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THE DEMAND FOR MONETARY AGGREGATE M3 AND INFLATION FORECASTS IN JORDAN:EVIDENCE FROM CO INTEGRATION ANALYSIS

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ABSTRACT

The main purpose of this study is to show how monetary policy can use monetary aggregate s as reliable information using annual data for the period 1975- 2010. The paper focuses on the information content on M3 on future changes in prices, by exploiting both the growth rate of M3 and the error term of an error correction model (ECM).Within the context of an (ECM), the paper provides empirical evidence to the that both the growth rate of monetary aggregate M3 and the size of excess M3 incorporate useful information. This evidence strongly suggests that money supply should remain an important indicator for monetary policy.

KEYWORDS: *Monetary policy, Money demand, Inflationary forecasting, Co- integración, Error Corrección modele, Jordan*
JEL Clasificación*:* E5, E41, E47

INTRODUCTION

The objective of this study is to examine how monetary policy can use monetary aggregates as reliable information in Jordan during the period 1975- 2010. This paper argues that money should continue to play an important role in monetary policy even if a central bank pursues a strategy based on inflation forecasts.

As a small open economy subject to shocks, Jordan faces particularly difficult challenges in the conduct of its monetary policy. Understanding the effects of monetary policy and the channels through which it is transmitted is critical to its successful conduct. Thus far, little analytical work has been done in this area, and scant guidance is available to help Jordanian policymakers evaluate changes in policy and their effects on the economy.

A stable money demand function is considered essential for the formulation and conduct of efficient monetary policy. Consequently, a steady stream of theoretical and empirical research papers has been published during the past several decades. In the case of Jordan, few studies see for example, [1 &2] has attempted to determine the factors that affect the demand for money. None of these papers, however, focuses on the stability of the estimated coefficients. Furthermore, these studies have ignored the impact of financial liberalization on the demand for money in Jordan. During this period (1976-1988), the main instruments of monetary policy consisted of reserve requirements, direct credit controls based on credit ceilings, and Treasury bill auctions. [3]. A stable money demand function is a necessary condition to establish a direct link between the relevant monetary aggregate and nominal income.

However, the effective role of monetary aggregates both as policy action variables and leading information variables requires a stable empirical relationship between monetary aggregates vis-à-vis macroeconomic variables of interest like national income and price level. In practice more than one monetary aggregate are usually defined in the hope that multiple aggregates may collectively provide more information for the conduct of monetary policy and developments in the economy.

The compositions of various monetary aggregates differ from one country to another. However, the differences are prominent in case of higher order monetary aggregates like M2, M3, M4 etc. compared to slight variation in the components of narrow monetary aggregate (M1), which is mostly composed of financial assets that can directly be used as medium of exchange. This is one of the major differences observed from the country practices. Most of the countries (except India, Jordan and Mauritius) have excluded government deposits from their monetary aggregates. Although the country experiences suggest that both the functional and empirical approaches have been applied to define monetary aggregates in most of the countries, there is not a single definition of any monetary aggregate that is acceptable for all the countries [4] and [5].

In Jordan three different definitions of money demand will be associated: *M1* consists of currency in circulations plus demand deposits. *M2* includes (M1) plus Quasi-money (time and saving deposits) with the Central Bank, Commercial Banks, Housing bank Private sector (resident), Municipalities and Public entitles; and *M3* which additionally includes government deposits (see table 1) In essence, the higher order monetary aggregates take into account both the medium of exchange and the store of value characteristics of the money.

Table 1. Definitions of Jordan area monetary aggregates (in Millions JD)

Liabilities	M1	M2	M3
Currency in circulation	X	X	X
demand deposits	X	X	X
Quasi-money (time and saving deposits)		X	X
Government deposits			X

Source: CBJ, Monthly Bulletin.

The rest of the paper is organized as follows. Section two presents a brief historical prospective. Section three present a review of literature and country experiences on monetary aggregate for M3. Section four discusses the data and methodology. The data and their time series properties are also presented in this section. Section five: Estimation and Discussion of test results. Section six discusses whether a stable long-run demand for *M3* exists within a vector error correction framework including the variables money, prices, output and long-run interest rate .Section seven formulates some assumptions for the information content of money concerning future inflation. Section eight summarizes the paper.

SECTION TWO: HISTORICAL BACKGROUND

During the 1970s and most of the 1980s, the Central Bank of Jordan (CBJ) pursued a policy of maintaining the stability of Jordanian diner by imposing foreign exchange restrictions. These restrictions, however, increased the value of the diner vis-à-vis all other currencies. The higher value of the diner affected the competitiveness of the Jordanian economy by making Jordanian products more expensive than the foreign products; this led in turn to a reduction in export and an increase in imports [6]. Also, these restrictions weakened Jordanian economy base and hindered new productive investments, for the bulk of investment was concentrated in real estate and the mineral sector. The Jordanian government implemented a number of policies at reactivating the economy and reducing the shortage of foreign currency at the second half of 1980s, including privatization of state-owned companies. Non-Jordanian Arab capital was granted the same investment rights, privileges, and protection of Jordanian capital to encourage free movement of capital and profit into and out of the country Jordanian working abroad was thus motivated to bring back as much as they wish and to dispose of it as they chose. The Jordanian economy in late 1988 started to decline as a result of a huge capital flight from Jordan. This led to the initiation of an economic adjustment programme for the 1989-1993 periods. However this programme was disputed after the Gulf crises in 1990. The government dealt with these difficulties through the initiation of the new economic adjustment programme for the 1992-1998 periods. The programme was designed: 1) to reduce the chronic imbalances in the balance of payment and budget; 2) to achieve fiscal and monetary stability; and 3) to build strong foundations for sustained economic growth with stable prices. The 1990-1992 period witnessed the Gulf crises and it aftermath. The Jordanian economy, during this period, suffered from high unemployment and inflation rates coupled with a decline in real *GNP* growth and the flow of thousands of Jordanian from the Gulf States to Jordan. Currency in circulation grew by 5.2 percent on average annually from 1990 to 1992 and demand deposits grew by 16.8 percent. Narrow money supply (M1) grew by 8.7 percent and broad money supply (*M2*) grew by 10.5 percent annually during 1990-1992 periods. Qusi-money grows by 12 percent annually over the above period. The policy of the *CBJ* during the 1990-1992 period restrictive and designed to control inflation, reinforce the foreign reserve position to maintain stability of the diner's exchange rate, to improve the performance of the economy, and to meet the objectives of the economic restructuring programme [6].

Monetary policy is controlled by the Central Bank of Jordan, which has played a key role in promoting balanced and sustainable economic growth in the Kingdom. In 1996, monetary policy facilitated fiscal stability, with a greater focus on increasing the foreign currency reserves of the Central Bank to enhance the stability of the exchange rate of the Diner, one of the main requirements of balanced and sustainable economic growth.

To achieve monetary stability, the Central Bank continued its intervention in the money market through use of the indirect monetary control approach as a seller or buyer of three and six-month certificates of deposit (CDs) denominated in the Jordanian Diner. Consequently, the outstanding balance of CDs in 1997 increased by JD 438 million, increasing the total balance of CDs by 71% to JD 1055.6 million. Interest on these CDs decreased slightly in 1997: the highest rate on three-month CDs was 6.25% and the highest rate on six-month CDs was 6.5%, compared to 9.25% and 9.5%, respectively, in the previous year.[7]

Accordingly, monetary expansion slowed in 1996 to 0.3% and grew to 7.8% in 1997. Credit extended to the private sector grew by JD 176.1 million in 1997 over its 1996 level. This was due to a decline of JD 111.2 million in net credit extended to the government by the banking sector. The decline in net credit extended to the government would have fallen to JD 115.6 million if net government borrowing from the International Monetary Fund (IMF) had been taken into consideration. As a result, the increase in the net foreign assets of the banking system contributed 8.1% to the growth of domestic liquidity in 1997, while net domestic assets had a concretionary effect of -3 %. [7].

Monetary policy was successful in achieving its goals because of aggregate monetary measures taken during 1996. Inflationary pressures were contained, particularly those which arose from the aggregate demand side of the national economy. The stability of the Diner's exchange rate relative to most major foreign currencies was maintained, to a great extent because of the exchange rate policy adopted by the Central Bank toward the end of October 1995, which gave priority to stabilizing the exchange rate of the Dinar relative to the US Dollar, while allowing the former to fluctuate slightly relative to other currencies.

The Central Bank's policy played a major role in preserving confidence in the Diner as a saving instrument because of its stable exchange rate, and as a result of the increase in returns on Diner deposit relative to the return on US dollar deposits. Consequently, the attractiveness of Diner-denominated assets increased relative to foreign currency-denominated assets. This led to an increase in the foreign currency reserves of the Central Bank by JD 996.1 million over its level in 1996 to reach JD 1200 million or US$ 1700 million at the end of 1997. [7].

According to this vision, the CBJ is focusing its role in maintaining monetary stability. This has been done through open market operations by tendering certificate of deposits aiming at absorbing any liquidity surplus in the financial market. The lending rate of interest to the CBJ, normally determines the minimum rate of interest in the banking system.

During 2001 the CBJ has reduced the level of interest, by reducing the level of discount rate and interest rates on repurchase agreement of certificate of deposit's (REPO) to a level of 6 percent. The bank has also reduced the interest rate on overnight interbank loan to a level of 3.75 percent. In addition the bank reduced the level of reserved requirements by 2 percent from 10 to a level of 8 percent of total deposits.

These measures have resulted in reducing the interest rate on the certificates of deposits from a level of 6 percent by the year 2000 to a level of 3.9 percent by the end of 2001 and further to a level of 3.85 percent by the end of June 2002.

During the first five months of the year 2002, deposit and lending rates have declined. This downward trend is expected to continue in the financial market due to the slow response of commercial banks to CBJ's signals.

The role of the CBJ in achieving these results was indirect and it has resulted mainly throughout securing financial stability i.e. Maintaining relevant level of prices for goods and services, interest and exchange rates.

SECTION THREE: LITERATURE REVIEW

The role of monetary aggregates in policy making has elicited immense interest and voluminous empirical literature for more than three decades and across a number of countries. One of the early works by [8] proposed that changes in money stock preceded changes in nominal income in the U.S. In Australia [9] and [10] all found evidence of monetary aggregate leading real activity.

[11] examines whether money in Switzerland is exogenous and cannot con firm this hypothesis.

[12] treat money as endogenous and find that M3 is not a superior measure of money.

[13] com pare the performance of short-run models of money growth (using M2) and inflation (using M3) and conclude that the model involving M3 appears more stable.

[14] specifies a money-demand function which includes the exchange rate and a foreign interest rate in order to appropriately model Switzerland as a small open economy. [15] model Swiss monetary policy with a Markov switching model, which also includes the exchange rate.

[16] identified three roles for monetary aggregate: as information variables, as indicators of policy actions and as instrument in a policy rule. Successively stronger and stable relationships between the monetary aggregates and final policy targets are required for those roles. The authors found little evidence for U.S. and Germany data, indicating monetary aggregate (monetary base and M2 in particular) could not be used in a straightforward way for monetary policy purposes.

[17] for Australia, examined two (monetary aggregate and inflation or output), three (plus inflation), four (adding interest rate) and five (including exchange rate) variable VAR systems. The author found that monetary aggregates contained significant information for explaining subsequent fluctuations in output growth or inflation.

[18] show that the results of Granger-Causality tests depend on the use of (log-) level variables or growth rates. They argue in favor of using level variables since a simulation study found that the power of the test on growth variables was low and that there was a danger of making a false inference.

[19] examined the money demand function in Fiji to determine if a stable relationship existed between money, income and interest rates. The author used an error correction model to estimates the money demand relationship in Fiji. The Johansen co integrating VAR technique was also used for consistency. The results of this study cast doubt on monetary aggregate as intermediate targets, Joynson found that a change in income is quickly translated into a change in the demand for money; however, a rigorous investigation into the information in monetary aggregates has not been examined.

[20] develop a constant, data-coherent, error correction model for broad money demand (M3) in Greece. The purpose of this paper is to model the empirical relationship between broad money, prices, real output, and interest rates, and to examine the constancy of this relationship, especially in light of recent changes in the financial system. In spite of its importance for forecasting and policy, constancy has proved elusive for estimated money demand functions of many countries; this model contributes to a better understanding of the effects of monetary policy in Greece, and of the portfolio consequences of financial innovation in general. The broad monetary aggregate M3 was targeted until recently, and current monetary policy still uses such aggregates as guidelines, yet analysis of this aggregate has been dormant for over a decade. The dynamics of money demand are important, with price and income elasticities being much smaller in the short run than in the long run.

[21[examines whether there exists a stable long-run demand for money function in Jordan over the period 1975-1998, using annual data The main finding of this paper have shown that there exists a stable long-run demand for money function for M3.while the demand for M1 and M2 display parameter instability in Jordan following financial reforms since 1989. The results largely support that M3 money stock could serve as an indicator for monetary policy.

[3] test empirically whether there exist a stable function of demand for board aggregate in Jordan over the period 1976-2000.The main results indicates that there is a long-run relationship for the real board aggregate in Jordan.

[22] examines whether the relationship between inflation and economic growth has a structural breakpoint effect or not for the Jordanian economy from 1970 to 2003. He finds that this relation tends to be positive and significant below an inflation rate of 2-percent and the structural breakpoint effect occurs at an inflation rate equal to 2-percent. Beyond this threshold level inflation affects economic growth negatively.

[23] analyzed the stability of M3 money demand function for German following the monetary unification. Their results indicate that M3 money demand function in Germany is not stable.

[24] analyze theoretical as well as empirical soundness of the monetary aggregates (M2) and to propose a broader monetary aggregate (M3), by exploring the functional characteristics and empirical relevance of financial assets. The study used annual time series data from year1976 to 2003 and employed both the functional and empirical (F-M dual criteria) approaches.

The results indicate that current monetary aggregates seemed to have been defined more on functional considerations compared to the empirical evidence. The analysis of new set of financial assets suggests that, while the various savings schemes individually as well as in aggregate were able to meet F-M dual criteria, deposits of NBFIs failed to satisfy this criteria. However, the functional considerations suggest that these deposits should, nevertheless, be included in a broader definition of monetary aggregates (M3).

Due to the apparent success of monetary policy in stabilising inflation, the predictive power of monetary aggregates might have declined. The findings of [25] suggest that the inflation risk has fallen over the past years. Due to unconventional monetary measures, however, inflation could shift from the current benign regime of price stability to a higher inflation regime [26]. Our results indicate that models based on excess liquidity outperform the benchmark as well as money growth. At the longer forecasting horizons, standard alternatives such as the term structure of interest rates are also outperformed

[27] reported evidence that an aggregated monetary overhang can predict country-specific inflation in the four largest euro area countries, but it does not encompass measures of the country-specific monetary overhang. According to [27] broad money growth corrected for trend velocity and potential output growth is a leading indicator for switches between inflation regimes

Furthermore, even if one argues on the basis of a known model and lag structure, it is easy to imagine structures where money should play an important role in monetary policy [28] First, imagine a model where the Central Bank sets the money market rate but where the long-term interest rate is determined by market forces through expectations and the relative liquidity characteristics of the different segments of the financial market. This requires specifying independent equilibrium conditions for different types of monetary and financial assets. Under these circumstances, the relation of the long term interest rate to the short rate is influenced by monetary factors. This can establish a role for money in monetary policy.

Second, the supply money, the interest rate and the aggregate demand are usually determined simultaneously in the same period. Consequently, decisions about interest rates are also decisions about the quantity of liquidity. Given this simultaneity, the comparative advantage of controlling money or interest rates depends on the nature of the shocks hitting the economy. If the economy is hit by goods market shocks, monetary policy acts as an automatic stabilizer if the Central Bank controls the quantity of money. This is the well-known result of the analysis by Poole (1970) and underlines the potential usefulness and importance of monetary aggregates for monetary policy.

Third, the main purpose of monetary policy is to ensure that there is no drift of underlying inflation from its target path. Theoretically, a central bank could manage this task by choosing the correct path of the natural real interest rate, which closes the output gap at all times exactly so that no inflationary pressure arises. However, the natural real interest rate is not observable. Small deviations of the actual from the natural real interest rate may induce large deviation of inflation from the target. Using money as an information variable could be useful for detecting such policy errors early.

This discussion intends to show that there are sound theoretical reasons for using monetary aggregates in the process of monetary policy. In a world of model uncertainty, the ultimate decision about the usefulness of money must, come from its empirical regularity with subsequent movements in prices.

The paper argues that money should continue to play an important role in monetary policy even if the central bank pursues a strategy based on inflation forecasts. Within the context of an error correction model, the paper delivers empirical evidence that both the growth rate of monetary aggregate M3 and the size of excess M3 incorporate useful information with urgent to future inflation in Jordan. This evidence strongly suggests that money should remain an important indicator for monetary policy.

SECTION FOUR: DATA AND METHODOLOGY

Data

The data used in this study consist of annual observation from the year1975 to 2010 on the monetary aggregate M3 (Million JD) and inflation for Jordan and were obtained from various sources. Annual data on variables are used to estimate the long-run demand for money: The monetary aggregate *(M3)* in Jordan consists of currency, demand deposits, saving deposits , time deposits and government deposits Output which serves as a scale variable, is quantified by the gross domestic product at factor cost of 1997 prices are all from statistical series issued by the Central Bank of Jordan *(CBJ)* and Statistical Yearbook and IFS The measure of prices corresponds to the GDP-deflator (INFGDP).The long-term interest rate (R) Table 2 present the summary statistics, which consist of the mean, median, maximum, minimum, standard deviation, skewness, kurtosis, Jarque-Bera and the associated probability The mean values of monetary aggregate (M3), RGDP price and interest rate R are 7.98 percent, 3.47 percent, 8.68 percent and 6.71 percent respectively. Interest rate, price, real M3 with standard deviation 1.55 percent, 0.92 percent and 0.52 percent fluctuated the most for the period under consideration. However, real GDP recorded the lowest standard deviation (0.22 percent). All of the variables exhibit positive Kurtosis and negative Skew ness except for Real GDP. The Jarque-Bera test statistics and the accompanying probabilities, suggest that real M3, Real GDP, price and interest rate are not normally distributed.

Table 2: Summary Statistics

	LM3	LRGD	L INFGDP	R
Mean	7.98284	3.492908	8.688414	6.7155
Median	8.07757	3.486408	8.759355	6.25
Maximum	9.28634	3.918865	9.311994	9
Minimum	5.96717	2.888527	7.654443	2.5
StdDev	0.92404	0.222328	0.518142	1.5508
Skew ness	-0.5661	0.397427	-0.39984	-0.4443
Kurtosis	2.36106	3.938145	1.886617	3.0017
J-B	2.04239	1.826891	2.27059	0.9542
Probability	0.36016	0.40114	0.321327	0.6206

The model used in this paper is implements the following M3 money demand function for Jordan:

$$M3 = \sim + iINFGDP + {}_1 RGDP - {}_2 R + u_i \qquad (1)$$

Where M3 is the nominal monetary aggregate, inflation of real GDP (INFGDP) is the GDP-Deflator; RGDP represent output which serves as a scale variable, R is the long term interest rate, u_t is an error term, assumed to be white-noise. The regression coefficient on economic activity is expected to be positive long-run price (i.e. >0) in other words, as economic activity improves, demand for monetary aggregate M3 increases. In contrast, the regression coefficient on interest rate is expected to be negative (i.e. ($_2$< 0). This stipulation implies that asnominal interest rate rises, the demand for monetary aggregate for M3 weakens and provides positive incomeelasticties ($_1$ > 0). The whole analysis is carried out with annual data is used in the monetary policy decision process. With Exception of interest rate, all variables enter the analysis in natural logarithmic form for the presences of unit roots.

METHODOLOGY

In order to verify to what degree these series share univariate integration properties, we perform both unit root tests and stationary tests. While this is necessary condition prior to testing for co integration. The Dickey-fuller (DF) type test and the non-Parametric DF test attempt to account for temporally dependent and heterogeneously distributed error by including lagged sequences of first differences of the variable in repressors.

It is demonstrated in [29] that the procedure involves the identification of rank of the $|mxm|$ matrix Π in the specification given in equation 2.

$$\Delta X_t = ¢ + \sum_{i=1}^{k-1} \Gamma_i \, \Delta X_{t-i} + \Pi \, \Delta X_{i-k} + u_i \qquad (2)$$

Where ΔX_t a column vector of the m variables, $\Gamma \, and \, \Pi$ represents coefficient matrices, Δ is a difference operator, k denotes the lag length, and ¢ is a constant. If Π has zero rank, no stationary linear combination can be identified. In other words, the variable X_t are non-co integrated. If the rank r and Π is greater than zero, however, there will exist r possible stationary linear combinations and Π may be decomposed into two matrices ~ and , |each m x r| such that Π =~ ′ In this representation contains the coefficient of r distinct co integrating vectors that render ′ X_t stationary, even though X_t is itself non-stationary ~ contains the speed of the adjustment coefficients.

The more recent and more robust method, particularly in small samples, proposed by [30] which corrects for possible simultaneity bias amongst the repressors, involves estimation of long run equilibria via dynamic OLS *(DOLS).* [30] Suggest a parametric approach for estimating long run equilibria in systems, which may involve variables, integrated by different order but still co integrated. The potential of simultaneity bias and small sample bias amongst the regressors is dealt with by the inclusion of lagged and lead values of the change in the regressors. The procedure advocated is similar to recent estimators proposed by [31], but much more practically convenient to implement and estimate. These are single equation methods for FIML estimates.

The *DOLS* procedure is preferred here due to its favorable performance, in small samples. [30] Dynamic OLS *(DOLS) is specified as:*

$$B=(c,,\sim,\ )',\ X=[1, INFGDP,\ RGDP, R]$$

$$M3_t = B' X_t + \sum_{j=-n}^{j=n} ¦_j \Delta INFGDP_{t-j} + \sum_{j=-m}^{j=m} ¢_j \Delta RGDP_{t-j} - ¤R + £_i \qquad (3)$$

Where *n* and *m* are the lengths of leads and lags of the repressors. I is indicator variable. Suppose that M3 has been found to be I(1) and at least some of the RHS variables I(1) or I(0), then DOLS estimates reobtained by regression analysis of the above equation.

SECTION FIVE: ESTIMATION AND DISCUSSION OF TEST RESULTS

A necessary but not sufficient condition for co integration is that each of the variables should be integrated of the same order (more than zero) or that both series should contain a deterministic trend. It is necessary to test whether the relevant variables in equation (1) are stationary and to determine the order of integration of the variables. To test for unit roots in the levels and first differences of the variables, a standard Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) test is performed. The results reported in table 3. Results are reported for the ADF test. The number of lagged variables included in the ADF test, equation was chosen so that the Lagrange multiplier (LM) test fails to reject the hypothesis of no serial correlation of the residuals. The same lag length was used for the DF-GLS test. The results of both tests show that the null hypothesis of a unit root cannot be rejected for levels, but is clearly rejected for first differences. All variables, *M3, INFGDP, RGDP* and *R*, as well as the real stock of money (*M3-INFGDP*) and the nominal income (*INFGDP+RGDP*), are therefore integrated of order one (see table 3 Appendix A).

SECTION SIX: THE LONG RUN MONEY DEMAND

This is to analyze whether a stable long-run demand for *M3* exists. If the demand for *M3* is stable, one should find (at least one) co integrating vector among the variables *M3, INFGDP, RGDP* and *Ri*, given that they are all integrated of order one. Furthermore, if the price elasticity of the demand for the nominal money is equal to one, one could expect to find at least one co integrating vector. Similarly, one co integrating vector ought to be found among the variables *M3, INFGDP+RGDP*, R, if the output elasticity of nominal money is one. The results for the maximum Eigen value test and the trace test proposed by [32] are presented in table 4

Appendix A. Both tests show the existence of only one co integration vector at the level of significance of 1 % between nominal money M3, the price level (*INFGDP*), real income (RGDP) and the long-run interest rate (R). Only the maximum Eigen value tests shows the existence of a co integration vector among real money (*M3-INFGDP*), real income(RGDP), and the interest rate of (R), and only at 5% level of significance. Between nominal money M3, nominal income *INFGDP+RGDP* and the interest rate (R) the existence of a co integration vector can be shown only at 10% level of significance and again only with the maximum Eigen value test. The evidence of co integration is thus strongest in the case of a nominal money demand function. With the possibility to use a nominal rather than a real money demand function we can focus directly on the link between nominal money and inflation [33]. In the following analysis we find that the existence of a single co integrating vector.

There are several alternative approaches to estimate co integration equation... Table 5 Appendix A, presents the results for the [34], Stock-Watson Dynamic OLS (DOLS) parameters estimates of the long run parameters with all variables appearing in levels, are shown in table 4, equation 3 were estimated including up to j= ± 3 leads and lags, the insignificant; lags and leads were dropped., a long with the Autoregressive Distribution Lag (ARDL) method advocated by [35]. The ARDL and DOLS method produce price elasticties higher than income elasticties. The other method show lower price elasticties and higher income elasticties [1]

1. Using the Johansen maximum-likelihood and ARDL approaches, the null hypothesis of a price and income elasticity of one cannot be rejected at conventional significance levels. The p-values of the tests are 0.16 and 0.83 in the case of price elasticity and 0.85 and 0.80 in the case of income elasticity.

Since the data shows that *M3, INFGDP, RGDP,* R, are co integrated, the differences between M3 and the value of the co integrating vector, i.e. excess money, should potentially be- in addition to money growth an exploitable indicator of future inflationary pressure. In order to use this information we applied the co integrating vector estimated by the Johansen maximum likelihood method:

$$M3 = -8.08 + 1.04\,INFGDP + 0.87\,RGDP + 0.0039\,R$$

These analyses are qualitatively and quantitatively consistent with the theory of money demand. The price elasticties are close to one, output elasticity is less than one the semi interest elasticity is about 0.0039. Furthermore, the ARDL method, which produces similar results as the Johansen maximum-Likelihood method, is known to have good small sample properties when compared to the FM-OLS approach in Monte-Carlo studies [35].

As a first check of the potential information content of M3, we look at the coefficients of the error correction term ec_t of the estimated vector error correction model as can be seen from table 6. The coefficient of money and price equations are significantly different from zero, according to the usual critical values where as the long term interest rate and output are weakly exogenous with respect to the error correction parameter, M3 and price are not . Thus a positive error correction term, i.e. a positive amount of excess M3, decreases M3 and increases prices.

The rapid structural changes in the Jordanian economy makes it necessary to check for stability of the M3 money demand equation for Jordan, if the equation is unstable this makes it very difficult to interpret regression results. Since the parametric econometric model is completely described by its parameters, model stability is equivalent to parameter stability [36]. The CUSUM test is based on the Cumulative recursive residuals. The CUSUMSQ test, on the hand, is based on the cumulative Sum of Squares of Recursive Residuals. Both the CUSUM and the CUSUMSQ procedures are updated recursively and are plotted against the break points. In general if the CUSUM and the CUSUMSQ is outside the critical values at 5% significant level, the null hypothesis will be rejected, which means that the equation is unstable. The test results are presented in Figure 1 and 2 (Appendix A),and it appears from the figure 1 that the squares of the recursive residuals CUSUMSQ crossed the critical bounds in 1995 and crossed back in the 2000 and have remained within those bounds since then. This may indicate that money demand parameters shifted during the period 1995-2000 periods but then returned to their pr-1995 levels. This may reflect the greater financial sophistication, and more accelerated financial innovation and development of Jordanian financial sector.

SECTION SEVEN: THE DEMAND FOR M3 AS INDICATOR FOR INFLATION

Money fulfils three functions in the economy. It serves as a medium of exchange, as the unit of account and as a store of value. The better a certain asset fulfils the functions typically performed by cash, the higher its "degree of money ness". This is generally measured by the degree of liquidity of the asset. The lower the transaction costs incurred when making a payment using the purchasing power embedded in the asset, and the less volatile the nominal value of the asset over time, the higher its liquidity will normally be. Given that many different assets are substitutable, and that the nature and features of financial assets, transactions and means of payment are changing over time, it is not always clear how money should be defined and which financial assets belong to a certain definition of money. For these reasons, central banks usually define and monitor several monetary aggregates. These range from very narrow aggregates such as base money to broader aggregates, which include currency, bank deposits and certain types of securities.

Why focus on M3? As pointed out before, in selecting a monetary aggregate to serve as intermediate target, three criteria are relevant a) Stability of money demand. b) Money has leading indicator properties. c) Controllability of a monetary aggregate.

Broad aggregates normally show higher stability and better leading indicator properties than narrow aggregates. In contrast, in the short term narrow aggregates are easier to control via official in The above discussion confirmed that M3 and the other variables are co integrated and that prices are not weakly exogenous with respect to the error correction term. Interest rates than broad aggregates.

This indicates the excess M3 together with the growth rate of M3 should incorporate important information about future prices. In the following, we concentrate on the information content of these two indicators. (M3 growth and excess M3) in a single equation approach. We choose this approach for two reasons: (1) it allows us to measure the actual information content of M3 better than if we would include M3 in a system for variables. (2) in monetary policy there is a need for simple indicators for monetary policy authorities to have a simple monetary indicator yielding reliable inflation forecasts.

In the following discussion will therefore focus on the role of money for inflation forecasts. Taking the results of the co integration analysis into account, the following three assumptions can be formulated:

A1. The growth rate of M3 is a predictor of annual inflation. It is a better predictor of annual inflation in the longer run than in the shorter run..

A2. Forecasts of annual inflation improve if the growth rate of M3 is combined with information about excess money (i.e. error correction term).This improvement is excepted to be more imported in the short and the medium run than in the very long run[2]

2. The error correction term is expected to improve the short to the medium run forecast of inflation. See Chirstoffersen and Diebold (1997).

In-Sample Forecasting Performance: Goodness of fit

To examine the forecasting performance with indicator model:

$$\Delta INFGDP_{t+k} = \alpha + \beta \Delta INFGDP_t + \beta_1 \Delta m3 + \beta_2 ec_t + e_t \qquad (4)$$

The dependent variable is the annual inflation in time *t+k* forecasted in t so that k is the forecast horizon. The indicator variables are the current annual inflation rate ($\Delta INFGDP_t$), the current annual growth rate of (*M3* $\Delta m3$), and the error correction term ec_t (excess money) in term t. The error correction term ec_t is computed according to equation (1). The forecast error e_t , follows a moving average process of order k-1.The specification of equation 2 is chosen because monetary policy decisions are often based on annual percentage changes of seasonally adjusted data. We consider three forecasting horizons of one (k=1), two (k=2), and three years (k=3), since these are the most relevant ones for monetary policy decisions.

In order to test the information content of money, three specification of equation 4 used. In the specification (5), only current annual inflation centers the equation. Results for this specification are presented as a "naïve" benchmark. In the specification (6), the annual growth rate of M3[3] is included which shows assessing its marginal information content. Finally, specification (7) adds the error correction term in order to assess the information content of excess money.

3. The *annual growth rate of M3*, calculated as M3= $\frac{m3 - m3(-1)}{m3(-1)}$ and the current annual inflation rate ($INFGDP_t$)= $\frac{INFGDP - INFGDP(-1)}{INFGDP(-1)}$

In order to compare the relative performance of these equations, we use the adjusted ($\overline{R}^2$) and Akaike's information criterion (AIC) as test statistics of goodness of fit of the three specifications. Money is a valuable indicator, if it is carries information about future inflation beyond the information already contained in the current level of annual inflation. Thus, the rejection of the null hypothesis $_2$ =0 in the specification 6 would be considered as evidence in favor of assumption A1.The empirical validity of assumption A1 can be further examined by comparing the goodness of fit statistics of specification 6 in comparison to specification 5. Similarly the rejection of the null hypothesis =0 would be evidence for the validity of specification 6. i.e. evidence that the error term of the co integration relations contains information for future inflation in addition to the information already contained in M3 growth. A comparison of specification 6 and 7 allows furthering assessing the empirical validity of assumption A2.

The estimates of the three specifications, with forecasting horizons of. One, two, and three years are presented in Table 7. Since the dependent variable in all equations is always the annual inflation rate, the goodness of fit can directly be compared between the different specifications. Specification (5) shows that current annual inflation is an indicator for future inflation. However, its predictive power decreases rapidly with the forecast horizon. 2 decrease its value as an indicator for three-year-ahead forecast.

The results of a comparison of specification 5 and 6 are striking. The goodness of fit of specification 6, contrary to the one of specification 5, improves with the forecast horizon. This improvement is not only relative, but also absolute. The best fit is achieved at the longest forecast horizon. The null hypothesis $_2$ =0 ?cannot be rejected for one-year-ahead forecasts, two and even more for three year- ahead forecasts. As the comparison of specification 7 with specification 4 shows, the inclusion of the error correction term increases the goodness of fit considerably. The improvement relative to the specification 5 is higher, the shorter the forecast horizon. The highest improvement of fit is reached for one-year-ahead forecasts. The null hypothesis $_3 = 0$ can't be rejected for all three horizons, showing that the error correction term may even improve long-run forecasts. These empirical results support assumption 2 that, especially for short-term forecast horizons, the error correction term has predictive power in addition to M3 growth.

The results of the one-year-ahead forecasts for annual inflation from Table 7 Appendix A are reported as well. A direct comparison of the goodness of fit is only possible for regressions with the same forecast horizon because the dependent variable does not corresponds any more to annual inflation in all regressions.

SECTION EIGHT: CONCLUSIONS

This paper argues that there are good theoretical reasons for using money as an important information variable in a monetary policy setup, even if this policy is guided by inflation forecast and not by a monetary target, in order to find empirical evidence for the role of money in such a setup, the paper reconsiders the importance of the monetary aggregate M3 as a predictor of future inflation in Jordan. The empirical analysis is based on Vector error correction models of the demand for money. The results of various empirical methods are consistent and allow us to draw the following conclusions:

First, the results from the unit root test suggest that the time series have one order of co integration [i.e. I (1)]. The Johansen and Jueslius co integration test indicates that the existence of only one co integration vector at the level of significance of 1 % between nominal money M3, the price level (*INFGDP*), real income (RGDP) and the long-run interest rate (R). Only the maximum Eigen value tests shows the existence of a co integration vector among real money (*M3-INFGDP*), real income(RGDP), and the interest rate of (R), and only at 5% level of significance. Between nominal money M3, nominal income *INFGDP+RGDP* and the interest rate (R) the existence of a co integration vector can be shown only at 10% level of significance and again only with the maximum Eigen value test. The evidence of co integration is thus strongest in the case of a nominal money demand function. The result from stability test, it appears that the squares of the recursive residuals CUSUMSQ crossed the critical bounds in 1995 and crossed back in the 2000 and have remained within those bounds since then. This may indicate that money demand parameters shifted during the period 1995-2000 periods but then returned to their pr-1995 levels. This may reflect the greater financial sophistication, and more accelerated financial innovation and development of Jordanian financial sector.

Third, excess money, i.e., the error correction term of the co integrated money demand function, contains - in addition to money growth -information about future inflation. Combining the information of money growth with the information provided by excess money not improves the inflation forecasts in the short run, medium but also those in the long run. For monetary policy decisions it is important to take into account both money growth and excess money. One indicator taken in isolation may give a misleading signal about future prices. Low money growth, e.g., does not mean that there will be no future inflation if an excess of money has already been built up in the past. This shows that using a reference value for a monetary aggregate alone may not be without danger. Forth, the coefficient of money and price equations are significantly different from zero, according to the usual critical values whereas the long term interest rate and output are weakly exogenous with respect to the error correction parameter, M3 and price are not . Thus a positive error correction term, i.e. a positive amount of excess M3, decreases M3 and increases prices. Fifth, the highest improvement of fit is reached for one-year-ahead forecasts. The null hypothesis $_3 = 0$ can't be rejected for all three horizons, showing that the error correction term may not even improve long-run forecasts. These empirical results support assumption 2 that, especially for short-term forecast horizons, the error correction term has predictive power in addition to M3 growth. Sixth, the ARDL and DOLS method produce price elasticties higher than income elasticties. The other method show lower price elasticties and higher income elasticties.

We have to bear in mind that all evidence presented is, of course, of historical nature. There exists no guarantee that the relation between money and subsequent changes in prices will remain the same in the future. In order to use money for policy decisions, a constant re-examination of the information content of money is necessary. All in all, however, we can conclude that money up to now remains an important indicator and information variable for monetary policy.

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APPENDIXA: TABLES AND FIGURES

Table 3: Unit Root Tests

Variables[2]	Lag[1]		ADF t-test		DF-GLS	
	Level	Diff	Level	Diff	Level	Diff
LM3	1	0	-6.03*	-2.74***	-0.399	-2.23
M3-INFGDP	6	4	-8.95	-2.40	-9.55*	-2.35
INFGDP	6	4	-1.67	-2.66***	-0.24	-3.22**
RGDP	1	0	-2.21	-4.17*	-0.46	-3.28**
INFGDP+RGDP	1	5	-1.87	-3.34**	-2.87***	-3.94*
R	0	0	-0.038	-3.05**	-0.38	-3.11**

*Notes: *,**,*** show that the null hypothesis of a unit root is rejected at the 1, 5 or 1 percent significance level ,respectively. A constant included in the test equation for interest rates and for differenced variables. The reported ADF statistic corresponds to the t-test version of DF test. The DF-GLS by Mackinnon, 1996 is a test with an unconditional alternative hypothesis. The critical values for the ADF test at the 5% and 10% significance level are -3.69, -2.97 ,-2.63 (with constant) respectively (source: Mackinnon,1996).*

1. *Lags are added in the ADF equation until the Lagrange multiplier test fails to reject the hypothesis of no serial correction of the residuals at a level of 5%. The same lag length is used for the DF_GLS test*

2. Notes: *With Exception of interest rate, all variables enter the analysis in natural logarithmic form for the presences of unit roots.*

M3= the nominal Broad Money Aggregate

INFGDP+RGDP = nominal income

R = the long term interest rate,

RGDP =represent output which serves as a scale variable

M3-INFGDP= real stock of money

INFGDP= inflation of real GDP is the GDP-Deflator; as measured by the consumer price index (CPI)

Table 4: Test For Co integration

Max Eigen value						
Null	**Alternative**	**Test Statistics**	**Test Statistics**	**5% CV**	**1% CV**	Hypothesized No. of CE(s)
Co integration vector: *LNM3, LINFGDP,LRGDP,R*						
r=0	r=1 ($r \geq 1$)	43.09		47.21	54.46	None
r≤ 1	r=2 ($r \geq 2$)	23.45		29.68	35.65	At least one
r≤ 2	r=3 ($r \geq 3$)	12.85		15.41	20.04	At least two
r≤ 3	r=4 ($r = 4$)	5.19		3.76	6.65	At least Three(*)
Co integrating vector : *LINFGDP,LRGDP, R*						
r=0	r=1 ($r \geq 1$)	20.25		29.68	35.65	None
r≤ 1	r=2 ($r \geq 2$)	14.39		15.4	20.04	At least one
r≤ 2	r=3 ($r = 3$)	3.67		3.67	6.65	At least two*
Co integrating Vector: *LNM3, INFGDP+RGDP, R*						
r=0	r=1 ($r \geq 1$)	23.16		29.68	35.65	None
r≤ 1	r=2 ($r \geq 2$)	12.43		15.4	20.04	At least one
r≤ 2	r=3 ($r = 3$)	0.21		3.67	6.65	At least two

Trace Test						
Co integrating vector: *LNM3, LINFGDP,LRGDP,R*						
r=0	r=1 ($r \geq 1$)		84.61	47.21	54.46	None(**)
r ≤ 1	r=2 ($r \geq 2$)		41.51	29.68	35.65	At least one(**)
r ≤ 2	r=3 ($r \geq 3$)		18.05	15.41	20.04	At least two(*)
r ≤ 3	r=4 ($r = 4$)		5.19	3.76	6.65	At least Three(*)
Co integrating vector : *LINFGDP,LRGDP, R*						
r=0	r=1 ($r \geq 1$)		38.33	29.68	35.65	None(**)
r ≤ 1	r=2 ($r \geq 2$)		18.07	15.4	20.04	At least one*
r ≤ 2	r=3 ($r = 3$)		3.67	3.67	6.65	At least two*
Co integrating Vector :*LNM3, INFGDP+RGDP, R*						
r=0	r=1 ($r \geq 1$)		42.44	29.68	35.65	None(**)
r ≤ 1	r=2 ($r \geq 2$)		18.83	15.4	20.04	At least one(*)
r ≤ 2	r=3 ($r = 3$)		6.39	3.67	6.65	At least two(*)

Notes: *The Test is the Eigen value Maximum and Trace test of the Johansen maximum likelihood Approach (Johansen, 1988, 1991, and 1995).The VECM with 8 lags has an unrestricted intercept and no trend.*

**(**) denotes rejection of the hypothesis at 5% (1%) level.*

For Definition of variables See Notes on table 3

Table 5: Long-Run Relations Estimated With Different Methods[1]

	EG	DOLS	ARDL
Constant	-3.47 (-18.34)	-7.73 (-19.20)*	-2.79 (-1.87)***
LM3(-1)¤	-	-	0.79 (3.71)*
LM3(-2)	-	-	-0.19 (-0.92)
LGDPDEF	0.49 (-13.03)	0.86 (5.99)*	0.58 (2.63)*
LRGDP	0.87 (10.32)	0.41 (-3.46)*	0.30 (1.46)
R	0.0069 (0.42)	-	-
D2LRGDP(+2)	-	-0.37 (-3.20)*	-
D2LGDPDEF(+2)	-	-0.65 (-5.57)*	-
LRGDP(-2)	-	-0.45 (-5.01)*	-
LGDPDEF(-2)	-	0.60 (4.84)*	-
Rate(+2)	0.0039 (0.42)	0.0098 (0.83)	-0.0042 (-0.40)
R-square	0.984	0.998	0.998

Notes: *The t-ratio is in parentheses*

1) *EG: Engle and Granger(1987); DOLS: Dynamic OLS using two leads and two lags, Stock and Watson (1993); ARDL: Long-solution of an autoregressive distribution lag model (2,0,2,0) selected with the Schwarz Bayesian criterion from all possible models with maximum lag of each variables less than 9, Pesaran and Shin(1999).*
2) **(**) denotes rejection of the hypothesis at 5% (10%) level.*

(D) is the difference

(+) Leads period

(-) Lags period

Table 6: Vector Error Correction Model[1]

Equation with dependent Variable	Δ LM3	Δ LINFGDP	Δ LRGDP	Δ R
Co integration Equation	1.00	1.13 0.15 (-7.52)	-2.16 0.26 (-8.10)	0.026 0.038 (0.68)

Notes the t-ratios are in parentheses

The VECM has unrestricted intercepts and no trend. The loading parameters corresponding to the cointegration vector of each equation of the VECM are reported Johansen (1991).

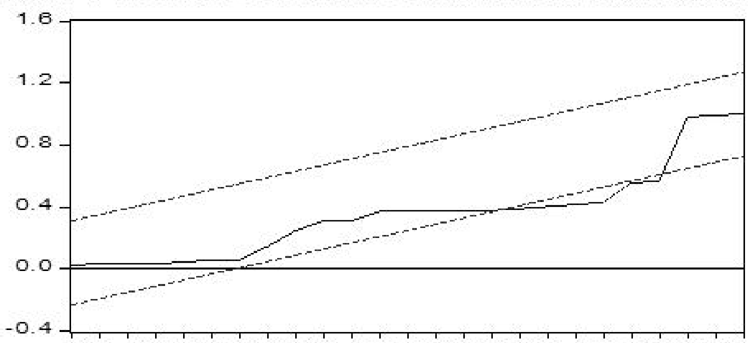
Δ is the first difference of natural logarithm of variables

Table 7: comparison of the goodness of fit with the same forecast horizon Annual Inflation

Equation:	Explanatory Variables 1	2	3	Goodness of fit: $\overline{R}^2$	AIC
Next Year (k=1)					
Eq 3)	4.99 (-3.89)			0.35	-6.22
Eq 4)	-4.49 (-2.97)	-0.056 (-0.2565)		0.34	-6.16
Eq 5	5.59 (-3.55)	-0.29 (0.36)	-0.29 (-1.77)	0.39*	-6.24*
Year after the next Year (k=2)					
Eq 3)	6.65 (2.58)			0.18	-4.84
Eq 4)	-4.69 (-1.59)	-2.21 (-1.32)		0.21	-4.84
Eq 5	-7.19 (2.16)	-1.64 (-1.03)	0.63 (-1.97)	0.30*	4.92*
Year after the next two Years (k=3)					
Eq 3)	-6.37 (-1.69)			0.072	-4.11
Eq 4)	-2.30 (-0.57))	-4.72 (2.05)		0.19	-4.20
Eq 5	6.18 (-1.38)	-4.15 (-1.86)	-0.89 (-1.73)	0.23*	4.25*

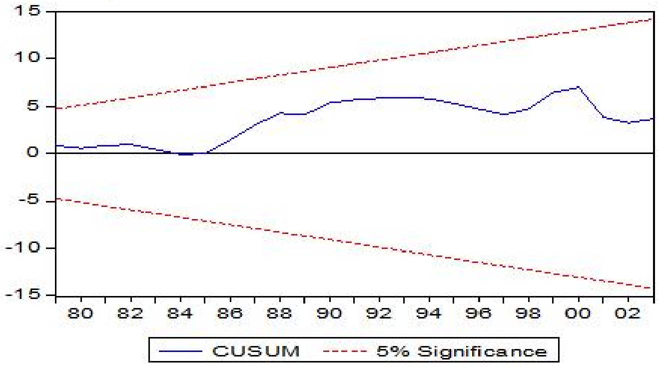
Notes: * denotes the best value with respect to the corresponding criterion of goodness of fit for the chosen forecasting horizon.
The t-ratios are in parentheses

Figure 1: CUSUMQ Test for the Demand of Monetary Aggregate M3



Dotted Lines represents Critical Value of bonds at the 5% level of significance

Figure 2: Cummulative Sum of Recursive Residual



APPENDIX B: DATA SOURCES AND CONSTRUCTION

This appendix describes the data in greater detail. It lists the definitions used .The data used in this study were obtained from various issues of the monthly statistical bulletins from the central Bank of Jordan. All data are annually, and the sample period is from the year1975 to 2003.

Broad Money Aggregate M3:

Definition. The components of the broad money aggregate M3 are currency in circulation (CC), demand deposits (DD), savings deposits (SD), time deposits (TD), bank bonds (BB), and Government Deposits (GD). Demand deposits, savings deposits and time deposits are those held by individuals and private enterprises.

Units: Millions of Jordanian Diner

Source. Central Bank of *Jordan Monthly Statistical Bulletin*, the Bank of Jordan and *Economic Bulletin*, the Bank of Jordan..

International Financial Statistics (IFS)

www.obj.gov.jo

Interest Rates (R):-

Definition. Interest rates on demand deposits (RD), savings deposits with commercial

Banks (RS), time deposits at 12-month maturity for individuals and private enterprises

(RT), repurchase agreements (RR), and Treasury bills of 12-month maturity (RB). Each rate is a weighted average of the various interest rates paid on the given financial instrument.

Units. Annual rate expressed as a fraction, calculated as the arithmetic average of monthly (average) rates.

Source. Central Bank of *Jordan Monthly Statistical Bulletin*, the Bank of Jordan and *Economic Bulletin*, the Bank of Jordan..

International Financial Statistics (IFS)

www.obj.gov.jo

Consumer Price Index (CPI):-

Definition. The general consumer price index (CPI).

Units. The series was calculated as the arithmetic average of yearly value,which have 1997 as their base year,.

Source. *Monthly Statistical Bulletin*, National Statistical Service of Jordan.

International Financial Statistics (IFS)

www.obj.gov.jo

Nominal GDP Gross domestic product at current prices.

IMF *International Financial Statistics Yearbook* (2001).

Bureau of Statistics, *Current Economic Statistics*, various issues.

Central Bank of Jordan

www.obj.gov.jo

Real Output (RGDP)

Definition. Real gross domestic product (GDP) at factor cost.

Units. Million Jordanian Diner in 1997 prices.

Source. *Monthly Statistical Bulletin*, National Statistical Service of Jordan International Financial Statistics (IFS)

www.obj.gov.jo