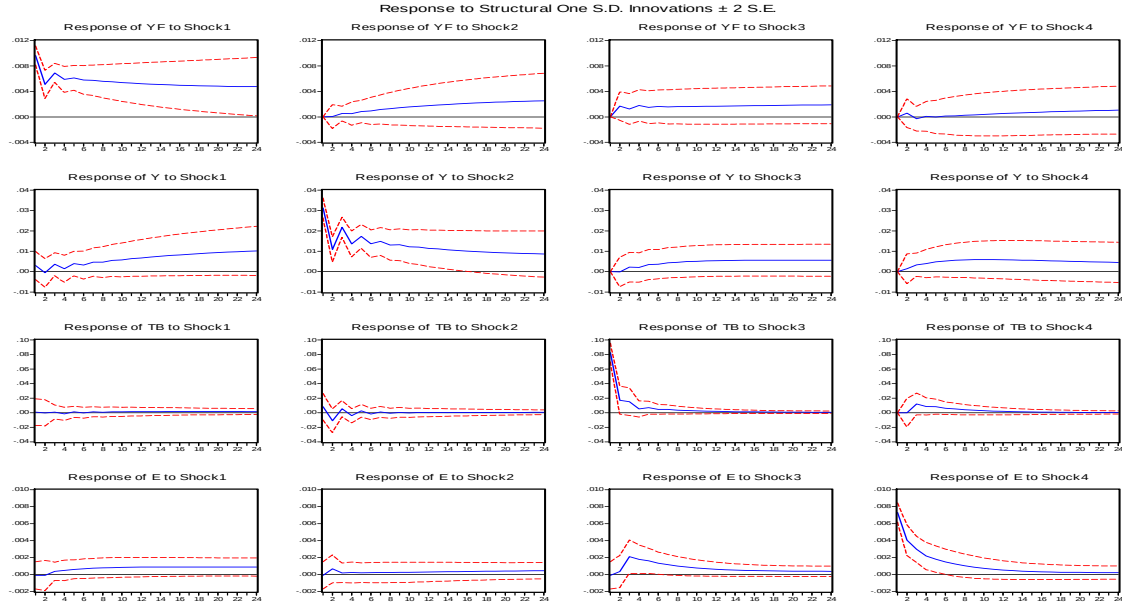


Fig.4: Impulse responses of variables to one standard-error innovation (*Benchmark model where all variable are estimated in level form*); VAR estimated over 1993M1-2000M1

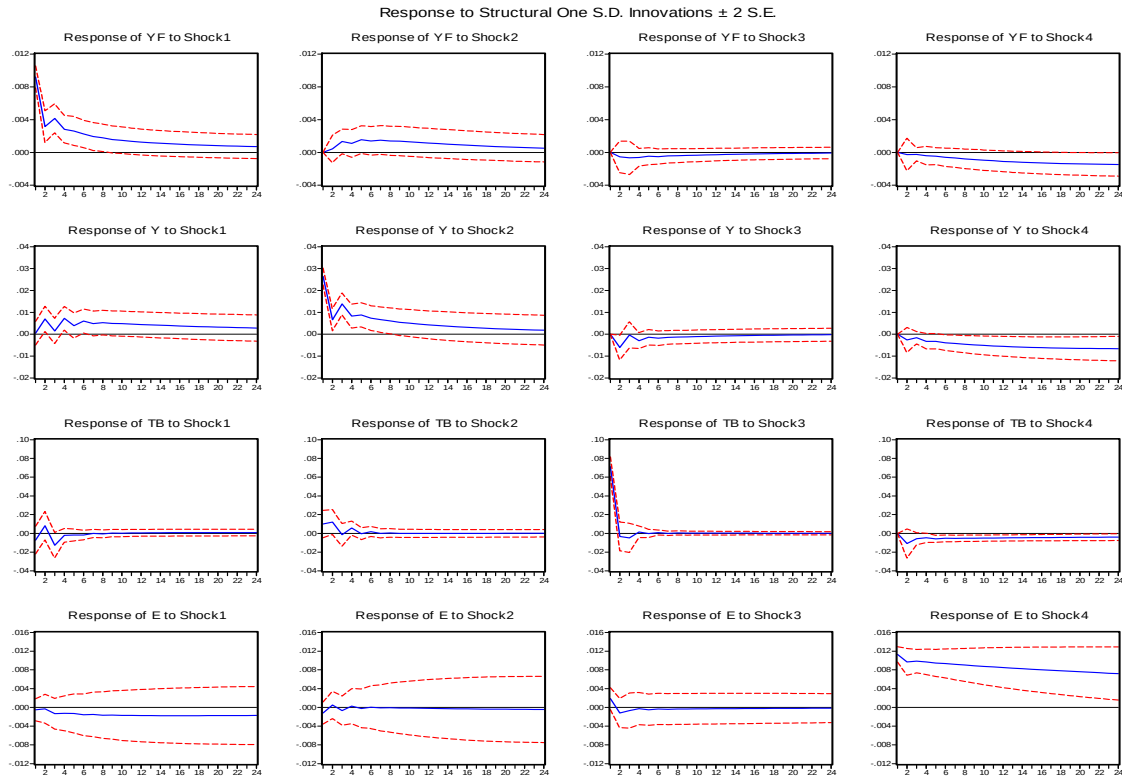


Fig.5. Impulse responses of variables to one standard-error innovation (*Tb* included in the bottom of ordering of variables included in benchmark model); VAR estimated over 1993M1-2000M1

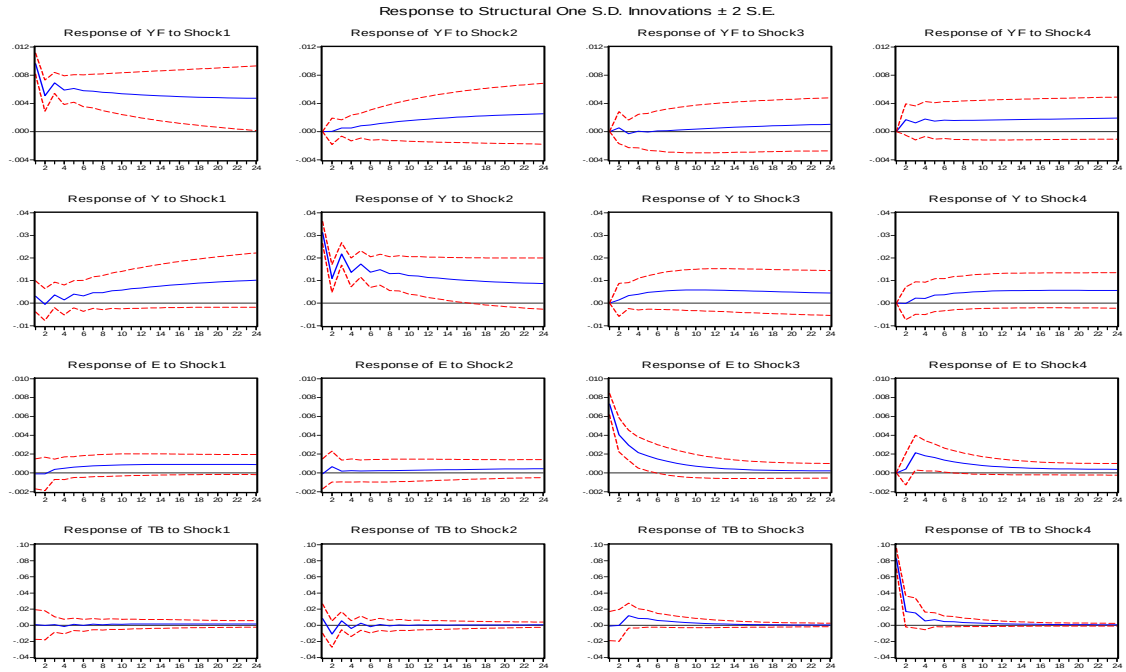


Fig.6: Impulse responses of variables to one standard-error innovation (*Tb* included in the bottom of ordering of variables included in benchmark model); VAR estimated over 2000M1-2008M1

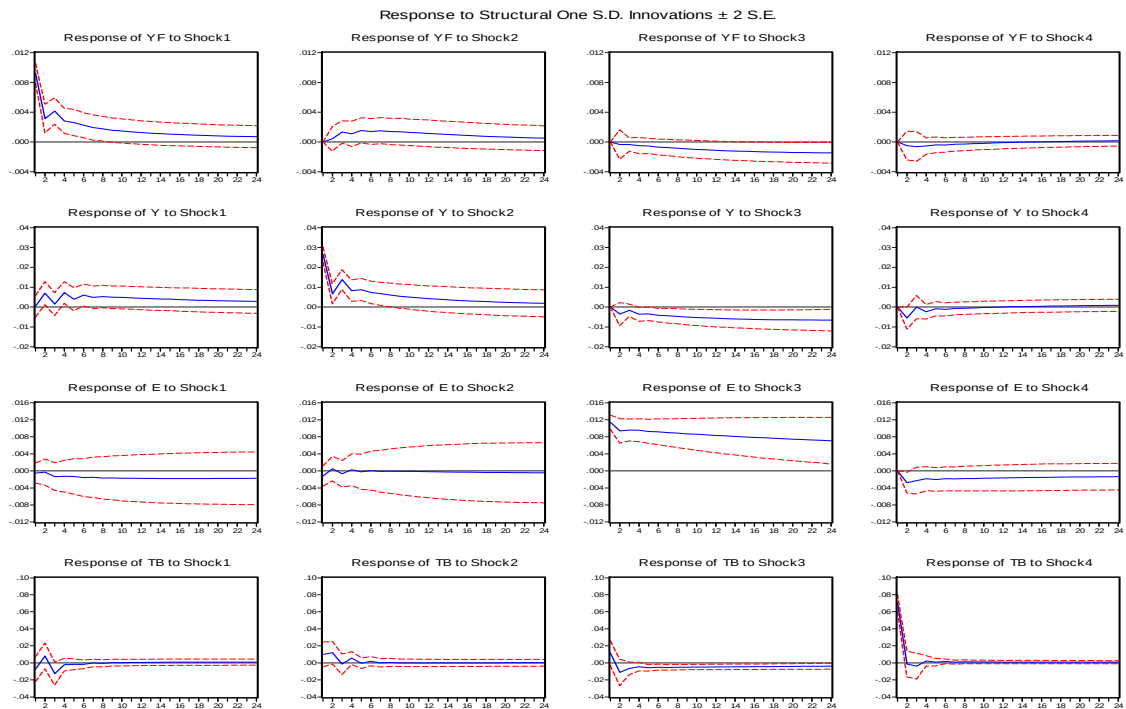


Fig.7: Impulse responses of variables to one standard-error innovation (*export and import are introduced instead of Tb in the benchmark model*); VAR estimated over 1993M1-2000M1

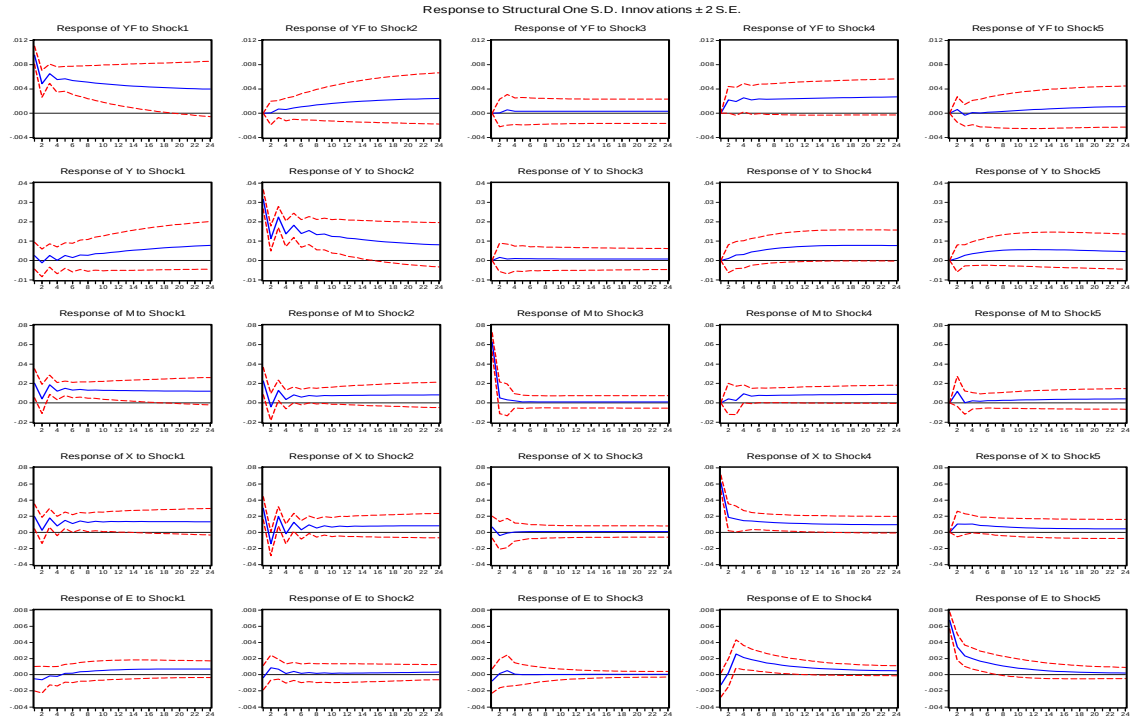


Fig.8: Impulse responses of variables to one standard-error innovation (*export and import are introduced instead of Tb in the benchmark model*); VAR estimated over 2000M1-2008M1

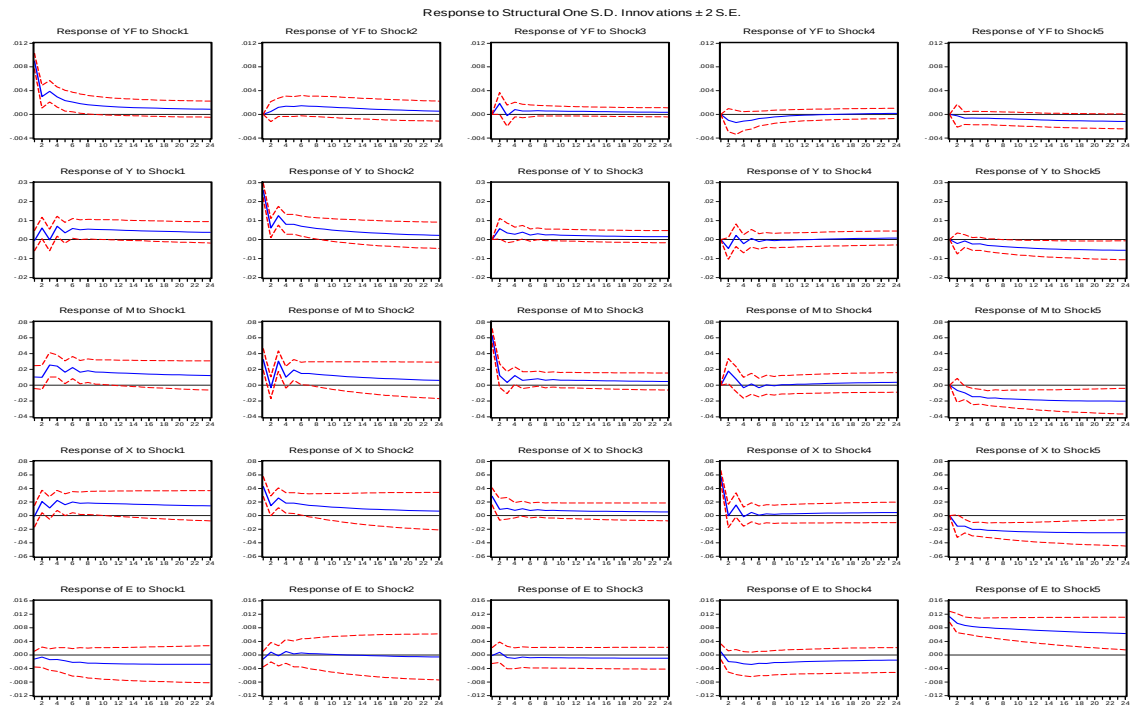


Fig.9: Plot of the variables during first period (lasting from 1993M1 to 2000M1)

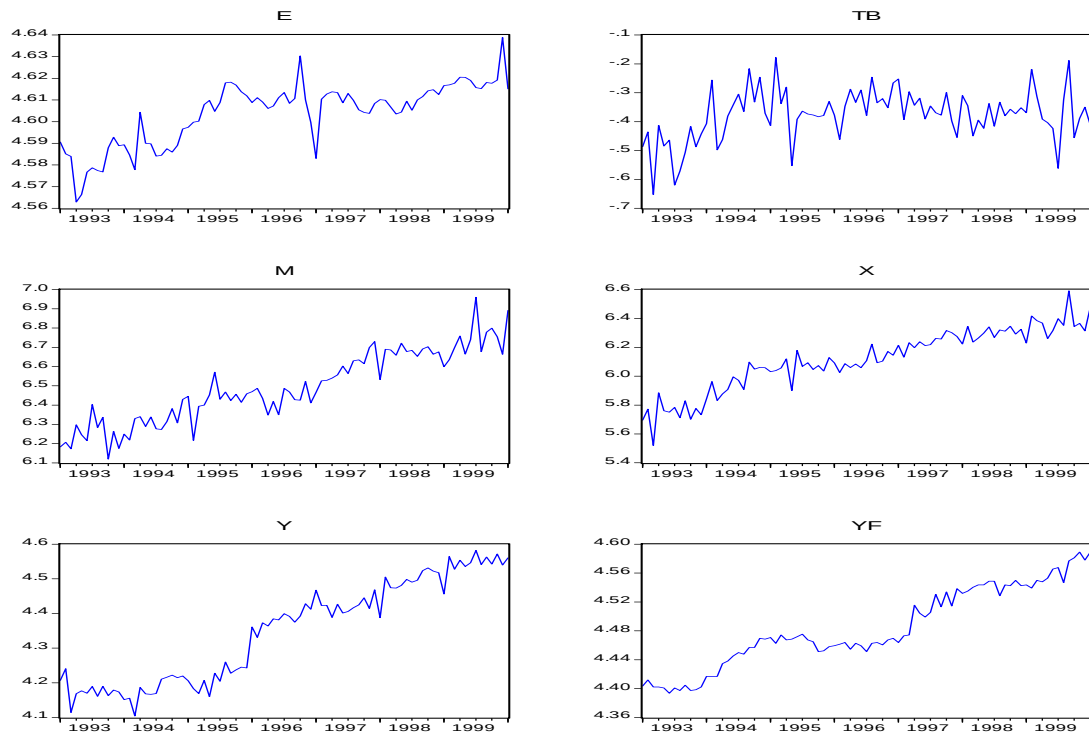
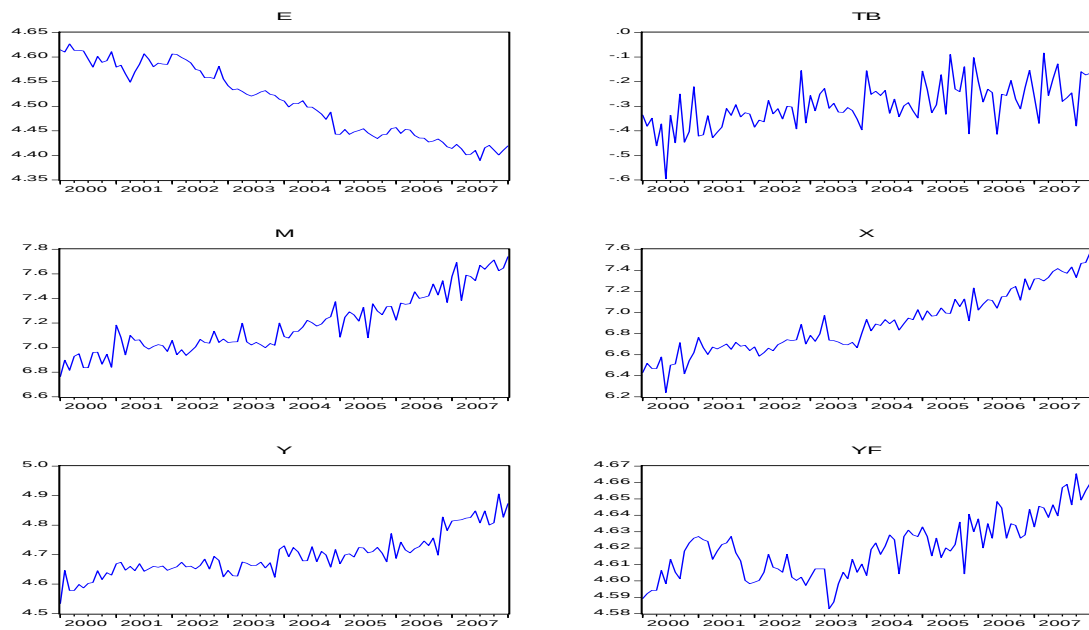


Fig.10: Plot of the variables during second period (lasting from 1993M1 to 2008M1)



Note: data is taken from IFS data code: Foreign output YF (66czf), Tunisian output Y(64zf), Tunisian export X (70zf), Tunisian import M (71zf), Real effective exchange rate E (RE czf). All series are seasonally adjusted using X12 and are taken in logarithm.

Chapter 4

Source of Real Exchange Rate Fluctuation in Tunisia

1. Introduction

Real exchange rate fluctuations play a key role in establishing the degree of competitiveness of the economy. In emerging economies, like Tunisia, real exchange rate fluctuation may influence inflation and output, and can have detrimental effects on the balance of payments. Broadly speaking, there are two different explanations for the sources of real exchange rate fluctuations. The first approach, termed the disequilibrium view, presumes that the largest part of exchange rate volatility can be attributed to financial market disturbances, or nominal shocks. The second approach, termed the equilibrium view, presumes that real exchange rates fluctuate so as to accommodate shocks to real macroeconomic variables, helping to bring about the necessary adjustments. In this chapter, we will try to answer whether nominal shocks or real shocks are major source of real exchange rate fluctuation in Tunisia?

The rest of the chapter is organized as follows: previous theoretical and empirical findings concerning the source of real exchange rate fluctuations are reviewed in section 2. Models specifications and their estimations results are reported in section 3. In this regard, the specifications of the bivariate model and its estimation results are given in section 3.1. The specifications of the trivariate model and its estimation results are given in section 3.2. Estimation results of the re-estimated trivariate model are given in section 3.3. Last section, section 4, is a brief conclusion where we summarize the main findings of the chapter.

2. Review of theoretical and empirical findings concerning the source of real exchange rate fluctuation

The volatile nature of exchange rate movements since the collapse of the Bretton Woods system of fixed exchange rates has led economists to consider these important questions: What are the sources of exchange rate fluctuations? Are monetary policy shocks the main factors? Do other macroeconomic shocks matter more? Numerous empirical studies have been done to answer these questions, however, they did not reach consensus on what is the major source of exchange rate fluctuations.

In recent floating period, real exchange rate fluctuations have gone almost step-in-step with nominal exchange rate changes and have consequently shown the same high level of persistence; the correlation between the two is near unity. These empirical regularities, which were extensively analyzed in an influential paper by Mussa (1986), among others, have become stylized facts of the exchange rate economics. Quite naturally, the question has arisen as to the sources of the higher real rate volatility under floating than under fixed nominal rates, and

specifically, as to whether it is the nominal exchange rate changes that drive real rate fluctuations or whether the causality chain is the reverse. Two contrasting views have been put forward on that question. On the one hand, Mussa (1986) pointed out that the substantial and systematic differences in the pattern of real exchange rate fluctuations contradict the hypothesis of nominal exchange rate regime neutrality. Rather, they are consistent with theories that contrast the “asset price” behavior of nominal exchange rates under floating with the relatively sluggish adjustment of national price levels under both floating and fixed rates.

In other words, Mussa advocates the so so-called “disequilibrium view” of exchange rate fluctuations, originally due to Mundell (1962), Fleming (1962) and Dornbusch (1976), stressing that it is the high volatility of nominal rates that drives the real exchange rates. In contrast, Stockman (1983) shows that the significant differences between the real exchange rate behaviors under fixed and flexible nominal rates can be explained without postulating the sluggishness of national price levels adjustment. Specifically, Stockman develops an equilibrium model of exchange rates that incorporates the nominal regime neutrality, but only under certain assumptions. Although his empirical findings confirm the statistically significant impact of the nominal regime on the real exchange rate volatility, he argues that this does not establish the direction of causality: the higher volatility of real rates under floating might simply reflect the fact that countries whose real exchange rates are subject to greater real disturbances are more likely to float their currencies (incidentally, this possibility was also acknowledged by Mussa). This is the so-called “real economy view”. Stockman (1988) further develops his equilibrium model of exchange rates, putting forward another argument in favor of the real economy view. The argument goes as follows. Real shocks alter real exchange rates as well as nominal exchange rates (under floating) or the level of international reserves (under pegged nominal rates). Obviously, disturbances that would lead to a real – and nominal, if prices are sticky – depreciation when the nominal rate is floating entails reserve losses under fixed rates. Faced with reserve losses that, if large enough, could create a balance of payments crisis and a forced devaluation, countries that choose a pegged exchange rate system are more inclined to impose trade restrictions, such as tariffs and quotas, or capital controls. Stockman argues that agents’ expectations of such policies tend to stabilize real exchange rate fluctuations. This effect alone, without the assumption of sluggish price level adjustment relative to the “asset price” behavior of nominal exchange rates, can account for the differences between the patterns of real rate behavior under alternative nominal regimes. As MacDonald (1998) notes, an important difference between the two views described above is the question of causality: whether it runs from nominal to real exchange rates, as postulated by the disequilibrium view, or the reverse, as the real economy view seems to posit. Closely connected with this issue is the question of the usefulness of a flexible nominal exchange rate as a shock absorbing instrument. The disequilibrium approach posits that the largest part of real exchange rate volatility under floating can be attributed to financial market shocks, or nominal shocks. The flexible nominal rate is

therefore a propagator of shocks that spring up from financial markets, particularly from foreign exchange markets. Consequently, fixing the parity would shield the real economy from such disturbances and thus prove beneficial with regard to macroeconomic stability. In contrast, the equilibrium approach presumes that real exchange rates fluctuations tend to accommodate shocks to real macroeconomic variables like output or employment. In other words, real (and, if prices are sticky, also nominal) exchange rates change so as to bring about rapid adjustment of relative prices in the face of real disturbances that call for such adjustment, acting as an equilibrating force when asymmetric, i.e. country specific real shocks occur. Accordingly, a country would find it relatively costly in terms of macroeconomic stability to give up nominal exchange rate flexibility, again provided that prices are sluggish.

The rapid development of methods of econometric analysis on the one hand and econometric software on the other since the end of the 1980s has brought about vast empirical literature on the sources of real exchange rate fluctuations. MacDonald (1998) distinguishes four alternative empirical approaches that seek to shed light on this question. The first involves an examination of the relationship between real exchange rates and real interest differentials, which should be present in the data if the propositions of the disequilibrium view hold. The second is to decompose the real exchange rate changes into permanent and transitory components, usually by means of the decomposition method pioneered by Beveridge and Charles (1981). The third approach, drawing upon the Balassa-Samuelson theorem, consists in decomposing real exchange rate fluctuations into parts due to changes in internal and external relative prices, i.e. movements in the relative price of traded to non-traded goods within countries and in the relative price of traded goods across countries. Finally, the fourth approach involves estimating a VAR model with (the change in) the real exchange rate as one of the endogenous variables and, using the long-run identification scheme developed by Blanchard and Quah (1989), decomposing real exchange rate movements into parts due to different structural shock types. In this paper we employ that last approach to investigate the sources of real exchange rate fluctuations in Tunisia

Lastrapes (1992), whose framework we employ in this paper, was among the first to analyze the sources of exchange rate fluctuations using the Blanchard and Quah (1989) approach. The variables in his bivariate VAR model are the rates of change in the real and in the nominal exchange rate. Lastrapes identifies two types of structural disturbances, of which one has no long-run impact on the real exchange rate level but can affect the level of the nominal rate, and one can influence the levels of both variables in the long run; he interprets the former as a nominal shock and the latter as a real shock. Lastrapes analyses six countries: the United States (US), Germany, the United Kingdom (UK), Japan, Italy, and Canada over the period 1973 to 1989, using monthly data. His results indicate that for all countries under scrutiny and at all frequencies, real shocks account for the major part of both real and nominal exchange rate

fluctuations, which is consistent with the real economy view.

Another seminal piece of work in this strand of literature is due to Clarida and Gali (1994). The authors develop a three-equation stochastic two-country, rational expectations open macro model that exhibits the Mundell-Fleming-Dornbusch properties in the short run when prices are sluggish to adjust. Based on the model, Clarida and Gali specify a trivariate VAR with the rate of change in the real output, in the real exchange rate and in the price level as endogenous variables. The three structural disturbance types that are identified are interpreted as real aggregate supply shocks (those which can influence the level of all three variables in the long run), real aggregate demand shocks (those which have no long-run impact on the real output level) and nominal shocks (those which only affect the price level in the long run). The analysis, based on quarterly data, covers four countries: Japan, Germany, the UK, and Canada (and implicitly the US, since all variables are measured relative to that country) over the floating period 1973 to 1992. The results suggest that in the former two countries nominal disturbances explain a substantial amount of the variance in the real exchange rate against the dollar, whereas in the latter two the real rate fluctuations are mainly driven by real demand shocks; real supply shocks play virtually no role in any of the countries under study. Hence, Japan and Germany seem to comply with the disequilibrium view of real exchange rate fluctuations, while the UK and Canada conform to the real economy view.

The models of Lastrapes (1992) and Clarida and Gali (1994) set a benchmark for researchers seeking to explain real exchange rate movements. Chadha and Prasad (1997) carry out the same analysis as in the latter study for the slightly later period 1975 to 1996, applying the trivariate VAR described above to quarterly data for Japan. Their findings confirm those of Clarida and Gali, with the important difference that the contribution of real supply shocks to real exchange rate fluctuations is larger and statistically significant at all forecast horizons.

The simpler two-dimensional model of Lastrapes (1992) has usually been adopted in studies of emerging rather than developed economies. One of important exceptions is the paper of Enders and Lee (1997), who apply this model to Canada, Germany and Japan relative to the US, using monthly data for the floating period 1973 to 1992. Their results are consistent with that of Lastrapes: real shocks account for the major part of both real and nominal exchange rate fluctuations. Chowdhury (2004) explores the sources of movements in real exchange rates against the US dollar in Chile, Colombia, Malaysia, Singapore, South Korea, and Uruguay, applying the model of Lastrapes to monthly data from 1980 to 1996. His conclusion, rather unusual for transition countries (see below), is that real shocks clearly dominate nominal shocks in all countries under scrutiny. Soto (2003) estimates a VAR with the rate of change in the real exchange rate of the Chilean peso against a basket of currencies and the interest rate differential between Chile and the international capital market (as proxied by LIBOR) on the basis of

monthly data from 1990 to 1999. The results show that in the longer run, real shocks account for the greater part of the real rate volatility; however, nominal shocks play an important role in the short run.

Several authors extend the VAR dimension and thus the menu of structural disturbances identifiable within this framework. Weber (1997) specifies a five-dimensional VAR with the labor input, the real output, the real exchange rate, the real money supply, and the price level and identifies five disturbance types: labor supply, productivity, aggregate demand, money demand, and money supply shocks. Applying the model to monthly data for the US vs. Germany, the US vs. Japan and Germany vs. Japan, spanning the period 1971 to 1994, Weber finds that the major part of the short-term volatility in the real exchange rates is attributable to demand shocks and a much smaller proportion to monetary shocks, while supply-side shocks play virtually no role.

Rogers (1999) also estimates a VAR with five endogenous variables (the rate of change in the real government spending, in the real income, in the real exchange rate, in the money multiplier, and in the real monetary base) and five innovation types (fiscal, supply, demand or preference, money multiplier, and monetary base disturbances), using over 100 years of annual data (1889-1992) for the US and the UK. In addition to the baseline model he tries several alternative specifications, embodying different assumptions about the effects of the various shock types. The results suggest that nominal disturbances, i.e. those to the money supply or the money multiplier, account for nearly 50 percent of the variation in the real exchange rate over short horizons; in the alternative models the contribution of these shocks amounts to at least 20%. A kind of stylized fact to emerge from this strand of literature is that real exchange rates of developed (low-inflation) countries are mainly driven by real or permanent shocks, whereas the movements in the real rates of emerging (high-inflation) economies are predominantly attributable to nominal or temporary shocks.

The above-discussed results of Rogers (1999), who argues that most studies understate the role of nominal shocks for real exchange rate fluctuations in industrial countries, are a notable exception. Importantly, Rogers stresses that the results of SVAR modelling are sensitive to specification. The sensitivity to specification can also be observed in studies of CEE economies. Dibooglu and Kutan (2000) were among the first to apply the structural VAR approach to study the sources of real exchange rate fluctuations in these countries. The authors specify a bivariate VAR with the rate of change in the real exchange rate and in the price level as endogenous variables, and identify two structural innovation types, one nominal (with no long-run impact on the real exchange rate) and one real. Using monthly data from 1990 to 1999 for Hungary and Poland, the authors find that real exchange rate movements are driven mainly by real disturbances in the former country and predominantly by nominal shocks in the latter country.

Borghijs and Kuijs (2004) focus on five CEE economies: the Czech Republic, Hungary, Poland, Slovakia, and Slovenia. Using monthly data covering the floating period in these countries (from 1993 or later to 2003), they estimate bivariate VAR models with the rate of change in the nominal exchange rate and in the real output as endogenous variables, and trivariate ones similar to that of Clarida and Gali (1994), with the difference that nominal exchange rates are used instead of prices. They find that the real exchange rates of all these countries are driven mainly by nominal shocks and conclude that the flexible nominal exchange rates have been propagators of such shocks rather than stabilization instruments.

In a larger study, Kontolemis and Ross (2005) analyze nine of the ten new EU member states (Malta is not included in the sample) over the period 1986 or later to 2003. They try several specifications: a bivariate VAR like that of Lastrapes (1992), a trivariate VAR like that of Borghijs and Kuijs (2004), and a four-dimensional model with the same variables as in the trivariate one and interest rates or, alternatively, credit to the private sector. In contrast to Borghijs and Kuijs, the results of Kontolemis and Ross indicate that real exchange rate fluctuations are predominantly due to real demand shocks, although the role of nominal shocks and in particular credit shocks is also significant over short horizons; in contrast, interest rate shocks have virtually no effect on real exchange rates. As can be seen from the above examples, results vary widely across studies, depending on the exact model specification and data used. Therefore, one has to be cautious when interpreting the findings of any specific model, especially when the conclusions are to be drawn upon when formulating policy recommendations.

Previous work concerning the source of real exchange rate fluctuation

Author	Time frame, Data Frequency and Sample	Variables and SVAR Specification	Sources of RERF
Bayoumi and Eichengreen (1992)	1953-1988; Annual G-7 countries	Real GDP and GDP deflator; Bivariate	Dispersion of supply shocks but not their magnitude
Lastrapes (1992)	1973-1989; Monthly USA, GER, UK, JAP, ITA, CAN	Real Exchange rate (RER) and Nominal Exchange Rate (NER); Bivariate	Real Shocks
Evans and Lothian (1993)	1975-1989; Monthly ITA, JAP, UK, GER	RER and price level Bivariate	Real Shocks
Chen and Wu (1997)	1981-1994; Quarterly JAP, Korea, Taiwan, Philippines	RER and Price level (CPI) Bivariate	Real Shocks
Enders and Lee (1997)	1973-1992; Monthly CAN, GER, JAP	RER and NER; Bivariate	Real Shocks
Lee and	1979-1994; Monthly	RER, Current account;	

Menzie (1998)	USA, CAN, UK,JAP, GER,FRA, ITA	Bivariate	Real Shocks
Dibooglu and Kutan (2001)	1990-1999;Monthly Hungary, Poland	RER and price level; Bivariate	Real Shocks in Hungary Nominal shocks in Poland
Soto (2003)	1990-1999;Monthly Chile	RER and interest rate differential; Bivariate	Real Shocks in the long run Nominal shocks in the short run
Borghijs and Kuijs (2004)	1993-2003;Monthly Czech Republic, Hungary,Poland, the Slovak Republic, and Slovenia	NER, REER,real output; Bivariate and trivariate	Nominal shocks
Chowdhury (2004)	1980-1996;Monthly Chile,Colombia, alaysia,Singapore,South Korea, andUruguay	RER and NER; Bivariate	Real Shocks
Clarida and Gali (1994)	1974-1992 Monthly JAP, GER, UK, CAN	Real output, RER, price level Trivariate	Nominal Shocks for JAP and GER Real Shocks in the UK and CAN
Weber (1997)	1971-1994 Monthly USA, GER, JAP	Labor input, Real output, RER,Real money supply and price level Five-dimensional VAR	Demand shocks
Thomas (1997)	1979-1995;Monthly Sweden	Relative output, RER and relative price level Trivariate	Supply and demand shocks (higher fraction for demand shocks)
Wang (2004)	1980-2002;Annual China	Relative output, RER and relative price level Trivariate	Real Shocks
Kontolemis and Ross (2005)	1986-2003;Monthly Poland, Latvia, Slovakia and the Czech Republic, Cyprus, Poland, Estonia and Lithuania.	RER, NER, relative interest rates and relative credit Bivariate, trivariate and a four-dimensional VAR	Real Shocks (demand shocks)
Sfia Mohamed Daly (2006)	1993-2002;Monthly, Tunisia	Real output, RER, price level; Trivariate	Real Shocks
Stazka (2006)	1995-2005;Monthly Czech Republic EstoniaHungary Latvia Lithuania Poland Slovakia Slovenia	RER, Industrial production index and price level (CPI); Trivariate	Nominal shocks in non ERM II countries and Latvia Real demand shocks in ERM II countries

3. Models' specifications, estimation results and interpretations

To answer what is the source of real exchange rate fluctuation in Tunisia, we estimated two different SVAR models. The first is a bivariate model; the second is a trivariate model. The bivariate model is similar to the one developed by Lastrapes (1992). It is a simple two variables

model consisting of real effective exchange rate and nominal effective exchange rate. The trivariate model hinges on Clarida and Gali (1994). It is estimated using the following three variables: real effective exchange and relative output to reflect real shocks, and relative price level to reflect nominal shocks. The trivariate model is also re-estimated after substituting the relative price level variable by the nominal effective exchange rate variable (NEER). Thus, it is re-estimated using the following three variables: real effective exchange rate and relative output to reflect real shocks, and nominal effective exchange rate to reflect nominal shocks. Hereafter, the specifications of the bivariate model and its estimation results are given in section 3.1. The specifications of the trivariate model and its estimation results are given in section 3.2. The estimation results of the re-estimated trivariate model are reported in section 3.3.

3.1 Bivariate model specifications, estimation results and interpretations

3.1.1 Specification and identification scheme

The SVAR approach has been developed over the last decade to interpret business cycle fluctuations and to help identify the effects of different economic policies. It is an extension on the traditional theoretic VAR approach in that it combines economic theory with time-series analysis to determine the dynamic response of economic variables to various disturbances. The main advantage with SVAR analysis is that the necessary restrictions on the estimated reduced form model, required for identification of the underlying structural model, can be provided by economic theory. These restrictions can be either contemporaneous or long-run in nature depending on whether the underlying disturbances are considered to be temporary or permanent in nature. Once the identification is achieved it is possible to recover the structural shocks. These shocks can then be used to generate impulse response and variance decomposition functions to assess the dynamic impacts on different economic variables. In addition these functions can be used to test whether such shocks affect the economic variables as economic theory would predict so providing a check on the theory. SVAR analysis has been used internationally to examine a variety of research topics, such as asymmetric shocks from monetary union and impacts of exchange rate movements.

To assess the source of real exchange rate fluctuation in Tunisia, we used the Blanchard-Quah (BQ) structural VAR methodology which bases the identification restrictions on the long-run effect of the exogenous shocks on the endogenous variables. Following Lastrapes (1992), we developed a two-variable model consisting of Real Effective Exchange rate (REER), and Nominal Effective Exchange Rate.

We begin introducing our methodology by considering two types of orthogonal shocks, that are the source of variation in the observed movements in real and nominal exchange rates: A real

shock, ε_{qt} , that reflects changes in endowment, productivity, technology, etc., and a nominal shock, ε_{et} , that reflect financial market disturbances, or nominal disturbances such as a devaluation of the exchange rate.

- **Data**

In our study, the nominal exchange rate (NEER) is measured by the log of nominal effective exchange rate index; and the real exchange rate (REER) is the CPI based real effective exchange rate index. The data are monthly observations form, seasonally adjusted using X12, and analyzed over 2 periods. First period lasts from 1993M1 to 2000M1, and the second period lasts from 2000M1 to 2008M1. The data are taken from the CD-ROM edition of the *International Financial Statistics (IFS)*.

- **Unit root test and model identification**

In order to properly specify the SVAR, we first determine the time series properties by testing for unit roots and stationarity. Augmented Dickey-Fuller (ADF) unit root test, DF-GLS unit root test, and Philips-Perron unit root test were conducted on both variables NEER and REER. Results of the first and second period are reported in table 1 and 2 (reported in the end of this chapter) respectively. The null hypothesis that variable has a unit root is rejected for both variables over both periods. Thus, both variables are level stationary. They should be included in the model in their level form.

Let $X_t = (REER_t, NEER_t)'$ be the vector of both series. Since both series are stationary, the model can be written as an infinite moving average in the structural shocks as follow:

$$\begin{bmatrix} REER_t \\ NEER_t \end{bmatrix} = \begin{bmatrix} A_{11}(L) & A_{12}(L) \\ A_{21}(L) & A_{22}(L) \end{bmatrix} \begin{bmatrix} \varepsilon_{REERt} \\ \varepsilon_{NEERt} \end{bmatrix}$$

Where A_{ij} are polynomials in the lag operator, L . In order to identify the shocks, it is assumed that nominal shocks have no long-run effect on the real exchange rate. This restriction can be imposed by restricting the coefficients in $A_{12}(L)$ to sum to zero. If $a_{12}(k)$ is the k th

coefficient in $A_{12}(L)$, the restriction is equivalent to $\sum_{k=0}^{\infty} a_{12}(k) = 0$ so that the cumulative

effect of ε_{NEERt} on $REER_t$ is zero.

Note that the effects of nominal and real shocks on the nominal exchange rate are not restricted. It is known that this method of decomposing a series into its permanent and temporary components is valid provided that the joint behavior of real and nominal exchange rates contains reliable information about the underlying sources of fluctuation (Lastrapes 1992).

A finite order bivariate VAR was estimated with 2 lags in the first period and 3 lags in the second period based on the multivariate version of Akaike information Criterion. The VARs are then inverted to obtain the moving average representation and restriction was imposed as explained above. After identifying the shocks, the dynamic effect of the nominal and real shocks can be analyzed by variance decompositions and impulse response function typical of VAR methods.

3.1.2 Estimation results and interpretations

- **Interpretation of the impulse responses**

The impulse response functions can shed some light on the dynamic path of the real exchange rate to nominal shocks. They are a useful tool to assess the signs and magnitudes of responses.

(Insert fig. 3 and fig. 4 here)

Fig.3 and fig.4 report the impulse responses to structural shocks of the estimated SVAR over period lasting from 1993M1 to 2000M1 and 2000M1 to 2008M1 respectively.

The response of real exchange rate to real shock, and to nominal shock are illustrated in the top left and top right charts of each figure respectively. To assess the source of real exchange rate fluctuation over each period, and to check if there is any difference between them we will try to interpret both figures.

-In both figures we observe that the real exchange rate increases (appreciate) as a response to both nominal and real shock.

-Given that responses of variables have the same scale, the exchange rate response to real shock is smaller than to nominal shock in the first period as shown in the top two charts of fig.1. This turns to be the opposite in the second period as shown in the top two charts of fig.4.

-While the response of real exchange rate to nominal shock dies within a year in the first period (top right chart of fig.3), it lasts for more than 2 years in the second period (top right chart of fig.4).

-Concerning the nominal exchange rate, similar to real exchange rate shock, while it responds

more to nominal shock in the first period (as shown in the bottom two charts of fig 3), it responds more to real shock in the second period (as shown in the bottom two charts of fig. 4).

-Nominal exchange rate depreciates as response to real shock for the first period (bottom left chart of fig 3), however it appreciates in the second period (bottom left chart of fig.4). This could be explained by the change in the real exchange rate regime. While in the first period Tunisian authorities have to adjust nominal exchange rate to keep the exchange rate within the target since they are conducting real exchange rate targeting, in the second period they are not committed to do so.

In sum we can conclude that, while nominal shocks are behind the real exchange rate's variation in the first period, real shocks seem to be behind it in the second period.

The same interpretation goes for the nominal exchange rate.

- **Interpretation of the forecast error variance decomposition**

While impulse response functions are a useful tool to assess the signs and magnitudes of responses to specific shocks, the relative importance of different shocks for a particular variable's fluctuations can really be gauged only through the forecast error variance decomposition.

(Insert table 3 and table 4 here)

Table 3 and table 4 report the forecast error variance decomposition of both variables over period lasting from 1993M1 to 2000M1 and 2000M1 to 2008M1 respectively.

In the first period, we can observe that within 1 year period, most of the variation in the real exchange rate originated from a nominal shock. The fourth column in the real exchange rate variation decomposition indicates that within 1 year period 68 % of real exchange rate variation is due to a nominal shock. Within a 2 years period 56% of real exchange rate is due to nominal shock.

Similar to real exchange rate, we can observe that within 1 year period, most of the variation in the nominal exchange rate originated from a nominal shock. The fourth column in the nominal exchange rate variation decomposition indicates that within 1 years period 94 % of nominal exchange rate variation is due to a nominal shock. Within 2 years period 86% of nominal exchange rate variation is due to nominal shock.

In the second period, real shocks are the origin of both nominal and real exchange rate variations. Within a two years period, they account for 84% in real exchange rate variation (third column, table 4 in the variance decomposition of real exchange rate), and 97% in the

nominal exchange rate variation (third column, table4 of the variance decomposition of nominal exchange rate).

In sum we can conclude that, while nominal shock are behind the real exchange rate's variation in the first period, real shocks seems to be behind it in the second period.

The same interpretation goes for the nominal exchange rate.

3.2. Trivariate model specifications, estimation results and interpretations

3.2.1 Model specification and identification schemes

To assess the source of real exchange rate variations, we also used a trivariate SVAR. The theoretical framework that we considered hinges on Clarida and Gali (1994) which is based on the pioneering Mundell-Fleming-Dornbusch model. The stochastic rational expectations open macro model derived by Clarida and Gali (1994) is a version of the one developed by Obstfeld (1985). It also draws on previous papers of Dornbusch (1976) and Flood (1981) and illustrates how the Mundell-Fleming-Dornbusch model can be used as a baseline framework to identify three different types of shocks in the economy. The representation of this model is sketched in the following four equations:

$$Y_t^d = d_t + \eta(e_t - p_t) - \sigma[i_t - E(p_{t+1} - p_t)] \quad (1)$$

$$p_t = (1 - \theta)E_{t-1}p_t^e + \theta p_t^e \quad (2)$$

$$m_t^s - p_t = Y_t - \lambda i_t \quad (3)$$

$$i_t = E_t(e_{t+1} - e_t) \quad (4)$$

Equation (1) is an open economy IS equation in which the demand for home output relative to foreign output (Y_t^d) depends positively of the real exchange rate ($e_t - p_t$) and the relative demand shock d_t and negatively of the real interest differential in favor of the home country.

Equation (2) is a price setting equation in which the price level in period t is an average of the market clearing price expected in t-1 to prevail in t and the price that would clear the output market in period t

Equation (3) is a standard LM equation and equation (4) is a statement of interest parity Clarida and Gali (1994).

Shocks in the stochastic open macro model can be categorized into three types (to money, supply and demand). Under the assumption of a sluggish prices and output adjustment, these shocks influence the levels of prices, output and real exchange rate in the short run in accordance with the traditional Mundell-Fleming-Dornbusch model; nevertheless the system is expected to converge to equilibrium in the long run once price adjusted fully to all shocks. Therefore, only supply shocks (such as higher productivity growth) are expected to have an impact on the level of relative output in the long run. Also, supply and demand shocks (such as changes in relative government spending) are expected to influence the long run level of real exchange rate. Finally, both real supply shocks and nominal monetary shocks (such as monetary policy shocks, money demand shocks and effects of financial liberalization) are expected to influence the long run level of prices.

- **Data and implementation of the methodology**

In this section, the three variables in the SVAR are relative output (Y), the real effective exchange rate (REER), and the relative price level of Tunisia vis-à-vis the Euro area (P). Relative outputs are measured as the log of Tunisian industrial production minus the log of the Euro Area Industrial production; the relative price levels are measured as the log of Tunisian CPI minus the log of the Euro Area CPI. All three variables are monthly, seasonally adjusted using X12, and analyzed over 2 periods. First period lasts from 1993M1 to 2000M1, and second period lasts from 2000M1 to 2008M1. The data are taken from the CD ROM edition of the *International Financial Statistics (IFS)*.

Unit root test results of the three variables REER, Y, and P over first and second periods are reported in table 1 and table 2 (see end of the chapter) respectively. REER is level stationary in both periods. Y is level stationary only in the second period. P becomes stationary up on its first difference in both periods. In our model we introduced all variables in their level form over both periods.

To implement the econometric methodology, the first step is to estimate the following Reduced-form VAR:

$$X_t = A(L)u_t \quad (1)$$

Where $X_t = [Y_t, REER_t, P_t]'$. $A(L)$ is a lag polynomial; and u_t is a vector of disturbances.

It has an estimated covariance matrix Σ . To uncover the impact of various structural shocks, the coefficients in the following structural VAR model need to be estimated:

$$X_t = C(L)\varepsilon_t \quad (2)$$

Where $\varepsilon_t = [\varepsilon_{yt} \varepsilon_{REERt} \varepsilon_{Pt}]'$ is a vector containing (unobserved) mutually uncorrelated shocks that could be interpreted as the (relative) supply shocks, (relative) real demand shocks, and (relative) nominal shocks.

Equations (1) and (2) imply a linear relationship:

$$u_t = C_0 \varepsilon_t \quad (3)$$

Where C_0 is a 3 x 3 matrix that defines the contemporaneous structural relationship among the three variables and that need to be identified for the vector of structural shocks ε_t to be recovered from the estimated disturbance vector u_t . The symmetric matrix $\Sigma = C_0 C_0'$ imposes six of the nine restrictions that are necessary to identify C_0 . Following Clarida and Gali (1994), three additional restrictions on the long-run multipliers are imposed while the short-run dynamics are freely determined. The three restrictions are nominal (monetary) shocks have no long-run impact on the levels of output and the real exchange rate, and real demand shocks have no long-run impact on the level of output. The long-run multipliers of the structural VAR are denoted by the matrix $C(1) = [C_0 + C_1 + C_2 + \dots]$. The three long-run restrictions make the (1, 2), (1, 3), and (2,3) elements of $C(1)$ matrix equal to zero, and hence the $C(1)$ matrix lower triangular. This is then used to recover C_0 .

3.2.2 Estimation results and interpretations

The fig.5 and fig.6 report the impulse responses of variables included in the trivariate SVAR model estimated over period lasting from 1993M1 to 2000M1 and 2000M1 to 2008M1 respectively.

(Insert fig. 5 and fig. 6 here)

The response of real exchange rate to supply, demand, and nominal shock are illustrated in the second row of both figures. The response of real exchange rate to supply shock is given in the left chart. The response of real exchange rate to demand shock is given in the middle chart. The response of real exchange rate to nominal shock is given in the right chart. To assess the source of real exchange rate fluctuation over each period and to check if there is any difference between them we will try to interpret the three charts given in the second row of each figure.

Given that responses of variables have the same scale, the real exchange rate response to real shock (aggregate of supply and demand shock) is smaller than to nominal shock in the first

period (Second row of fig.5). In the second period, this turns to be the opposite. In the second period, large part of real exchange rate fluctuations is due to real shock (aggregate of supply and demand shock). More specifically, real exchange rate fluctuation seems to be mainly due to supply shock (Second row of figure 6)

The findings from the trivariate model are in accordance with the finding from the bivariate model. In both models we found that nominal shocks are behind real exchange rates fluctuations in the first period, and real shocks are behind exchange rate fluctuations in the second period. In addition, the trivariate model reveals that large part of real exchange rate fluctuations in the second period is due to supply shock (output shock).

3.3 Re-estimation of the above trivariate SVAR model: substituting relative price by nominal effective exchange rate

We substituted the relative price variable (P) in the above trivariate model by nominal effective exchange rate variable (NEER) and re-estimated the trivariate model over the same two periods.

Results are reported in fig.7 and fig.8.

(Insert fig.7 and fig.8 here)

-We again observe that the exchange rate response to real shock (aggregate of supply and demand shock) is smaller than to nominal shock in the first period (as shown in the second row of fig.7). However, the real exchange rate response to real shock (aggregate of supply and demand shock) is larger than to nominal shock in the second period (as shown in second row of fig.8). In addition, we observe that large part of real exchange rate fluctuations in the second period is due to output shock (Second row of figure 8).

- **Interpretation of the forecast error variance decomposition**

Table5 and table 6 report the forecast error variance decomposition variables over period lasting from 1993M1 to 2000M1 and 2000M1 to 2008M1 respectively.

In the first period, we observe that most of the variation in the real exchange rate originated from a nominal shock. The fifth column, table 5 in the real exchange rate variation decomposition indicates that within 1 year period 62% of real exchange rate variation is due to a nominal shock. Within a 2 years period 52% of real exchange rate variation is due to a nominal shock. This is quite similar to our finding with the bivariate VAR where within 1 year period 68 % of real exchange rate variation is due to a nominal shock and within a 2 years period 56%

of real exchange rate is due to nominal shock.

Similar to real exchange rate, we can observe that within 2 years period, most of the variation in the nominal exchange rate originated from a nominal shock. The fifth column, table 5 in the nominal exchange rate variation decomposition indicates that within 2 years period 79 % of nominal exchange rate variation is due to a nominal shock.

In the second period, real shocks (aggregate of supply and demand shock) are the origin of both nominal and real exchange rate variations. The nominal shocks account only for 20% in real exchange rate variation (fifth column, table 6 in the variance decomposition of REER), and only 5% in the nominal exchange rate variation (fifth column, table 6 of the variance decomposition of NEER). This is quite similar to our finding with the bivariate VAR where within 2 years period real shock accounts for 84% in real exchange rate variation and 97% in the nominal exchange rate variation.

We can see also that in the first period, the share of real shocks in real exchange rate fluctuations is almost balanced between demand shocks and supply shocks (24% and 22% respectively). However, in the second period, almost all the share of real shocks in real exchange rate fluctuation is supply shocks (outputs shocks). Third column of table 6 of the variance decomposition of REER shows that after two years period, outputs shocks are behind almost 78% of real exchange rate fluctuations.

In sum, we conclude that, nominal shock are major source of real exchange rate fluctuations in the first period, while real shocks are major source of real exchange rate fluctuations in the second period. In addition, we conclude that the share of real shocks in real exchange rate fluctuations is almost balanced between demand shocks and supply shocks in the first period, while almost all the share of real shocks in real exchange rate fluctuation is output shock in the second period. The same interpretation goes for the nominal exchange rate.

4. Conclusion

Answering the question of what behind real exchange rate fluctuation provides policy makers an idea about how to conduct an exchange rate policy, and the effectiveness of promoting competitiveness through currency devaluation. To this end, we used structural VARs identified with long-run restriction to identify macroeconomic shocks and evaluate their relative importance for real exchange rate fluctuations. Bivariate SVAR similar to Lastrapes (1992), and trivariate SVAR similar to Clarida and Gali (1994) are estimated over two periods; the first period lasts from 1993M1 to 2000M1, and the second period lasts from 2000M1 to 2008 M1. We found that, nominal shocks are major source of real exchange rate fluctuations in the first period, while real shocks are major source of real exchange rate fluctuations in the second

period. In addition, we found that the share of real shocks in real exchange rate fluctuations is almost balanced between demand shocks and supply shocks in the first period, while almost all the share of real shocks in real exchange rate fluctuations is output shock in the second period. The same interpretation goes for the nominal exchange rate. Our results are in accordance with the findings of Sfia Mohamed Dali who found that real disturbance account for more than 80% of the forecast error variance of the real exchange in Tunisia. The results for Tunisia are also comparable to those from some other open and industrialized countries and some economies in transition

Fig.1: Time-series plot over the first period lasting from 1993M1 to 2000M1

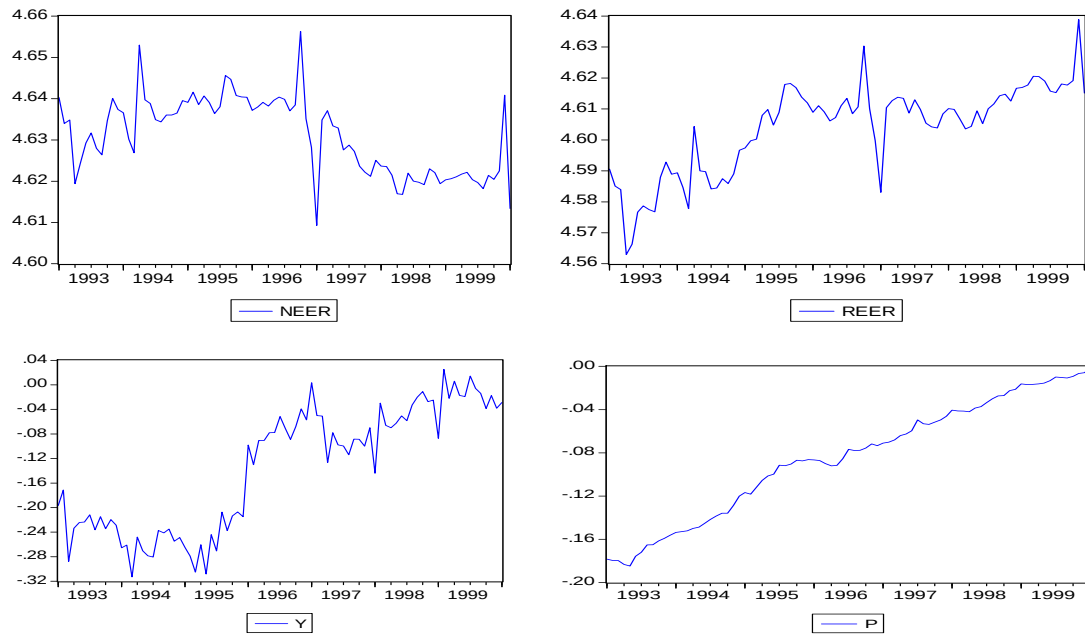
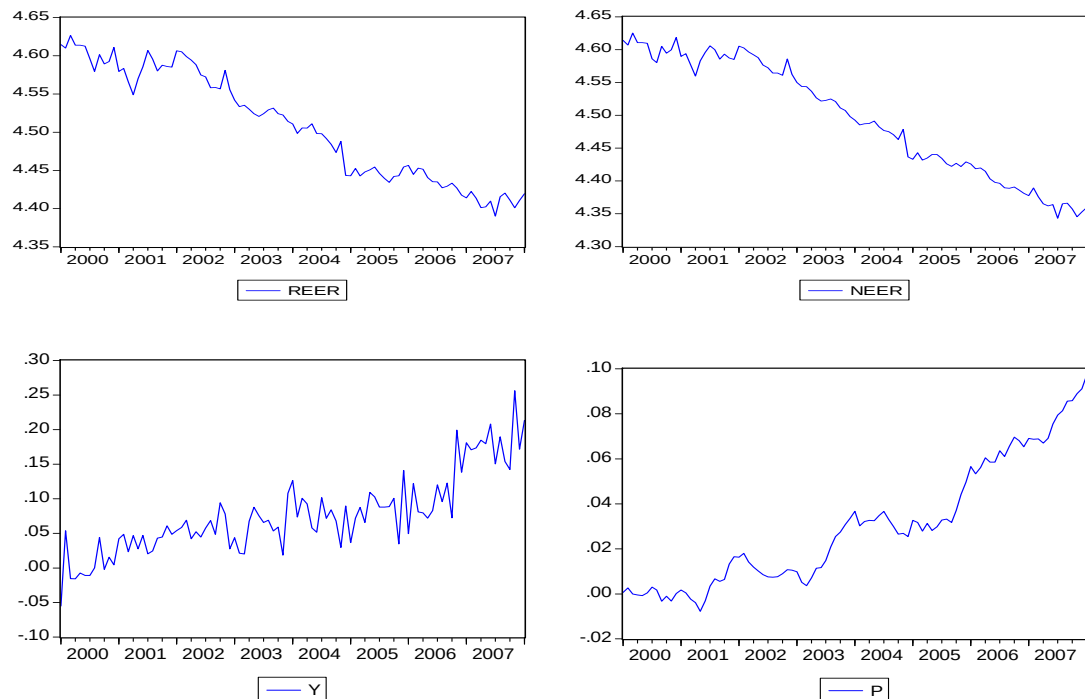


Fig.2: Time-series plot over the second period lasting from 2000M1 to 2008M1



Note

REER refers to real effective exchange rate; NEER refers to nominal effective exchange rate; Y refers to Tunisian industrial production taken as proxy for Output; P refers to CPI taken as proxy for price variation. The data are taken from the CD ROM edition of the *International Financial Statistics (IFS)*. They are monthly observation form and seasonally adjusted using X12

Unit root test

Table. 1: 1993m1-2000M1

Null Hypothesis: variable has a unit root

Variables	ADF	DF-GLS	Philip-Perron
	Constant, linear trend	Constant, linear trend	Constant, linear trend
	test statistic		test statistic
REER	-4.469426*	-4.350773*	-4.408624*
NEER	-4.919474*	-4.965572*	-4.822946*
Y	-2.585720	-1.789657	-3.791556**
P	-1.618129	-1.671590	-1.727817

(*) significant at 1% (null hypothesis is rejected)

(**) significant at 5%(null hypothesis is rejected)

Table. 2: 2000M1-2008M1

Null Hypothesis: variable has a unit root

Variables	ADF	DF-GLS	Philip-Perron
	Constant, linear trend		Constant, linear trend
	test statistic		test statistic
REER	-3.473283**	-3.378538**	-3.383460**
NEER	-3.525786**	-2.885325***	-3.320951**
Y	-3.609576**	-3.208135***	-8.618033*
P	-1.112066	-0.774863	-1.363138

(*) significant at 1% (null hypothesis is rejected)

(**) significant at 5%(null hypothesis is rejected)

(***)significant at 10%(null hypothesis is rejected)

Note that

test C.V	ADF; Philip-Perron	DF-GLS
1%	-4.071006	-3.6408
5%	-3.464198	-3.0812
10%	-3.158586)	-2.7880

Fig.3: Impulse responses of variables included in the bivariate SVAR model estimated over 1993M1-2000M1

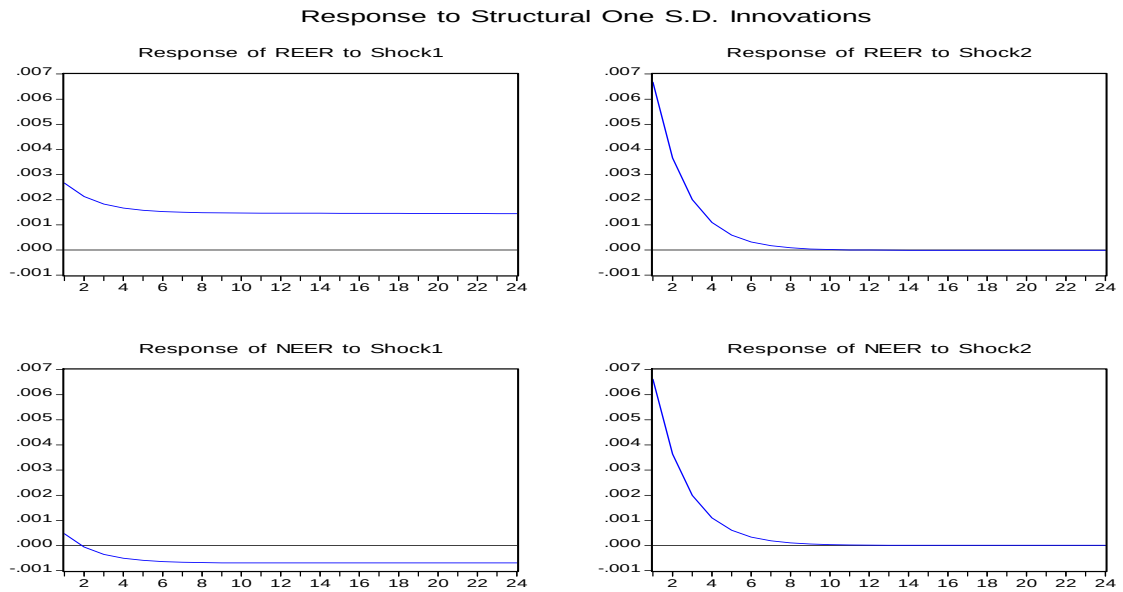
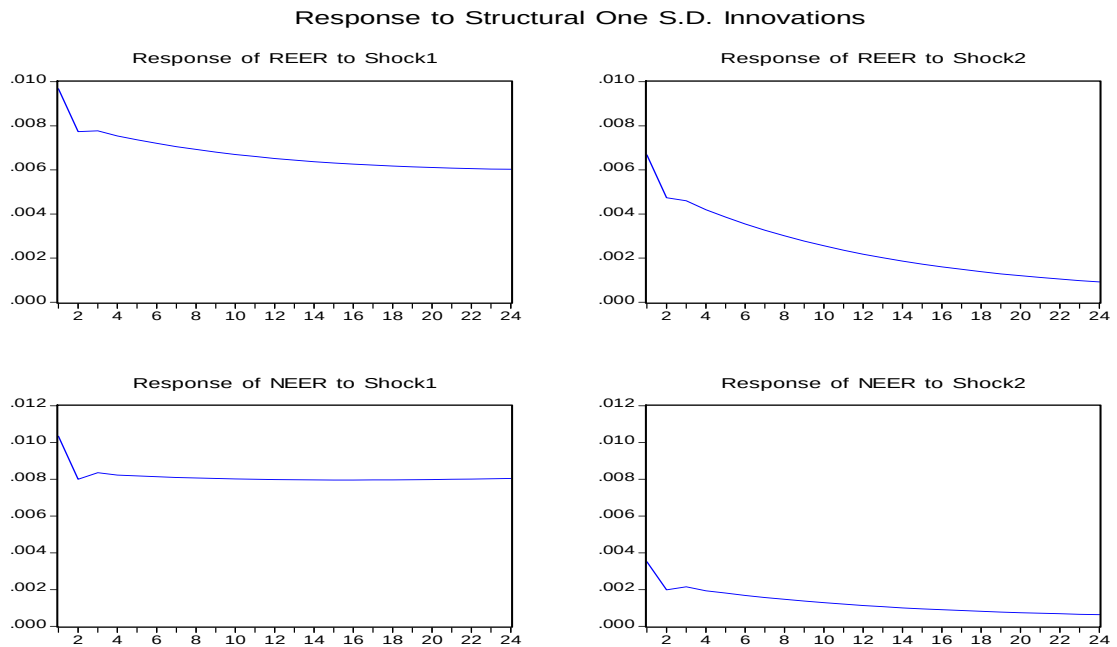


Fig.4: Impulse responses of variables included in the bivariate SVAR model estimated over 2000M1 to 2008M1



Note: Shock 1 refers to an appreciation of real exchange rate (increase in REER)
 Shock 2 refers to an appreciation of nominal exchange rate (increase in NEER)

Table.3: Variance decomposition (in %) of variables included in the Bivariate SVAR model estimated over 1993M1-2000M1

Variance Decomposition of REER:			
Period	S.E.	$\mathcal{E}_{REERt}$	$\mathcal{E}_{NEERt}$
3	0.009063	16.33409	83.66591
6	0.009755	23.16023	76.83977
12	0.010387	31.90393	68.09607
24	0.011431	43.78271	56.21729
36	0.012373	52.00968	47.99032
Variance Decomposition of NEER:			
Period	S.E.	$\mathcal{E}_{REERt}$	$\mathcal{E}_{NEERt}$
3	0.007636	0.614903	99.38510
6	0.007895	1.624472	98.37553
12	0.008084	5.731028	94.26897
24	0.008454	13.79829	86.20171
36	0.008805	20.53676	79.46324

Table.4: Variance decomposition (in %) of variables included in the Bivariate SVAR model estimated over 2000M1-2008M1

Variance Decomposition of REER:			
Period	S.E.	$\mathcal{E}_{REERt}$	$\mathcal{E}_{NEERt}$
3	0.016106	71.13701	28.86299
6	0.020323	72.48080	27.51920
12	0.024717	77.39231	22.60769
24	0.029996	84.01612	15.98388
36	0.034321	87.74313	12.25687
Variance Decomposition of NEER:			
Period	S.E.	$\mathcal{E}_{REERt}$	$\mathcal{E}_{NEERt}$
3	0.014246	93.86562	6.134376
6	0.018405	94.93532	5.064679
12	0.024177	96.49959	3.500411
24	0.032636	97.95194	2.048065
36	0.039598	98.57761	1.422386

Fig.5: Impulse responses of variables included in the trivariate SVAR model estimated over 1993M1-2000M1

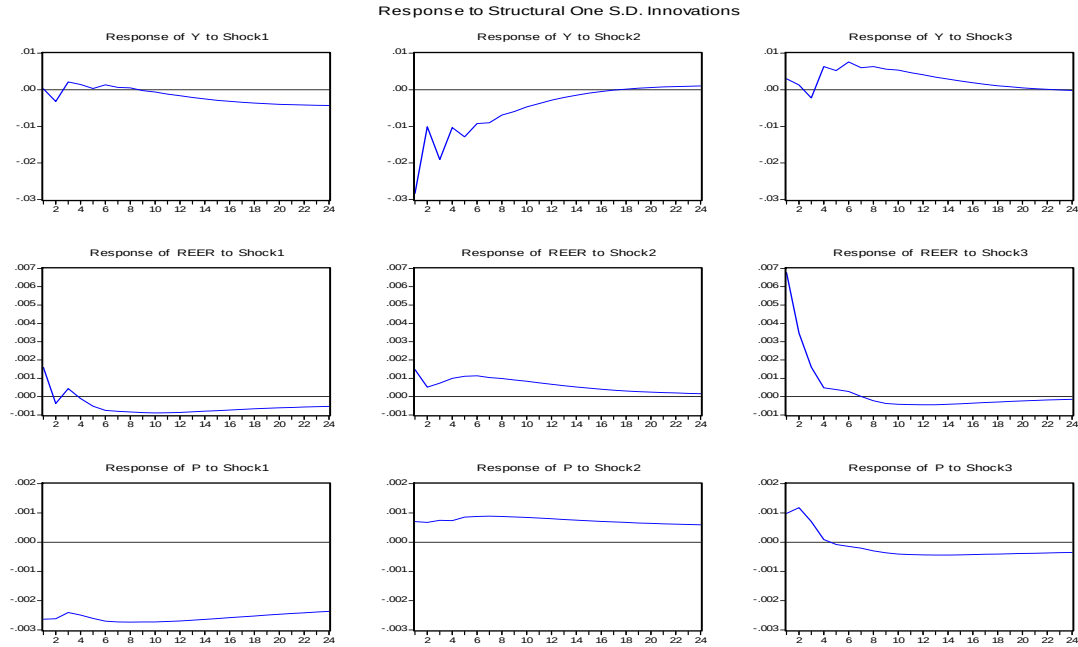
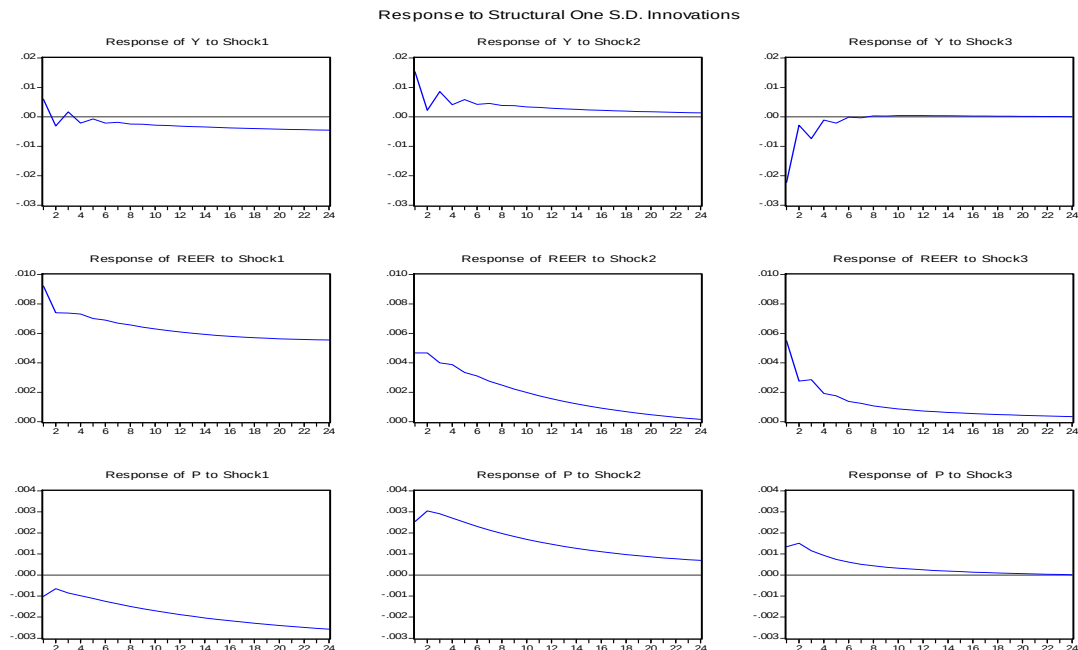


Fig.6: Impulse responses of variables included in the trivariate SVAR model estimated over 2000M1 to 2008M1



Note: Shock 1 refers to Supply shock; Shock 2 refers to Demand shock; Shock 3 refers to nominal shock

Fig.7: Impulse responses of variables included in the trivariate SVAR model estimated over 1993M1to 2000M1 (NEER are taken instead of price P)

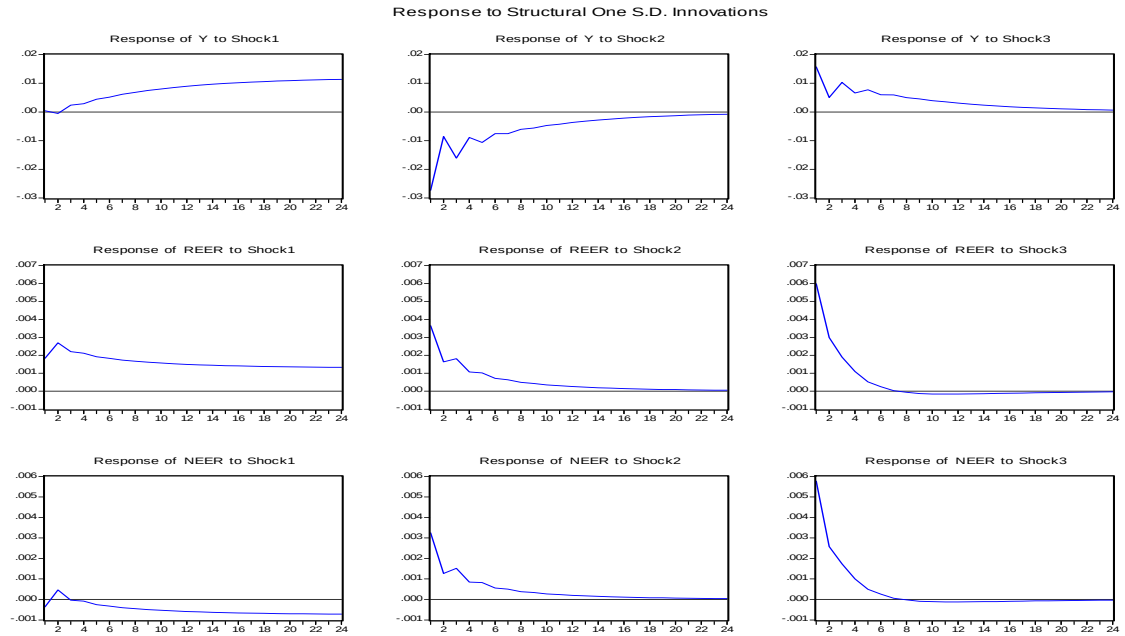
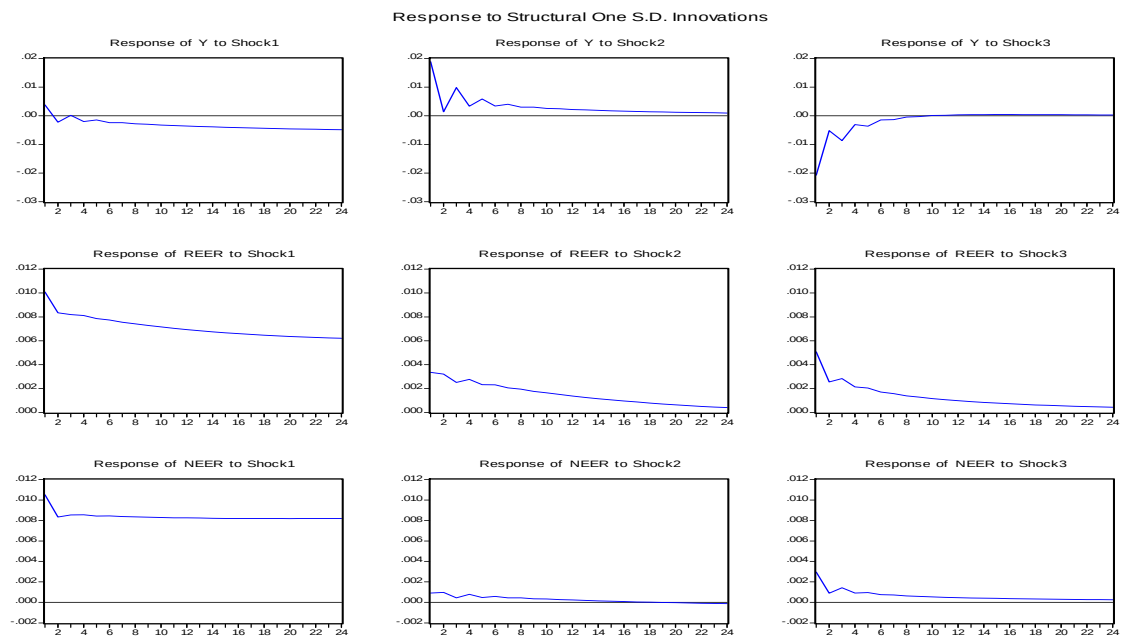


Fig.8: Impulse responses of variables included in the trivariate SVAR model estimated over 1993M1to 2000M1 (NEER are taken instead of price P)



Note: Shock 1 refers to Supply shock; Shock 2 refers to Demand shock; Shock 3 refers to nominal shock

Table.5: Variance decomposition (in %) of variables included in the trivariate SVAR model estimated over 1993M1-2000M1

Variance Decomposition of Y				
Period	S.E.	ε_{yt}	ε_{REERt}	ε_{NEERt}
3	0.036842	65.95760	30.07424	3.968160
6	0.037441	65.86828	30.20181	3.929915
12	0.037466	65.87138	30.19806	3.930557
24	0.037466	65.87089	30.19859	3.930521
Variance Decomposition of REER:				
Period	S.E.	ε_{yt}	ε_{REERt}	ε_{NEERt}
3	0.009119	17.63802	5.792273	76.56971
6	0.009795	20.33140	9.641783	70.02681
12	0.010384	21.51238	15.96170	62.52593
24	0.011306	22.24988	24.98731	52.76281
Variance Decomposition of NEER				
Period	S.E.	ε_{yt}	ε_{REERt}	ε_{NEERt}
3	0.007747	5.628173	2.538011	91.83382
6	0.008023	5.451319	4.032580	90.51610
12	0.008222	5.948192	7.336342	86.71547
24	0.008588	7.581202	12.91575	79.50305

Table.6: Variance decomposition (in %) of variables included in the trivariate SVAR model estimated over 2000M1-2008M1

Variance Decomposition of Y				
Period	S.E.	$\mathcal{E}_{yt}$	$\mathcal{E}_{REERt}$	$\mathcal{E}_{NEERt}$
3	0.039392	12.35512	75.91626	11.72863
6	0.039591	12.38109	75.82878	11.79013
12	0.039622	12.38819	75.81253	11.79927
24	0.039626	12.39815	75.79930	11.80255
Variance Decomposition of REER				
Period	S.E.	$\mathcal{E}_{yt}$	$\mathcal{E}_{REERt}$	$\mathcal{E}_{NEERt}$
3	0.017218	61.87093	0.089980	38.03910
6	0.022116	65.84632	0.169638	33.98404
12	0.027701	71.40100	0.552167	28.04683
24	0.034225	77.97598	1.603865	20.42016
Variance Decomposition of NEER				
Period	S.E.	$\mathcal{E}_{yt}$	$\mathcal{E}_{REERt}$	$\mathcal{E}_{NEERt}$
3	0.016006	83.01592	2.024734	14.95935
6	0.021288	85.59921	2.370216	12.03057
12	0.028471	88.20319	3.077111	8.719697
24	0.038507	90.37762	4.167016	5.455360

General Conclusion and Recommendations

Tunisia is attempting to move from a broad money targeting framework, with base money as the operating target to inflation targeting policy, and from managed float exchange rate policy to a floating exchange rate regime. Before this movement, some questions have to be answered. Among others, is the question about the impact of monetary policy shock and exchange rate shock on Tunisian economic variables, such as output and prices? To answer this question, we used vector autoregressive (VAR) framework to assess the effect of monetary policy shock (monetary easing) and exchange rate shocks (appreciation) on output and price in Tunisia over two different periods; the first last from 1993M1 to 2000M1, and the second from 2000M1 to 2008M1. We found that in the first period, neither monetary policy shock, nor exchange rate shock has an effect on, both, output and price. In the second period, while monetary policy shock has an impact on output and not on price, the exchange rate shock has small impact on output and large impact on price. Results are in accordance with the economic and financial status in which monetary and exchange rate were conducted.

In the first period, the CBT did not have any influence on a large part of the CPI basket. CBT targets also did not provide real guidance to economic agents regarding expectations over the economy. The first period was characterized by uncertain monetary policies and changing objectives. CBT policy was indeed driven more by the fear of financial system instability and by the government needs and development strategy. Furthermore, in practice, the system has not systematically operated according to the rules of the monetary targeting policy followed during this period, and the targets have often been missed; the gap between M2 (and later M3) targets and observed values exceeded the 2% level in more than 60% of the time during the period 1987-2002. This gap even exceeded 8% during the years 1988, 1996 and 1999. CBT derives its targets on the basis of its staff experience, which is not enough, and has always published its targets months late behind their schedule. These factors mean that CBT targets did not provide real guidance to economic agents regarding expectations over the economy during the first period.

In the second period, targeting growth of broad money and pursuing a tightly managed exchange rate regime have represented the core of the monetary policy framework. The banking system has been modernized and improved; nevertheless, there is a consensus calling for further and deeper reforms. Controlled and administrated price share also decreased, nevertheless, there is consensus calling for full liberalization before implementing inflation targeting. These factors may explain somehow why the results of our estimation are more significant in the second period.

Our finding that there is a small impact of exchange rate shock on Tunisian output over both

periods raises the question about the impact of exchange rate on Tunisian trade balance. Again VAR frame work was used over both periods to answer this question. We found that real exchange rate shock (appreciation) has a modest impact on trade balances, and there is no evidence of J-curve shape for both periods. This lends further robustness for our previous finding about the small impact of exchange rate on output. The marginal effect of exchange rate shock on Tunisian trade balance could be explained by the fact that exports and imports respond with the same sign to an exchange rate shock. Since Tunisia is major importer of intermediate products, which it processes into finished products for export, the demand for these products seems to follow the trend of exports. Thus, some part of trade balance worsening due to real exchange rate shock seems to be offset by the decrease in the demand for foreign intermediate goods.

Before moving to the new policy framework in regard to monetary and exchange rate policies, policy makers have to know the source of real exchange rate fluctuation. We also answered this question by estimating a bivariate (2 variables) and trivariate (3 variables) SVAR over the same both periods. We found that while, nominal shock are behind the real exchange rate's variation in the first period, real shocks seems to be behind it in the second period. The same interpretation goes for the nominal exchange rate. Our results are in accordance with the findings of Sfia, M. D (2006) who found that real disturbance account for more than 80% of the forecast error variance of the real exchange rate in Tunisia. The results for Tunisia are also comparable to those from some other open and industrialized countries and some economies in transition.

From the finding in this research we can raise the following:

- CBT has to look for a target that provides real guidance to economic agents regarding expectations over the economy, such as inflation targeting.
- For monetary policy to effectively control inflation, the share of administered prices should be reduced significantly through price liberalization. While price liberalization may induce a short-term increase in inflation, which would require a monetary policy response, monetary policy will become more flexible and more efficient.
- The existence of a sound financial system is the most crucial condition for inflation targeting. The Tunisian financial system remains fragile and might find itself under heavy stress if submitted to the requirements of inflation targeting. Inflation targeting, indeed aims at controlling inflation and makes it the main objective of monetary policy. It goes well beyond the simple adoption of a quantitative goal for inflation. A set of institutional and/or economic preconditions have to be fulfilled: central bank independence, accountability and transparency, the existence of a sound financial system, fiscal discipline and a flexible exchange rate regime are necessary before inflation targeting can even be attempted.

- Inflation targeting also requires a flexible exchange rate regime and, more generally, the absence of any other targeted nominal variable. The inflation target should be the sole predominant target for monetary policy. Having more than one target may destroy the credibility of the central bank, given the conflicts between objectives. When a country adopts an inflation target and chooses a fixed exchange rate regime the exchange rate target subordinates the monetary policy to its requirements and is likely to lead to deviations from the targeted inflation rate.
- Policy maker should be aware that with the ongoing trend of trade liberalization and the overall degree of openness of the economy, the real exchange rate shock may will generate a larger trade balance worsening (than the one found in chapter 3), since the imported good will not be mainly intermediate goods.
- Since large share of real exchange rate variation is due to real disturbance, to improve the degree of competitiveness of the economy, policy maker should attempts to improve productivity rather than devaluating nominal exchange rate.

The overall conclusions is that a lot remains to be done before committing the country to move to inflation targeting in terms of financial and fiscal soundness and discipline and in terms of institutional and governance design symbolized by the independence of the central bank. Fiscal discipline and sound financial system are in fact a necessity for the success of inflation targeting or any other sound monetary policy. The key issue, which is beyond this study is whether the current policy makers have the incentive and are likely to undertake the necessary moves given their political possibilities and interest? For the moment, the cost of doing so and the uncertainties linked to the transition to inflation targeting makes it unlikely to expect such a transition unless a major shock takes place; which is not excluded as it liberalizes further its trade and capital movements.

References

- AfDB. 2009. “. Tunisia Mid-Term Review – Country strategy Paper 2007-2011”. African Development Bank Publication, October 2009.
- Akboanci, Elif. 2002. “Dynamics of the Trade Balance: The Turkish J-curve”. *ERC Working Papers*, 02/05.
- Alexander, S. 1959. “Effects of Devaluation: A Simplified Synthesis of Elasticities and Absorption Approaches”. *American Economic Review*, 49, 21- 42.
- Alexander, S. 1952. “Effects of devaluation on a trade balance”. *IMF Staff Papers*, 2, 263- 278.
- Beveridge, S and Charles, R. N. 1981. “A New Approach to Decomposition of Economic Time Series into Permanent and Transitory Components with Particular Attention to Measurement of the Business Cycle”. *Journal of Monetary Economics*, Vol. 7, No. 2, 151-174.
- Bickerdike, C. 1920. The Instability of Foreign Exchange. *The Economic Journal*, 30, No 17, 118-122.
- Baharumshah, A, Z. 2001. “The Effect of Exchange Rate on Bilateral Trade Balance: New Evidence from Malaysia and Thailand”. *Asian Economic Journal*, Vol. 15, No.3, 291-311.
- Bahmani-Oskoei, M and Alse, J. 1994. “Short-Run vs. Long-Run Effects of Devaluation: Error-Correction Modeling and Cointegration”. *Eastern Economic Journal*, Vol. 20, No. 4, 453- 464.
- Bahmani-Oskoei, M. 2001. “Nominal and Real Effective Exchange Rates of Middle Eastern Countries and Their Trade Performance”. *Applied Economics*, Vol. 33, 103-111.
- Bahmani-Oskoei, M and Kantiapong, T. 2001. “Bilateral J-Curve Between Thailand and Her Trading Partners”. *Journal of Economic Development*, Vol. 26, No. 2, December, 107-117.
- Bayoumi, T and Eichengreen, B. 1992. “Shocking Aspects of European Monetary Unification”. *National Bureau of Economic Research Working Paper* No. 3949.
- Blanchard, O. J and Quah, D. 1989. “The Dynamic Effects of Aggregate Demand and Supply Disturbances”. *The American Economic Review*. Vol. 79, No. 4, 655-673.
- Borghijis, A and Kuijs, L. 2004. “Exchange Rates in Central Europe: A Blessing or a Curse?”. *International Monetary Fund Working Paper* No. 04/2.
- Boughrara, A. 2004. “Would the inflation targeting strategy be relevant for Tunisia?”. *The 11th conference of the economic research forum (ERF) in Beirut-Lebanon*, December 14th -16th, 2004.
- Boughrara, M, Boughrara, A and Hassouna, M. 2008. “The Tunisian financial system and Inflation targeting”. *FEMISE Workshop*. October 24th -25th, Tunis, Tunisia.

- Alexandre Chailloux, Alain Durré, and Bernard J. Laurens. 2009. "Requirements for Using Interest Rates as an Operating Target for Monetary Policy: The Case of Tunisia". IMF working paper WP/09/149.
- Central Bank of Tunisia (CBT) home page available at www.bct.gov.tn (last visited August 2010).
- CBT. 2010. "Financial statistic reports No 170". Central Bank of Tunisia publication, March 2010.
- Chadha, B and Prasad, E. 1997. "Real Exchange Rate Fluctuations and the Business Cycle: Evidence from Japan". *International Monetary Fund Staff Papers*, Vol. 44, No. 3, 328-355.
- Chen, S.L and Wu, J.L. 1997. "Sources of Real Exchange-Rate Fluctuations: Empirical Evidence from Four Pacific Basin Countries". *Southern Economic Journal*, Vol. 63, No. 3. 776-787.
- Chowdhury, I.S. 2004. "Sources of Exchange Rate Fluctuations: Empirical Evidence from Six Emerging Market Countries". *Applied Financial Economics*, Vol. 14, No.10, 697-705.
- CIA .2010. CIA world fact book-Tunisia, available at:
<https://www.cia.gov/library/publications/the-world-factbook/geos/ts.html> (Last visited Mai 2010)
- Clarida, R and Gali, J. 1994. "Sources of Real Exchange Rate Fluctuations: How Important Are Nominal Shocks?". *National Bureau of Economic research working paper*. No. 4658.
- Demirden, T and Pastine, I. 1995. "Flexible exchange rate and the J-Curve". *Economic letters*. 1995. 373-377.
- Dibooglu, S and Kutun, A .2001. "Sources of Real Exchange Rate Fluctuations in Transition Economies: The Case of Poland and Hungary". *Journal of Comparative Economics*, 29, 257 – 275.
- Dibooglu, S and Kutun, A. 2000. "Sources of Real and Nominal Exchange Rate Fluctuations in Transition Economies". *Federal Reserve Bank of Snt.Louis*, Working Paper 1998-022A.
- Dickey, D and Fuller, W. 1979. "Distribution of the estimators for autoregressive time series with a unit root". *Journal of American Statistical Association*, 74, 427-431.
- Dornbusch, R. 1976. "Expectations and Exchange Rate Dynamics". *The Journal of Political Economy*, Vol. 84, No. 6, 1161-76.
- Dornbusch, R. 1973. "Devaluation, Money and Non-traded goods". *American Economic Review*, 63, 871- 880.
- Enders, W and Lee, B.S. 1997. "Accounting for Real and Nominal Exchange Rate Movements in the post Britton Woods Period". *Journal of International Money & Finance*, Vol. 16, No. 2, 233-254.
- Evans, M. D. D. and Lothian, J. R. 1993. "The response of exchange rates to permanent and

- transitory shocks under floating exchange rates". *Journal of International Money and Finance* 12, 563-586.
- Faust, Jon, and Lars.E.O. S. 2001. "Transparency and Credibility: Monetary Policy with Unobservable Goals". *International Economic Review*, Vol.42:369-397.
 - Fleming, J. M. 1962. "Domestic Financial Policies under Fixed and Floating Exchange Rates". *International Monetary Fund Staff Papers*, Vol. 9, No. 3, 369-379.
 - Flood, R. 1981. "Explanations of exchange rate volatility and other empirical regularities in some popular models of the foreign exchange market". *Carnegie-Rochester Conference series on public policy*, 15.
 - Frenkel, J and Rodriguez, C. 1975. "Portfolio Equilibrium and the Balance of Payments: a Monetary Approach". *American Economic Review*, 65, 674 - 688.
 - Gupta-Kapoor, A and Ramakrishnan, U. 1999. "Is There a J-curve? A New Estimation for Japan". *International Economic Journal*, Vol. 13, No. 4, 71 - 79.
 - IFS CD-Rom, released, July 2008.
 - IMF.2006. "Tunisia: 2006 Article IV Consultation - Staff Report; Staff Statement; Public Information Notice on the Executive Board Discussion; and Statement by the Executive Director for Tunisia". IMF publication, July 2006.
 - Abdelhak Senhadji, Tahsin Saadi Sedik, Kangni Kpodar. 2007. "Inflation forecasting and exchange rate pass-through". IMF and Tunisia selected issue. July 12th 2007.
 - IMF.2008. Tunisia country report (2008) available at www.imf.org last visited (September 2008).
 - IMF. 2009. "Tunisia: 2009 Article IV Consultation-Staff report; and public Information Notice". IMF Tunisia country report N.09/329. IMF publication, December 2009.
 - IMF. 2010. "Tunisia-Preliminary conclusions of the 2000 Article IV mission". IMF publication, June 15, 2010
 - IMF. 2010.. "Tunisia selected issues. IMF Country Report No. 10/109, May 2010.
 - Johansen, S. 1988. "Statistical analysis of cointegration vectors". *Journal of Economic Dynamics and Control*, vol.12, 231-254.
 - Johansen, S and Juselius, K. 1990. "Maximum likelihood estimation and inference on cointegration-with the application to the demand for money". *Oxford Bulletin of Economics and Statistics*, vol. 52, 169-210.
 - Jung, C and Khosrow, D. 1998. "The Persistence of Japan's Trade Surplus". *International Economic Journal*, Vol. 12, No.1, Spring 1998.
 - Kale, Pelin. 2001. "Turkey's Trade Balance in the Short and the Long Run: Error Correction Modeling and Cointegration". *The International Trade Journal*, Vol. 1, No. 1, 27-55.
 - Kontolemis, Z.G and Ross, K. 2005. "Exchange Rate Fluctuations in the New Member States of the European Union". *Economics Working Paper Archive* , No. 0504015.
 - Lastrapes, W.D. 1992. "Sources of Fluctuations in Real and Nominal Exchange Rates". *Review of Economics & Statistics*, Vol. 74, No. 3, 530-539.

- Lerner, A. 1944. "The Economics of Control: Principles of Welfare Economics". *The Macmillan*, N.Y.
- Lee, J and Menzie, D. C. 1998. "The Current Account and the RER: A Structural VAR Analysis of Major Currencies". *National Bureau of Economic Research Working Paper* No.6495.1.
- MacDonald, R. 1998. "What Do We Really Know About Real Exchange Rates?", *Oesterreichische Nationalbank Working Paper* No. 28.
- Marshall, A. 1923. "Money, Credit and Commerce". *The Macmillan*, N.Y.
- Marial,A, Yol,A and Baharumshah,Z. 2006. "The effect of exchange rate changes on trade balances in North Africa: Evidences". *International Trade and Finance Association*, 15th International Conference.
- Marwah, K and Lawrence, R. K. 1996. "Estimation of J - Curves: United States and Canada". *Canadian Journal of Economics*, Vol. 29, No. 3, 523-539.
- Masson, P, Miguel S and Sunil, S. 1997. "The Scope for Inflation Targeting in Developing Countries". *International Monetary Fund Staff Working Paper* 97/130.
- Meade, J. 1951. "The Balance of Payments". Oxford University Press, Oxford.
- Metzler, L. 1948. "The Theory of International Trade, in Ellis H. (eds.)" *A Survey of Contemporary Economics*, 1, Blakiston, Philadelphia.
- Miyao, R. 2008. "Monetary Policy Behavior and Exchange Rate Stability in East Asia". *Preliminary paper presented on "Monetary Economics Seminar" at Kobe University* on January 17th 2008.
- Mundell, R. A. 1962. "The Appropriate Use of Monetary and Fiscal Policy for Internal and External Stability". *International Monetary Fund Staff Working Papers*, Vol. 9, No. 1, 70-79.
- Mussa, M. 1986. "Nominal Exchange Rate Regimes and the Behavior of Real Exchange Rates: Evidence and Implications". *Carnegie-Rochester Conference Series on Public Policy*, Vol. 25, No. 0, 117-213.
- Obstfeld, M. 1985. "Floating Exchange Rates: Experience and Prospects". *Brookings Papers on Economic Activity*, Vol. 1985, No. 2, 369-464.
- Robinson, J. 1947. "The Foreign Exchanges, in Ellis, H. and Metzler, L. (eds.)". *Readings in the Theory of International Trade*, Allen and Unwin, Philadelphia.
- Rogers,J.H. 1999. "Monetary Shocks and Real Exchange Rates". *Journal of International Economics*, Vol. 49, No. 2, 269-288.
- Rose, A.K and Yellen,J.L. 1989. "Is there a J-curve?". *Journal of monetary economics* 24,53-68.
- Sfia, M. D. 2006. "Tunisia: Sources of Real Exchange Rate Fluctuations". MPRA Paper No. 3129.
- Sims, C. A. 1980. "Macroeconomics and Reality". *Econometrica*, Vol. 48, No. 1,1-48.
- Soto, C. 2003. "The Effects of Real and Nominal Shocks on the Chilean Exchange Rate

- during the 1990s". *Central Bank of Chile Working Paper* No. 220.
- Stazka, A. 2006. "Sources of real exchange rate fluctuations in central and eastern Europe-Temporary or Permanent?". *Cesifo Working Paper* No.1876, December 2006.
 - Stockman, Alan.C. 1988. "Real Exchange-Rate Variability Under Pegged and Floating Nominal Exchange-Rate Systems: An Equilibrium Theory". *Carnegie-Rochester Conference Series on Public Policy*, Vol. 29, No. 0, 259-294.
 - Stockman, Alan. C. 1983. "Real Exchange Rates Under Alternative Nominal Exchange-Rate Systems". *Journal of International Money and Finance*, Vol. 2, No. 2,147-166.
 - Stockman, A. C. 1987. "The Equilibrium Approach to Exchange Rates". *Economic Review, Federal Reserve Bank of Richmond*, 1987, 22-30.
 - Thomas, A. 1997. "Is the Exchange Rate a Shock Absorber? The Case of Sweden". *International Monetary Fund Working Paper* No. 97/176.
 - Upadhyaya, K. P and Dhakal, D. 1997. "Devaluation and the Trade Balance: Estimating the Long Run Effect". *Applied Economics Letters*, Vol. 4, 343 - 345.
 - Wang, T. 2004. "China: Sources of Real Exchange Rate Fluctuations". *International Monetary Fund Working Paper* No. 04/18.
 - Weber, A. A. 1997. "Sources of Purchasing Power Disparities between the G3 Economies". *University of Bonn Discussion Paper* No. B-419.
 - Wilson, P. 2001. "Exchange Rates and the Trade Balance for Dynamic Asian Economies - Does the J-Curve Exist for Singapore, Malaysia, and Korea?". *Open Economies Review*, Vol. 12, 389 - 413.

Appendix

Map of Tunisia



Flag of Tunisia



Basic information

- **Geography**

Location: North Africa, bordering the Mediterranean Sea, between Algeria and Libya.
Area: 163,610 sq. km. (63,378 sq. mi.).
Capital city: Tunis
Terrain: Arable land in north, along central coast; south is mostly semiarid or desert.
Climate: Hot, dry summers and mild, rainy winters.

- **People**

Nationality: Noun and adjective: Tunisian(s).
Population (2010): 10,431,000.
Population growth rate (2010): 1.1 %.
Ethnic groups: Arab-Berber 98%, European 1%, other 1%.
Religions: Muslim 98%, Christian 1%, Jewish less than 1%.
Languages: Arabic (official), French (commerce).
Life expectancy (2009): 75.78 total, 73.93 years male, 77.7 years female.
Work force (2009): 3.691 million.
Unemployment rate (2009): 14.2%.

- **Economy**

Real GDP,PPP (2009):	\$86,35 billion.
Real GDP growth rate (2009):	3%.
Per capita GDP, PPP (2009):	\$8,200.
Natural resources:	natural gas, crude oil, phosphates, salt, iron ore.
Agriculture:	Products: olives, dates, citrus, almonds, grains.
Industry:	petroleum, mining, textiles, footwear, food processing.
Services:	Tourism, commerce, transport, communications.
Sector share of GDP (2006 .):	Agriculture 12%; industry 33%; services 55%.
Trade (2005):	

a-Exports--\$11.7 billion

Hydrocarbons, agricultural products, phosphates, chemicals, textiles, mechanical, electric components. *By region--*Africa 9.9%, Americas 3.1%, Asia 3.7%, Europe 83.3%. *By country* (U.S.\$ million)--France \$3807.07; Italy \$2598.46; Germany \$926.0; Spain \$739.0; Libya \$635.15; Belgium \$282.61; U.K. \$322.0; U.S. \$145.6.

b-Imports (\$15.2 billion)

Industrial goods and equipment, hydrocarbons, food, consumer goods. *By region--*Africa 7.8%, Americas 5.9%, Asia 10.5%, Europe 75.8%. *By country* (U.S.\$ million)--France \$3461.61; Italy \$2836.15; Germany \$1200.61; Spain \$714.69; Libya \$743.0; China \$501.84; U.S. \$435.15.

Agriculture

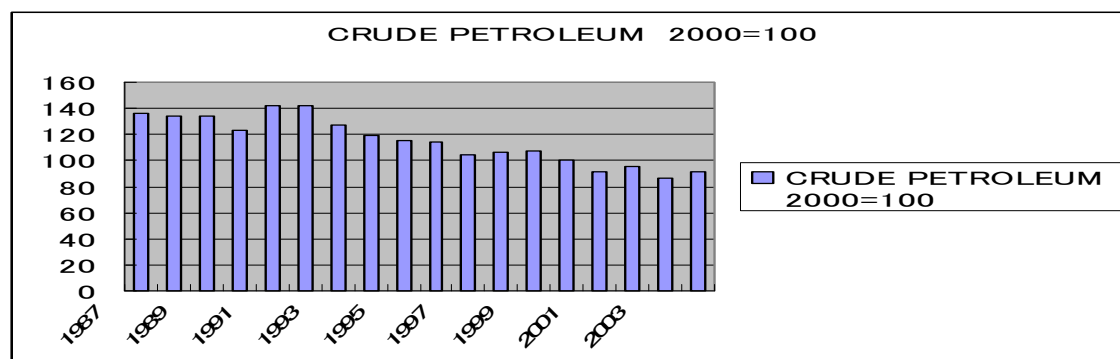
Although the GDP figure varies from year to year depending on the weather, agriculture has never fallen below 11 % and in good years has topped 16 %. It represents 9 % of exports and employing about 22 % of the working population. An agricultural agreement with the European Union (EU) in January 2001 presented new opportunities for Tunisian exports and boosted the country's position in the European market, especially for products such as olive oil, double concentrate tomato paste and table grapes.

Fishing is one of the principle activities in the broadly-defined agricultural sector and is the second major source of food-export revenue after olive oil, contributing 8 % of the agricultural value added.

Oil

When the reforms began in 1987, oil provided about a third of all exports. Despite minor new discoveries however, reserves are steadily diminishing and the economy can rely neither on oil nor on natural resources as a whole. Between 1993 and 2001, crude oil's share of exports fell from 12.7 % to 7.3 %. Recently national production is far from covering the country's needs.

Fig.3: Crude petroleum production in Tunisia



Source: International Financial statistics (IFS) data

Industry

The country has an industrial infrastructure of more than 10 000 firms and comparative advantage in the textile, clothing and leather sector, and in mechanical and electrical industries. Manufacturing production, especially of export goods, shrank by 1.1 % in 2002, against growth of 12 % the previous year. While industry in Tunisia is gifted in adapting to the market, it suffers from being chiefly composed of contractors that are largely dependant on the European market.

In 2006, the manufacturing sector accounted for more than 60% of industrial production, about 20 % of the working population and 18.2 % of GDP. Growth reached 3.6 % in 2006, a mere 0.9 % progression from 2005, due to the bad performance of the textile sector (down 5 %) and the agrifood industries (down 0.6%). The textile sector put up relatively good resistance to Asian competition by positioning itself on the short distribution channel, i.e. by catering to nearby European consumers, and on quality production.

The machinery and electricity industries sector is dynamic, with a 10% growth rate in 2006.

The construction sector, which had grown by 5.5 % in 2006, has good perspectives owing in particular to increased investments in infrastructure, roads and tourist facilities.

Services

The services sector represents about 40 % of GDP and half of the working population. It has expanded significantly in the past few years and has driven Tunisian growth upwards. New information and communication technology (NICT) has been designated as a strategic sector because of its employment potential, but tourism holds the leading position in services. It represented 6 % of GDP in 2006, employed more than one-third of the working population and constituted an important source of foreign exchange. In 2006, a record 6.7 million tourists entered the country, with EUR 1.7 billion in revenues. An action plan aiming to improve the yield in this key sector will be finalized by 2011. Sea water therapy and hydrotherapy are

among the areas chosen for diversification in tourism, as well as golf tourism.

Fig. 4: GDP per sector 2001

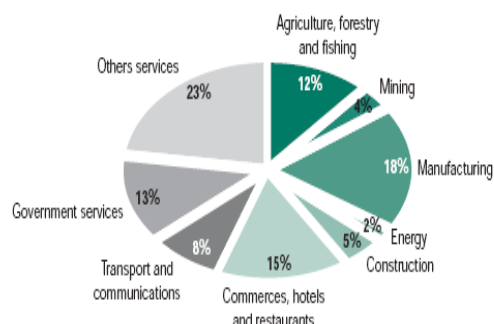
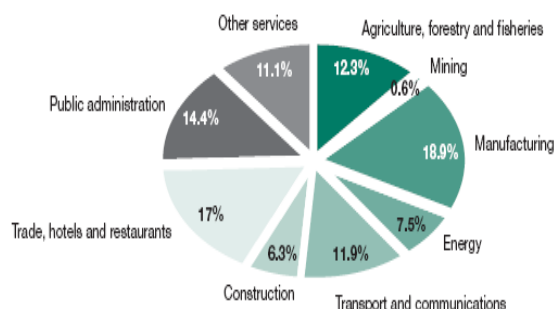


Fig.5: GDP per sector 2006

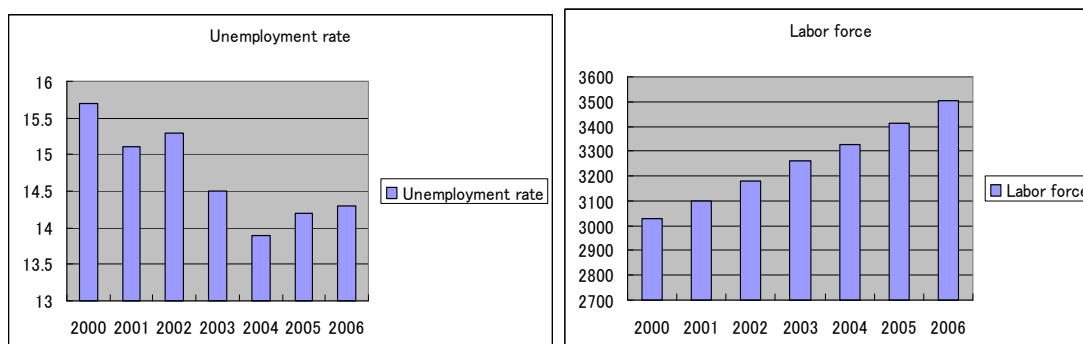


Source: <http://www.oecd.org/dataoecd/14/15/2497628.pdf> ; <http://www.afdb.org/pls/portal/docs/>

Labor

Tunisian labor is readily available. Tunisia has a labor force of approximately 3.4 million and a national literacy rate of about 75%. About 90% of the work force under 35 is literate. The official unemployment rate is under 14% (although this is considerably higher in some areas). The figure does not include many who are underemployed.

Fig.10. Unemployment rate and labor force



Source: IFS data

The structure of the workforce has remained stable over the past 20 years (15% agriculture, 32% industry and 53% commerce and services). Wages and working conditions are established through triennial collective bargaining agreements between the UGTT (the General Union of Tunisian Workers) and the national employers association (UTICA - Union Tunisienne de l'Industrie, du Commerce et de l'Artisanat). These agreements set industry standards and generally apply to about 80% of the private sector labor force, whether or not individual companies are unionized. The current monthly minimum legal wage in the industrial sector is

about \$180 for a 40 hours week and \$200 for a 48 hours week. Currently the main challenge that Government faces is the creation of nearly 80,000 new jobs each year to curb unemployment. To this end, sustained annual growth above 6% would be required.

Tunisia: Selected Economic Indicators, 2004–10							
(Quota: SDR 286.5 million)							
(Population: 10.3 million; 2008)							
(Per capita GDP: \$3,632; 2008)							
(Poverty rate: 3.8 percent; 2005)							
(Main export: electronic and mechanical goods, textiles, energy, tourism; 2008)							
	2004	2005	2006	2007	2008 Prel.	2009 Proj.	2010 Proj.
Output and Prices							
Real GDP (market price)	6.0	4.1	5.3	6.3	4.6	3.0	4.0
Consumer prices (end of period)	1.2	3.7	3.3	5.3	4.1	3.5	3.4
Consumer prices (period average)	3.6	2.0	4.5	3.1	5.0	3.5	3.4
Investment and Saving							
Gross capital formation	24.5	22.3	24.6	25.7	27.5	25.7	26.6
Of which: Nongovernment 1/	17.5	15.9	18.4	19.8	21.1	18.4	19.2
Gross national savings	21.8	21.3	22.6	23.2	23.3	22.5	24.0
Of which: Nongovernment 1/	17.3	18.0	19.6	20.3	17.9	19.0	20.4
Public Finances 2/							
Revenue, excluding grants and privatization	23.8	23.6	23.4	23.8	26.2	23.7	23.3
Expenditure and net lending	26.6	26.8	26.5	26.7	27.3	27.5	27.0
Budget balance, excluding grants and privatization	-2.8	-3.2	-3.0	-2.9	-1.2	-3.8	-3.8
Primary balance, excluding grants and privatization	0.0	-0.4	-0.3	-0.3	1.1	-1.4	-1.5
Total government debt	59.4	58.1	53.7	50.0	47.5	48.7	49.0
(Annual percentage change, unless otherwise indicated)							
Monetary Sector							
Credit to the economy	5.3	6.3	6.6	9.7	13.5	8.0	...
Base money	12.2	21.9	17.6	15.3	17.6	21.8	...
Broad money	10.3	11.0	11.4	12.5	14.4	10.9	...
Velocity of broad money	1.6	1.6	1.6	1.5	1.5	1.4	...
Three-month treasury bill rate (period average, in percent) 3/	5.1	5.1	5.1	5.1	5.1	4.0	...
(In percent of GDP, unless otherwise indicated)							
External Sector							
Exports of goods (in US\$, percentage change)	20.7	9.8	9.9	29.6	26.6	-21.5	5.8
Imports of goods (in US\$, percentage change)	18.3	3.4	12.8	26.9	28.7	-21.4	8.2
Merchandise trade balance	-8.8	-6.7	-8.1	-8.1	-9.8	-8.2	-9.3
Current account excluding official transfers	-2.7	-1.0	-2.0	-2.5	-4.2	-3.3	-2.6
Current account including official transfers	-2.3	-0.6	-1.5	-2.2	-4.0	-3.0	-2.3
Foreign direct investment 4/	2.1	2.2	3.2	6.0	5.3	3.1	3.2
Total external debt 5/	66.5	65.3	58.1	53.9	53.7	52.5	52.3
Gross reserves (in billions of U.S. dollars) 6/	4.0	4.4	6.8	7.9	9.0	9.7	11.0
In months of next year imports of goods and services	3.1	3.3	4.0	3.6	4.9	5.1	5.5
In percent of short-term external debt (on remaining maturity basis)	82.2	88.3	136.7	146.4	150.3	171.2	173.7
Memorandum Items:							
Nominal GDP (in US\$ billions)	29.3	27.7	31.9	37.4	38.4	39.0	40.5
Unemployment rate (in percent)	13.9	14.2	14.3	14.1	14.2	...	...
Net imports of petroleum products (in millions of U.S. dollars)	399.0	393.4	632.1	-106.3	676.8	-157.5	-354.1
Terms of trade (deterioration -)	-4.4	-2.3	-3.6	-1.9	1.0	3.9	-2.1
Local currency per U.S. dollar (period average)	1.2	1.3	1.3	1.3	1.2	...	...
Real effective exchange rate (annual average, percentage change)	-3.5	-4.6	-0.8	-2.8	-0.9	...	...
Stock market index 7/	1,331.8	1,615.1	2,331.1	2,614.1	2,892.4	3,589.4	...
Sources: Tunisian authorities; and IMF staff estimates.							
1/ Includes public enterprises.							
2/ The fiscal year is the calendar year.							
3/ In 2009, average for March.							
4/ Excludes privatization receipts.							
5/ Includes bank deposits of non-residents, most of whom in Tunisia for a long-term horizon, estimated at 7.7 percent of GDP in 2008.							
6/ Includes privatization receipts, which were about US\$2.2 billions in 2006 and averaged US\$0.1 billion in 2005 and 2007–08.							
7/ TUNINDEX (1000=4/1/1998). The 2009 data as of July 13, 2009.							

Source IMF 2009

- **People and history**

Recorded history in Tunisia begins with the arrival of Phoenicians, who founded Carthage and other North African settlements in the 8th century B.C. Carthage became a major sea power, clashing with Rome for control of the Mediterranean until it was defeated and captured by the Romans in 146 B.C. The Romans ruled and settled in North Africa until the 5th century, when the Roman Empire fell and Tunisia was invaded by European tribes, including the Vandals. The Muslim conquest in the 7th century transformed Tunisia and the make-up of its population, with subsequent waves of migration from around the Arab and Ottoman world, including significant numbers of Spanish Muslims and Jews at the end of the 15th century. Tunisia became a center of Arab culture and learning and was assimilated into the Turkish Ottoman Empire in the 16th century. It was a French protectorate from 1881 until independence in 1956, and retains close political, economic, and cultural ties with France.

Nearly all Tunisians (98% of the population) are Muslim. There has been a Jewish population on the southern island of Djerba for 2000 years, and there remains a small Jewish population in Tunis and other cities, which is mainly descended from those who fled Spain in the late 15th century. A small Christian community is dispersed throughout the country, and includes foreign residents, as well as a few hundred native-born citizens who have converted to Christianity. Small nomadic indigenous minorities have been mostly assimilated into the larger population.

- **Government and political conditions**

Tunisia is a republic with a strong presidential system dominated by a single political party. President Zine El Abidine Ben Ali has been in office since 1987, when he deposed Habib Bourguiba, president since Tunisia's independence from France in 1956. The ruling party, the Democratic Constitutional Rally (RCD), was the sole legal party for 25 years--including when it was known as the Socialist Destourian Party (PSD)--and still dominates political life. The president is elected to 5-year terms--with virtually no opposition--and appoints a prime minister and cabinet, who play a strong role in the execution of policy. Regional governors and local administrators are also appointed by the central government; largely consultative mayors and municipal councils are elected. There is a bicameral legislative body. The Chamber of Deputies has 189 seats, 20% of which are reserved for the opposition. It plays a limited role as an arena for debate on national policy but never originates legislation and virtually always passes bills presented by the executive with only minor changes. A referendum in 2002 created a second chamber, the Chamber of Advisors. First-time elections for the Chamber of Advisors were held in July 2005. The judiciary is nominally independent, but responds to executive direction, especially in politically sensitive cases. The military is professional and does not play a role in politics.