ON THE INFLATIONARY PROCESS IN KUWAIT: SOME EMPIRICAL RESULTS *)

I. INTRODUCTION

The present paper attempts to analyze the inflationary experience of Kuwait over the quarterly period 1972-1989. The main objective is to test empirically the validity of the monetarist view of inflation which has become more acceptable in recent years. ([1])

With perhaps one notable recent exception (Salih, 1993), the inflation problem in Kuwait has been largely ignored in the published literature. This paper is different from Salih's study in many respects. First, Salih's model could be misspecified due to omitting several important variables from the inflation model. For example, absent from his model were variables from the underlying money demand function like non-oil real GDP and expected inflation. In the present paper, I incorporate both variables in the monetary model. Second, Salih's paper uses the Almon distributed lag scheme but with arbitrary restrictions on the lag lengths and on the degree of polynomials. Use of some empirical methods (e.g., the Akaike Final Prediction Error criterion) seems more appropriate and could result in a different lag structure within the same model specification. In the present paper I use the Akaike procedure to determine the optimal lags. Third, Salih employs annual data with only 17 observations. However, most hypothesis tests are asymptotic with known properties only in large samples. Therefore, I use quarterly data, resulting in a large sample of 72 observations. Fourth, Salih's study ignores the structural stability of the estimated equations, an important property that is required for policy analysis. In this paper, I employ a battery of testing procedures to examine the structural stability of my estimated regressions.

The rest of the paper is organized as follows. Section II specifies a monetary model of inflation for Kuwait. Section III discusses the results

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([1]) For supporting evidence, see HARBERGER (1963), VOGEL (1974), DARRAT (1994), HASLAG and OZMAN (1991), BELTAS and JONES (1993), and SALIH (1993). See also AGHEVLI and KHAN (1978), TURNOVSKY and WOHAR (1984), TOGAN (1987), BAIRAM (1990), DHAKAL and KANDIL (1993), and GHATAK (1995).

from testing for unit roots and cointegratedness among the variables. Section IV reports the empirical results from the inflation model. Finally, section V concludes with some policy implications.

II. Model Specification

To study the determinants of inflation in Kuwait using the monetarist approach, I start with the usual equilibrium condition in the money market:

$$\left(\frac{M^s}{P}\right) = \left(\frac{M}{P}\right)^d \tag{1}$$

where M^s is the nominal money supply, P is the price level, and $(M/P)^d$ is real money demand. If I rewrite equation (1) in a logged form, I get:

$$\log P_t = \log M_t^s - \log(M/P)_t^d \tag{2}$$

Taking first differences of equation (2), and denoting the results (percentage changes) by a delta (Δ) for each variable, I get:

$$\Delta P_t = \Delta M_t^s - \Delta(M/P)_t^d \tag{3}$$

Equation (3) is the basis of the monetarist theory of inflation. It states that the percentage change in the price level (i.e., the inflation rate) equals the difference between growth in the nominal money supply and growth in the real money demand. Thus, inflation occurs only if the growth of nominal money supply exceeds that of real money demand. In this sense, "inflation is always and everywhere a monetary phenomenon". (2)

As is typical in most studies, nominal money supply is assumed exogenous (controlled by the monetary authorities). Real money demand, on the other hand, is endogenous and influenced by (non-oil) real GDP (as a proxy of the budget constraint) (3) and by expected inflation (representing the opportunity cost of holding money). (4) An increase in non-oil

(2) This dictum originated with Milton Friedman (1966, p. 18), a leading advocate of the monetary approach to inflation.

(3) Non-oil real GDP, rather than total real GDP, is used in the case of Kuwait since oil revenues accrue directly to the Kuwaiti government and, as such, have no direct effect on private liquidity.

(4) Another important measure of the opportunity cost of holding money is the rate of interest representing other financial assets. However, interest rates, if data on them existed, are usually fixed in most developing countries, and Kuwait is no exception. Therefore, they are commonly dropped from money demand equations, a practice I follow in this paper.

GDP is expected to increase the transaction money demand, which in turn would mitigate inflationary pressures. On the other hand, higher expected inflation would reduce the speculative demand for money which would then fuel inflation.

Accordingly, the inflation model for Kuwait can be written as

$$\Delta P_t = \Delta M_t^s - \Delta f(X_t^n, \Pi_t^e) \tag{4}$$

where X^n is non-oil real GDP, and Π_t^e is inflation expected at time t to prevail at time $t + 1$.

Lagged adjustments in the response of inflation to its fundamentals must be incorporated in the estimated model. This sluggishness in the inflation adjustments has been justified in many ways in the literature. According to the neo-classists, the lagged response of prices to changes in money supply is attributable to the existence of information lags representing the delay between the change in money supply and its recognition by economic agents. Keynesians, on the other hand, see this price sluggishness as a manifestation of disequilibria in both commodity and labor markets, where prices differ from their equilibrium values to which they adjust only slowly. Thus, changes in money supply affect aggregate demand initially with prices responding only gradually to the resultant excess demands in these two markets [Drazen (1980)]. Still, there are others who explain the delayed response of prices by lags in the response of aggregate demand itself. For example McCallum (1980) argues that individuals are more responsive to changes in money supply that are perceived to be permanent. Hence, aggregate demand would fully and instantaneously react to *permanent* money supply changes which may be proxied by the average of current and past money-supply changes.

Therefore, after allowing for lagged adjustments, the final inflation model for Kuwait becomes:

$$\Delta P_t = \alpha + \sum_{i=0}^{h_1} \beta_i \Delta M_{t-i}^s + \sum_{i=0}^{h_2} \lambda_i \Delta X_{t-1}^n + \sum_{i=0}^{h_3} \psi_i \Delta \Pi_{t-1}^e + \varepsilon_t \tag{5}$$

where all variables are defined as before, h_i $(i = 1, 2, 3)$ denotes the lag lengths for the three determinants, and ε is an error term which is assumed as is commonly the case to be serially uncorrelated with zero mean and constant variance. Based on the underlying theory, I expect:

$$\Sigma \beta_i,\ \Sigma \psi_i > 0; \text{ and } \Sigma \lambda_i < 0$$

Before turning to the next section containing unit root results, some technical comments are in order. As I mentioned earlier, I use the Akaike final prediction error (FPE) criterion to determine the proper lag profile of my model [for a review of this procedure, see Fackler (1985), and Darrat (1988)]. I measure prices by the non-oil GDP deflator, and the money supply by the narrowly defined money stock (*M1*). Compared to broader measures of money stock, *M1* represents transaction balances which appear more closely related to aggregate demand pressures. Using an adaptive expectation scheme, I approximate expected inflation for any future period by the weighted average of the current and past inflation rates. All time series come from various publications of the Ministry of Planning (Statistical Unit). Since data on all variables are available only annually, I generate the corresponding quarterly figures using the interpolation procedures available in the RATS program. [5]

III. Unit Roots and Cointegration Tests

To obtain reliable and unbiased regression results, each variable in the estimated model must be stationary (free from unit roots). Non-stationarity can cause the "Spurious Regression" problem discussed in Granger and Newbold (1974), and Phillips (1986). Furthermore, Stock and Watson (1989) have also shown that when a model includes non-stationary variables, the usual test statistics (t, F, and χ^2) would not have the standard distributions.

I check for the existence of unit roots (non-stationarity) in the model using the Augmented Dickey Fuller (ADF) test [See Maddala (1992)], in conjunction with the FPE procedure for determining the proper lags. Table 1 reports the test results. As is clear from the table, I could not reject the null hypothesis of nonstationarity for all variables if expressed in levels and in first-differences (Panels *A* and *B*). However, when the variables are transformed to second-differences, both inflation and money supply achieve stationarity (Panel *C*). Non-oil real GDP requires third-differences to achieve stationarity (Panel *D*). In other words, two of the variables in our model (inflation and money supply) are integrated of order 2 [$\sim I(2)$], while, the third (non-oil real GDP) is $\sim I(3)$. Therefore, inflation may be cointegrated with money supply since they share the same order of integration. However, non-oil real GDP, on the other hand, is integrated of a different order than either prices or money supply and therefore it cannot be cointegrated with either variable.

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(5) Data problems also precluded the inclusion of a variable representing import prices. Use of a unit import value index as a proxy yielded coefficients that consistently bear the wrong (negative) signs.

TABLE 1 - *Augmented Dickey-Fuller Unit Root Test*
Null Hypothesis: The Variable in the Examined Form is Nonstationary

The Variable (y)	Test Statistics	Appropriate Lag Lengths
A. Levels		
Non-Oil GDP Deflator (P_t)	− 1.70	10
Narrow Money Stock (M_t)	− 0.91	8
Non-Oil Real GDP (X_t^n)	− 1.72	10
B. First-Differences		
ΔP_t	− 2.81	10
ΔM_t	− 2.87	4
ΔX_t^n	− 2.33	8
C. Second-Differences		
$\Delta^2 P_t$	− 3.40*	8
$\Delta^2 M_t$	− 3.42*	9
$\Delta^2 X_t^n$	− 2.77	8
D. Third-Differences		
$\Delta^3 X_t^n$	− 3.47*	12

Notes: The testing equations are of the form:

$\Delta y_t = \alpha + \sum_{s=1}^{n} d_s \Delta y_{t-s} + \rho y_{t-1} + \beta T +$ residuals. All variables are in natural logs and T is a time trend (included if proved significant). The lag length is determined by Akaike's "final prediction error" criterion. An * indicates rejection of the nonstationarity hypothesis at the 10% level of significance.

To check whether prices and money supply are indeed cointegrated, I use the Engle and Granger (1987) and Engle and Yoo (1987) two-step procedure. In the first step, I estimate the cointegrating equation using the two variables in their first-differences (nonstationary) form. The second step in the test is to recover the estimated residuals from the cointegrating equation and test them for nonstationarity using a similar ADF test. If they prove stationary, then the two variables (inflation and money supply growth) are said to be cointegrated. However, the results of this test lead me not to reject the null hypothesis that the two variables are not cointegrated since the test statistics is only − 2.94 which is smaller than the 5% critical value of − 3.75. This finding of no cointegration between inflation and money supply growth is supported also by the Cointegrating Regression Durbin-Watson (CRDW) test which gives a relatively low value of 0.04 compared to the critical value of 0.78 at the 5% level of significance. This evidence from the unit root and cointegration tests suggest that there is no *long-run* relationship between inflation and its fundamentals (money supply growth and real economic growth) in Kuwait. In the next section, I examine whether a reliable *short-run* relationship exists between inflation and the proposed determinants.

IV. Empirical Evidence

In this section, I report in Table 2 the OLS regression results from estimating model (5) for Kuwait over the quarterly period 1972:1-1989: 4. (6) These results appear quite adequate on statistical grounds. Adjusted R^2 is high (= 0.795) and, since all variables in the present model are expressed in differenced forms, the reported results do not suffer from the "spurious regression" problem. Moreover, the standard-error of the regression (= 0.008) is much smaller than the standard-deviation of the dependent variable (= 0.018). Other diagnostic tests also support the statistical adequacy of the estimated inflation model of Kuwait. In particular, the Durbin-m statistics ($t = -0.24$) indicates the absence of significant first-order serial correlation, a result confirmed by the score of the Bruesch-Godfrey statistic ($\chi^2 = 10.76$; $\chi^2(0.05) = 15.51$) which tests for autoregressive and moving-average processes of the error terms [See Johnston (1984)]. This evidence against autocorrelated residuals implies that the reported test statistics are reliable measures of the statistical significance of the various coefficients. It also suggests that there is no serious omission of variables from the model. This last aspect of my model is further supported by the score of the Ramsey's RESET statistic which tests for a general misspecification either resulting from omitting important variables or from using an incorrect functional form. The RESET statistic is too small to reject the null hypothesis of no misspecification.

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(6) Note that all right-hand-side variables appear with a lag. As such, they can be considered statistically exogenous to the left-hand-side variable (the inflation rate). In other words, OLS estimates of equation (5) should not suffer from a simultaneous-equation bias.

TABLE 2 - *Regression Estimates of the Monetary Model of Inflation for Kuwait (Quarterly Data, 1972:1-1989:4)*

Coefficient on (Absolute t-statistics)			
Lag	Money Growth	Non-Oil Real GDP Growth	Changes in Expected Inflation
1	0.146 (3.73)	− 0.072 (− 1.10)	0.007 (9.79)
2	0.002 (0.07)	− 0.082 (− 2.23)	0.007 (16.86)
3	0.025 (2.38)		0.007 (10.97)
			− 0.003 (− 3.13)
			0.003 (4.32)
			0.002 (7.25)
			0.002 (7.22)
Sum	0.173 [6.29]	− 0.154 [0.20]	0.025 [29.75]

Summary Statistics: S.E.R = 0.00805929, Bruesch-Godfrey (χ^2) = 10.76, Chow Test (F) = 0.23, Adjusted R-squared = 0.795, Durbin-m(t) = − 0.24, Ramsey's RESET (F) = 1.56, Farley and Hinich (F) = 1.36

The empirical results indicate that all the proposed determinants of domestic inflation have the correct signs predicted by the underlying theory. In addition, the estimated summed coefficients for two of the independent variables (money supply and expected inflation) are significant at the 5% level of significance, while that for non-oil real GDP is not. Specifically, the cumulative impact of money supply on inflation is positive (= 0.173) with a highly significant F-value = 6.29. Expected inflation too has a positive summed coefficient (= 0.003) with a highly significant F-value = 29.75. Non-oil real GDP, on the other hand, although appears with the correct negative summed coefficient (= − 0.154), is statistically insignificant (F = 0.20).

These empirical results can be used by policy-makers for forecasting the future path of inflation in Kuwait since the estimated model proves structurally stable according to results from the Chow and the Farley and Hinich tests. To apply the Chow test, I employ 1982:1 as the breaking date since the post-1981 period witnessed two major developments with far reaching economic implications. The first was the drastic fall in oil prices with its immense adverse effects on the Kuwaiti economy. The early 1980s also coincided with the collapse of the Kuwaiti capital market

(Al-Manakh). If the estimated inflation equation does not show any significant shift over these difficult times in the financial history of Kuwait, it will be unlikely that the equation would shift under less severe circumstances. The results from both the Chow and the Farley-Hinich tests (also reported in Table 2) do not reject the null hypothesis of structural stability of the estimated equation [the Chow-F = 0.23, the Farley-Hinich-F = 1.36].

V. Conclusions and Policy Implications

This paper attempts to examine major determinants of inflation in Kuwait using the monetarist model. Accordingly, the explanatory variables in this model are the money supply, non-oil real GDP, and expected inflation. Before estimating the inflation model, I test for unit roots in each variable and use the proper degree of differencing to achieve stationarity. I also check for cointegratedness among the variables and find none. The estimated model proves statistically adequate in that it is free from serial correlation, free from serious misspecification, and free from significant temporal shifts in its parameters.

The empirical results indicate that excessive money growth is a primary cause of inflation in Kuwait. The results suggest that every ten percent increase in money growth in Kuwait would, over a period of three quarters, raise her inflation rate by about two percent. A remarkable feature of the empirical evidence is the speed by which money growth exerts its impact upon inflation. The results suggest that most of the impact (about 90%) is completed within one quarter of the money change. Such a quick and significant effect of money supply growth on inflation supports the use of restrictive monetary policy as an anti-inflation strategy in Kuwait. Besides money growth, the empirical results further show that inflationary expectations exert a positive and significant effect on inflation in Kuwait, although with a relatively long lag of about seven quarters. Thus, mitigating the public's expectations of higher inflation should prove an effective tool against inflation. Authorities in Kuwait can mitigate inflationary expectations of the public by confirming their resolve to contain inflationary pressures in the economy through restrictive monetary policy.

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ABSTRACT

This paper investigates the empirical validity of the monetarist view of inflation in the small open economy of Kuwait. The estimates presented indicate that growth in money stock was a primary source of inflation in Kuwait; its impact is swift, completed within one quarter of the money change. Such a quick and significant impact of money supply growth on inflation supports the adoption of restrictive monetary policy as a means to curb inflation in Kuwait. In addition to money growth, the results also show that inflationary expectations exert a positive and significant effect on inflation, although with a relatively long lag of about seven quarters. Hence, lowering the public's expectations of higher inflation can also be an effective anti-inflation policy.

RIASSUNTO

Sul processo inflazionistico nel Kuwait: alcuni risultati empirici

Nello studio si effettua una verifica empirica del modello monetarista dell'inflazione per il caso di una piccola economia aperta come quella kuwaitiana. Le stime presentate indicano che la crescita della massa monetaria è stata una delle cause scatenanti dell'inflazione; i suoi effetti sono stati rapidi essendosi completati nell'arco di un trimestre dalla variazione monetaria. Un effetto così repentino e rilevante dell'aumento dell'offerta monetaria sull'inflazione suggerisce l'adozione di una politica monetaria restrittiva come mezzo per contenere l'inflazione nel Kuwait. Oltre alla crescita monetaria, i risultati indicano che le aspettative inflazionistiche esercitano un effetto positivo significativo sull'inflazione, sebbene con un ritardo relativamente lungo di circa sette trimestri. Ne deriva che anche l'attenuazione delle aspettative del pubblico circa una più alta inflazione può essere una politica antinflazionistica efficace.