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# MONETARY TRANSMISSION AND BANK LENDING IN CYPRUS

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# MONETARY TRANSMISSION AND BANK LENDING IN CYPRUS


## Abstract

*This paper investigates the role of bank lending in the monetary transmission process in Cyprus. We observe significant differences between the responses of total bank lending following a shock in one of the policy variables used. The main implication of our study is that there is a bank lending channel in Cyprus.*

*This is very clear in the case of a shock being imposed in the M0 variable as in this case the total loans answer to a positive shock by increasing more than what they do in the other cases, where a shock is imposed in the M1 or M2 variable.*

*When the shock is imposed in the primary liquidity (M1) variable, then there is no long run effect of the shock in the other variables and the short run effect is very small. The latter happens as well when the shock is imposed in the total liquidity (M2) variable.*

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## EXECUTIVE SUMMARY

Κύριος στόχος αυτής της μελέτης είναι, βάση των δεδομένων που έχουν χρησιμοποιηθεί, να αποδείξει την ύπαρξη ή μη του μηχανισμού μετάδοσης νομισματικής πολιτικής μέσω του καναλιού του τραπεζικού δανεισμού στη Κύπρο.

Όλη η έρευνα έχει γίνει με δεδομένα από το 1960 μέχρι το 1994, μια περίοδο κατά την οποία η χώρα προσπαθούσε να προσαρμοστεί στα ζητούμενα της Ευρωπαϊκής Ένωσης με σκοπό την ένταξη της σε αυτήν. Κατά τη διάρκεια αυτής της προσπάθειας υπήρξαν πολλές «ανωμαλίες» στα οικονομικά μεγέθη και αυτό επηρεάζει και τα αποτελέσματα της έρευνας αυτής. Γενικά μιλώντας, στην Κύπρο υπήρχε μια συγκεντρωτική αγορά, όπου ο έλεγχος ήταν πολύ σημαντικός για τη σωστή λειτουργία της. Με την ένταξη στην Ευρωπαϊκή Ένωση η αγορά φιλελευθεροποιήθηκε και το τραπεζικό σύστημα πέρασε από πολλές αλλαγές για μια πιο ομαλή λειτουργία του.

Ένα πολύ σημαντικό αποτέλεσμα της έρευνας είναι ότι στη Κύπρο υπάρχει το κανάλι του τραπεζικού δανεισμού, το οποίο είναι πιο εμφανές στην περίπτωση ενός σοκ στη νομισματική βάση (M0).

Τέλος, ένα άλλο εξίσου σημαντικό αποτέλεσμα είναι ότι δεν υπάρχει κανάλι επιτοκίου στην Κύπρο και αυτό συνδέεται με το ότι τα επιτόκια ήταν σταθερά κατά την περίοδο που μελετήσαμε.

## 1. INTRODUCTION

In recent years a large literature has developed that focuses on the existence and importance of bank lending channel. According to this, banks respond to a monetary contraction by reducing the supply of bank loans, which has a negative impact on real activity.

The importance of the bank lending channel in the monetary transmission process has been established by a large number of studies, but the empirical evidence has been much less conclusive.

The role of this paper is to provide evidence on the existence of a bank lending channel in Cyprus. The analysis is carried within the VAR context with aggregate data.

The rest of this paper is organized as follows: Section two will provide a detailed analysis of the theoretical framework, focusing on the money view and the credit view of the monetary transmission mechanism. Section three will continue with a brief analysis of the institutional framework in Cyprus. Section four will refer to previous empirical evidence focusing mainly on the work of Spanos, Andreou and Syrichas (1997). Section five will continue with the methodology used in the paper and the analysis of the empirical results. Section six will be dedicated to the conclusions derived from the study.

## 2. THEORETICAL FRAMEWORK

Monetary policy is a powerful tool in the hands of policymakers allowing them to influence the real economy. In the short run, monetary policy can significantly influence the growth of the real economy. Much research has been done to find how the monetary policy decisions are transmitted into changes in real economy variables.

Two widely discussed definitions of the monetary transmission mechanism are as follows:

- The monetary transmission mechanism is a process through which monetary policy decisions are transmitted into changes in income and inflation, and

- The monetary transmission mechanism is the process in which monetary factors operate via equilibrium in asset markets to influence output and asset prices, and these in turn influence desired consumption and investment spending

Therefore the monetary transmission mechanism remains as Bernanke and Gertler (1995) mentioned, *a black box* to be explored.

In the recent literature development, there are three main schools of thought on the channels of the monetary transmission mechanism. The first view stresses the role of money ("the money view"), the second view stresses the role of credit ("the credit view/the bank lending view") and the third view focuses on credit rationing as another channel of the transmission mechanism.

In the pure money version of the monetary transmission mechanism, there are effectively only two assets – money and bonds. In this world the banking sector's only special role has to do with the liability side of its balance sheet – the fact that it can create money by issuing demand deposits. On the asset side of their balance sheets, nothing unique is done. The banks just invest in bonds as households do.

In the credit view there are three types of assets – money, publicly issued bonds and intermediated loans. The banking sector now can be specialized in two relevant ways: in addition to creating money it gives loans.

Advocates of the credit view claim that the credit market has been completely ignored by the money view. They believe that bank credit is another important factor that might be responsible for changes in the real economy. There exist two possible channels supporting the credit view.

1. *The balance sheet channel* focuses on the impact that changes in monetary policy have on the borrowers' balance sheets. One way to think about the balance sheet channel is through the effect of a monetary policy contraction. This leads to a decrease in firms cash flows as now firms pay more on their actual loans made. The decrease in the cash flow lowers the net worth of the firm and as such increases the adverse selection and moral hazard problems. These in turn lead to a decrease in lending and as a result in a decrease in investment and output.

2. *The bank-lending channel* focuses on the possible effects of monetary policy actions on the supply of loans by the banking system. This simply means that a contractionary monetary policy leads to a fall in bank deposits, which in turn decreases bank loan supply. This decrease in loan supply leads to a decrease in investment and output. If banks manage to control the effects of monetary policy contraction by finding non-deposit funding then the bank lending channel becomes impotent.

Credit rationing on the other hand takes place, if the demand for loans exceeds the supply at the prevailing price. The credit-rationing phenomenon is oftenly categorized into Disequilibrium Credit Rationing (DCR) and Equilibrium Credit Rationing (ECR).

The DCR is a short run phenomenon, which is caused by the loan rate stickiness or by institutional constraints such as government setting the credit limits or regulations, which control the limit on interest rates.

The Equilibrium Credit Rationing phenomenon is caused by non-price factors. Arndt (1982) proposed that Equilibrium Credit Rationing is most probably caused by "bank rationing" of credit.

## 3. INSTITUTIONAL FRAMEWORK

The financial sector in Cyprus has experienced a rapid growth due to the liberalisation of the market and the development of the island as an international business centre. The main component of the financial sector is the banking sector.

The financial sector in Cyprus has different characteristics, which make it interesting to study. Some of the characteristics are:

- **Fragmented Regulatory Structure -** the financial sector in Cyprus has two supervisory bodies. On one hand is the Central bank of Cyprus, which has the supervision of the onshore and the offshore banks and on the other hand is the Commissioner of Co-operative Societies and Co-operative Development of the Ministry of Commerce and Tourism, which has the supervision of the co-operative credit institutions.

- **Highly Concentrated -** in Cyprus there are three banks, which control the largest part of the market. They control 75% of banking assets and 73% of lending.

- **No State Banks -** in Cyprus there are no state banks except (i) the Housing of Finance Corporation which is a government controlled institution that grants loans for housing purposes mainly to medium and low income families and (ii) the Cyprus Development Bank, which concentrates on long term finance for development projects.

- **Highly Regulated -** before the liberalization process (2001), the system was working with interest rate ceilings, lending and exchange rate controls.

- **Direct Monetary Policy Tools -** before 1996 the implementation of monetary policy was carried out with the usage of direct tools. After 1996 a new framework of monetary policy was introduced with the indirect tools replacing the direct ones.

The banking sector consists of 12 banks, out of which 9 are commercial banks and 3 are specialised institutions.

The Commissioner of Co-operative Development supervises the co-operative credit societies. The Co-operative credit societies are of two types of liabilities:

- *Limited Liability*: *There* are 65 saving co-operative societies

- *Unlimited Liability:* There are 297 credit co-operative societies

## 4. EMPIRICAL EVIDENCE

Empirical evidence from the paper of Spanos *et al* (1997) was a valuable source of reference for the completion of this work. In their paper the main objective was to model the monetary sector of the Cypriot economy in order to discover the economic relationships among macroeconomic variables which will help to achieve a more efficient implementation of monetary policy. The methodology used was VAR as viewed in the context of the Probabilistic Reduction Approach. The data used in the paper were annual observations for the period 1960 to 1994 for certain time series variables of the Cyprus economy. In our paper we will use

the same methodology as in the paper of Spanos *et al* (1997) and will consider quarterly data from 1980 quarter one to 2001 quarter four.

## 5. METHODOLOGY AND RESULTS

This paper investigates the existence of a bank lending channel in the monetary transmission mechanism in Cyprus using cointegration and impulse response analysis within a vector autoregression (VAR) context.

The data was obtained from the IFS database and cover the period from 1980 first quarter until 2001 fourth quarter and can be divided into four categories:

**Policy Variable:** Following Bernanke and Blinder (1992) and most of the VAR based literature on the monetary transmission mechanism an attempt was made to include a short-term interest rate as a policy variable. One option was to use the discount rate, which was used before 1996 and afterwards was replaced by the so-called Marginal Lending Facility (Lombard Type).

Another option was to use the interbank rate, which is the rate at which the commercial banks lend each other in the interbank market. The problem with these rates was that historically interest rates have been constant until 2001 when they were fully liberalized (refer to appendix 1) and do not have much information about monetary policy decisions.

In an attempt to deal with this problem and based on Sims, Leeper and Zha (1996), the quantity of money is used as policy variable. In this case there are three options to look at. First is the monetary base (M0), which includes currency in circulation plus deposits of commercial banks with the central bank. Second is the narrow money supply (M1), or primary liquidity, consisting of currency holdings by the public and demand deposits with commercial banks. And third, is the total liquidity, or broad money supply (M2), comprising of demand, savings and time deposits held by the domestic non-government sector with deposit money banks and currency held by the public (refer to appendix 2). During our analysis, the three options will be analyzed to see how shocks in the policy variables are best transmitted. The data on monetary base, primary and total liquidity are in real terms and will be used in logs.

**Key Macroeconomic Variables:** the main macroeconomic variables that reflect the effects of monetary policy are the real Gross Domestic Product (GDP), prices represented by the GDP deflator (GDPD) and the long-term interest rate represented by the Treasury bill rate (TB) (refer to appendix 3).

Quarterly data on real GDP were not available; therefore from quarterly data available for nominal GDP from 1990 to 2001, weights were calculated for each quarter, where the average for the period 1990 to 2001 for each quarter was first calculated and then this average was divided by the total average to find the weight that each quarter had and were finally used to find quarterly real GDP.

**Bank Balance Sheet Data:** the only bank asset included is bank loans (LT). These are loans from the commercial banks not including the amount of loans given by the co-operative societies. It would be interesting to have another variable for bank loans in our model, which would include the co-operative societies. This however cannot be done at the present moment due to lack of data. Bank loans will be used in total, the loans to the private and public sector (refer to appendix 4).

**Exogenous Variables:** A permanent dummy for the period 1996:1 (with value 1 in 1996:Q1 and 0 elsewhere) is included in our VAR model to account for the structural changes due to the introduction of the new monetary policy framework.

All the time series variables were tested for the presence of seasonality and structural break. They are all seasonally adjusted while some of them have structural breaks which were taken into account using dummies where appropriate. Structural breaks are found for the following variables only:

LnM1 for 1999Q4

LnGDPD for 1981Q1

TB for 1997Q3 and 2001Q4

LnLT for 1996Q1 and 1999Q3

In order to test for the presence of stochastic nonstationarity in our data, the integration order of the individual time series is first investigated and they all are integrated of order one. The tests were performed using Dickey and Fuller (1979,

1981) for time series without structural breaks and Perron (1988) tests where structural breaks were present.

Misspecification tests are performed for each of the regression equations and they are all well-specified.

The VAR approach treats every variable in the system as a function of the lagged values of all the endogenous variables in the system defined as:

$$Y_t = \mathrm{B}_0 + \sum_{i=1}^{p} \mathrm{B}_i Y_{t-i} + U_t$$

Another important issue is the order selection of the VAR model. The optimal specification of the lag length is such that the $U_t$ is an independent process. There are different procedures or criteria used for choosing an adequate VAR order. The criterion used in this study is the Akaike Information Criterion.

In total 14 VAR models were estimated. For each of the policy variables a very general model was first estimated considering all possible endogenous and exogenous variables (not only the permanent dummy but also the real exchange rate and the oil price to account for the exogeneity of the economy) and the rest of the models were estimated with fewer endogenous or exogenous variables. The models estimated are as follows:

6 models with TB as endogenous variable

4 models with TB neither endogenous nor exogenous

4 models with TB exogenous variable

The results under each group do not differ radically therefore in order to save degrees of freedom we focus on a restricted model with only one exogenous variable, the dummy for 1996 (D1996).

The models we will focus and analyze are the following:

<u>Model 1</u>

$Y_t = [LnM, LnGDP, LnGDPD, LnLT, TB, D1996]$

$Z_t = [LnM, LnGDP, LnGDPD, LnLT, TB]$

$X_t = [D1996]$

Model 2

$Y_t = [LnM, LnGDP, LnGDPD, LnLT, D1996]$

$Z_t = [LnM, LnGDP, LnGDPD, LnLT]$

$X_t = [D1996]$

Model 3

$Y_t = [LnM, LnGDP, LnGDPD, LnLT, TB, D1996]$

$Z_t = [LnM, LnGDP, LnGDPD, LnLT]$

$X_t = [D1996, TB]$,

where $Y_t$ are the endogenous and exogenous variables, $Z_t$ are the endogenous variables and $X_t$ are the exogenous variables. Model one represents the case of TB being included as endogenous variable and is estimated for M0, M1 and M2. Model two represents the case of TB neither endogenous nor exogenous and is estimated for M0, M1 and M2 and model three represents the case of TB as exogenous variable and is also estimated for M0, M1 and M2. Before though estimating the VAR models we have tested for the presence of cointegration.

As Enders (1995) points out, it is quite possible for there to be a linear combination of integrated variables that is stationary, and such variables are said to be *cointegrated.* In order for cointegration to take place the data should be integrated of the same order. Extending to the multivariate case, the stochastic process that generates the times series of a vector of variables is modelled within the context of a vector autoregressive model (VAR).

When more than two variables are involved, cointegration analysis is more complex, because now the cointegrating vector generalizes to a cointegrating space. In this case, when we have a set of k I (1) variables, there may exist up to k-1 independent linear relationships that are I (0). This implies that individual cointegrating vectors are no longer statistically identified; only the space spanned by these vectors is. Vectors in the cointegrating space can be found that have an

economic interpretation and can be interpreted as representing long run equilibrium.

Another approach to cointegration is the one proposed by Johansen (1988). He promoted a maximum likelihood estimation procedure, which allows testing for the number of cointegrating relations.

The first step in the Johansen approach tests the hypothesis about the rank of the long run matrix Π, which determines the long run dynamic properties of $Z_t$ and it can be written as the product of a k*r matrix α and a r*k matrix β. That is:

$$\Pi = \alpha \times \beta'$$

For a given r it can be shown that the ML estimate for matrix β equals the matrix containing the r eigenvectors corresponding to the r largest (estimated) eigenvalues of a k x k matrix that can be estimated fairly easy by using OLS. Let us denote the eigenvalues of this matrix in decreasing order as $\lambda_1 \geq \lambda_2 \geq .... \geq \lambda_\kappa$. If there are r cointegrating relationships (and Π has rank r) it must be the case that log $(1-\lambda_j) = 0$ for the smallest k-r eigenvalues, that is for j=r+1,r+2.…k. We can use the estimated eigenvalues to test the hypothesis about the rank of Π.

For example the hypothesis $H_0$: $r \leq r_0$ vs. $H_1$: s can be tested using the statistic

$$\lambda_{trace(r_0)} = -\mathrm{T} \sum_{j=r_0+1}^{\kappa} \log(1-\lambda_j)$$

This test is the so-called trace test. It tests whether the smallest k-$r_0$ eigenvalues are significantly different from zero.

Cointegration tests using the Johansen approach have been performed in all the time series variables of our study and the results are shown below (the first column refers to models 1, 2 and 3 estimated respectfully for M0, M1 and M2, while the first row refers to the five models under the Johansen approach[1]):

[1] Johansen (1995a, pp. 80-84) considers the following five deterministic trend cases:

Model A: the level data have no deterministic trends and the cointegrating equations do not have intercepts

Model B: the level data have no deterministic trends and the cointegrating equations have intercepts

Table 1: Cointegration tests

| | Model A | Model B | Model C | Model D | Model E | Decision |
|---|---|---|---|---|---|---|
| 1-M0 | 1 | 0 | 0 | 0 | 0 | **0** |
| 1-M1 | 1 | 1 | 0 | 0 | 0 | **0** |
| 1-M2 | 1 | 1 | 0 | 0 | 0 | **0** |
| 2-M0 | 0 | 1 | 0 | 0 | 0 | **0** |
| 2-M1 | 1 | 1 | 0 | 1 | 1 | **1/D** |
| 2-M2 | 1 | 0 | 0 | 0 | 0 | **0** |
| 3-M0 | 0 | 0 | 0 | 1 | 0 | **0** |
| 3-M1 | 0 | 1 | 1 | 1 | 1 | **1/C** |
| 3-M2 | 0 | 0 | 0 | 0 | 0 | **0** |

From the results in table 1 (where 1 stands for cointegration and 0 for no cointegration) we can see that there is cointegration only in the case of a shock being imposed in M1 when TB is either exogenous or neither endogenous nor exogenous. When the shock is imposed on M0 or M2 there is no cointegration and only the short-run relationship among the variables can be analysed.

When exogenous variables are taken into consideration as in our case, then the critical values provided by Johansen are not valid as they do not account for the exogenous variables. Therefore the critical values provided by Mackinnon *et al* (1999) have been used to take into account the exogeneity element. Based on the above mentioned, it is convenient to express a VAR (p) model for an $Y_t$ m-dimensional column vector of I (1) variables in the form of a VEC model as follows:

$$\Delta Y_t = \Pi Y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-i} + \mu_0 + \mu_1 t + \varepsilon_t$$

Where t = 1…T and Π and $\Gamma_i$ are m*m matrices of coefficients, and $\mu_0$ and $\mu_1$ are respectively m-vectors of constant and trend coefficients defined by:

$$\mu_0 = -\Pi\mu + (\Gamma + \Pi)\gamma$$

$$\mu_1 = -\Pi\gamma$$

Where $\Gamma = I_m - \sum_{i=1}^{p-1} \Gamma_i$.

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Model C: the level data have linear trends but the cointegrating equations have only intercepts

Model D: the level data and the cointegrating equations have linear trends

Model E: the level data have quadratic trends and the cointegrating equations have linear trends

A vector error correction (VEC) model is a restricted VAR designed for use with nonstationary series that are known to be cointegrated. The VEC has cointegration relations built into the specification so that it restricts the long-run behavior of the endogenous variables to converge to their cointegrating relationships while allowing for short-run adjustment dynamics. The cointegration term is known as the correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments.

In the case of the VECM described considering the exogenous variables, $Y_t$ will be partitioned into a k-vector of endogenous variables $Z_t$ and n-vector of exogenous variables $X_t$ with respect to Π. Therefore the conditional VECM for $Z_t$ is:

$$\Delta Z_t = \Pi_Z Y_{t-1} + \sum_{i=1}^{p-1} \Xi_i \Delta Y_{t-i} + \Lambda \Delta X_t + c_0 + c_1 t + U_t$$

where $c_0 = -\Pi_y \mu + \Theta\gamma$ and $c_1 = -\Pi_y \gamma$ and Θ is a k*n matrix of unknown parameters derived from the parameters of the unconditional model.

The hypothesis of cointegration can be stated in terms of the conditional long-run impact matrix $\Pi_Z$, which can be written as follows:

$$\Pi_Z = \alpha\beta'$$

Where α is a $k \times r$ and β a $m \times r$ matrix of full rank.

For all the models mentioned above VAR and VEC models have been estimated which are all well specified as shown in appendix 5 for the VAR estimations and appendix 6 for VEC estimations.

The Impulse Response Analysis (IRA) indicates how a shock to any one variable filters through the model to affect every other variable and maybe to feedback to the original variable itself.

Looking at the impulse response graphs in appendix 7, there is a positive shock in M0, which tends towards equilibrium, but does not reach it until the fourth quarter. In all the estimated models with the shock being imposed to the M0 variable, there is a positive answer of GDP that becomes significant in the second quarter until the third quarter and then goes towards the equilibrium until

the fourth quarter. In the case of a shock in M0 in all the models estimated, there is a negative impact of GDPD until the second quarter. From there on there is a positive impact. This seems to say that prices do not adjust immediately after a shock. This however is under research from other economists as well, in order to check the behaviour of prices after a monetary policy shock. On the other hand, total loans LT show a positive reaction to a positive shock in M0 until the third quarter and thereon LT decreases until it almost reaches the equilibrium in the fourth quarter. In the case of Model 1-M0, where TB is said to be an endogenous variable, the effect on TB to a positive shock in M0 is positive. It increases instead of decreasing, acting this way as a “bad” transmission variable. This explains the fact that results do not change in the case where TB is exogenous or neither exogenous nor endogenous.

In the case of a positive shock in M2 (refer to appendix 8) there is no impact on GDP in the case where TB is neither endogenous nor exogenous, until the second quarter, while in the case that the TB it is endogenous or exogenous there is a negative answer of GDP until the second quarter. From the second quarter to the third there is a positive impact in all cases and from the third quarter to the fourth there is a decrease towards the equilibrium. There is a positive impact in all cases of GDPD until the third quarter contrary to the case of a shock in M0. And from the third quarter there is a decrease towards the equilibrium. As far as it concerns LT there is a very small increase until the second quarter. The latter is followed by a sharp decrease, which reaches the equilibrium until the third quarter and thereon it decreases more below the equilibrium point. The long-term interest rate, TB, in the case of a shock in M2 is not a good transmission variable as it happened when the shock was in M1 or M0. What is of interest here to mention is the fact that a shock in M2 is not transmitted as well as it is transmitted when the shock is either in M0 or M1 and this is evident from the fact that the LT variable increases less in this case.

Finally when the shock is imposed in M1 variable, there is no transmission mechanism working, except for the case of the shock imposed in M1 when TB is endogenous. In the latter case there is a short run transmission mechanism which works like the one in the case of a shock being imposed in the M2 variable.

In order for the bank-lending channel to be effective, there are several conditions, which must hold and most of them do hold for the case of Cyprus:

- *Bank loans must be an important source of credit for firms* – and in the case of Cyprus this is a very well known phenomenon. Firms and households mainly compose a very important part of the demand for loans and this supports the existence of bank lending channel in Cyprus.

- *There should be no perfect substitute for this kind of credit* – in the case of the banking system in Cyprus there is substitute for banking credit and this is supplied from the Cooperative Societies. This might be one reason why the monetary transmission mechanism in Cyprus does not work in the long run.

- *There must exist bank dependent borrowers* – this is a condition that holds in the case of Cyprus as it is one of its main characteristics the fact that there exist bank dependent borrowers.

- *There must be imperfect price adjustments for monetary policy to affect real variables*

## 6. CONCLUSIONS

The question of how monetary policy affects the real economy is a perennial one in macroeconomics.

In this paper we have analysed the role of bank behaviour in the transmission of unanticipated monetary policy shocks in Cyprus. Using VAR analysis aggregate effects have been analysed. An important conclusion is that there is bank lending channel in Cyprus, which is more evident in the case of a shock being imposed in the M0 policy variable. Another important conclusion is that there is no interest rate channel in Cyprus and this is closely related to the fact that interest rates were constant during the investigated period.

When a positive shock is imposed on one of the monetary policy variables there is a positive impact on the total loans variable, which is significant in the case of the shock imposed in the M0 variable and less evident when the shock is imposed in the other two policy variables. In addition there is no impact on the TB variable indicating this way that there is no interest rate channel.

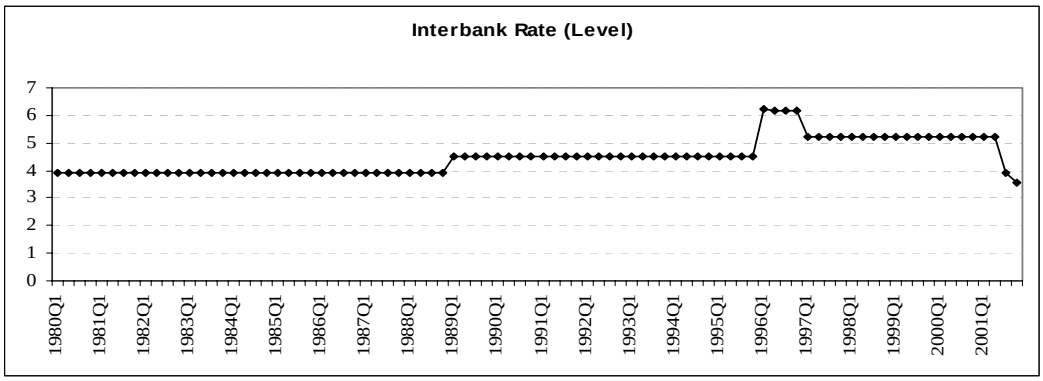
When the shock is imposed on the M1 variable there is a long run relationship while the transmission mechanism does not work in the long-run but only in the short-run.

Knowing how the shocks are imposed will help the monetary policy decision makers know for how long the effect of a monetary policy decision will keep and will therefore be able to react appropriately. As such when they will increase the M0 quantity, in case of liquidity shortage, they know that this will increase the total loans until the third quarter after the shock and thereon it will decrease, the GDP will increase until the third quarter as well and thereon it will decrease too. GDPD will decrease after the shock for two quarters and thereon will increase until it reaches the equilibrium. This allows them to take appropriate measures. The only disadvantage is that in Cyprus it seems that the transmission mechanism works only in the short-run and therefore the decision makers have to use other ways as well to affect the real economy in the long-run.

The monetary policy seems to be effective only for the first three quarters after the shock is imposed and thereafter something else needs to be done.

Finally this work can be extended to include in its analysis the co-operative societies and corporate and household loans included by sector. This would allow for a more detailed analysis which would help estimate each sector contribution.

## APPENDIX 1


Interbank Rate (Level)
7
6
5
4
3
2
1
0
1980Q1
1981Q1
1982Q1
1983Q1
1984Q1
1985Q1
1986Q1
1987Q1
1988Q1
1989Q1
1990Q1
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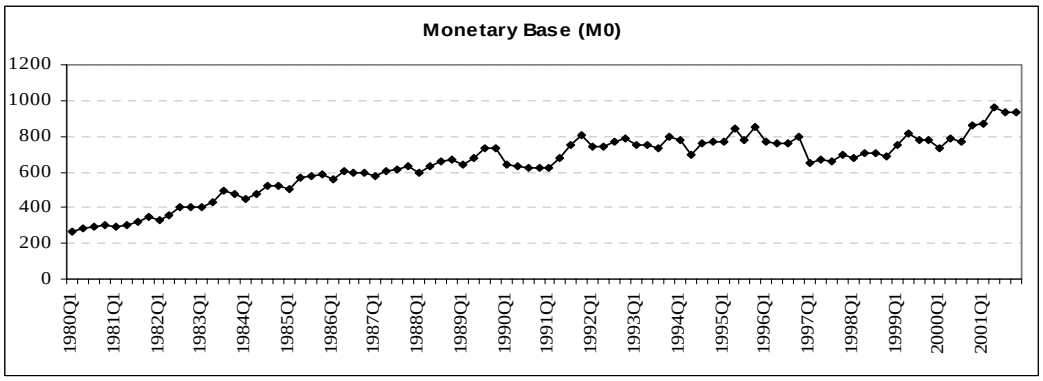
1999Q1
2000Q1
2001Q1


Monetary Base (M0)
1200
1000
800
600
400
200
0
1980Q1
1981Q1
1982Q1
1983Q1
1984Q1
1985Q1
1986Q1
1987Q1
1988Q1
1989Q1
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1994Q1
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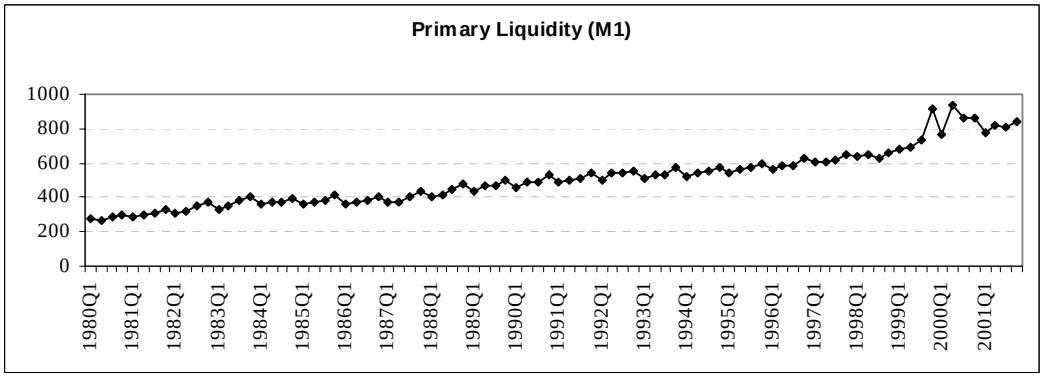
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1


Primary Liquidity (M1)
1000
800
600
400
200
0
1980Q1
1981Q1
1982Q1
1983Q1
1984Q1
1985Q1
1986Q1
1987Q1
1988Q1
1989Q1
1990Q1
1991Q1
1992Q1
1993Q1
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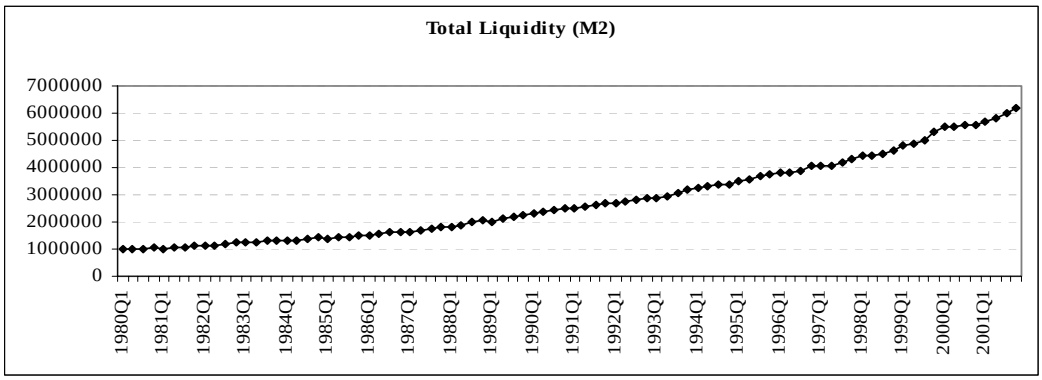
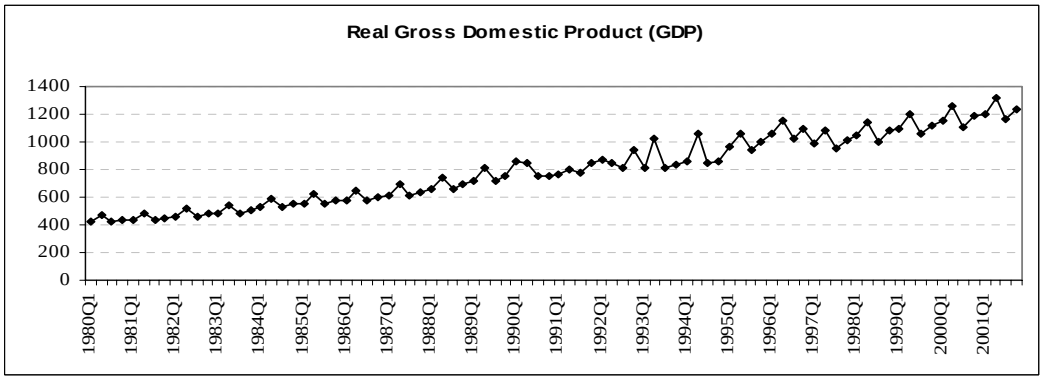
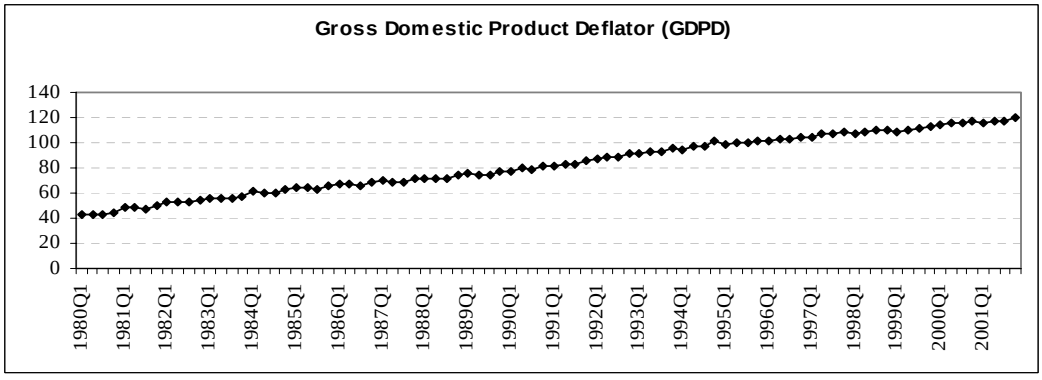
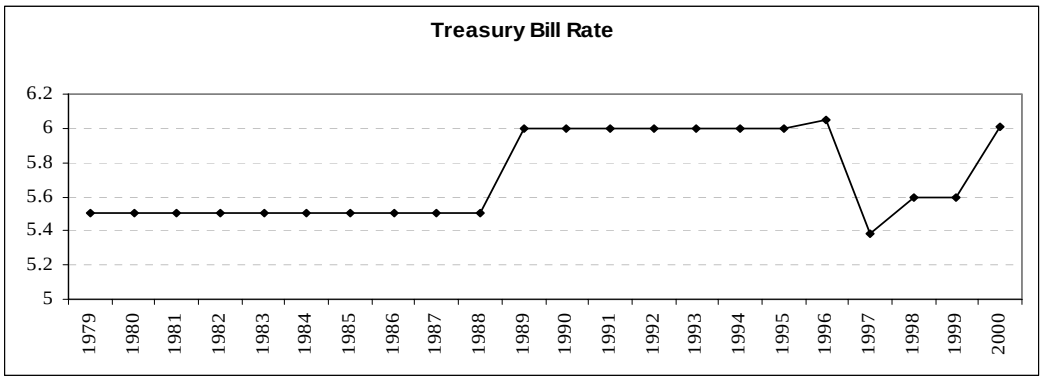
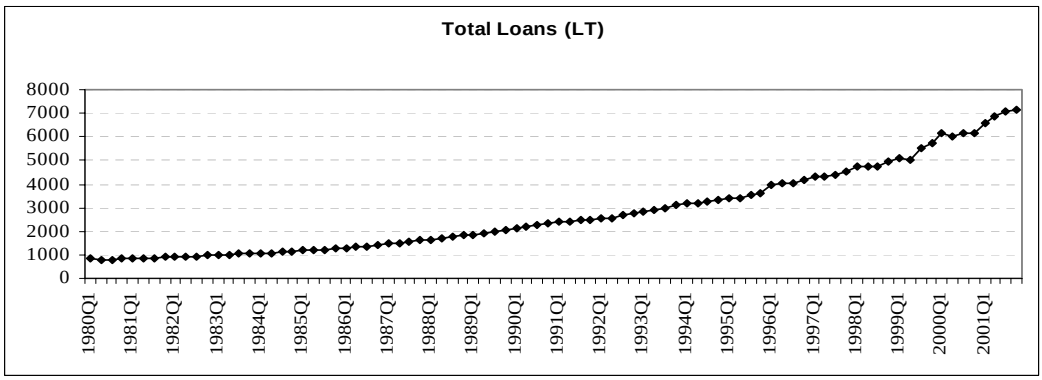
2000Q1
2001Q1


Total Liquidity (M2)
7000000
6000000
5000000
4000000
3000000
2000000
1000000
0
1980Q1
1981Q1
1982Q1
1983Q1
1984Q1
1985Q1
1986Q1
1987Q1
1988Q1
1989Q1
1990Q1
1991Q1
1992Q1
1993Q1
1994Q1
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1


Real Gross Domestic Product (GDP)
1400
1200
1000
800
600
400
200
0
1980Q1
1981Q1
1982Q1
1983Q1
1984Q1
1985Q1
1986Q1
1987Q1
1988Q1
1989Q1
1990Q1
1991Q1
1992Q1
1993Q1
1994Q1
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1


Gross Domestic Product Deflator (GDPD)
140
120
100
80
60
40
20
0
1980Q1
1981Q1
1982Q1
1983Q1
1984Q1
1985Q1
1986Q1
1987Q1
1988Q1
1989Q1
1990Q1
1991Q1
1992Q1
1993Q1
1994Q1
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1


Treasury Bill Rate
6.2
6
5.8
5.6
5.4
5.2
5
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000

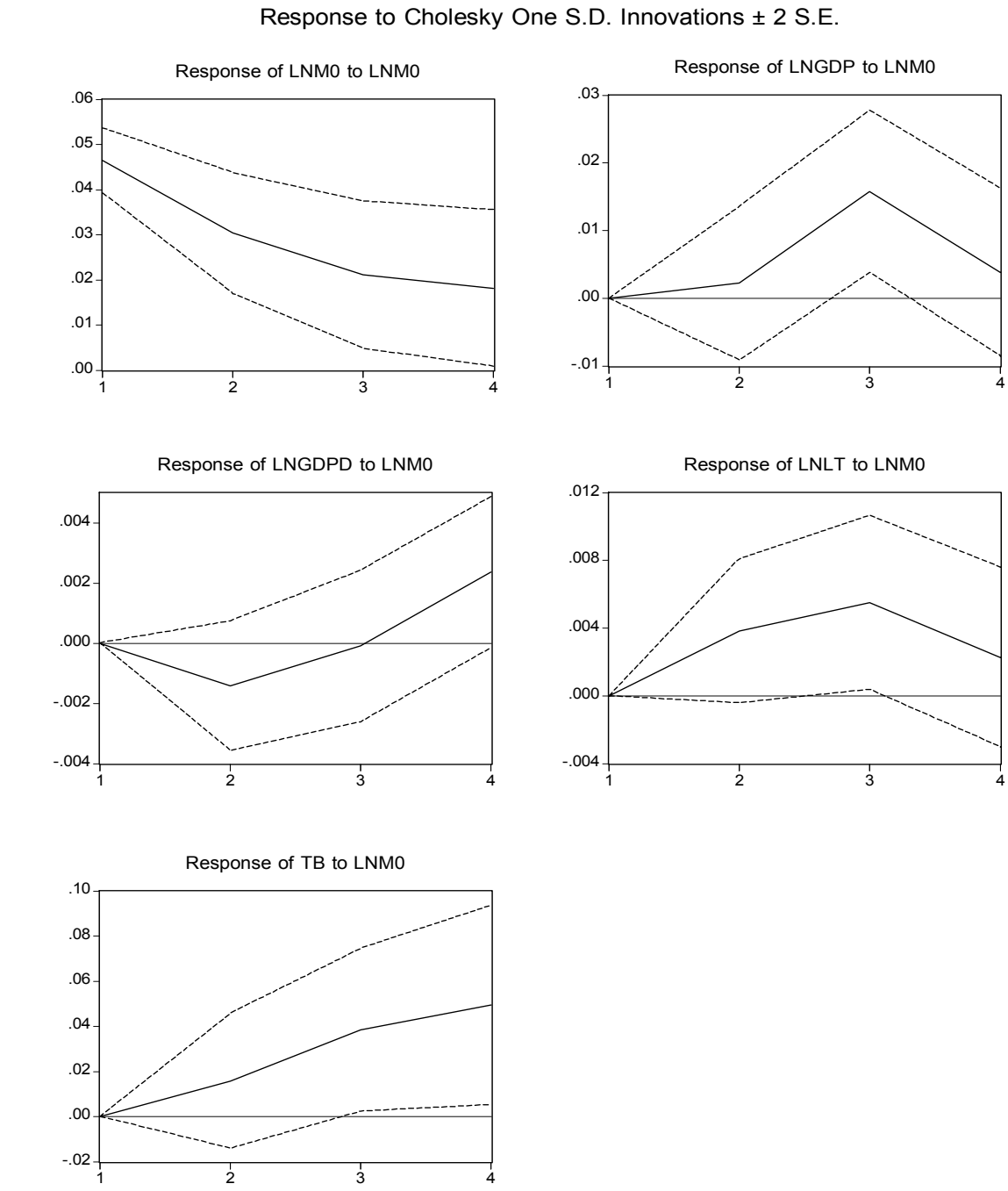

Total Loans (LT)
8000
7000
6000
5000
4000
3000
2000
1000
0
1980Q1
1981Q1
1982Q1
1983Q1
1984Q1
1985Q1
1986Q1
1987Q1
1988Q1
1989Q1
1990Q1
1991Q1
1992Q1
1993Q1
1994Q1
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1

## APPENDIX 2

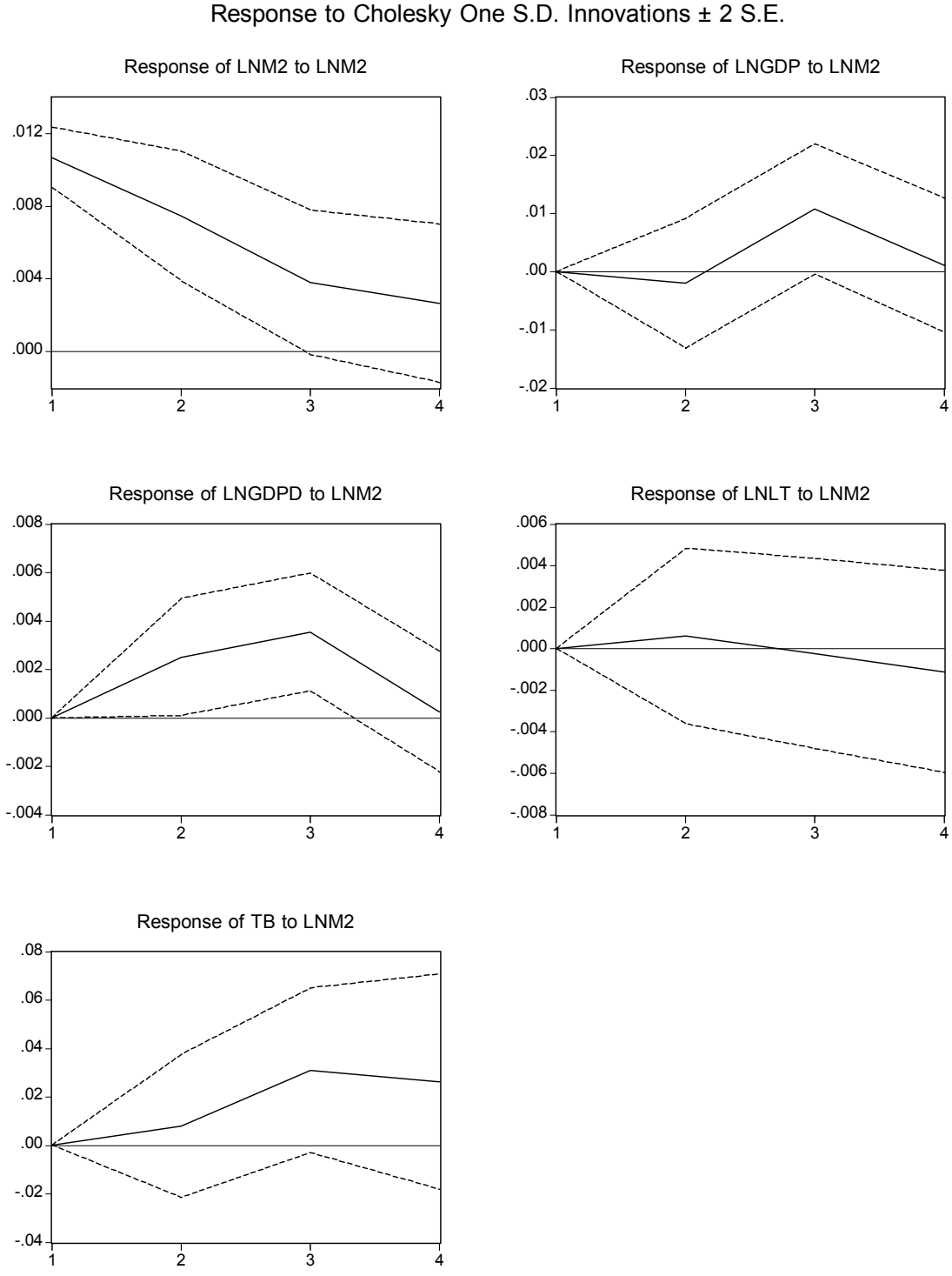
| Model | $H_0$: No Serial Correlation | | $H_0$: Normality | | $H_0$: Homoskedasticity | | $H_0$: Stability |
|---|---|---|---|---|---|---|---|
| | Probability | $H_0$ | Probability | $H_0$ | Probability | $H_0$ | $H_0$ |
| 1-M0 | 0.5113 | Accept | 0.0958 | Accept | 0.0302 | Accept* | Accept |
| 1-M1 | 0.1819 | Accept | 0.0572 | Accept | 0.0148 | Accept* | Accept |
| 1-M2 | 0.0948 | Accept | 0.1846 | Accept | 0.0332 | Accept* | Accept |
| 2-M0 | 0.0664 | Accept | 0.1307 | Accept | 0.5799 | Accept | Accept |
| 2-M1 | 0.1598 | Accept | 0.3831 | Accept | 0.0145 | Accept* | Accept |
| 2-M2 | 0.1014 | Accept | 0.5239 | Accept | 0.0157 | Accept* | Accept |
| 3-M0 | 0.0812 | Accept | 0.0772 | Accept | 0.8158 | Accept | Accept |
| 3-M1 | 0.1077 | Accept | 0.2627 | Accept | 0.0181 | Accept* | Accept |
| 3-M2 | 0.1218 | Accept | 0.2044 | Accept | 0.0104 | Accept* | Accept |

| Model | $H_0$: No Serial Correlation | | $H_0$: Normality | | $H_0$: Homoskedasticity | | $H_0$: Stability |
|---|---|---|---|---|---|---|---|
| | Probability | $H_0$ | Probability | $H_0$ | Probability | $H_0$ | $H_0$ |
| 2-M1 | 0.8432 | Accept | 0.3932 | Accept | 0.0371 | Accept* | Accept |
| 3-M1 | 0.4949 | Accept | 0.4633 | Accept | 0.0320 | Accept* | Accept |

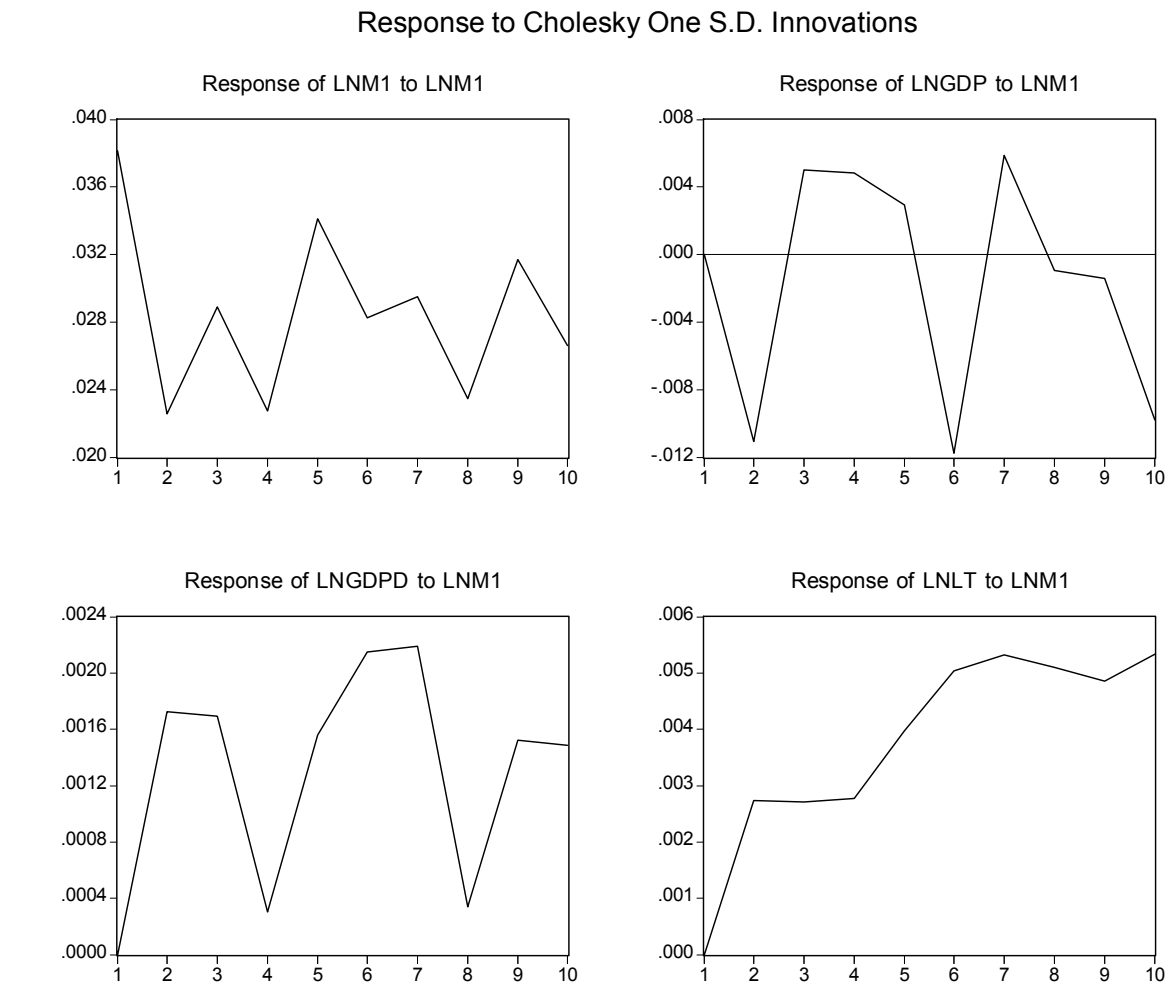
**APPENDIX 3**


Response to Cholesky One S.D. Innovations ± 2 S.E.
Response of LNM0 to LNM0
.06
.05
.04
.03
.02
.01
.00
1
2
3
4
Response of LNGDP to LNM0
.03
.02
.01
.00
-.01
1
2
3
4
Response of LNGDPD to LNM0
.004
.002
.000
-.002
-.004
1
2
3
4
Response of LNLT to LNM0
.012
.008
.004
.000
-.004
1
2
3
4
Response of TB to LNM0
.10
.08
.06
.04
.02
.00
-.02
1
2
3
4

**APPENDIX 4**


Response to Cholesky One S.D. Innovations ± 2 S.E.
Response of LNM2 to LNM2
.012
.008
.004
.000
1
2
3
4
Response of LNGDP to LNM2
.03
.02
.01
.00
-.01
-.02
1
2
3
4
Response of LNGDPD to LNM2
.008
.006
.004
.002
.000
-.002
-.004
1
2
3
4
Response of LNLT to LNM2
.006
.004
.002
.000
-.002
-.004
-.006
-.008
1
2
3
4
Response of TB to LNM2
.08
.06
.04
.02
.00
-.02
-.04
1
2
3
4

**APPENDIX 5**


Response to Cholesky One S.D. Innovations
Response of LNM1 to LNM1
.040
.036
.032
.028
.024
.020
1 2 3 4 5 6 7 8 9 10
Response of LNGDP to LNM1
.008
.004
.000
-.004
-.008
-.012
1 2 3 4 5 6 7 8 9 10
Response of LNGDPD to LNM1
.0024
.0020
.0016
.0012
.0008
.0004
.0000
1 2 3 4 5 6 7 8 9 10
Response of LNLT to LNM1
.006
.005
.004
.003
.002
.001
.000
1 2 3 4 5 6 7 8 9 10

## BIBLIOGRAPHY


Anil K. Kashyap, Jeremy C. Stein, David W. Wilcox, *Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance,* The American Economic Review, Vol. 83, No. 1 (Mar., 1993), 78-98

Anil K. Kashyap, Jeremy C. Stein, *What Do A Million Banks Have to Say About The Transmission of Monetary Policy*, NBER Working Paper Series, Nr. 6056, June 1997

Anil K. Kashyap, Jeremy C. Stein, *Monetary Policy and Bank Lending,* NBER Working Paper Series, Nr. 4317, April 1993

Aris Spanos, Elena Andreou, George Syrichas, *A VAR Model for the Monetary Sector of the Cyprus Economy,* Central Bank of Cyprus and the University of Cyprus, 1997

A. Tarkan Cavusoglu, *Credit Transmission Mechanism in Turkey: An Empirical Investigation,* METU and Hacettepe University

Bennett T. McCallum, *Analysis of The Monetary Transmission Mechanism: Methodological Issues,* NBER Working Paper Series, Nr. 7395, October 1999

Benoit Mojon, *Monetary Policy Under a Quasi – Fixed Exchange Rate Regime, The Case of France Between 1987 and 1996,* CEPII, Nr. 98-14



Bennett T. McCallum, *Analysis of The Monetary Transmission Mechanism: Methodological Issues,* NBER Working Paper Series, Nr. 7395, October 1999

Benoit Mojon, *Monetary Policy Under a Quasi – Fixed Exchange Rate Regime, The Case of France Between 1987 and 1996,* CEPII, Nr. 98-14



Ben S. Bernanke, Alan S. Blinder, *The Federal Funds Rate and the Channels of Monetary Transmission,* The American Economic Review, Vol. 82, Nr. 4, (Sep. 1992), 901-921

Ben S. Bernanke, Mark Gertler, *Inside the Black Box: The Credit Channel of Monetary Policy Transmission,* The Journal of Economic Perspectives, Vol. 9, Nr. 4, (Autumn, 1995), 27-48

Ben S. Bernanke, Ilian Mihov, *Measuring Monetary Policy,* NBER Working Paper Series, Nr. 5145, June 1995

Bill Hung, *Econometric Modeling and Analysis*

Carlo A. Favero, Francesco Giavazzi, Luca Flabbi, *The Transmission Mechanism of Monetary Policy in Europe: Evidence from Banks Balance Sheets,* NBER Working Paper Series, Nr. 7231, July 1999

Cara S. Lown, Donald P. Morgan, *Credit Effects in the Monetary Mechanism,* FRBNY Economic Policy Review, May 2002

Frederick S. Mishkin, *Symposium on the Monetary Transmission Mechanism,* The Journal of Economic Perspectives, Vol. 9, Nr. 4 (Autumn, 1995), 3-10

Jan Kakes, Jan-Egbert Sturm, Philipp Maier, *Monetary Transmission and Bank Lending in Germany,* April 1999

Jan Kakes, *Monetary Transmission and Bank Lending in the Netherlands,* June 1998

James G. Mackinnon, Alfred A. Haug and Leo Michelis, *Numerical Distribution functions of likelihood ratio tests for cointegration,* Journal of Applied Econometrics, 1999

Jeffrey M. Davis, *Monetary Policy and Financial Reform*

John McCallum, *Credit Rationing and the Monetary Transmission Mechanism,* The American Economic Review, Vol. 81, No. 4 (Sept., 1991), 946-951

Jukka Topi, Jouko Vilmunen, *Transmission of Monetary Policy Shocks in Finland: Evidence from Bank Level Data on Loans,* European Central Bank Working Paper Series, Nr. 100, December 2001

Leonardo O. Reyes, *A VAR Analysis of the Monetary Transmission Mechanism in the USA,* Pennsylvania State University, December 2002

Nouriel Roubini, Vittorio Grilli, *Liquidity Models in Open Economies: Theory and Empirical Evidence,* NBER Working Paper Series, Nr. 5313, October 1995

Pany Karamanou, Lavan Mahadeva, Paul Robinson, George Syrichas, *Monetary Transmission Mechanism in Cyprus: The Fixed Exchange Rate Case,* Central Bank of Cyprus

Riccardo Fiorentini, Roberto Tamborini, *The Monetary Transmission Mechanism In Italy: The Credit Channel and a Missing Ring,* Giornale degli Economisti

Rodrigo Alfaro, Helmut Franken, Carlos Garcia, Alejandro Jara, *Bank Lending Channel and the Monetary Transmission Mechanism: The Case of Chile,* Working Papers Central Bank of Chile, Nr. 223, August 2003

Hyun E.Kim, *Was Credit Channel a Key Monetary Transmission Mechanism Following the Recent Financial Crisis in the Republic of Korea,* Policy Research Working Paper 3003, April 1999

W. Jos Jansen, *What do Capital Inflows Do? Dissecting the Transmission Mechanism for Thailand, 1980-1996,* Journal of Macroeconomics 25 (2003), 457-480

## Economic Policy / Economic Analysis Papers

07-04 Hasapis C., "Longrun Effects of the Money and Capital Market on Economic Growth and Shortrun Effects on Stockexchange and Real Economic Activity ", Economic Analysis Paper, November 2004 – in Greek.

06-04 Mitsis P., and L. Christofides, "Macroeconomic Model of Cyprus: Estimation of Quarterly Time Series for the GDP and the Domestic Expenditure Components for the years 1990-2001 ", Economic Analysis Paper, July 2004 – in Greek.

05-04 Komodromou D., and S. Hajispyrou "Pension Plans in Cyprus: Challenges and Perspectives", Economic Policy Paper, October 2004 – in Greek.

04-04 Ktoris C., L. Christofides, "Macroeconomic Model of the Cyprus Economy: Exports and Imports", Economic Policy Paper, June 2004 – in Greek.

03-04 Haroutunian St. and P. Pashardes "Structural Fiscal Balance Estimates for the Cyprus Economy", Economic Policy Paper, June 2004 – in English.

02-04 Haroutunian S., P. Mitsis and P. Pashardes "Using Brochure Information for the Hedonic Analysis of Holiday Packages", Economic Policy Paper, March 2004 – in English.

01-04 Pashardes P., P. Nearchou and N. Empora, "The Economics of Education in Cyprus", Economic Policy Paper, February 2004 – in Greek.

09-03 Haroutunian S., N. Pashourtidou and N. Pospori "Potential Output and Output Gap. Estimates for the Economy of Cyprus", Economic Policy Paper, December 2003 – in English.

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07-03 Pashardes P., "Poverty and Social Exclusion in Cyprus", Economic Policy Paper, December 2003 – in English.

06-03 Pashardes P. and S. Hajispyrou, "The Economic Effects of the Turkish Invasion on the Greek Cypriots", Economic Policy Paper, November 2003 – in English.

05-03 Pashardes P. and S. Hajispyrou, "The Measurement of Inflation and the Cost of Living of Households", Economic Policy Paper, July 2003 – in Greek.

04-03 Karamanou P., P. Mitsis and P. Pashardes, "Macroeconomic Model of the Cyprus Economy – Initial Results", Economic Policy Paper, April 2003 – in Greek.