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MONEY DEMAND IN THE CZECH REPUBLIC SINCE TRANSITION

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Abstract

We analyse the demand for money since the ' break up ' of the Czech-Slovak Republics at the beginning of 1993 and for the aggregates M0, M1, and M2 using monthly data. Due to the widespread use of foreign currency in formally centrally planned economies, we also investigate the issue of currency substitution. Because of our relatively small sample period the Johansen cointegration approach is not used and instead we use the general to specific methodology in a single equation framework. Previous empirical evidence on money demand in Eastern Europe, and specifically Czech Republic, has been mixed. Both graphical and empirical results suggest that any *currency substitution* was a one-off event due to increased uncertainty at the end of 1992 at the time of the monetary dissolution. Certainly currency substitution in the Czech Republic is not as strong as has been found in other former centrally planned economies. However, our results do indicate that Czech National Bank may have to take account of foreign interest rates when interpreting movements in the monetary aggregates.

1. Introduction

Since the break up of the Czech-Slovak Federation on 31 December 1992, the Czech Republic has been at the forefront of the transition to a market economy. Key aims of the Czech Republic, and many other former centrally planned economies (FCPE), is low inflation and a stable exchange rate, particularly for those who ultimately wish to enter the European Union (EU).

Similar to the US Federal Reserve and the European Central Bank (ECB), the Czech National Bank (CNB) adopts some form monetary targeting to control domestic inflation. One of the key elements (along with other economic indicators) is a stable demand for money function[1], which in the long run we initially take to be the following form;

$$[1] \qquad (m - p)_t = \beta_0 + \beta_1 y_t + \beta_2 R_t + \beta_3 inf_t$$

where (m-p) = the logarithm of real money balances, p = price level (CPI), y = logarithm of real household income, R = the percentage per annum opportunity cost of holding money and *inf* = logarithm of p_t/p_{t-1} grossed up to the annual level, where p is the price level[2]. We expect real money demand to be positively related to the level of real income and negatively related to the rate of interest and inflation. We use three measures of money, currency in circulation (=M0), M0 plus demand deposits (=M1), and M1 plus quasi money (=M2). Following estimation of the domestic demand for money we also investigate the portfolio balance effect and currency substitution. We estimate a dynamic error correction model of the demand for money in the Czech Republic since 1993[3].

The contribution of this paper is empirical. We examine the key economic variables in an economy which has been at the forefront of the transition process and investigate whether the transition programme has been credible. The evidence we present for the Czech Republic has implications for other east European economies and the policy being adopted. The rest of the paper is organised as follows, section 2 gives a brief description of the performance of the transition process in Czech Republic. An account of previous empirical evidence on money demand in Eastern Europe since transition is given in section 3. Section 4 outlines the methodological approach adopted. Data and empirical results are discussed in section 5. Finally conclusions and policy implications are given in section 6.

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[1] All variable are in logarithms, except interest rates.

[2] We were unable to use industrial output due to data restrictions and GDP figures are only available quarterly. However private household income is likely to proxy gross transactions better than GDP, since it directly effects both transactions and speculative demand for money during transition (Klacek and Smidkova, 1995).

[3] The dissolution of the monetary union between the Czech and Slovak Republics took place in February 1993.

2. The Transition Process and The Issue of Currency Substitution

During the early turbulent years of transition the Czech money market was hit by a number of shocks. Following expectations of a dissolution of Czechoslovakia, large capital outflows and enlarged trade ensued. The inevitable happened at the end of 1992 when there was the formal dissolution of the former Czechoslovakia. Early 1993 brought about 2 important events; the dissolution of the monetary union and the introduction of a new tax system. The dissolution of the monetary union meant that the structure of monetary aggregates altered temporarily, since Czech citizens were asked to deposit their cash holdings into commercial banks. Alongside the changing monetary structure, the introduction of the new tax system was followed by a large price jump.

Figure 1 shows the relationship between money demand (M0) and inflation (CPI). Inflation hit a high in 1993 as a result of the introduction of VAT, since then it has declined and fluctuated between 5% and 10% per annum. Due to the high level of inflation at the early stages of transition, people hold smaller amounts of domestic currency, while lower inflation, from 1994 onwards, led to higher money holdings. A clear negative relationship between inflation and money demand is evident from figure 1 and this relationship will be investigated empirically later in the paper.

The economic instability that prevailed in most FCPE, following the implementation of the reform programmes, led to a strong increase in currency substitution or dollarization (Van Aarle and Budina, 1996). Currency substitution exists when foreign money substitutes domestic money in its basic roles as a means of exchange and a store of value. The financial liberalisation of the foreign exchange regulations meant that currency substitution was a viable option. A finding of currency substitution would point to a lack of credibility of programs to control inflation as foreign money is used as a method of transactions and a store of value (Clements and Schwart, 1993 and Guidotti and Rodriguex, 1992).

In Figures 2-5 we plot the monthly exchange rate returns, $\Delta S/S$, (left axis) and the ratio of foreign currency deposits to domestic money (right axis)[4]. A rise in the exchange rate returns (korona per unit of foreign currency) represents a depreciation of the Czech Korona. We analyse the exchange rate returns in terms of the US Dollar and the German Mark. We take two measures of currency substitution, first we use the ratio of foreign currency deposits (FCD) to currency in circulation (M0) which we designate as (FCD/M0) and second the ratio of FCD to

[4] The ratio of foreign money to domestic money is frequently used to measure the degree of dollarization of an economy (Van Aarle and Budina, 1996).

narrow money (M1), (FCD/M0)[5]. Figures 2-3 take the US dollar to be the foreign currency, while figures 4-5 take the German Mark to be the foreign currency. As can be seen from figure 2 following a rise in the KOR/USD exchange rate between April 1992 and August 1992, the exchange rate fell dramatically by 7% between August and November of that year. Graphical evidence would suggest that currency substitution was important immediately after the depreciation of the korona against the US dollar at the end of 1992. As can be seen in figure 2, following the depreciation there was a rise of around 2% in FCD/M0. This currency substitution may have been triggered by the expectation that the korona would fall further due to the dissolution of monetary union with Slovakia. However increased uncertainty (rather than expectations concerning the future level of the korona) about the korona exchange rate at the time of the break up of Czechoslovakia might also account for the rise in currency substitution at the end of 1992. After the end 1992 the ratio of FCD to M0 falls monotonically until the end of 1995, (figure 2), even though the KOR/USD exchange rate behaves largely as a random walk. The exception is the Spring 1997 exchange rate crisis. However, as can be seen from the above figures this did not appear to lead to the same level of currency substitution, as in the 1992 case[6]. This suggests that the currency substitution was a once off event triggered by the increased uncertainty surrounding the dissolution of monetary union at the end of 1992 and it is unlikely to be captured by the econometric estimation over the whole sample period. This uncertainty declined slowly (which is consistent with most ARCH/GARCH models of the exchange rate) and this led to a gradual reduction in FCD/M0.

When we turn to fluctuations in the KOR/DM exchange rate we find a broadly similar pattern. There is a large 6% depreciation over 1 month at the end of 1992 which is immediately followed by a rise in FCD/M0 (figure 4). This depreciation of the Korona against the DM was immediately reversed (figure 4) in January 1993. However FCD/M0 fell only slowly which is consistent with increased exchange rate uncertainty being persistent (as in GARCH models) and slow adjustment of money balances (we find the latter in our empirical results). Hence the graphical analysis shows that the scale of currency substitution does not appear to be as strong in the Czech Republic as has been found for other FCPE (Van Aarle and Budina, 1996). This may be due to the fact that apart from the increased uncertainty about the exchange rate and high inflation at the time of dissolution, the Czech Republic has since the end of 1993 implemented its policy of reform gradually and therefore has had relatively stable rates of inflation and stable volatility in the KOR/DM exchange rate.

3. Money Demand in Eastern Europe

[5] We do not look at the relationship between FCD and M2, since FCD are included in M2. In our empirical work, we do however investigate the effect of the foreign interest rate, as a proxy for capital mobility, on the demand for M2, since this represents movement into foreign bonds as opposed to currency.

[6] The pressure on the exchange rate was as a result of the trade and current account deficits of 11% and 9% of GDP respectively. This coupled with the exchange rate turmoil in Asia led to the Spring 1997 exchange rate crisis.

Klacek and Smidkova (1995) estimate the long-run demand for broad and narrow money in the Czech Republic since transition. The authors initially include GDP as a scale, but the estimated function did not characterise a money demand function due to incorrectly signed parameters. Private consumption was then used, since it may give a better approximate of the volume of transactions. This estimated model had the correct signs, with private consumption having a significant effect. The inflation term was significant for narrow money, while the interest rate on foreign (German) bonds was significant for broad money.

Van Aarle and Budina (1996) estimated money demand and specifically the effect of currency substitution using the portfolio balance approach for Poland, Hungary, Romania, and Bulgaria during transition. As a result of the reform taking place in FCPE, this has led to the liberalisation of foreign exchange restrictions and so legally allow the possibility of foreign currency to replace domestic as a means of payment and a store of value. The authors in most cases found a long-run relationship between money and income and interest rates. An important contribution to this paper is that the authors investigate the impact of currency substitution on money demand. Alternative theoretical models of currency substitution in the money demand literature are given in the survey article by Giovannini and Turtleboom (1993). Currency substitution had a significant impact in the long-run for Hungary, Bulgaria and Romania using M1, but not for Poland. A drawback to the Van Aarle and Budina (1996) study is that they limit their definition of the foreign country to the US. An interesting extension would be to investigate the impact of the return from investing in German assets, given is close proximity and the strong trade links.

Many Eastern European Economies have suffered from periods of very high inflation and there are a number of papers which assess the possibility of rational speculative bubbles[7]. Charemza and Ghatak (1990) noted the importance of speculative motives in the development of the money market in Poland, while Charemza (1990 and 1993) detected rational expectations speculative bubbles in the foreign exchange market for Poland 1988-89. Funke et al (1994) test for the existence of rational bubbles during the period of Poland's hyperinflation at the end of the 1980's. Hall and Sola (1993) allow for regime switching and they find the existence of a stochastic (or temporary) bubble in the foreign exchange market, which they conclude caused Poland's hyperinflation. However Charemza (1994) argues that although there is evidence of a bubble in the foreign exchange market, the hyperinflation was not caused by a bubble, but arises from price liberalisation and an end to the monetary overhang. Therefore all that is needed to tackle inflation is firm control on market fundamentals.

4. Econometric Methodology

[7] A rational bubble occurs when an asset price is influenced by its own expectation. It is a self-confirming expectation about the future movement of the price which departs from its fundamental determinants.

Given the small post reform data set the Johansen cointegration approach is not adopted and instead Hendry's general to specific methodology which results in a dynamic error correction model is used (Hendry, 1987)[8]. The models are estimated using non linear least squares (NLLS) or nonlinear instrumental variables (NLIV), where appropriate, which allows a clear analysis of long-run and short-run effects.

We begin by estimating a general model which includes several lagged differences and the level variables lagged once to capture long-run effects. The general-to-specific regression strategy is then used to reach a robust preferred model. At each step in the testing down procedure diagnostic tests are used (e.g. for serial correlation, autoregressive heteroscedasticity, normality etc.). Finally the robustness of the model is tested by checking for parameter stability. The final preferred equations are of the following form;

$$[2] \qquad \Delta(m-p)_t = \beta_0 + \beta_1\Delta(m-p)_{t-n} + \beta_2\Delta y_{t-n} + \beta_3\Delta R_{t-n} + \beta_4\Delta inf_{t-n} + \beta_5\Delta z_{t-n}$$

$$+ \alpha\,[\,(m-p)_{t-1} - \lambda_1 y_{t-1} - \lambda_2 R_{t-1} - \lambda_3 inf_{t-1} - \lambda_4 z_{t-1}].$$

where z_t consists of a vector of alternative variables used in testing variants to our basic specification (e.g. foreign interest rates, currency substitution and portfolio balance effect).

A secondary aim of the paper is to investigate the extent of currency substitution in the Czech Republic. Given the nature of a transitional economy and following the influential paper by McKinnon (1982) and some recent empirical evidence (Van Aarle and Budina, 1996, Chowdhury, 1997, and Cuthbertson and Gallindo, 1997), we included a proxy for currency substitution[9]. Empirical evidence has found currency substitution to have a significant effect on money demand in Eastern Europe, as outlined in section three. We take the ' conventional ' domestic money demand equation and augment it with the return from holding foreign bonds (i.e. the foreign interest rate plus the expected change in the exchange rate) - this is often referred to as the ' *portfolio balance effect* ', UR. We also include the expected change in the exchange rate which is referred to as *currency substitution*, CS. We define the foreign country to be either the US or Germany. A rise in UR represents a depreciation of the Czech Korona. The foreign interest rate is taken to be the eurodollar or euromark rate and the exchange rates are the Korona/Dollar and the Korona/DM. Given the nature of a transitional economy, the gradual

(Funke et al. , 1994).

[8]The principle problem associated with the Johansen approach is the potential finite sample bias in a systems approach due to the possibility that the other equations (non-money demand equations) in the system may be misspecified.

[9] Klacek and Smidkova (1995) include the interest rate on short-term foreign (German) bonds when estimating the demand for broad money and found it to be statistically significant.

openness of the market and the developments in financial markets we would expect currency substitution to be significant . An important improvement on the Van Aarle and Budina (1996) paper is that we investigate the impact of currency substitution from the US and Germany. Given the close geographical proximity and the strong trade links between Germany and the Czech Republic, currency substitution from Germany should also be investigated. A finding of currency substitution would point to a lack of credibility of programs to control inflation as foreign money is used as a method of transactions and a store of value (Clements and Schwart, 1993 and Guidotti and Rodriguex, 1992).

5. Data and Empirical Results

5.1 Data

Our data set consists of monthly series, over the years 1992-1997. The required data are taken from the CNB, *Financial Statistics Report* and Datastream[10]. Real household income represents our scale variable[11]. The interest rate used is the per annum opportunity cost of holding money and prices are proxied by consumer price index (CPI).

Our empirical work focuses on a number of different monetary aggregates: currency in circulation (=M0), M0 plus demand deposits (=M1), and M1 plus quasi-money (=M2). Our secondary aim is to analyse the extent of currency substitution and therefore indirectly test the credibility of the reform programme.

5.2 Empirical Results

Following our analyse of the data in section 2, we are now in a position to estimate the demand for money since transition. However, because of the paucity of data we initially include only domestic variables in the demand for money namely, interest rates, income and inflation. Following the testing down procedure we arrive at a model which captures both the long-run demand for money and it's short-run interactions. The equations are then estimated using non-linear least squares in the error correction form (Phillips, 1991)[12].

5.2.1 Results for M1

The final parsimonious model for money demand in the Czech Republic (with standard

[10] A full list of the data is given in the appendix.
[11] GDP figures are only available quarterly. However private household income is likely to proxy gross transactions better than GDP, since it directly effects both transactions and speculative demand for money during transition (Klacek and Smidkova, 1995).
[12] Seasonal dummies are included in the equations when appropriate, but are not reported.

errors in parenthesis and diagnostic tests) are shown below.

Monetary Aggregate: M1

$$[3] \qquad \Delta(m1\text{-}p)_t = 0.70 + 0.12\Delta(m1\text{-}p)_{t-3} + 0.14\Delta(m1\text{-}p)_{t-3} + 0.05\Delta yh_t - 0.21\Delta inf_t$$

(0.16) (0.05) (0.05) (0.02) (0.01)

$$-0.06[\,(m1\text{-}p)_{t-1} - 1.15yh_{t-1} + 4.04inf_{t-1}\,]$$

(0.03) (0.65) (1.81)

NLLS: Diagnostic Tests, $R^2 = 0.92$, SE = 0.01,

AR = 1.26[0.32], ARCH = 0.32[0.57],

B-J(2) = 5.53[0.06], D-F(4) = -3.78*.

As can be seen by the statistical significance of the error correction term (ECT) (in square brackets) there is a long-run relationship between real money and real income, and inflation. All variables have the appropriate sign and therefore we are confident that the estimated function is a money demand function, unlike previous work done on the Czech Republic (Klacek and Smidkova, 1995), which reported incorrect signs for interest rates and GDP. The equation implies that the long-run income and inflation elasticity's are 1.15, -4.04 respectively. The income elasticity of 1.55 is in the range of estimates typically found for developed countries (Boughton, 1991). Our coefficient on the ECT is 0.06 implies relatively slow error correction, i.e. that 6% of the error correction takes place in 1 month.

The usual diagnostic tests are also reported and do not indicate any misspecification[13]. The F-test (AR) test does not indicate any evidence of serial correlation, (p-value = 0.32)[14]. Test results for autoregressive conditional heteroscedasticity (ARCH) errors are also not significant. The standard error of the equation is around 1%, which is similar to that found in studies of money demand in developed economies. The Dickey-Fuller (Fuller, 1976 and Dickey and Fuller, 1979) test statistic indicate the ECT is stationary[15]. The test results do not point to any evidence of misspecification at the conventional significance level. Forecasts for 12 months, beginning

[13] See Hendry (1989) for an account of these diagnostics which are now widely reported for time series models.

[14] The asymptotic F-test is reported for serial correlation due to its better finite sample properties (Davidson and McKinnon, 1993)

[15] The 95% critical value for the Dickey-Fuller is -1.95 (Hamilton, 1994, pp. 763)

1995 are shown in figure 6 and our model would appear to forecast well.

The above model represents an improvement on previous work done on the Czech Republic since transition, Klacek and Smidkova (1995), for three reasons. First the model is estimated only over the post monetary separation period, while Klacek and Smidkova (1995) estimate a money demand function for 1992 to 1994 which includes the pre and post monetary separation period. Second, we find coefficients with the appropriate size and signs. This may be due to the fact that we use an alternative scale variable, namely real household income, since GDP is only available quarterly. Private household income is likely to proxy gross transactions better than GDP, since it directly effects both the transactions and speculative demand for money during transition (Klacek and Smidkova, 1995). Finally, we introduce dynamics into the money demand function.

We now investigate the importance of currency substitution, equation 4. After testing for currency substitution using a number of different variations, we found that if the euromark rate (R*) was a long-run relationship did exist. The significance of R* infers that instead of moving into foreign currency, individuals move into foreign bonds. The euromark rate was found to have a significant impact in the long-run along with income and inflation.

Monetary Aggregate: M1

[4] $$\Delta(m1\text{-}p)_t = 0.68 - 0.06\Delta(m1\text{-}p)_{t-1} + 0.22\Delta yh_t - 0.14\Delta inf_t$$

(0.27) (0.11) (0.03) (0.02)

$$-0.17[\ (m1\text{-}p)_{t-1} - 0.56yh_{t-1} + 0.77inf_{t-1} + 0.02R^*_{t-1}\ ]$$

(0.05) (0.17) (0.28) (0.01)

NLLS: Diagnostic Tests, R^2 = 0.83 SE = 0.02,

AR = 0.38[0.77], ARCH = 0.08[0.97],
B-J(2) = 3.91[0.14], D-F(4) = -2.41*.

As can be seen from the above the foreign interest rate has the correct sign and the fact that it represents a move into DM is certainly intuitive given the strong trade links. The long-run coefficient on income much smaller when the foreign interest rates is included. The diagnostics reported above do not indicate any misspecification. The errors are serially uncorrelated and normally distributed, while the ECT is stationary. Our coefficient on the ECT is 0.17, again implying relatively slow error correction, i.e. that 17% of the error correction takes place in 1 month. Out of sample forecasts are shown in figure 7 and again our model would appear to forecast well.

5.2.2 Results for Alternative Monetary Aggregates

As has been mentioned we also estimate the money demand function using alternative monetary aggregates[16]. The results are shown below for currency in circulation (M0).

[16] We estimated the money demand functions for both M0 and M2 including our proxy for currency substitution. Our proxy for currency substitution was found not to have a significant effect on the narrow definition of money, M0. For M2 our proxy for currency substitution, the euromark rate, was found to have a significant relationship in the long-run, but our long-run income elasticity fell to an implausibly low level, 0.15, hence we do not report in detail.

Monetary Aggregate: M0

$$[5] \quad \Delta(m0\text{-}p)_t = -0.16 - 0.08\Delta(m0\text{-}p)_{t-2} - 0.02\Delta R_{t-1} - 0.72\Delta inf_t$$
$$(0.21) \quad (0.04) \quad (0.02) \quad (0.03)$$

$$-0.14[\,(m0\text{-}p)_{t-1} - 1.40yh_{t-1} + 4.82inf_{t-1}\,]$$
$$(0.03) \quad (0.34) \quad (0.86)$$

NLLS: Diagnostic Tests , $R^2 = 0.91$, SE = 0.03,

AR = 1.59[0.15], ARCH = 1.47[0.22],

B-J(2) = 2.82[0.24], D-F(4) = -5.24*.

We find similar results to our standard domestic M1 model using monthly data, that is, a long-run relationship between currency in circulation, income and inflation. The income elasticity found is 1.40. Our diagnostic tests indicate no misspecification for the above model. Again we graph the out of sample forecasts and are shown in figure 8. Our model appears to forecast relatively well. Given the strong graphical indications we tested for currency substitution, but found no significant effect.

Finally we estimate the demand for money for a broad measure of money, M2.

Monetary Aggregate: M2

$$[6] \quad \Delta(m2\text{-}p)_t = -0.24 - 0.10\Delta inf_t - 0.05[\,(m2\text{-}p)_{t-1} - 0.53yh_{t-1} + 2.47inf_{t-1}\,]$$
$$(0.08) \quad (0.01) \quad (0.02) \quad (0.32) \quad (0.90)$$

NLLS: Diagnostic Tests , $R^2 = 0.88$, SE = 0.01,

AR = 0.32[0.98], ARCH = 0.59[0.98],

B-J(2) = 3.69[0.16], D-F(4) = -3.79*.

As with previous results we find a long-run relationship between money and income and inflation. The coefficient on the ECT implies even slower adjustment, while the diagnostic test results indicate no model misspecification. Figure 9 shows the out of sample forecasts.

Finally we run a number of step response functions for our preferred equations. We take

our preferred models and assess the impact of an increase in a key variable, e.g. income, interest rates, foreign interest rates, when money is at its long-run equilibrium level. Of interest will be the path and the speed of the adjustment. Figure 10 shows the response of equation 3 (M1) to a 1% increase in income. As can be seen the equation achieves it's new equilibrium within 2 years and with a median lag of about 6 months. A similar result was found when we increase prices by 1% for equation 3, figure 11. We also assess the effect of a 1% change in the foreign interest rate for equation 4 (M1), figure 12. A 1% increase in the euromark rate would lead to a 0.7% reduction in money demand, given that we take the initial eurorate = 10%. The full adjustment takes about 2 years. These lag responses are broadly consistent with our graphical analysis of currency substitution effects, where we observed that foreign currency balances took considerable time to adjust from their post monetary dissolution high level.

6. Conclusion

We have estimated the demand for money using several definitions in the Czech Republic since its transition to a market economy. Given a limited time span of data since the 1992 split, we use a variety of measures of money and monthly data. However even faced with a limited data set we do consistently find that a long-run relationship exists between real money balances (M0, M1 and M2), a measure of real income and inflation, with the coefficients having the expected sign. An important variant on the standard domestic model is the investigation of currency substitution. Both graphical and empirical results suggest that any *currency substitution* was a one-off event due to increased uncertainty at the end of 1992 at the time of monetary dissolution. Certainly currency substitution in the Czech Republic is not as strong as has been found in other FCPE. This may be due to the gradual reform taken by the Czech authorities, the stable rates of inflation and the relatively stable exchange rate (and volatility of the exchange rate) established after 1993 which provides less incentive in currency substitution. We do however find evidence of *capital mobility* when Germany is taken as the foreign country. This is certainly intuitive given the strong trade links.

Our estimates for money demand on the Czech Republic represent an improvement on those of Klacek and Smidkova (1995) for a number reasons. Firstly the model is estimated only over the post monetary separation period. Secondly we introduce dynamics into the money demand function. Thirdly we find coefficients with the appropriate size and signs and investigate the impact of currency substitution. Finally our equations imply plausible step responses to changes in the independent variables in the money demand function.

Given such momentous changes in the Czech Republic (see section 2) it is encouraging that the estimated money demand function performs reasonably well empirically. Our results indicate that the Czech National Bank could institute a monetary policy based on the long-run money demand function estimated here. However, it might also have to take account of foreign interest rates when interpreting movements in Czech monetary aggregates.

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Appendix: Definitions of Variables and Data Sources

M0 : Currency in circulation

M1 : M0 plus demand deposits

M2 : M1 plus quasi money

P : CPI - monthly data

Y : Real household income

R : Interest rate on term deposits

S : exchange rate Korona /Dollar and Korona/Dollar

Source: Czech National Bank Financial Statistics Report

R* : Euro rates (Eurodollar/Euromark)

CS : Monthly change in the exchange rate grossed up to an annual rate

UR : Uncovered return of investing in Foreign Assets grossed up to an annual proportional rate

$$= R_t^* + [\,[(S_{t+1} - S_t)/S_t] * 12\,]$$

Source: Datastream

Figure 1: Money Demand and Inflation

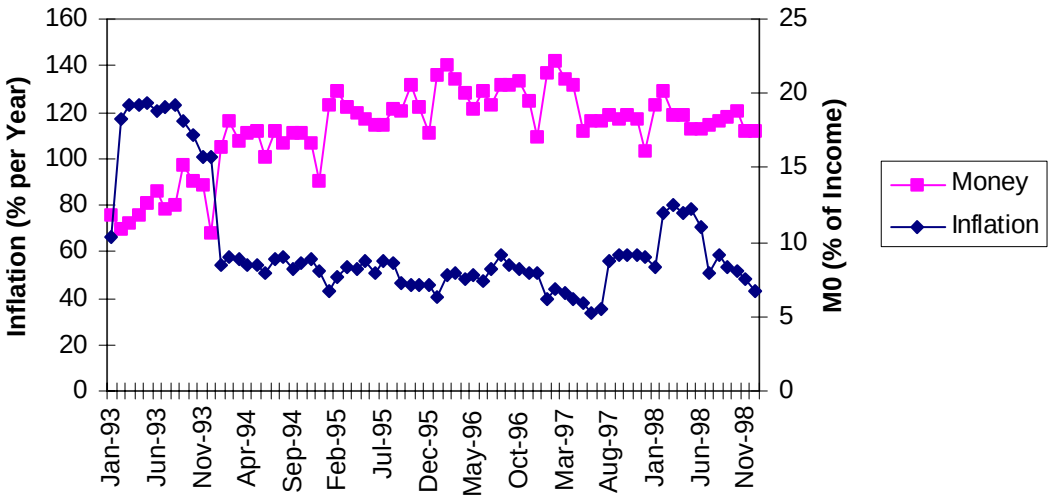

Figure 2 Exchange Rate Returns and Currency Substitution (1992-1998)

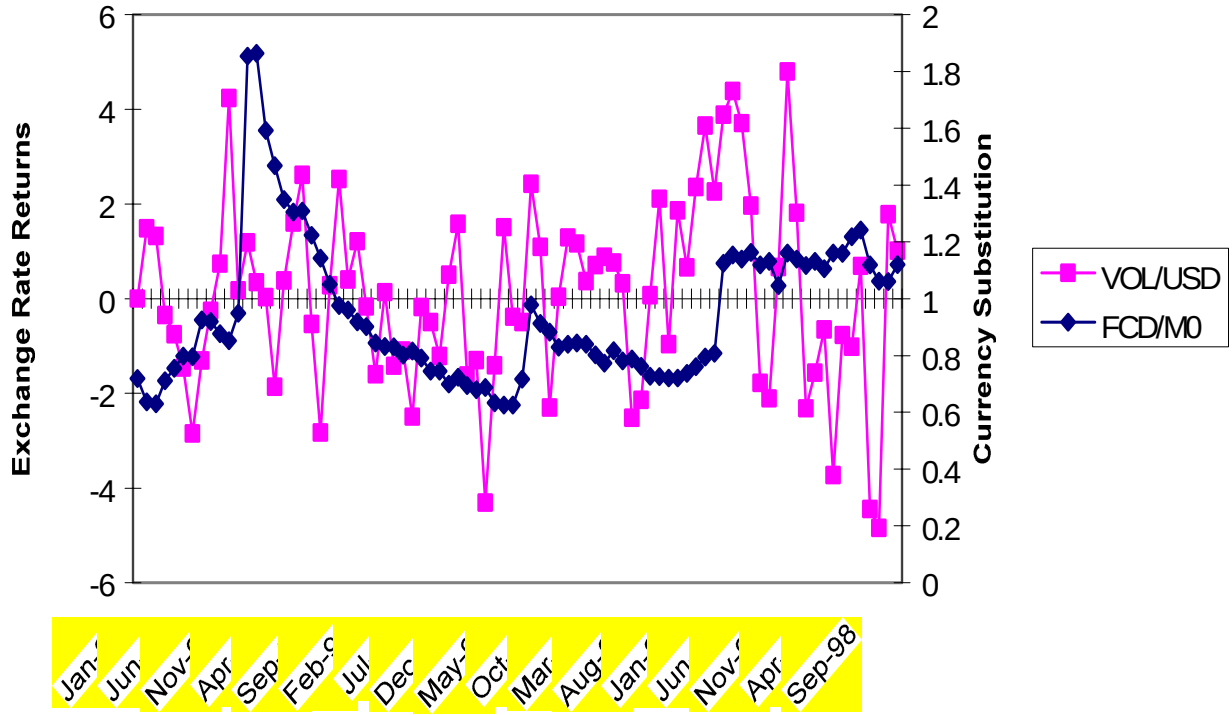

Figure 3 Exchange Rate Returns and Currency Substitution

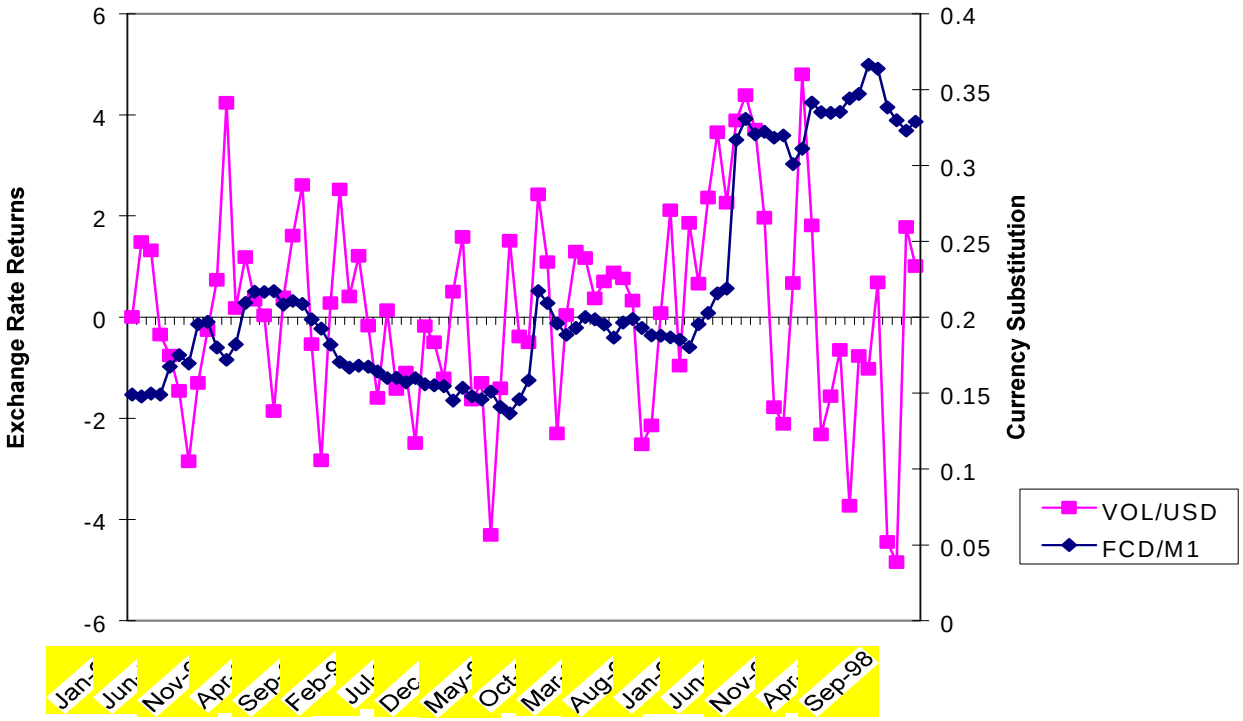

Figure 4 Exchange Rate Returns and Currency Substitution

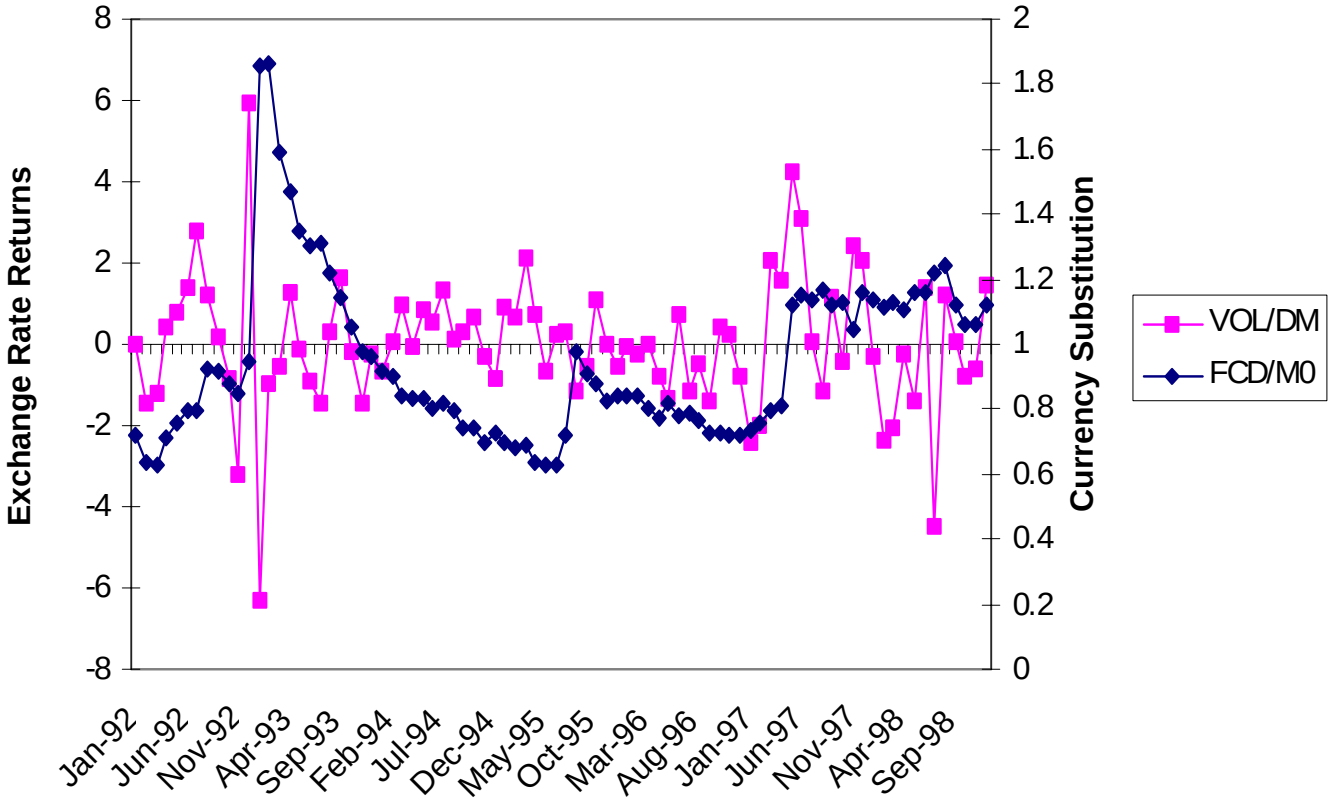

Figure 5 Exchange Rate Returns and Currency Substitution

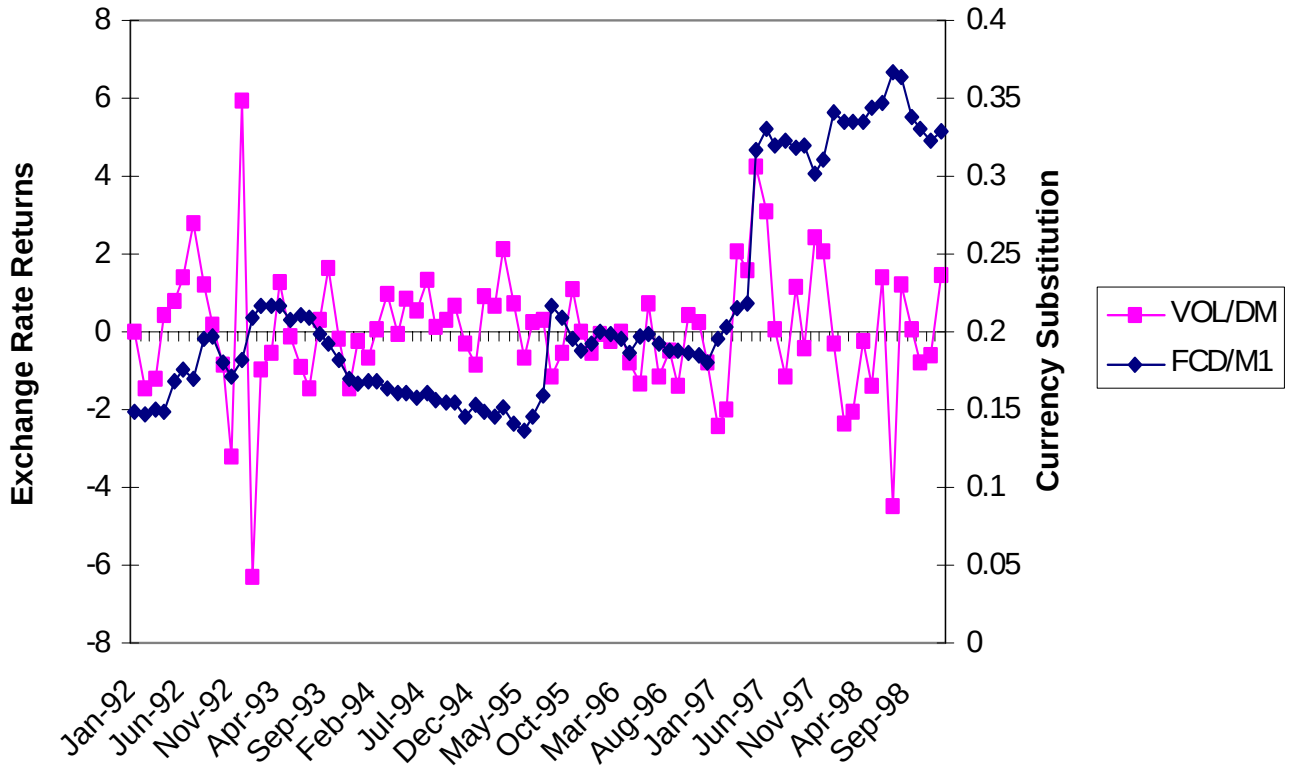

Figure 6: Forecast Changes for M1 - Equation 3 (in logarithms)

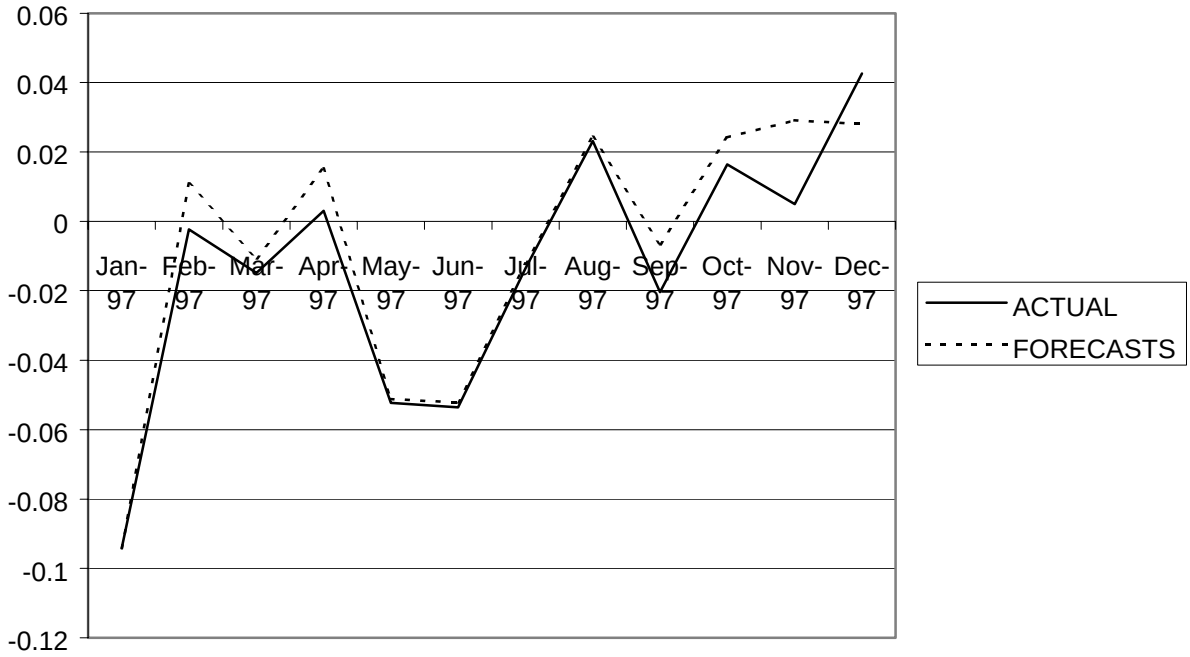

Figure 7: Forecast Changes in M1 - Equation 4 (in logarithms)

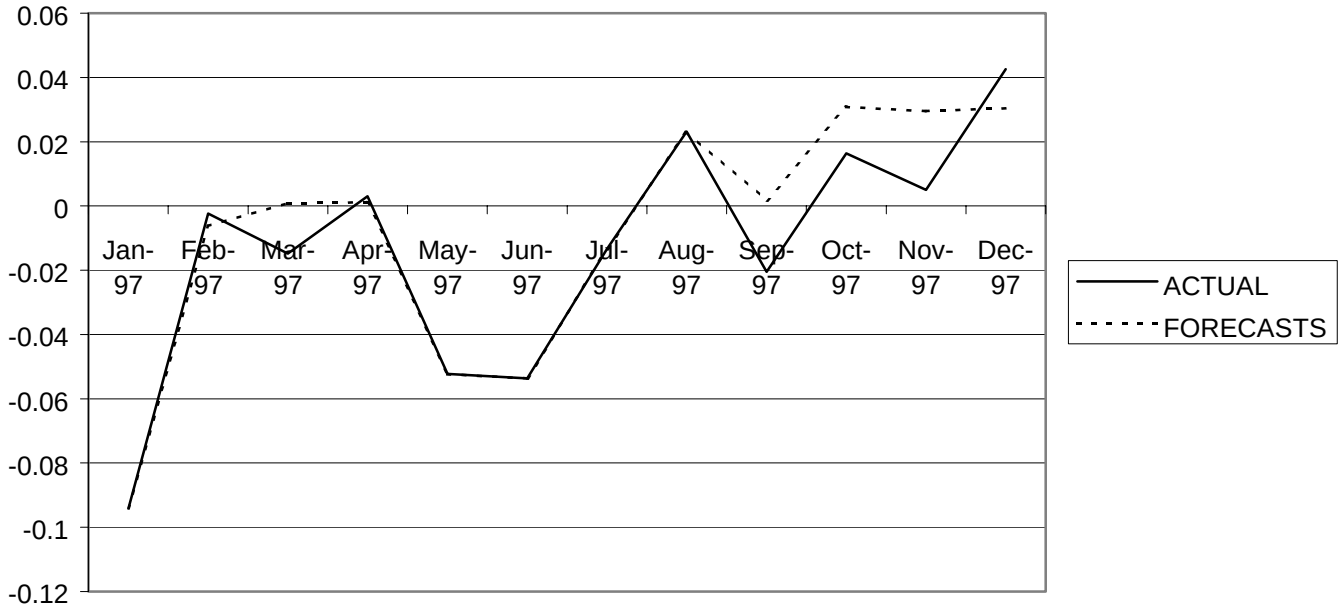

Figure 8: Forecast Changes in M0 - Equation 5 (in logarithms)

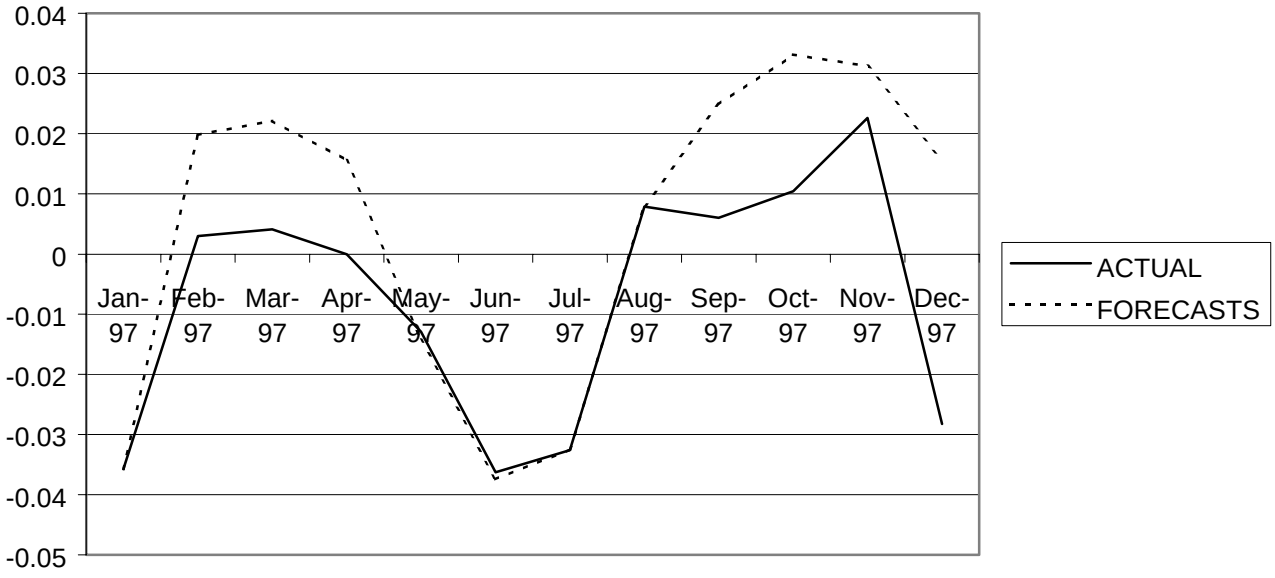

Figure 9: Forecast Changes in M2 - Equation 6 (in logarithms)

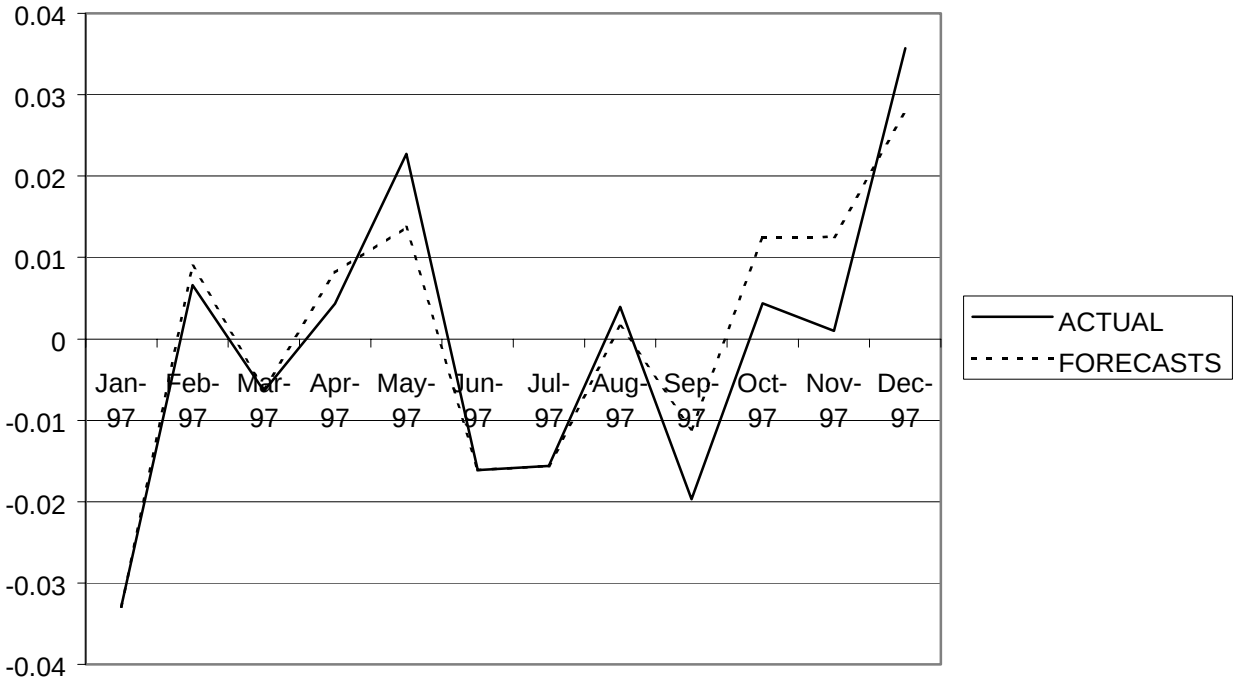

Figure 10: Step Response for Equation 3 a 1% increase in income

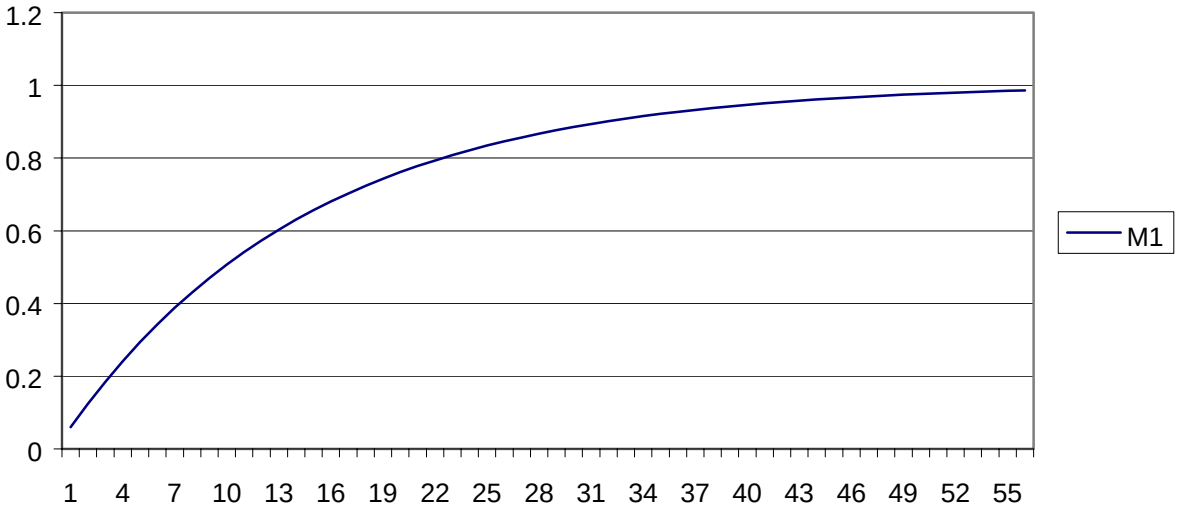

Figure 11: Step Response for Equation 3 a 1% increase in prices

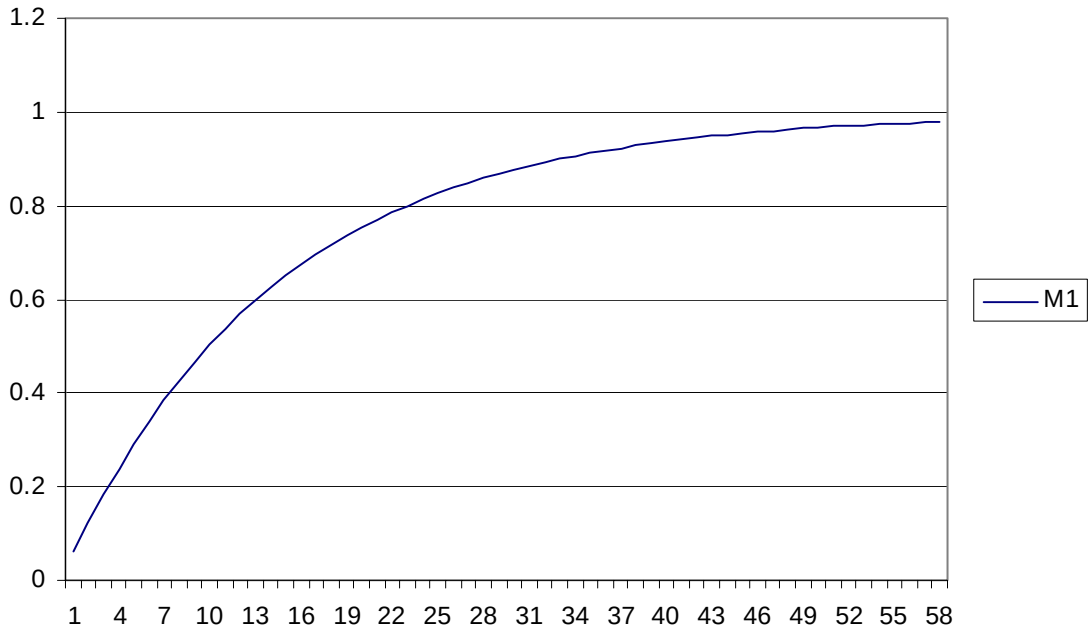

Figure 12: Step Response for Equation 4 a 1% increase in foreign interest rates