Investigating Relationship Between the Bahraini Exchange Rate Policy and Domestic Inflation Using Time Series Approach

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ملخص

البحث في العلاقة بين سياسة سعر الصرف البحرينية والتضخم المحلي

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تبحث الورقة في أمثلية سياسة سعر صرف الدينار البحريني خلال الحقبة اللاحقة للنظام النقدي بريتون وودز. تقترح الورقة أن للأخذ بسياسة سعر صرف مربوط لاقتصاد صغير مفتوح كالبحريني له تأثير مباشر على مقدرة متخذى القرار وبالتحديد السلطات النقدية في التأثير على الاقتصاد المحلى. لقد برهن ذلك باختبار انعكاس سياسات سعر الصرف البحرينية على كل من سياسة سعر الفائدة والتضخم البحرينيين حيث بينت نتائج الاختبارين التالي: (أ) غياب أي علاقة ارتباط أو سببية بين التضخم وسياسة سعر الفائدة البحرينيين ويعاز السبب في ذلك إلى تبعية سعر الفائدة البحريني لسعر الفائدة في الولايات المتحدة الأمريكية ؛ (ب) اقتراب التضخم البحريني على المدى البعيد من متوسط التضخم لأهم شركاء البحرين التجاريين وذلك على الرغم من أن العلاقة التجارية التى تربط البحرين بهذه الاقتصادات غير تنافسية. تعد هذه النتيجة أحد سلبيات النظام النقدى بريتون وودز وقد توقع زوالها مع زوال ذلك النظام ، إلا أن حالة البحرين تدل على أن ذلك مشروط بسياسة سعر الصرف المتبعة. وبما أن سعر الفائدة الأمريكى ومتوسط التضخم لأهم شركاء البحرين التجاريين متغيران خارجيان ليس لدى متخذ القرار البحريني المقدرة على التأثير بهما ، فإن النتائج الواردة في الورقة تؤكد على عمق انكشاف الاقتصاد البحريني على الاقتصاد العالمى . كما تبين الورقة إسهام سياسات سعر الصرف البحرينية في ذلك مما يدعو للتشكيك في أمثلية سياسات سعر الصرف البحرينية التى تم الأخذ بها خلال الحقبة المذكورة .

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I. INTRODUCTION

The Bahrain Monetary Agency (BMA), sets the preservation of Bahrain Dinar (BD) value as one of its primary objectives. Preserving in here is synonymous to maintaining the value of BD in term of goods and services, i.e. its purchasing power. To fulfil this objective, it is anticipated that the BMA will pursue monetary policy aiming at promoting growth without fuelling inflation. In a small open economy with high level of capital mobility, the exchange rate policy has a fundamental role in determining the effectiveness of monetary policy (Fleming, 1962; Mundell, 1963). Nontheless, it is widely accepted in the theoretical literature that the choice of an optimum exchange rate regime is largely dependent on the stochastic environment characterising the home economy (Boyer, 1978; Flood, 1979; Aghevli et al. 1991). The same literature point out that if the home economy is encountering real shocks such as Bahrain, fixed exchange rate cannot be optimum. Alyousha (1995) demonstrated that with respect to output, the peg exchange rate regimes pursued by Bahrain in the post-Bretton Woods era cannot be considered an optimum choice. This paper will demonstrate that by pursuing peg exchange rate regimes, the Bahraini monetary authorities have severely limited their ability to influence domestic inflation hence, questioning the BMA ability on preserving the BD value. This is demonstrated by inferring on the results from two tests. The first investigates the effect of the BD exchange rate arrangement on the conduct of interest rate policy while the second test investigates the steady-state property of the exchange rate with respect to domestic inflation.

The remaining of this paper is organised as follows : Section 2 provides a brief review of the BD exchange rate arrangments. In section 3

tests are carried out to test for the impact of exchange rate arrangements on the conduct of domestic interest rate policy. The relevance of this policy to domestic fundamentals is investigated by testing for the causal relationship between interest rate and domestic inflation. The tests are carried out in Geweke canonical form using Granger and Sims definition of causality. The results not only reveal absence of causal relationships between interest rate and inflation, they additionally show that both series are independent, i.e. the divorce of interest rate policy from domestic fundamentals. Section 4 uses the Johansen maximum likelihood procedure to test whether or not Bahraini post-Bretton Woods exchange rate regimes diminished the exposure of domestic inflation to world price shocks. The test fails to reject the hypothesis of the convergence of domestic inflation to world average inflation using post-Bretton Woods data. Section 5 concludes this paper by providing a summary on the results and their implication for exchange rate policy

2- A Background to Bahrain Dinar Exchange Rate Arrangements

The history of the exchange rate arrangements of Bahrain can be traced back to the period following the formation of the Bahrain Currency Board in 1964. Prior to this period, Bahrain has used various types of currencies as the means of exchange. For instance, in 1880 the Indian Rupee replaced the long used Austrian Schilling "Maria Theresa" and in 1959 the authorities decided, to refer to the Indian Rupee, which was in circulation in the Arab countries of the Gulf, as the "Gulf Rupee" (Alkhalifa, 1980). Both regimes had the same arrangement and both were in the scheduled territory of the Sterling Area.

The decree that led to the formation of the Bahrain Currency Board

assigned to the Board the duty of undertaking responsibility for issuing the BD. On 16 October 1965 the BD was issued and recognised as the country's official currency, it was pegged to gold at a par value of 1.86621 grams per BD of fine gold (IMF, 1975). Under the new exchange rate regime the BD continued to be within the Sterling Area, however, Bahrain ceased to be within the scheduled territory of the Sterling Area in June 1972, when the currency was unpegged from the Sterling pound. The unpegging of the BD from the Sterling was inspired by the realisation of the importance of the US Dollar to domestic economic activities, particulary to the oil and gas sectors.

Following the collapse of the Bretton Woods system, Bahrain, as well as other countries, encountered a situation in which each country had to adopt either a floating or a peg exchange rate regime, and if a country opted for the second option it needed to determine what that peg should be. In testing to determine the choice between a peg and floating regime for a large sample of countries including Bahrain, Heller (1978) showed that Bahrain would be better off pegging its exchange rate. However, Heller's (1978) paper did not specify what the peg will be, this issue is addressed in earlier study carried out by Crockett and Nsouli (1977) and demonstrated that pegging the BD to the SDR would enhance economic stability.

Approximately five years after joining IMF, the BMA announced in January 1978 that the BD pegged to the SDR at the rate BD+SDR2.1. Bahrain agreed to confine the BD exchange rate to be within the narrow margins of 2.5 percent of the central rate. However, following the depreciation of the BD against the SDR in August 1978, the BMA opted for the wider margin of 7.25 percent.

In December 1980 the monetary authorities modified the existing

exchange rate arrangement by dully pegging the BD to the SDR and maintaining a fixed rate with the US Dollar at the rate BDI=$2.6595 (IMF, 1985). The appreciation of the US Dollar in the first half of the 1980s caused the BD rate in terms of the SDR to move outside the permitted margin. However, Following the depreciation of the Dollar after the Plaza Agreement in September 1985, the BD exchange rate against the SDR depreciated steadily to fall in July 1986 within the official margin. The 1980s exchange rate policy showed BD to be an exogenous foreign-dependent currency whose rate was solely determined by the US Dollar. This would suggest that a shock to the US Dollar would instantaneously spill over to Bahrain's exchange rate.

The move to a fixed Dollar regime can be explained by the following :

I. The US Dollar is the main foreign trade and investment denominating currency (BMA, 1991).

II. The weights allocated to currencies composing the SDR were not in tandem with Bahrain's foreign trade shares.

III. The US appeared to have a relatively stable inflation rate and that the inflation differential between the US and Bahrain was relatively low. Fleming (1971), regarded the similarity in inflation rates as an important factor in determining the choice of exchange rate regime. Empirical studies found Fleming's proposition to be a significant variable determining the choice of exchange rate regime (see Heller, 1978; Holden et al., 1979; Melvin, 1985) Thus a stable exchange rate versus the Dollar might have been considered compatible with internal price level stability.

Connolly and Yousef (1982) demonstrated, using monetary stability comparisons for 1973-1979, that if Bahrain were to opt for a

single peg, the Dollar would provide a suitable anchor for the stability of domestic inflation. They ascribed their result to the stability of US monetary policy.

IV. Crockett and Nsouli (1977) argued that pegging to a major currency would enhance domestic and international confidence in the domestic currency and might stimulate foreign investments.

V..A single peg is the simplest and least costly arrangement (Crockett and Nsouli, 1977).

Bahraini monetary authorities continued to pursue the exchange rate policy they have adopted in December 1980. This stance reflects the monetary authorities willingness to stick to their announced policy. As a result they have gained a reputation that is built on a credible exchange rate policy. The most obvious prove of the credibility of BD exchange rate policy is the stance taken by the Bahraini monetary authorities to pursue their announced exchange rate policy during Kuwait invasion and to maintain its rate vis-a-vis the US Dollar in spite the massive shock to the Bahraini money market which manifested itself in a very large domestic demand for US Dollar. However, credibility does not imply optimality since a policy can be credible but it may not be the first best choice, so the rest of the paper is addressing the optimality of the BD rather than its credibility which the author considers it to be.

3 - Implications of the BD Exchange Rate Arrangements for the Conduct of Interest Rate Policy

The existence of capital mobility under a fixed exchange rate regime implies that the authorities have agreed to surrender their interest rate policy to the peg currency policy (Friedman 1953). The loss of an

important monetary instrument, the interest rate, means that such a regime provides the appropriate monetary conditions to enhance the exposure of the domestic economy to foreign interest rate shocks (Flood, 1979). Flood shows that through wealth effects, a foreign interest rate shock increases the forecast error of a target variable.

As Bahrain has always pegged its exchange rate and has had no restriction on capital movements, its interest rate is strongly influenced by international interest rates. Following the fixing of the BD to the US Dollar in December 1980, the Bahraini rate basically shadowed the Dollar rate. Interest rates on US treasury bills represent an obvious opportunity cost for holding domestic assets (Osborne, 1989; Alyousha, 1990).

In general, the interest rate policy pursued by the Bahraini monetary authorities was based on setting a recommended maximum interest rate for the Dinar customer. Such an interest rate policy was argued by McKinnon (1973) and Show (1973) to lead to disequilibrium; a domestic rate below the market clearing rate. The McKinnon-Show proposition postulated that the disequilibrium rate discourages saving, causes lower real output growth and hampers the development of the financial system.

Acknowledging the effects of such an interest rate policy, BMA (1991, p. 166) stated :

" The policy was not, however, very conducive to encouraging domestic saving or discouraging outflow of capital".

Thus on 16 June 1990 the ceiling rate policy was abandoned.

Obviously, the McKinnon-Show proposition pays little attention to the effect of exchange rate policy on domestic interest rates. Combining capital mobility with the existing exchange rate regime, the abolition of

the ceiling policy cannot enhance the influence of domestic monetary policy on domestic interest rates. The issue that remains to be addressed is the ability of the domestic monetary authorities to mobilise domestic interest rates to achieve domestic economic objectives, rather than the type of interest rate policy. In a sence, as long as there is neither foreign exchange risk nor restrictions on capital movements, the monetary authorities ability to influence interest rates remains extremely limited.

In this section the hypothesis on the divorce of interest rate policy from domestic fundamentals is investigated by testing for the absence of a short-run causative relationship between the nominal interest rate and domestic inflation. Thus, the hypothesis will be accepted if and only if the null hypotheses of the absence of causality are not rejected .

3.1 - Testing Causal Relationships Between Interest Rates and Inflation

In the late 1960s, Granger (1969) developed a method of testing causal relationships between variables. Granger causality is formulated in terms of the forecasting ability of the series under consideration. If a series, say Y_t causes X_t then this implies taht X_t is better forecast if the information in Y_{t-1} is used than if it is not used. This is referred to as "in mean" causality (see Granger, 1988).

Granger's causality test aims at testing for causal direction between time series. Geweke (1982, 1984) has reformulated the causality tests and developed a canonical form to measure the degree of dependence and feedback among stationary time series. Gewek's canonical measures can be used to test for linear feedback $(F_{X \longleftrightarrow Y})$, instantaneous linear feedback $(F_{X.Y})$ and linear dependence $(F_{X,Y})$. In the

instantaneous and linear dependence cases, the roles of X and Y are symmetric. Since the null hypotheses of linear feedback and instantaneous feedback are nested, $F_{X \longrightarrow Y}$, $F_{Y \longrightarrow X}$ and $F_{X,Y}$ are asymptotically independent. The independence of these hypotheses implies that these restrictions can be tested jointly. This is carried out using the measure of linear dependence between X and Y. Thus $F_{X,Y}$ can be decomposed additively into the three linear feedback's :

$$F_{X,Y} = F_{X \longrightarrow Y} + F_{X,Y} + F_{Y \longrightarrow X} \tag{1}$$

Hence the absence of a particular causal ordering is equivalent to one of the three measures being zero. If the null of independent series cannot be rejected, then the joint probability function of X and Y can reflect their independence by factoring it to be the product of the marginal density functions of both series. For such series, events in one series cannot influence the other.

To test the null hypotheses of no feedback, Geweke (1982) suggested using the likelihood ratio (LR) statistic. In addition to the LR statistic, Geweke (1984) suggested using the Wald (W) and Lagrange Multiplier (LM) test statistics. Using Granger's (1969) definition of causality, tests of the null hypothesis $F_{X \longrightarrow Y} = 0$ will take the following forms :

$$W^G : n[tr\left(\hat{\Sigma}_1 \hat{\Sigma}_2\right) - k] \sim \chi^2(klp) \tag{2}$$

$$LM^G : n[k - tr\left(\hat{\Sigma}_2 \hat{\Sigma}_1\right)] \sim \chi^2(klp) \tag{3}$$

$$LR^G : n \ln\left(\left|\hat{\Sigma}_1\right| / \left|\hat{\Sigma}_2\right|\right) \sim \chi^2(klp) \tag{4}$$

Where n stands for sample size, $\hat{\Sigma}_1$ and $\hat{\Sigma}_2$ are, respectively, the

residual covariance matrices from the regressions of X on its past values and X on its and Y's past values. tr and k stand for the trace and the number of variables in the system minus the number of restricted variables (L) respectively. p is the order of the lag polynomial. When testing the same null hypothesis using Sims (1972) definition of causality, the above test statistics take the following forms :

$$W^S : n\left(tr\left(\hat{\Sigma}_3 \hat{\Sigma}_4 - I \right) \right) \sim \chi^2(klr) \tag{5}$$

$$LM^S : n\left(I - tr\left(\hat{T}_4 \hat{T}_3 \right) \right) \sim \chi^2(klr) \tag{6}$$

$$LR^S : n\ln\left(\left| \hat{T}_3 \right| / \left| \hat{T}_4 \right| \right) \sim \chi^2(klr) \tag{7}$$

Where r is order of the lag polynomial. $\hat{\Sigma}_3$ is the residual covariance matrix from the regression of X on its past values and Y's present and past values. Σ_4 is the covariance matrix from the regression of X on its past values and Y's future, present and past values. $\hat{T}_3$ and $\hat{T}_4$ directly correspond to $\hat{\Sigma}_3$ and $\hat{\Sigma}_4$ but are from regressions of Y on X. Under the null hypotheses $F_{X \longrightarrow Y} = 0$, $F_{Y \longrightarrow X} = 0$ $F_{Y\,X} = 0$ and $F_{X,Y} = 0$, the above test statistics have χ^2 distributions with (klp), (kl) and ((k1 (2p + 1)) degrees of freedom corresponding to each null.

The relation between the three test statistics is defined by the following inequality :

$$W^G \geq LR^G \geq LM^G$$

Similarly,

$$W^S \geq LR^S \geq LM^S$$

A difficulty which arises with the application of any causality test is determining the order of the lag polynomials. Given that the data is quarterly, the models are estimated with four lags.

3.2 - Interpreting the Results

The results show the absence of any causal ordering between interest rates and inflation, implying that they are independent of each other (see Table

1). In all cases, the inequality between test statistics is observed. However, it is important to acknowledge that in the case of Bahrain there are two factors that might distort the causality tests. The first factor is attributed to using the ceiling rather than the actual interest rate. The second factor is related to a religious (Islamic) doctrine which prohibits Muslims from either receiving or paying interest on their banking transactions. This second factor may seriously distort the transmission mechanism. Nevertheless, in the period 1980 - 89 the Bahrain Islamic Bank's average annual shares in total deposits and advances were only 3.3% and 2.0% respectively. Hence it is highly unlikely that this was a decisive factor in determining the causality tests results. With respect to the first factor, the causality tests were also carried out using a US interest rate : this is a good proxy of Bahrain's actual interest rate. The results from using the US data reveal that it is not possible to reject the null hypotheses of the divorce of interest rate policy from domestic fundamentals (see Table 2).

Table 1

Results on Causality Tests / Bahrain Interest Rates

(1975I - 1989 IV)

	W	LM	LR
Granger Causality			
$F_{INF \to r}$	2.754	2.631	2.691
$F_{r \to INF}$	4.547	4.222	4.380
$F_{r.INF}$	0.438	0.435	0.436
$F_{r,INF}$	3.523	3.325	3.422
Sims Causality			
$F_{INF \to r}$	0.065	0.065	0.065
$F_{r \to INF}$	0.183	0.182	0.182
$F_{r.INF}$	0.395	0.393	0.394
$F_{r,INF}$	0.337	0.335	0.336

Notes : The regressions are estimated with polynomials of order four. INF is inflation measured by first difference of the natural logarithm of consumer price index and r is the nominal interest rate. INF is a stationary process while r is an integrated of order one, thus the models are estimated for the level of INF and the first difference of r. The critical values of the X^2 statistic at 5% significance levels are :

$$n F_{r \leftrightarrow INF} \sim \chi^2_{0.05}(klp) = 9.488$$

$$n \hat{F}_{r \cdot INF} \sim \chi^2_{0.05}(kl) = 3.841$$

$$n \hat{F}_{r,INF} \sim \chi^2_{0.05}(kl(2p+1)) = 16.919$$

Table 2
Results on Causality Tests / US Interest Rates
(1975I - 1989IV)

	W	LM	LR
Granger Causality			
$F_{INF \rightarrow r_{US}}$	1.420	1.387	1.403
$Fr_{US \rightarrow INF}$	1.645	1.600	1.623
$Fr_{US.INF}$	0.004	0.004	0.004
$Fr_{US,INF}$	2.221	2.141	2.180
Sims Causality			
$F_{INF \rightarrow r_{US}}$	1.446	1.089	1.100
$Fr_{US \rightarrow INF}$	0.000	0.000	0.000
$Fr_{US.INF}$	1.086	1.066	1.076
$Fr_{US,INF}$	0.000	0.000	0.000

Notes : The regressions are estimated with polynomials of order four. r_{us} is the nominal US interest rate and it is an integrated proccess, thus the mode estimated for the first difference of r_{us} .

The critical values of the X^2 statistic at 5% significance levels are :

$$n \hat{F}_{r \leftrightarrow INF} \sim \chi^2_{0.05}(klp) = 9.488$$

$$n \hat{F}_{r.INF} \sim \chi^2_{0.05}(kl) = 3.841$$

$$n \hat{F}_{r,INF} \sim \chi^2_{0.05}(kl(2p+1)) = 16.919$$

These results have important implication for Bahraini macroeconomics policy : namely, that movements in interest rates do not lead to changes in the domestic inflation, thus limiting the influence of monetary policy. Given that Bahrain does not impose any restricion on capital movements, it will not be imprudent to attribute these result to the pegged exchange rate regimes pursued by Bahrain.

4 - Inflation Under Pegged BD Exchange Rate Regimes

Inflation theories of a small open economy predict that, under a world fixed exchange rate regime, the national rate of inflation will converge over the long-run to the average world rate of inflation (Classeen, 1976). In such a regime, exchange rate effects are neutralised. In contrast, under a floating regime, inflation is fundamentally a national phenomenon (Classeen, 1976; Corden, 1976). Hence, it was argued, to inhibit international transmission of inflation the monetary authorities must consider abandoning fixed rate regimes (Friedman, 1953; Johnson, 1969; Emminger, 1973).

For Bahrain this implies using data from the post-Bretton Woods system to test for cointegration between Bahrain's price level and the world average price level, so that if the null of no cointegration is rejected, the result is interpreted as supporting the convergence hypothesis. Additionally, if the test leads to a rejection of the null of no cointegration then the results can be interpreted to represent a major deficiency in the pegged exchange rate regimes pursued by Bahrain following the collapse of the Bretton Woods system, for they imply that, even in a floating world, these regimes resulted in an inflation rate that is considered to be an outcome of a world with fixed exchange rate arrangements.

4.1 - International Transmission of Inflation Under Fixed Exchange Rates

Both the keynesian and Monetary theories of inflation agree that, in the long-run and under world fixed exchange rate regimes, the national rate of inflation will not diverge from the world rate of inflation (Branson, 1977; Swoboda, 1977). In both theories, the exchange rate plays a neutral role over the long-run. Nevertheless, these theories differ in their perception of the transmission mechanism.

The Keynesian models, being demand determined, tend to pay specific attention to the role of aggregate demand and relative prices when explaining the convergence process (see Turnovsky and Kaspura, 1974; Branson, 1977). In his model, Branson (1977) showed that a Keynesian-Phillips model will predict that real domestic variables, real output and unemployment, will adjust to foreign shocks in a way that makes inflation rates converge.

In a Keynesian model of an open economy, Dornbusch (1977) pointed to two main channels through which foreign disturbances can affect the equilibrium price level. The first channel is the trade balance, which encompasses shocks originationg from foreign demand and import prices, while the second is the capital market, which captures disturbances attributed to foreign interest rate shocks.

As in Keynesian models, the monetary approach emphasizes the role of the balance of payments in the international transmission of inflation. However, this role is dependent upon the exchange rate regime under consideration. From the assumption of continuous purchasing power parity (PPP), exchange rate movements in a floating regime will insulate domestic prices from foreign price shocks. In such a regime,

monetarist models postulate that money supply-inflation causal links operate similarly to monetarist models of a closed economy (Laidler 1975). The exogeneity of the money supply in a floating regime allows the monetary authorities to pursue a monetary rule that will determine the domestic rate of inflation.

For monetarists, exchange rates tend to preserve their parties; thus if prices are related by the law of one price and the exchange rate is fixed, domestic inflation rates will converge to the world rate. In a sense, the monetarist view of the international transmission of inflation is a by-product of the monetary approach to the balance of payments (Swoboda, 1977). According to this approach, domestic and foreign shocks will have only transitory effects on the balance of payments. If the same shocks have no influence on foreign prices, the domestic price level will remain unaffected.

The monetary approach proposes two complementary channels for the international transmission of inflation. The first emanates from the assumption of non-stochastic PPP, in which commodity arbitrage will equate prices (Parkin, 1977; Corden, 1985). The second rests on a fundamental proposition of the monetary approach to the balance of payments, that in a perfect capital mobility environment, external disequilibrium can only be maintained over the short-run by systematic sterilisation. In the long-run, the forces of ratification will set in to eliminate payments disequilibrium (Corden, 1985). The restoration, and in fact stability, of external balance equilibrium is ensured by convergence of the domestic inflation rate to world average inflation.

The above discussion can be summarised in the following : if PPP

were to hold,

$$E_t = CPI_t / WPI_t \quad (8)$$

where E is the nominal effective exchange rate (unit of domestic currency per unit of foreign currency), CPI is Bahrain's consumer price index and WPI is an index of world average price. Taking the logarithm of both sides and differentiating with respect to time yields

$$e = cpi_t - wpi_t \quad (9)$$

if the exchange rate is fixed, then in the long-run both theories predict

$$cpi_t = wpi \quad (10)$$

To test the above hypothesis requires a priori that both series have the same intergration property. Thus, if a linear combination of both series has an integration order less by one than the individual series, then the series are said to be cointegrated. In the next two subsections tests are carried out to determine the univariate and multivariate integration properties of both series.

4.2 - Testing For Unit Roots

Recent studies on the statistical properties of time series show that modelling relationships between macroeonomic variables often requires discarding the estimation and inferential procedures of standard econometric methods (Granger and Newbold, 1974; Granger, 1981). This is attributed to the fact that standard econometric theory is based on the assumption that the series data generating processes are stationary. Empirical studies reveal that many macroeconomic variables are non-stationary (see Nelson and Plosser, 1982; Hall, 1986; Schwert, 1987).

Granger and Newbold (1974) noted that a high degree of fit is

often accompanied by highly autocorrelated residuals (indicated by an extremely low Durbin-Watson statistic) when regressions are estimated on the levels of non-stationary series. They and Phillips (1986) demonstrated that such a result can be consequence of a "spurious regression", which will possess the following statistical properties :

I. The regression coefficient will not converge in probability to constants and will have non-degenerate limiting distributions as the sample size increases. Additionally, the distribution of the intercept diverges as the sample size increases.

II. The coefficient of correlation will have a non - degenerate limiting distribution as the sample size increases.The Durbin-Watson statistic converges to zero.

III. More seriously, the distribution of the t and F statistics diverge as the sample size increases, so that there are no asymptotically correct critical values. Granger and Newbold (1974) contended that these tests are seriously biased towards the rejection of the null hypothesis of no relationship even when the series are independent random walks.

Realising the danger of regressing levels of integrated processes, several tests were developed to test for unit roots in the level of a series. Among these tests are those of Dickey and Fuller (1979,1981) and Said and Dickey (1984).

If the series mean or trend function were subject to infrequent shocks, the full sample unit root tests suggested by the above studies may not reflect the true integration property of the series, Perron (1989, 1990), Rappoprt and Reichlin (1989) and Balke and Fomby (1991a,b) demonstrated that the effect of such shocks could be represented by a segmented trend, and that, without modelling such shifts, the power of

standard unit root test will be very low.

Consequently, we will not only have to test for unit roots but will need to insure that we are using the appropriate test. Inspecting the plots of the price indices shows that none of their trend functions are subject to the sort of shocks described above. Hence, the unit root tests are carried out using the standard Dickey-Fuller procedure.

The test for a unit root is carried out for Bahrain's CPI and the world average price index of the US, Japan, Germany, UK, Australia, France and Italy. The weights are calculated from the non-oil imports.

Each unit root test aims at testing the null hypothesis

H_0 : I (1) / First Difference Stationary

versus the alternative hypothesis

H_a : Trend stationary

Comparing the ADF statistics provided by Table 3 with the critical values given in Fuller (1976, Table 8.5.2) does not allow us to reject the null hypothesis that the CPI and WPI series are an integrated processes of order one. The result suggests that the actual series require differencing to achieve stationarity thus a shock to the level of either series will have a persistent effect.

Table 3
Results of the Unit Root Tests
(1975I - 1981IV)

Series	ADF
CPI (1)	-1.894
FPI (1)	-1.595

Notes : Figures in square brackets are the lag length order used to whiten the residuals .

4-3 Testing for the Existence of a Steady - State Relationship

To test for the presence of long - run relationships between time series, Johansen (1988, 1991) and Johansen and Juselius (1990) developed a maximum likelihood (ML) based method to test for cointegration. Johansen's procedure allows for the existence of more than a single distinct cointegrating vector. Thus with N variables there could be N-1 distinct cointegrating vector. These vectors are determined by the rank of the cointegrating matrix. In the present case, for the CPI to cointergate with WPI, the rank of the cointegrating matrix must not exceed one.

Compared to other cointegration approaches, the ML test is considered to be the most appropriate method. For instance : (i) Phillips (1991) shows that the ML estimator is super- consistent and optimal inference theory applies; and (ii) Kremers et al. (1992) demonstrated that, unlike residual based cointegration tests, the ML method does not encounter the common factor problem, hence it has better test power than the two-step procedure suggested by Engle and Granger (1987).

In this section, the joint integration property of the bivariate process is investigated using the following model :

$$(1 - L)X_t = C(L)(1 - L)X_{t-1} + \Pi X_{t-k} + \varepsilon_t \tag{11}$$

Here X is a (2x1) vector and C(L) is a polynomial in the lag operator L. ε is a (2x1) vector of white noise disturbances. The matrix Π = α β is a (2x2) matrix, known as the long - run matrix. α and β are (2x2) matrices, identified as the loading and cointegrating matrices respectively. Once the rank of β is determined the loading matrix can be used to test for weak exogeneity (see Johansen, 1992a ; Urbain 1992).

This tests the null $\alpha_{ij} = 0$ against the alternative $\alpha_{ij} \neq 0$. The test statistic has a X^2 distribution and it is essential for the efficiency of a partial or a single equation model. Since we are not interested in estimating an error correction model for any of the above series, exogeneity tests will not be carried out.

Using the Johansen procedure requires addressing the question of a constant term in (11). Johansen (1991, 1992b) shows that the asymptotic distribution of the test statistic is not independent of the hypothesis maintained about the constant term. Visual inspection of the data reveals that all of the series are trending, i.e. a drift is not included in the cointegrating vectors but it is considered to be in the $\{X_t\}$.

In the bivariate model, WPI is said to be cointegrated with the CPI only when the WPI cointegrating parameter is significantly different from zero. This will require testing for the significance of the cointegrating parametrers when the null of no cointegration is rejected. This is done for the reason that the maximum eigenvalue and the trace are statistics for a joint significance test and hence may not reject the null of no cointegration even when some of the cointegrating parameters are not singnificantly different from zero.

The cointegration tests show that CP1 and WPI do have a long-run relationship (see Table 4) and the significance test rejects the null of insignificance at the 5% level (see Table 5). Augmenting the VAR by adding either a monetary aggregate or exchange rate variable does not alert the above relation. In fact, the results from these VARs are rejected on the ground that the additional variable cointegrating parameter poses the wrong sign. Hence we conclude that, if inflation convergence was one of the reasons for abandoning the Bretton Woods fixed exchange rate

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regime, the Bahraini adopted peg regimes during the generalised floating period did not inhibit domestic inflation from tracking the world average inflation rate. This is indeed, a very strong result that question the validity of the pursued peg exchange rate regimes.

Table 4

Result on Cointegration Tests

Null Hypothesis	Eigenvalue	Maximum Eigenvalue	Trace
r = 0	0.237	16.216*	22.419*
r< 1	0.098	6.203	6.203
Normalised Cointegrating Parameters			
β_{CPI}		-1.000	
β_{FPI}		2.592	

Notes : An asterisk denotes significant at 5% level . The VAR is estimated with four lags

Table 5

Testing the Significance of the Cointegrating Parameter

Null Hypothesis	Test Statistics

Notes : An astrisk denotes significant at 5% level .

5 - Conclusion

The results of this paper show that, by following a pegged exchange rate policy, the Bahraini authorities have implicitly decided to reduce their control over monetary policy. Interest rate policy is no longer domestically determined and, given this, we have rested the implication of such a loss of control over domestic inflation. Granger and

Sims causality tests were carried out and the results show that inflation and interest rates are two independent series. The causality tests show that the post-Bretton Woods pegged regimes followed by Bahrain not only resulted in decreasing the monetary authorities ability to determine domestic interest rates but, further, these regimes led to the divorce of interest rate policy from domestic fundamentals. Additionally, cointegration analysis was carried out to test whether the post-Bretton Woods pegged exchange rate regimes followed by Bahrain altered the inflation relation that is hypothesised to exist in world fixed exchange rate regimes. The cointegration test revealed that, in spite of following different peg exchange rate arrangements, the hypothesised inflation was not altered, i.e. the post-Bretton Woods exchange rate regimes pursued by Bahrain did not lower the exposure of the Bahraini price level to foreign price shocks. Hence combining both results with that obtained by Alyousha (1995) lead us to seriously question the optimality of the peg exchange rate regimes pursued by the Bahraini monetary authorities in the post-Bretton Woods era.

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