An Econometric Study of Inflation in Egypt Using the Monetary and Structuralist Approaches

By

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I. Introduction:

The Egyptian economy experienced only mild inflation before 1974. This was mainly attributable to the favourable economic environment of the world at large as well as to the government measures implemented during that period. Since 1974, the economy has suffered from higher inflation rates as other less developed counties (LDC's). This was due to the openness of the economy and the changes that took place in the economic environment.

This study aims to develop theoretical and empirical models of inflation applicable to Egypt, and to examine econometrically, using these models, the determination of inflation in Egypt during the period 1974/1975 - 1988/1989.

To achieve this purpose, two approaches to inflation were differentiated; namely the monetary and the structuralist approaches. The first approach concludes that inflation can emerge when the quantity of money increases at a faster rate than the demand for money. On the other hand, the structuralist approach acknowledges that an inflationary process arises from the conflicting claims among productive sectors concerning their shares in the real income of the economy.

Using these two approaches together is quite necessary because each single approach fails to introduce full explanation for the inflationary process. The monetarists explanation.
does not show the process by which money affects prices. It also does not reflect the workings of the real side of the economy. Therefore, the monetarist approach misses important relationships that may help uncover the genesis of the rise in monetary growth. On the other hand, the structuralist overemphasis on supply bottlenecks is not sufficient to generate and sustain rapid inflation. Increasing the monetary growth is absolutely necessary to turn a general price increase arising out of structuralist factors into inflation.

After identifying the main features of each approach, basic empirical models were constructed. These alternative models are formulated in association with each approach. Using Egyptian data, the formulated models are estimated, tested, and analyzed. Economic implications of the results are then derived.

The study is organized into four sections. The second, and by far the largest one, presents the theoretical background underlying the two approaches. It starts with literature review, then introduces the formulation of relevant hypotheses and models. Section three reports the results of estimating the parameters of these models and the analysis of their policy implications. The final section presents summary and concluding remarks.

U. Formulation of Models:

There are several reputable approaches to which one can turn to analyze the inflationary pattern of a nation. However, most empirical studies on inflation of a specific country start by adopting only one analytical framework and its associated theoretical aspects.

The present study is based on differentiating two approaches to inflation; namely the monetary approach and the structuralist approach. In this section, the theoretical underpinnings of inflation according to each approach is discussed. Consequently, the characteristics of each approach are identified and relevant empirical models are then constructed.
Monetary Approach:

Some economists argue that neither a fiscal-induced excess demand nor a one-shot increase in costs by itself can create inflation unless accompanied by a monetary expansion (Gordon, 1976). Specifically, inflation is viewed as a monetary phenomenon and can emerge only in the situation where the quantity of money increases at a faster rate than the demand for money (Friedman, 1970).

The condition for original equilibrium in the money market is the equalization of the supply and the demand for real balances.

\[
\frac{M_s}{M_d} = \frac{M_s - M_d}{P - P}
\]

In terms of percentage rates of change one can write

\[
p = m_s - m_d
\]

where

\[
p = \text{rate of change in prices.}
\]

\[
m_s = \text{rate of change in real money stock.}
\]

\[
m_d = \text{rate of change in the demand for real balances}
\]

. If the growth rate of the money stock exceeds the growth rate of the desired level implied by the aggregate demand for money function, the public will spend at a faster rate than before until money market equilibrium is restored. The disequilibrium is eliminated by changes in the price level. The adjustment process is completed as soon as the inflation rate is equal to the growth rate of the monetary expansion.

It is assumed that prices are highly flexible. Since the price level is fully affected by the change in money stocks, no real effects can be traced from the model, and money is neutral. Accordingly, several models have been developed to investigate empirically the problem of inflation in the short - and long - run.
In the short-run, money supply changes can affect real output and the price level. Therefore, an inflation model should be set up in a simultaneous equation system with inflation rate and the output change as endogenous variables (Friedman, 1970; Dewald and Gavin, 1981; and Saboori, 1985). However, it is accepted that a simple reduced-form equation model of inflation is still applicable if real output changes are externally determined.

Another way of dealing with short-run inflation analysis is to formulate a long-run demand for money function and then transform it into a short-run equation by introducing lagged adjustment for each of the relevant variables. However, the selection of the lag structure for each variable remains a problem.

A third way to analyze inflation in the short-run is to estimate the demand for money function in a partial adjustment form. This implies the way individuals adjust their actual holdings of money to the desired levels. In the literature, the following alternative forms have been proposed for the partial adjustment model:

\[ \text{In} \left( \frac{p_t}{p_{t-1}} \right) = \alpha_1 f(X_t) + (1 - \alpha_1) \frac{1}{\mathcal{P}} - 1 \]

where the asterix denotes the desired level of real balances, and \( \alpha_1 \) is the adjustment coefficient. This partial adjustment equation was first suggested by Chow (1966). It implies that individuals may not be able to adjust their actual real balances to the desired level in a single time period. The resulting demand for money takes the following form:

\[ \text{In} \left( \frac{p_t}{p_{t-1}} \right) = \alpha_1 f(X_t) + (1 - \alpha_1) \frac{1}{\mathcal{P}} - 1 \]

where \( X_t \) is a set of other independent variables such as income and the opportunity cost. This equation has been used by Goldfeld (1973), and Otani (1975). It was criticized on the ground that the size of the adjustment coefficient \( \alpha_1 \) is assumed to be the same for all elements of \( X_t \). Such assumption could be considered invalid because the portfolio adjustment process following a change in interest rates may not be the same as for a change in real income (Gordon, 1984).
ii) If price changes are considered exogenous, real balances and real income decrease simultaneously without any transaction cost. If adjustment cost is used as a reason for the partial adjustment hypothesis, equation (2) should be written in nominal form as follows:

$$\ln \text{Mt} = (\ln \text{vc} - h_i \text{Mt}_{-1})$$

(4)

This equation implies that the demand for money equation takes the form:

$$k_t \left( \frac{\text{Mt}}{\text{Pt}} = a2 f(X_t) + (1- a2) \ln \left( \frac{\text{Mt}_{-1}}{\text{Pt}} \right) \right)$$

This form is still subject to the same criticism raised by Gordon (1984) as stated above.

iii) If nominal money balances are considered exogenous, individuals can only adjust the difference between the desired and the new actual money balances through accepting the variation in the price level. According to Hetzel (1984), the adjustment equation should be written as:

$$\ln \text{Pt} - \ln \text{Pt} = a3 \ln \text{Mt} - a3 \ln \left( \frac{\text{Mt}}{\text{Pt}} \right)$$

(5)

This gives a money demand equation of the form:

$$\ln \left( \frac{\text{Pt}}{\text{Pt}_{-1}} \right) = a3 f(X_t) + (1- a3) \ln \left( \frac{\text{Mt}_{-1}}{\text{Pt}_{-1}} \right)$$

(6)

iv) If gradual adjustments of nominal money balances and the price level are allowed, a more general form of these adjustment hypotheses can be written as:

$$\ln \text{Mt} - \ln \text{Mt}_{-1} = a5 \ln \left( \frac{\text{Mt}_{-1}}{\text{Mt}_{-1}} \right)$$

(7)

$$\ln \text{Pt} - \ln \text{Pt} = a5 (\ln \text{Pt}_{-1} - \ln \text{Pt}) + a6 f(Z_t)$$

(8)

where:
- $a5 = \text{portfolio adjustment coefficient}$
- $a6 = \text{price adjustment coefficient}$
- $Z_t = \text{vector of supply shock variables}$
With some mathematical manipulation and under some other assumptions, Gordon (1984) arrived at the following reduced form equation:

\[
\begin{align*}
la(V_t - a_5(X_t)) & = (a_4 - a_5) \ln M_t - \frac{1}{a_4} \ln(M) - a_4 - \ln(\lambda) \\
\end{align*}
\]

If \(a_4 = a_5\) and \(a_6 = 0\), this general form is reduced to the first view expressed by equation (3). If \(a_4 = 1\) and \(a_6 = 0\), this form is reduced to the third view presented by equation (6).

Laidler (1982) argued that in the short-run demand for money function with lagged dependent variable, the adjustment coefficient should be interpreted as summarizing the net result, of all the economic forces that move the price level to its equilibrium level after a monetary shock.

It is obvious from the literature review that there are several ways of formulating a model of inflation that reflects the salient features of the monetary approach. To use the model empirically, it has to be set up in a testable form. It is most appropriate to formulate the model in a long-run and a short-run form.

Conventional specification of the long-run model of the demand for money is as follows:

\[
\ln(\pi) = a_0 + \ln Y + a_2 \ln R
\]  

where \(Y\) = real income

- \(R\) = opportunity cost
- \(a\) = scale factor which is constant in the long-run
- \(a_1\) = income elasticity of demand for money
- \(a_2\) = opportunity cost elasticity of demand for money
Expressing equation (10) in terms of the rates of change, the growth rate of the demand for real money balances $b^*$ may be written as follows:

$$b^* = aty + a2.r$$

where small letters $y$ and $r$ denote the rates of change of the relevant variables, and the astrix stands for the long-run demand.

Inflation rate $p_t$ is expressed as the difference between the growth rate of the nominal money stock $m$ and the rate of change of the demand for real money balances $b^*$

$$p = m - b^* \quad (12)$$

This equation can be put in an estimable form of an inflation equation. This could be obtained by substituting $b^*$ form (11) int: (12) as follows:

$$P_t = \delta + 12:it + 3t + u_t \quad (13)$$

where $\delta > 0$ and $\tau < 0$

The equation represents the basic long-run inflation model for the monetary approach. However, the measurement of the opportunity cost variable remains a problem. The domestic interest rate might not be a realistic proxy for the opportunity cost of holding assets in the developing countries. This may be attributable to the fact that the financial markets in these countries are small and limited.

Barring a few exception, empirical studies of money demand in LDC's have confined their analysis to the interest rates prevailing in the organized capital markets (mainly the treasury bills rate or the rate on long-term government securities). These studies have produced ambiguous and inconclusive results.
In view of the structural characteristics of the Egyptian economy, there is a strong case for considering the substitute relationship between money and real assets. This approach is operationally more meaningful and net-adjusted yields on this particular category of assets is more representative compared to the yields on paper securities traded on the organized markets.

The approach underlying the present study considers the expected rate of inflation as the measure of opportunity cost of holding money. On theoretical grounds, we should have also incorporated some measure of real rate of interest. However, due to the unavailability of relevant data, we have used the inflation rate variable alone as a measure of the opportunity cost variable.

Obviously this procedure rests on the assumption that the real rate of interest remains constant or, on a weaker assumption, that variations in the nominal interest rate are dominated by the variations in the rate of inflation. This assumption is strongly confirmed by the literature (Aghevli and Khan, 1978). It comes out to be amply supported by the empirical twits of the present investigation.

Concerning the short-run, an inflation model could include some variables that explain the working mechanism of the monetary approach, no full or instantaneous adjustment of actual to desired level of real balances is assumed in this short-run model. The equilibrium money demand function is rewritten as an expression for the equilibrium price level as follows:

\[ \ln = MN < - (ao + a1 \ln Y_t + a2 \ln R_t) \] \hspace{1cm} (14)

Money holders are assumed to adjust their nominal money balances gradually to their equilibrium level in the following way:

\[ \ln_{Net} = CI \ln M_t + (1-C) \ln M_{t-1} \] \hspace{1cm} (15)
where $M^* =$ short-run disequilibrium demand for nominal cash balances.

$M_t =$ current supply of cash balances.

$CI =$ portfolio adjustment coefficient.

Money market clearing implies that:

$$\text{(16)}$$

Substituting from (15) into (16) we get:

$$\ln M_t = (F11) \ln M_t (1- \ln M_t)$$  \hspace{1cm} (17)

Prices are also assumed to adjust gradually to their equilibrium levels according to the following equation:

$$C_2 \ln P_t (1-C_2) \ln P_{t-1}$$ \hspace{1cm} (18)

where $C_2$ is the price adjustment coefficient.

Substituting for $\ln P_t$ in (14) gives:

$$\ln P_t = C_2 \ln M_t - C_2 (a_0 + a_1 \ln Y_t + a_2 \ln R_t) - (1-C_2) \ln P_{t-1}$$ \hspace{1cm} (19)

Substituting for $\ln M_t$ from (17) we get:

$$\ln P_t = (1-C_2) \ln P_{t-1} + (C_1) \ln M_t - (1-C_1) \ln M_{t-1} - a_0 C_2 - a_1 C_2 \ln Y_t - a_2 C_2 \ln R_t$$ \hspace{1cm} (20)

By rearranging terms in (20) and by first differencing the results we obtain:

$$P_t = k_0 + k_1 \ln M_t + k_3 \ln M_{t-1} + k_5 t + k_6$$ \hspace{1cm} (21)

where $k_0 =$ constant term added for estimation purposes

$\text{kt} = (1-C_2) > 0$
\[
\frac{C_2 (1-C_d)}{1-C_2} < \frac{C_1}{C_1} \quad \text{where } 0 < C_2 < 1
\]

\[
k_3 = \frac{c_2}{C_1} > 0
\]

\[
k_4 = a_1 C_2 < 0
\]

\[
k_5 = a_2 C_2 > 0
\]

\[c_m = \text{the change in the rate of growth of nominal money balances.}\]

Structuralist Approach:

Price stabilization policies based upon the monetary approach imply restrictive monetary measures to curb inflation. These measures will bring down the economic growth much needed by less developed countries.

Lioli (1974) argued that the structuralists distinguish between the causes of the inflationary pressures and the propagation mechanism that turns the pressures into an actual development of inflation. The causes of the inflationary pressures comprise the structural constraints of the economy.

As discussed in the literature (Lioli, 1974 and Wachter, 1976), the LDC's face the following constraints in the short-run:

i) Food supply in the short-run is price inelastic. It is not responsive to price increases caused by the demand pressure created by industrialization, urbanization and fast population growth. This causes continuous rise in food prices.

ii) The import bottleneck hypothesis stipulates that, other things being equal, LDC's will
experience difficulties with their balance of payments over the long-run. This is due to the fact that their exports consist essentially of primary products, which are subject to low income elasticity of demand. Their imports from the industrialized nations, on the other hand, are of high income elasticity of demand. The decline in their external position provokes import restrictions and domestic import substitution. Thus, via the mechanisms of excess demand associated with import substitution the inflationary situation is greatly emphasized.

Instability in the foreign sector of LDC's creates inflationary pressure, in two ways: (1) improvement in the foreign sector raises per capita income and thus generates demand pull inflation, (2) deterioration in this sector exerts cost-push inflationary pressures. Both types of inflation are said to exist in LDC's (Elcanem, 1982).

ifi) For sustained growth to take place, the government must provide adequate infrastructure and a general economic climate attractive to both domestic and foreign investment. In order to accomplish this, government expenditure will necessarily increase more than taxes and public loans can accommodate. Consequently, if other economic groups are unwilling to contract their expenditure and investment by the same amount of increase in government expenditure, then an inflationary process will be initiated. Due to the inflexibility of tax system in LDC's deficit financing cannot be avoided and inflationary pressures are developed even further (Kirkpatrick and Nixon 1977).

iv) The structuralists claim that the LDC's possess structural deficiencies, such as stagnant agriculture, comparative disadvantage in trade with industrialized countries and income inelasticity of the tax system. Such deficiencies cause and propagate inflationary pressures as soon as these countries attempt to achieve economic growth. They view inflation as a component of growth of LDC's. They argue that inflation cannot only be considered a monetary phenomenon since the reduction in the rate of growth of money supply to curb inflation leads only to a decrease in the level of output and employment.
They claim that inflation rate can be reduced only by eliminating these structural deficiencies.

Cumulative inflationary pressures that build up in these countries include distortions in the price system, inflation expectations, and lack of export incentives. Various economic groups try to maintain or improve their relative shares of the total income in the wake of inflation. In addition, the private and public sectors struggle to improve their relative control of real resources.

Wachter (1976), and Fischer and Mayer (1981) investigated empirically the causes of inflation in some Latin American countries and found that the structuralist hypothesis is more relevant than the monetary hypothesis in explaining inflation.

The structuralists argue that prices of the agricultural sector adjust to eliminate excess demand while in the non-agricultural sector, output changes positively in response to excess demand. Taylor (1982, 1983) argued that inflationary pressure arises because wage earners try to maintain the level of their real wage after an increase in food prices. He showed that wage and price inflation becomes more serious when relative prices between the two sectors shift in favour of the agricultural sector. This could be explained by the shortage in supply in the agricultural sector and the existence of food import constraints. This causes structural disequilibrium and generates inflation.

Different structuralists have developed theoretical models that may be adapted for empirical investigations. The following testable hypotheses are formulated along the lines suggested by Taylor (1982, 1983 and 1985) and Cardoso (1981).

The economy is assumed to have a large agricultural sector A that produces food for the whole economy and a fast growing non-agricultural sector N. The general price level P is a homogeneous function of prices in the two sectors Pa, Pn according to the following cobb-Douglas form:
The weights are \( a, 1-a \) where \( a \) is the food share in the consumption budget. The logarithmic form of this equation is:

\[
\ln P_t = a \ln(P_a) + (1-a) \ln(P_n) \tag{23}
\]

The terms of trade between the agriculture and non-agricultural sectors can be defined as:

\[
P_{*\text{F}} = \frac{P_n}{P_a} \tag{24}
\]

The non-agricultural sector:

The price in the non-agricultural sector is determined by the following mark-up price equation:

\[
(P_n)_t = uvP_t \alpha(t) + Olnw_t + rtlnP_m \tag{25}
\]

where \( u = \) mark-up rate assumed to be fixed in the short-run.

\( w = \) money wage rate.

\( P = \) price of intermediate commodities intended to represent exogenous foreign influences.

Disequilibrium caused by shifts in demand is adjusted through changes in output that could take place due to excess capacity in this non-agricultural sector. In this sector, workers are assumed to have a standard real wage rate \( w_{r*} \) in common. If the actual real wage rate \( w_r \) falls below this desired level, workers will push the money wage rate upward until the actual rate equals the standard rate. Accordingly, the inflation equation takes the form:

\[
w_{r} = X (\ln wr - \ln wr) \tag{26}
\]

where \( X \) is the speed of adjustment.

The real wage rate can be expressed as:

\[\text{---6. 6---}\]
In \( wt_t = \ln w_t - \ln p_t \) \hspace{1cm} (27)

Substituting (23) into (27), one gets the desired real wage rate which is consistent with the trend level of the terms of trade \( F^* \).

\[
\ln wr_t = \ln w_t - \ln (P_{ri_t} + 1) \hspace{1cm} (28)
\]

using equations (26), (28), (27) and (23) in that order, we get

\[
w_t = X a (\ln F_t - \ln F^*t) \hspace{1cm} (29)
\]

(1) This can be proved as follows:

Substituting (23) into (27) we get

\[
\ln wr_t = \ln wt_t - (a \ln Pt + (1-a) \ln Pat)
\]

\[
= \ln w_t - a \ln Pat - \ln Pat + a \ln P_{ol}
\]

\[
= \ln w_t - a [\ln P_{at} - \ln P_{nt}] - \ln P_{nt}
\]

\[
= \ln w_t - a (k-1-1) \cdot \ln P_{nt}
\]

\[
= \ln wt - a \ln Ft - \ln Pnt
\]

\[\ln wt = \ln wt - Fa_t \cdot \ln P_{at} \hspace{1cm} (28)\]

(2) This can be proved as follows

\[
w_t = Xan \ln wr_t - \ln wr_t \hspace{1cm} (26)
\]

Substituting for \( \ln wr_t \) from (28) we get

\[= X[\ln wt - a \ln Fst - \ln Pnt - \ln wr_t] \]

Substituting for \( \ln wr_t \) form (27) we get

\[
w_t = X[\ln w_t - cctInE^*t - \ln P_{nt} - \ln P_t + \ln P_t]
\]

\[
= X [-a \ln get - \ln Pat - II \ln Pt]
\]

\[
= -cct \ln - X \ln Pat + X \ln Pt
\]

\[
= \ln Fst - X \ln Pat + X [a \ln Put + (1-a) \ln Pnt]
\]

\[
= -aX \ln - X \ln Pat + aX \ln Pat + X \ln Pnt - \ln Pnt
\]
Price adjustment in the non-agriculture sector is mainly the result of wage and intermediate input price adjustment. Equation (25) can be rewritten in terms of rates of change as follows:

\[ P_{nt} = \pi_{wt} + xP_{nt} \]  

(30)

Substituting equation (29) into (30) we get:

\[ P_m = \text{thin} \left( t \right) \ln P_{nt} \]  

(31)

The Agricultural Sector:

Excess demand in the agricultural sector may be related to the percentage rate of change in the relative price of the agricultural products, or the inter-sectoral terms of trade.

Since the inter-sectoral terms of trade is defined as, \( F = \frac{P_n}{P_a} \) therefore

\[ \ln F = \ln P_a - \ln P_{nt} \]

Rearranging and expressing the variables in their rates of change we get:

\[ P_{at} = \pi t + P_{nt} \]  

(32)

Equation (23) can be expressed in terms of the rates of change as follows:

\[ pt = a + (1-a)P_{at} \]  

(33)

Substituting Pat from (32) and Pnt from (31) into (33) produces the general inflation model of the structural approach:

\[ = -a0t \ln P_t + \ln P_{at} - a \ln P_m \]

\[ = -aX \ln F + \text{cut (hi Pa - In Pnd)} \]

\[ = \ln ?t + aX Ft \]

\[ = \text{cam (ln Ft - ln ?t)} \]  

(29)
\[ Pt = a_f t + P_a \ln \left( \frac{F_t}{F_t} \right) \]

All the estimated coefficients are expected to have positive signs. This equation reveals that the inflation rate is mainly determined by both the growth rate and the level of the inter-sectoral terms of trade.

The inflationary process starts from the adjustment in the agricultural sector prices. Shifts in demand due to rapid urbanization and promotion of agricultural exports on the one hand, and slow increase in production and low productivity on the other, increase the price of agricultural relative to that of the non-agricultural sector.

According to equations (26) and (29), the difference between the observed and the desired real wages, and hence the terms of trade between the two sectors, will ignite the nominal wage adjustment. This forces prices in the non-agricultural sector, to go up.

The inflationary process may also originate in the non-agricultural sector through the increase in the price of imported raw materials. Prices have an upward trend in LDC’s for both raw materials and commodity prices.

M. Estimation and Analysis of the Results:

In this section alternative equations reflecting the corresponding general model of each approach will be estimated and the results will be analyzed. As an initial step, the general restated. This will be followed by the econometric specification of each model. The section is concluded by an analysis of the implications of the results.

(1) This could be derived as follows:
\[
P_t = a (f_t P_{nt}) (1-a) P_{nt}
\]
\[ = a_f t - a P_{nt} 1- P_{nt} ' a P_{nt}
\]
\[ = a_f t + P_{nt}
\]
\[ pt = a_f t + fiXa \ln \left( \frac{F_t}{F_t} \right) \]

(34)
Monetary Approach:

The two basic equations (13) and (21) derived in the previous section to reflect the general features of the monetary approach are restated here for convenience:

\[
Pt = f_0 + f_1m_{t} + f_2Y_{t} + f_3\text{rt} + u_t + \text{lc}2\text{n}_{1/4} + k_3\text{cmt} + k_4\text{rt} + u_2t
\]  

Equation (13) implies instantaneous effect of changes of the explanatory variables on the rate of inflation. The value of the coefficient of the money growth variable is unity if inflation is strictly a monetary phenomenon. However, the dynamic aspect of the inflationary process necessitates that each of the independent variables could be identified with a distributed lag structure. Accordingly, the short-run version of the long-run equations (13) and (21) can be specified for estimation as follows:

\[
\begin{align*}
Pt & = t_0 + \sum_{i=0}^{n_7} f_1m_{t-i} + \sum_{i=0}^{n_5} f_2Y_{t-i} + \sum_{i=0}^{n_6} f_3\text{rt-i} + U_t \\
pt & = k_0 + \sum_{i=0}^{n_4} k_1\text{Pt-i} + \sum_{i=0}^{n_5} k_2\text{in} + \sum_{i=0}^{n_6} k_3\text{cmt-i} + k_6 + \sum_{i=0}^{n_7} k_7 + \text{et}
\end{align*}
\]  

Estimation of equation (35):

Equation (35) is estimated by the Almon distributed lag model. Although the polynomial degree has been set arbitrarily at two, the appropriate lag lengths for each variable are searched in the following way:

1. Several regressions are initially estimated for (35) and results consistently reveal that the income variable with 4 lags, yields the most reasonable result as far as the expected sign and the statistical significance of the coefficients are concerned.
2. With this lag specification of \( y \), we proceed with the estimation of (35) containing \( int \) and \( cr_t \) with different lag specifications. The relevant combination is selected based upon statistical criteria such as the standard error of the regression and the F-ratio. Since the number of estimated regressions are large, it is more practical to show only the statistics of the relevant regressions.

Table 1 contains test statistics when regressions are estimated by the OLS method. When \( mt \) and \( crt \) are specified with 3 and 5 lags respectively it is found that the standard error of the regression is the lowest while the F-ratio is statistically significant indicating the relevance of the specified set of explanatory variables. In addition, the parameters of this particular regression (35-1) are significantly different from zero.

3. The Durbin-Watson statistic for regression (35-1) estimated by the OLS method is far below 2 implying that the autocorrelation problem is serious. Since the presence of autocorrelation is common in time series, it is logical to estimate the regression using the Cochrane-Orcutt specification as a method to correct for autocorrelation and obtain efficient estimates.

The results are shown in table 1 as (35-2). Although the significance level of \( mt \) and \( crt \) deteriorated slightly, the income variable coefficient is higher in (35-2) than in (35-1). The coefficient of determination decreased but the Durbin-Watson statistic approaches 2 indicating the removal of autocorrelation.

*Estimation of Equation (36):*

The presence of the lagged endogenous variable in the set of explanatory variables of equation (36) means that the usual assumption, that \( e_t \) is normally and independently distributed, may be invalid. If \( e_t \)'s are serially correlated, the OLS method will produce biased but consistent estimators in small or finite samples.
A variety of methods have been proposed to correct the biasedness. However, those methods revealed that their results are not better than the OLS method (Johnston, 1972).

The estimation process is a repetition of the steps indicated above. Initial estimation indicated that the income variable with 4 lags and a one-period lagged inflation rate pt_i yield the most favourable results as far as the expected signs and the statistical significance of the parameters are concerned.

With the specification of pt.i and yr the coefficients of mt, crt and cmt are estimated with different lag specifications to select the relevant combination. The results are reported in table 1.

These results reveal that mt with 6 lags, crt with 5 lags and cmt with 3 lages are the most empirically relevant lag specifications. None of the cmt coefficients is significantly different from zero. Accordingly, estimates of equation (36) is presented in three regressions. The first one (36-1) specifies cmt with 3 lags. Regression (36-2) specifies cmt with no lags, while in (36-3) the equation is estimated without cmt.

Model specifications that move towards the elimination of cmt give better results, although the coefficient of determination deteriorates slightly.
Table (1) : Regression Results of Econometric Models Representing the Monetary Approach

<table>
<thead>
<tr>
<th>Regression Number</th>
<th>ut/n, t-1</th>
<th>Explanatory Variables</th>
<th>F</th>
<th>R2</th>
<th>D-W</th>
</tr>
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<tbody>
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<td>(35-1)</td>
<td>-.621</td>
<td>.763</td>
<td>1.478</td>
<td>.763</td>
<td>20.213</td>
</tr>
<tr>
<td></td>
<td>(1.795)</td>
<td>(8.512)</td>
<td>(3.412)</td>
<td>(-2.544)</td>
<td>(-1.320)</td>
</tr>
<tr>
<td>(35-2)</td>
<td>.976</td>
<td>.752</td>
<td>1.213</td>
<td>.752</td>
<td>12.426</td>
</tr>
<tr>
<td></td>
<td>(2.238)</td>
<td>(5.312)</td>
<td>(2.728)</td>
<td>(-3.112)</td>
<td>(-1.715)</td>
</tr>
<tr>
<td>(36-1)</td>
<td>.183</td>
<td>.415</td>
<td>.032</td>
<td>.415</td>
<td>16.143</td>
</tr>
<tr>
<td></td>
<td>(1.329)</td>
<td>(3.721)</td>
<td>(3.159)</td>
<td>(-2.613)</td>
<td>(-.216)</td>
</tr>
<tr>
<td>(36-2)</td>
<td>.151</td>
<td>.462</td>
<td>.019</td>
<td>.462</td>
<td>19.212</td>
</tr>
<tr>
<td></td>
<td>(1.118)</td>
<td>(3.815)</td>
<td>(3.014)</td>
<td>(-2.715)</td>
<td>(-.322)</td>
</tr>
<tr>
<td>(36-3)</td>
<td>.162</td>
<td>.457</td>
<td>.129</td>
<td>.457</td>
<td>22.145</td>
</tr>
<tr>
<td></td>
<td>(1.217)</td>
<td>(3.936)</td>
<td>(3.273)</td>
<td>(-2.824)</td>
<td>(-.319)</td>
</tr>
</tbody>
</table>

- Figures in parantheses are [t]-statistics.

* Except for pc.t regression parameters are for the sums of the coefficients.

- Description of variables : 

  I. Nominal money balances (M): This variable is defined as the sum of currency held by the public and demand deposits, i.e., M1. The quarterly figures of this variable are obtained from the Central Bank of Egypt Economic Review. The rate of change of M is denoted by m and the change in m is denoted by cm.
2. Real Income (y): This variable is expressed as GDP in constant prices. y is the rate of change of real income. There are no quarterly observations on GDP for Egypt. One of the methods to get out of this problem is to link the annual GDP figures to another variable which is available on quarterly basis. Preliminary experiments reveal that real GDP is best proxied by industrial production. This was tested by regressing GDP on industrial production on an annual basis for which data on both variables are available. The following equation was obtained

\[ \text{GDP} = 43.614 + .M1 \text{ Pi'} \]

(8.112)

This estimated equation suggests that there is a strong relationship between the two variables. This is reflected by the value of the coefficient of determination (R² = .938) and the highly significant coefficient (t = 8.112). The equation suggests that industrial production can be appropriately used as a proxy for national income when the quarterly series are constructed (Sbakout, 1979).

**Structuralist Approach:**

The basic equation (34) derived in the previous section to reflect the features of the structuralist approach is repeated here for convenience:

\[ p_t = a + \text{f}f + \text{a ln} \left( \frac{F}{F^*} \right) + \text{ir} \left( P_m \right) \]

(37)

where \( p_t = \) the rate of change of the actual terms of trade between the two sectors.

\( F = \) the actual terms of trade

\( F^* = \) the trend term of trade.

\( P_m = \) the rate of change of the price of imported raw materials.
Initial results indicated that \( f_t \) influences the inflation rate with no lags. The ratio of \( F \) to \( F_s \) affects the inflation rate with a lag of one period. In addition, \( pmt \) can best be entered in the equation as a second degree Almon distributed lag model. Accordingly, the econometric version of the inflation model that reflects the structuralist approach takes the form:

\[
Pt = b_0 + b_1 f_t + b_2 \ln \left( \frac{F_t}{F_s} \right)_t \div \sum_{i=0}^{1} c_i \left( P_{idt_i} + u_t \right)
\]  

\( (38) \)

Estimation Results:

Table 2 shows four estimated regressions. In the first equation (37-1) the ordinary least squares method is used. It is evident from this table that all coefficients are significant at different levels of probability. The sum of the coefficients of the raw materials inflation rate \( (p_{in}) \) is highly significant at 1%, the coefficient of \( f_t \) is significant at 5% level. The coefficient of \( \ln \left( \frac{R_{r}}{F} \right) \) is significant only at 10% level.

However, the Durbin-Watson statistic shows that its calculated value is far below the lower bound. This indicates that there is a positive autocorrelation. The equation was reestimated using the Cochrane-Orcutt method to correct the autocorrelation problem. The obtained results are reported as the second equation (37-2) in the table. The size of the coefficients has not changed significantly indicating the robustness of estimates and confirming that the autocorrelation problem is not so serious.

Since the estimated coefficients of \( \ln \left( \frac{R_{r}}{F} \right) \) are not highly significant in these regressions, this variable is dropped in the remaining two equations. Equation (37.3) is estimated by the OLS method, while in equation (37.4) the Cochrane-Orcutt method is used to correct for autocorrelation.
Table 2: Regression Results of Econometric Models Representing the Structuralist Approach

<table>
<thead>
<tr>
<th>Regress# Number</th>
<th>Constant</th>
<th>Explanatory Variables</th>
<th>F</th>
<th>R2</th>
<th>D-W</th>
</tr>
</thead>
<tbody>
<tr>
<td>(37-1)</td>
<td>.857</td>
<td>.121 (2.915)</td>
<td>.030 (1.324)</td>
<td>.764 (8.064)</td>
<td>23.214</td>
</tr>
<tr>
<td>(37-2)</td>
<td>.872</td>
<td>.078 (1.984)</td>
<td>.027 (1.212)</td>
<td>.751 (7.316)</td>
<td>17.642</td>
</tr>
<tr>
<td>(37-3)</td>
<td>.891</td>
<td>.198 (2.738)</td>
<td>--- (7.925)</td>
<td>.758 (1.80)</td>
<td>18.350</td>
</tr>
<tr>
<td>(37-4)</td>
<td>.926</td>
<td>.180 (2.352)</td>
<td>--- (6.213)</td>
<td>.749 (1.18)</td>
<td>15.732</td>
</tr>
</tbody>
</table>

- Figures in parentheses are t-statistics.
- Regression panne= are for sums of the coefficients.
- Desaition of variables:
  1. Actual tams of unde (F) : This variable is measured by the ratio of the wholesale vice index of agricultural products to non-agricultural products.
  2. Trend terms of trade ffis): This vairable is defined as the estimated value of F when regressed on the time trend. The estimated euation is

\[ F \cdot .253 - .321 T \]

\[ R^2 = .817, D - W \cdot 1.822 \]
3. Wholesale price index of imported mw materials (Pmd : Data on this variables are not available. The wholesale price index number of raw materilas is used as a proxy for this variable.

IV. Summary and Conclusions:

Different approaches to inflation are available into literature each of which has some empirical support. The purpose of this paper has been to investigate the relative efficacy of alternative models of inflation with respect to the Egyptian economy during the period 1974/1975 to 1988/1989.

To achieve this purpose, two approaches to inflation were differentiated. namely die monetary approach and the structuralist approach. From te litemture review. the theoretical foundation of each approach was identified and the explanatory variables were chosen. The main features of each approach were summarized.

The monetary approach applies in situations where the quantity of money increases at a faster rate than the demand for money. The basic set of explanatory variables of this inflation model can be the same as those in the demand for money function. In order to shed light on the short-run dynamics of inflation, some modifications concerning the specifications of the demand for money function or its independent variables or both were made to accommodate lagged adjustment effects.

Two basic models of inflation were derived within the frame work of the monetary approach. The explanatory variables in the long-run equilibrium version of the model, included the growth rate of money balances. In the second model, the lagged inflation rate and the lagged growth rate of money balances were added to the set of the independent variables of the long-run model.
According to the structuralist approach, an inflationary process can arise from the conflicting claims among the agricultural and non-agricultural sectors concealing their shares of real income of the economy. The rate of change of the terms of trade between the two sectors, the logarithm of the ratio of the actual terms of trade to the trend terms of trade, and the unit price of raw materials are the explanatory variables of the inflation model.

Alternative regression specifications of the basic models specified according to each approach were estimated. Traditional statistical criteria proved that alternative models constructed for each approach are statistically acceptable.
References:


- - - - - "The Short-Run Demand for Money" A Reconsideration" Journal of Money, Credit, and Banking, Vol.16, 1984.


