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Effect of Government Spending on Non-Oil GDP of Bahrain

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Abstract

This paper uses the equilibrium approach to fiscal policy to study the effects of government spending on non-oil GDP of Bahrain within a two-country framework. The empirical implementation employs Bahrain and US annual data for the period 1977-2004. Results strongly suggest that the positive multiplier effect of permanent domestic government consumption is substantially neutralized by the negative impact of temporary US government spending on non-oil GDP of Bahrain. This result is significant and seems to be implied in many theoretical discussions but has largely been ignored in empirical research.

JEL Classification: E62; F41; O23; O53

Keywords: Non-oil GDP of Bahrain; Equilibrium approach to fiscal policy; System Non-Linear Least Squares.

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1. Introduction

Effects of fiscal policy have been extensively analyzed within the framework of traditional macroeconomic and neoclassical (or equilibrium) models. Traditional macroeconomic models, dominating contemporary textbooks[1] describe how expansionary fiscal policy, in a closed economy, increases output, employment, interest rate and crowds out private investment. The Mundell-Fleming model, in which the effect of fiscal policy is dependent on exchange rates regime, is an extension of these traditional closed economy macroeconomic models to an open economy. In a flexible exchange rate regime, an increase in government spending increases output, interest rate, and leads to an appreciation of the exchange rate. For a small open economy with fixed exchange rate, however, the fiscal policy can be more powerful than it would be under the flexible exchange rates.[2]

The equilibrium approach to fiscal policy, pioneered by Bailey (1971) and Barro (1981), and subsequently extended by Ahmed (1986, 1987) and Aschauer (1988) among others, uses an intertemporal framework. This approach emphasizes the distinction between temporary and permanent spending because the two components have different implications for wealth and consequently different effects on the economy. A temporary increase in government spending, in the context of a larger economy, induces excess demand that raises real interest rate rates; generating an increase in domestic production along the lines of intertemporal substitution, and ultimately resulting in a trade deficit. Permanent increase in government spending on the other hand, works via reducing private sector wealth, exerting a smaller effect on excess demand, output, and the current account. Baxter and King (1993) in a recent version of the equilibrium or the neoclassical model, in a closed economy context, find that

permanent changes in government spending induce larger effects than temporary changes. Moreover, they have established quantitatively that permanent changes in government spending can lead to both short-run and long-run output multipliers that exceed one. These results differ from Barro (1981, 1997) who claims that a temporary increase in government consumption has no multiplier effect.

The primary objective of this paper is to apply empirically the equilibrium approach to fiscal policy to examine the effects of government spending on the non-oil GDP of an oil-exporting mini state under fixed exchange rate. Bahrain, a mini (or city) state in the Middle East, has maintained an effective fixed exchange rate against the US dollar since 1980s, seems to fit the description. The main contribution of the paper lies in the empirical application of the model to a mini state under fixed exchange rate in a two-country framework. We find this is an important contribution because there is a presumption among the writers on the Gulf Cooperation Council (GCC) countries, for which Bahrain is a member, that fiscal policies of these countries have been directed to achieve economic objectives such as growth and employment while monetary policy is directed at maintaining a stable exchange rate and controlling inflation.[3] However, there is no study as such quantifying the fiscal policy effects by incorporating the foreign fiscal shocks.

The linkage of Bahrain is through the international flows of goods and capital and it works through changes in the interest rate. Since Bahrain is a mini state with fixed exchange rate against the US dollar, it cannot influence the world interest rate rather, it follows the US (world) interest rate. The paper argues that a temporary increase in the US government spending raises interest rate, trade surplus of Bahrain and thereby decreases non-oil GDP of Bahrain. Since a temporary increase in Bahrain government spending cannot influence the

interest rate, it will not influence the non-oil GDP of Bahrain. On the other hand, a permanent increase in Bahrain government spending will increase its non-oil GDP.

The empirical implementation employs Bahrain and US annual data for the period 1977-2004. Relevant variables are expressed as a ratio of GDP. Equations were estimated using the system nonlinear least squares by imposing rational expectation cross equation restrictions. Results strongly suggest that a permanent increase in Bahrain government spending relative to GDP increases non-oil GDP of Bahrain relative to overall GDP of Bahrain. As expected, a temporary rise in Bahrain government spending does not influence the non-oil GDP of Bahrain. Results also strongly indicate that a temporary rise in the US government spending relative to the US GDP decreases non-oil GDP of Bahrain relative to GDP of Bahrain. This latter finding is significant which seems to be implied in many theoretical discussions, and yet largely been ignored in empirical research.

The organization of the paper is as follows. Section 2 provides an overview of the main features of Bahrain economy. Section 3 discusses theoretical issues, sets out equations to be estimated, and hypotheses to be tested. Data sources and the methodology employed in constructing permanent government spending are given in section 4. Section 5 is devoted to the examination of the time series properties of the data. The unit root and cointegration properties of the data set are examined here. Section 6 presents the main empirical findings. Finally some conclusions are presented in section 7.

2. Bahrain Economy

Bahrain is an oil-exporting mini (tiny) island state in the Middle East. Bahrain maintained dual exchange rates against the SDR and the US dollar for most of the sample period. Since the end of 1980, the Central Bank of Bahrain pegged the Bahrain Dinar (BD) to the SDR and

has maintained a *fixed* rate with the US dollar at the rate of BD1 = US$2.65. Figure 1 shows the movements of BD and the US dollar rates in terms of SDR in the 1990s. BD per SDR is much smaller than the US dollar per SDR; the BD per SDR exchange rate is multiplied by a factor of two to bring two lines close to each other. As can be seen in Figure 1, the two lines are parallel to each other.[4] It shows clearly that the BD against the SDR appreciates or depreciates whenever the US dollar against the SDR appreciates or depreciates. In other words, the BD exchange rate in terms of the SDR is solely determined by the US dollar. This means the BD has unofficially but effectively been fixed to the US dollar since December 1980. The Central Bank of Bahrain has formally pegged the BD to the US dollar effective from December 25, 2001.

With no capital control and fixing the BD against the US$, the Bahrain real interest rate (r) has basically shadowed the US real interest rate (r^*). In the rest of the paper the US real interest rate (r^*) will be taken as the world interest rate and for Bahrain, and thus as given.

The other main feature of Bahrain economy is its heavy dependence on oil and gas. Though the contribution of oil and gas sector to the GDP has reduced over time and fluctuated around 22 percent for the recent period of 1998-2004, the mainstay of the economy of Bahrain is still provided by this sector. Historically, oil and gas sector contributed about 70 percent of total exports and government revenue. This sector accounted for about 65 percent of total exports for the recent period of 1998-2004 and about 63 percent of the government revenue for the same period. The non-oil GDP, dominated by infrastructure and services sectors, has recorded tremendous growth over time due to the heavy influence of government expenditure provided by the oil revenue. Authors on Bahrain economy [see for example,

Elbadawi and Majd (1993)] have pointed out that the activities in the services sectors would substantially decline in the absence of oil revenue.

3. Theoretical Issues

This section specifies a reduced form equation pertinent to empirical estimation. It summarizes the ideas available in the literature [see, for example, Barro (1981, 1997), Ahmed (1986, 1987), and Mankiw (2003)].

3.1 Predictions of the Equilibrium Model

In equilibrium models of fiscal policy, government spending provides two types of services: it provides an input to private production process (enters as a factor of production in the production function) and provides utility to households (enters as an argument in the utility function). Public services such as the provision of a legal system, education and national defense are likely to enhance the marginal products of private factors. Public services also affect private sector behavior through a direct interplay in utility function. Government services like parks, school lunch program, libraries, and subsidized hospitals are assumed to substitute for private consumption.

Bahrain's GDP can be divided into non-oil and oil (exportable) GDP. Let Y_t^n and Y_t^o denote non-oil and oil GDP at time t. Thus, GDP (Y_t) can be written as

$$Y_t = Y_t^n + P_t Y^o \qquad (1)$$

where P_t is the period t relative price of oil output in terms of non-oil output. Oil export which is the main source of revenue to finance government expenditure is assumed to be extracted at a constant rate requiring negligible labor inputs. We assume a linear production technology

with labor as the only direct input of production and government spending directly contributing to private production. Thus

$$Y_t^n = \alpha l_t + \beta G_t \qquad (2)$$

where l_t is work effort, α is the marginal product of labor, G_t is real government spending, and $\beta < 1$ is the marginal product of government spending. Private consumption of non-oil GDP (C_t^n) and G_t are assumed to be close substitutes in utility; that is, household utility depends on the effective consumption flow as

$$\hat{C}_t^n = C_t^n + \theta G_t \qquad (3)$$

where $\hat{C}_t^n$ is the effective consumption of non-oil GDP. Equation (3) implies an increase in G_t by one unit reduces aggregate private consumption demand (C_t^n) for non-oil output by θ units. For example, when Bahrain government provides health services, Bahrain private consumers reduce spending on health services. The representative household maximizes utility on the choice of effective consumption and leisure subject to the period t budget constraint:

$$C_t^n + \frac{W_{t+1}}{1+r^*} - W_t = Y_t^n + T_t - \tau_t \qquad (4)$$

where W_t is beginning of the period holdings of real bonds (which includes government debt), T_t is period t real transfer payments, τ_t is period t real (lump-sum) tax, and r* is the exogenous foreign real interest rate. The government budget constraint can be written as:

$$G_t + T_t = \tau_t + \frac{B_{t+1}}{1+r^*} - B_t + \mu P_t Y^o \qquad (5)$$

where B_t is the beginning of the period government debt and it is assumed that a fraction μ of oil revenue is used to finance government spending and transfer payments. An important

aspect of the government budget constraint (5) is that the fiscal policy has been constrained on the heavy dependence of government revenue on volatile oil receipts. The private and public sectors can be integrated by the substitution of the government budget constraint (5) into the household's budget constraint (4) and using (3) and (4), the lifetime budget constraint of the representative household can be written as:

$$\sum_{t=0}^{\infty} \frac{\hat{C}_t^n}{(1+r^*)^t} = (W_0 - B_0) + \sum_{t=0}^{\infty} \frac{(\alpha l_t + \mu P_t Y^0)}{(1+r^*)^t} - (1-\beta-\theta)\sum_{t=0}^{\infty} \frac{G_t}{(1+r^*)^t} \qquad (6)$$

Thus, the present discounted value of effective consumption is enhanced by the initial net economy wide wealth $(W_0 - B_0)$ and present values of labor income and oil revenue through transfer payments. The important aspect of the equation (6) is that a permanent rise in the government spending, defined as $\overline{G_t} = [r^*/(1+r^*)]\sum_0^{\infty}[G_t/(1+r^*)^t]$, effectively decreases permanent income by $(1-\beta-\theta)$. Assuming that $\beta + \theta < 1$, an increase in permanent spending by 1 unit, does not subtract the equivalent of 1 unit of real income per period from the representative household because of the direct consumption (θ) and production (β) value of the government's spending.

Equation (6) shows that the present value of household's income includes the negative of the present value of government spending. By definition, an increase in temporary government spending, defined as $(G_t - \overline{G_t})$, is high only temporarily, the present value of this government spending rises only a small amount (Barro, 1997). In other words, temporary government spending has a negligible wealth effect. However, the wealth effects become important for permanent changes in government spending.

Temporary Government Spending at Home: In a closed economy context, a temporary increase in government spending works through changes in the real interest rate. Bahrain is a

mini open state with no control over capital movements. Bahrain takes the world real interest rate (r^*) as given. A temporary increase in government spending in Bahrain cannot affect the world interest rate (r^*). A temporary increase in government spending (G_t) by one unit, increases aggregate demand by ($1 - \theta$) and aggregate supply by β creating an excess demand by ($1 - \beta - \theta$). In contrast to the closed economy, where the real interest rate adjusts to clear the market, in case of Bahrain the excess demand for non-oil output is satisfied by running a trade deficit at a given world interest rate. That is, the home country borrows from abroad to finance its temporary increase in government spending. Empirically the temporary government expenditures are identified with outlays during wartime (Ahmed 1987, Barro 1997). Bahrain never had this kind of surge in temporary expenditures. Because government spending is high only temporarily, any supply effect will be negligible. In summary, the prediction of the equilibrium approach to fiscal policy is that a temporary increase in Bahrain government spending, ($G_t - \overline{G_t}$), will have no effect on the non-oil GDP of Bahrain.[5]

Permanent Government Spending at Home: A permanent increase of government spending differs from a temporary increase. We have argued that a temporary increase in Bahrain government spending will create an excess demand for non-oil output that will be satisfied by running a trade deficit at a given world interest rate. That is, the effects described above for a temporary change still hold. If the change in government spending is perceived to be permanent, then the new element that we need to add is that households anticipate a sizable increase in the present value of government spending. The resulting fall in wealth reduces consumer demand and labor supply. We now show that an increase in government

spending raises the aggregates of non-oil commodities demanded and supplied by equal amounts.

A permanent increase in current government spending implies G_t and $\overline{G_t}$ rise together. If government spending rises permanently by one unit, the supply of goods increases by β units each period. This implies aggregate supply of non-oil output increases by $\beta + \phi$, where ϕ represents increase in supply due to one unit increase in $\overline{G_t}$. Next, an increase by one unit in G_t lowers consumer demand by θ units. Also, an increase by one unit in permanent spending means permanent income decreases by $(1 - \beta - \theta)$, as shown in equation (6). Assuming that marginal propensity to consume is close to unity, household's income from production rises by ϕ units. This means, an increase by one unit in $\overline{G_t}$, consumer demand changes by the amount $-(1 - \beta - \theta) + \phi$. Thus, one unit increase in permanent government spending increases aggregate demand by $\beta + \phi = (1-\theta) - (1 - \beta - \theta) + \phi$. Aggregate demand and aggregate supply of non-oil output increase by the same amount, $\beta + \phi$. It follows that permanent changes in government spending do not lead to a change in the trade balance but aggregate supply increases by $\beta + \phi$. Thus, we expect that a permanent increase in Bahrain government spending will increase non-oil GDP of Bahrain.

Government Spending Abroad: It is safe to assume that the foreign country, the United States (US), is a large part of the world economy. An increase in government spending in the US would cause a rise in the world interest rate (r^*). The linkage of Bahrain economy to the US economy is through changes in the world interest rate (r^*).

Permanent changes in the US government spending will increase the US aggregate demand and aggregate supply by the same amount, $\beta^* + \phi^*$, where a superscript (*) on a

variable or parameter would indicate the US variable or parameter. This implies that a permanent change in the US government spending will have no effect on the world interest rate and as a result there will be of no effect on home country's (Bahrain's) output.

One unit increase in the US temporary government spending ($G_t^* - \overline{G}_t^*$) will increase the US aggregate demand by ($1 - \theta^*$) and the US aggregate supply by β^* units. Since $(1 - \theta^*) > \beta^*$, the US or the world interest rate (r^*) will increase from a temporary increase in the US government spending. The interest rate in Bahrain is determined by the world interest rate and equals to r^*. This means a temporary increase in the US government spending will crowd out private consumption and investment in Bahrain by increasing interest rate. Bahrain will have a trade surplus and an excess supply of non-oil GDP at the initial price level. Thus, at the new equilibrium supply of non-oil GDP must be lower.

Reduced Form Equation: Following the predictions of the equilibrium approach, a reduced form equation for the non-oil GDP (Y_t^n) of Bahrain can be specified as

$$Y_t^n = f(G_t - \overline{G}_t,\ \overline{G}_t\ ,\ G_t^* - \overline{G}_t^*,\ \overline{G}_t^* \ldots..), \qquad (7)$$

where $G_t - \overline{G}_t$ and $\overline{G}_t$ are the domestic (Bahrain) temporary and permanent government spending and ($G_t^* - \overline{G}_t^*$) and $\overline{G}_t^*$ are the US temporary and permanent government spending. Dots in the equation (7) indicate other variables, that may have influenced the supply of non-oil GDP of Bahrain, are omitted for the purpose of the study. From our discussions the signs of partial derivatives are expected as follows:

$$f_1 \approx 0,\ \ f_2 > 0,\ \ \ f_3 < 0,\ \ f_4 = 0.$$

3.2 Relation with the Standard Macromodels

Since Bahrain is a small open economy with fixed exchange rate with no restrictions on capital mobility, the standard Mundell-Fleming model with fixed exchange rate and capital mobility would apply here. According to this model, a higher government spending at home stimulates aggregate demand and as a result output increases and put a pressure on the exchange rate. In this scenario, money supply must increase to keep the exchange rate fixed. The net effect is an increase in non-oil output with no change in trade balance. Because of monetary accommodation, fiscal policy is more powerful under fixed exchange rate than it is under flexible exchange rates. Qualitative aspect of these results seems to correspond to the results of the permanent government spending in the equilibrium model.

Effects of foreign government's increase of government purchases on home output and trade balance are similar to that described above. Here again the traditional model does not identify the foreign expansion of government spending as a temporary increase.

Following the predictions of the standard macro models, a reduced form equation for the non-oil GDP (Y_t^n) of Bahrain can be specified as

$$Y_t^n = \mathrm{F}(G_t, G_t^*, \ldots..), \qquad \mathrm{F}_1 > 0, \quad \mathrm{F}_2 < 0. \tag{8}$$

Here G_t and G_t^* are home and foreign government purchases respectively; where no distinction is made between temporary and permanent spending.

4. Data and Empirical issues

Although one would prefer working with real variables, we are however, constrained to work with nominal variables. The data on government purchases and other variables are taken from the *International Financial Statistics* (*IFS*). As an alternative, we could have used Bahrain's *National Accounts* (*NA*), but this is rife with inconsistency and more troublesome are the reporting of the real variables. It is troubling to note that some of the data have been reported

in *NA* as real variables, without giving due consideration. Since the non-oil GDP is not available in the *IFS*, we are forced to use *NA* for the non-oil GDP. We had to be careful and choose only those issues that are consistent with the GDP as reported in the *IFS*. To get sensible empirical estimation, we have imposed normalization by getting the variables in ratios with respect to a scale variable GDP. For example, Bahrain non-oil GDP as a ratio of Bahrain GDP (Y) and is expressed as $y_t^n \equiv (Y^n / Y)_t$, Bahrain government spending as a ratio of Bahrain GDP is defined as $g_t \equiv (G/Y)_t$, and the US government spending as a ratio of the US GDP (Y^*) is defined $g_t^* \equiv (G^*/Y^*)_t$.

The permanent flow of government spending ($\overline{G}_t$) as perceived at date t is generally unobservable. It requires obtaining optimal forecasts of discounted value of future government spending. As shown in Ahmed (1986), an estimable equation for Bahrain government spending can be postulated as

$$\log(G_t) = c/(1-\lambda) + [(1-\lambda)/(1-\lambda L)]\log(G_{t-1}) + \varepsilon_t, \qquad (9)$$

where L is the lag operator. The permanent government spending in terms of observable quantities can then be obtained as

$$\overline{G}_t = \{[\delta e^{c/(1-\lambda)}]/(1+\delta-e^c)\}\prod_{s=0}^{\infty}(G_{t-s})^{(1-\lambda)\lambda^s} \qquad (10)$$

where δ is the discount factor. An estimable equation for the US government spending can similarly be specified as equation (9) and the US permanent government spending will be obtained as in expression (10).

5. Testing for Unit Roots and Cointegration

Figures 2 and 3 indicate that the non-oil GDP of Bahrain as a ratio of GDP (y_t^n) and Bahrain government spending as a ratio of GDP (g_t or g_t^C) are drifting together in the same direction.[6] Figure 4, on the other hand, indicates that y_t^n and the US government consumption and investment as a ratio of the US GDP (g_t^*) are drifting together in opposite direction. This suggests they are likely to be cointegrated. According to the traditional macroeconomics models, as postulated in equation (8), these series are likely to be cointegrated. To formally establish cointegration, it is necessary first to check whether each of the variables used in this study is integrated and contains a unit root.

Table 1 presents results of the tests for a unit root. It displays the lists of variables tested, their definitions and their symbols used in this study. Note that we have also performed test for unit root for the constructed series, such as Bahrain permanent government consumption and investment as a ratio of GDP ($\bar{g}_t$) and the US temporary government consumption and investment as a ratio of the US GDP ($g_t^* - \bar{g}_t^*$). These series are constructed using the formulae (10) and its US analog and using the estimates of λ and λ^* reported in tables 3 and 4 below. Results presented in table 1 indicate that all series used in this study contain unit root. For a sample of size of 25 and at the 0.1 level, the critical value of the t-statistic for the null hypothesis of unit root is –3.24. ADF t-statistic for all variables in table 1 is far less than –3.00 and moreover, for the constructed series, sample size is less than 25. Thus, for all series in our study, we cannot reject the null hypothesis of unit root even at the 10 percent level.[7]

Table 2 presents results of testing for cointegration excluding and including the US government spending. MacKinnon critical values for cointegrating relations (with a constant

and trend in the cointegrating vector) using the Engle-Granger methodology are all greater than 3.00 in absolute value even at the 10 percent level for a sample size of 50.[8] When the US variables are excluded from the cointegrating vector (Panel A of table 2), all ADF t-statistics are far less than –3.00. Results presented in table 2 (Panel B) strongly indicate that US variables are important in the long-run movements of non-oil GDP of Bahrain. Note the difference between the series Bahrain government consumption and investment as a ratio of GDP (g) and the series Bahrain government consumption as a ratio of GDP (g^C). When the cointegrating vector consists of variables y^n, g^C, and g^*, the ADF t-statistic of the regression residual is –3.25 which is not very far from 10% critical value. That is, the long-run movements in y^n, g^C, and g^* appear to be correlated.[9] The estimated coefficient of g_t^C is $\hat{c}_2$ = 1.25 with t-statistic 6.43 implying that, as the traditional macroeconomics would expect, a multiplier effect running from Bahrain government consumption to Bahrain non-oil GDP. However, a much greater negative multiplier effect is provided by the US government spending. The estimated coefficient of g_t^* is $\hat{c}_3$ = –3.49 (t-statistic = –3.75).

We have also performed the cointegrating test using the constructed series. When the cointegrating vector consists of variables y^n, $\overline{g}$, and ($g^* - \overline{g}^*$), the ADF t-statistic of the regression residual in absolute value increases substantially and it is equal to –3.74 which is almost equal to the 10% critical value. We do not want to insist too much on the cointegration test because of the short length of the data. These tests help us to bring up some important points that the US variables are relevant variables or important determinants of Bahrain macro variables and a distinction between temporary and permanent components is something that must be considered.

6. Regression Results

In running the cointegrating regression consisting variables y^n, $\bar{g}$, and ($g^* - \bar{g}^*$), we first obtain the constructed series on $\bar{g}$ and ($g^* - \bar{g}^*$) and then ran the regression. This procedure would not give correct standard errors of the estimated coefficients of $\bar{g}$ and ($g^* - \bar{g}^*$). Because of this, no comment is offered on the estimates of their coefficients and standard errors. The more efficient estimates along with their correct standard errors will be obtained when the government spending equation (9), its US analog and the Bahrain non-oil GDP equation are simultaneously estimated. This is what we have done in this section.

The following system of equations was estimated simultaneously

$$\log(G_t) = c/(1-\lambda) + [(1-\lambda)/(1-\lambda L)]\log(G_{t-1}) + \varepsilon_t \tag{11}$$

$$\log(G_t^*) = c^*/(1-\lambda^*) + [(1-\lambda^*)/(1-\lambda^* L)]\log(G_{t-1}^*) + \varepsilon_t^* \tag{12}$$

$$\Delta y_t^n = b_0 + b_1\Delta(g_t - \bar{g}_t) + b_2\Delta\bar{g}_t + b_3(g_t^* - \bar{g}_t^*) + b_4\Delta\bar{g}_t^* + u_t \tag{13}$$

Equations (11) and (12) are the estimable equations for Bahrain and US government spending. Equation (13) is a linear version of equation (7). Variables in equation (13) are defined as: $y_t^n \equiv (Y^n/Y)_t$, $g_t \equiv (G/Y)_t$, $\bar{g}_t \equiv (\overline{G}/Y)_t$, $(g_t - \bar{g}_t) \equiv [(G-\overline{G})/Y]_t$, $g_t^* \equiv (G^*/Y^*)_t$, $\bar{g}_t^* \equiv (\overline{G}^*/Y^*)_t$, $(g_t^* - \bar{g}_t^*) \equiv [(G^* - \overline{G}^*)/Y^*]_t$, where Y^n and Y are non-oil GDP and GDP of Bahrain, Y^* is the US GDP. As mentioned above, a superscript (*) on a variable or parameter would indicate the US variable or parameter and Δ is the first difference operator, and u_t is the error term. Expression (10) and the US analog are substituted in (13) and the system consists of (11) – (13) are simultaneously estimated using System Non-Linear Least Squares.

The theoretical model implies the following hypotheses. The effects on non-oil GDP of Bahrain of a temporary change in Bahrain government spending and of a permanent change in the US government spending are zero, that is, $b_1 = b_4 = 0$ in equation (13). The effects on non-oil GDP of Bahrain of a permanent change in Bahrain government spending is positive ($b_2 > 0$) and of a temporary change in the US government spending is negative ($b_3 < 0$).

We have argued that changes in temporary government spending of Bahrain and changes in permanent government spending of the US would not influence the changes in non-oil GDP of Bahrain. Nevertheless, equations were estimated by including and excluding those variables. Including irrelevant variables in a model only reduce the power of the tests and make rejections of hypotheses even more telling. Consistent with previous study we have assumed $\delta = \delta^* = 0.2$ in the formula (10) and its US analog. We also imposed the restriction that $c = c^* = 0$ in equations (11) and (12), which amounts to testing no drift in the log of Bahrain and the US government spending.[10] Tables 3 and 4 present results of the main equation (13) along with the estimates of λ and λ^* from equations (11) and (12). Thus, the standard error of the regression (se), R^2 and D-W reported in tables 3 and 4 belong to equation (13).

As noted above, two measures of Bahrain government expenditures are used. In table 3, government expenditures include both government consumption and investment. Model (1) of table 3 presents results when all variables were included in the model. Results indicate that λ and λ^* are negative and highly significant in all estimations. As Ahmed (1986) has pointed out, negative values of λ and λ^* imply that a unit permanent shock raises the level of government spending more than a unit. Results of model (1) in table 3 show that the

estimated coefficient of the variable $\Delta\bar{g}_t$ is only statistically significant with the expected positive sign. That is, changes in permanent Bahrain government spending significantly affect the non-oil GDP of Bahrain. Results of model (2) in table 3 were obtained by imposing the restriction that the effects on non-oil GDP of Bahrain of a temporary change in Bahrain government spending and of a permanent change in the US government spending are zero, that is, $b_1 = b_4 = 0$. Results of model (2) in table 3 conform the theoretical model outlined above. The estimated coefficients of both variables $\Delta\bar{g}_t$ and $\Delta(g_t^* - \bar{g}_t^*)$ have expected signs and are highly statistically significant at less than 2% level. Result conforms to the theoretical assertion that the effect on non-oil GDP of Bahrain of a permanent change in Bahrain government spending is positive and of a temporary change in the US government spending is negative. Although, we are interested in more to qualitative effects than quantitative effects, the estimated values of b_2 and b_3 are worth mentioning. The estimates obtained from model (2), in table 3 are, $\hat{b}_2 = 1.05$ and $\hat{b}_3 = -0.70$. There is a one to one correspondence to changes in permanent Bahrain government spending to a change in non-oil GDP of Bahrain. However, two-third of this positive effect is nullified by a negative impact of changes in temporary US government spending on changes in non-oil GDP of Bahrain.

In table 4, government expenditures include only government consumption. Estimates of the unrestricted equation (13) are presented under the model (1) in table 4. Model (1) was estimated with the first-order autocorrelation correction. $\hat{\rho}$ is the estimated autocorrelation coefficient. The estimated coefficients of both variables $\Delta(\bar{g}_t^C)$ and $\Delta(g_t^* - \bar{g}_t^*)$ are statistically significant, at less than 1% and 10% levels, respectively; and both have their expected positive and negative signs. On the other hand, as in table 3, the estimated

coefficients of both variables $\Delta(g_t^C - \bar{g}_t^C)$ and $\Delta\bar{g}_t^*$ are not statistically significant as the model predicted. Estimates of b_2 and b_3 from model (2) in table 4 show that $\hat{b}_2$ = 1.51 and $\hat{b}_3$ = –0.58. Results seem to indicate that there is a multiplier effect of permanent Bahrain government spending to non-oil GDP of Bahrain. However, again this positive multiplier effect would be substantially reduced by a negative impact of changes in temporary US government spending on changes in non-oil GDP of Bahrain.

7. Conclusion

Bahrain maintains a fixed exchange rate against the US dollar. When a small country such as Bahrain ties its exchange rate to a larger country's currency, it surrenders its monetary policy. That is, the monetary policy by itself cannot affect output and employment. However, it is argued that under fixed exchange rate fiscal policy is more powerful than it is under flexible exchange regime because fiscal policy triggers monetary accommodation. The results obtained in this paper question the validity of this powerful effect of fiscal policy.

Considering the results obtained in this paper, textbooks discussion of the powerful effects of fiscal policy is exaggerated; and generally fails to recognize the importance of foreign shocks in an important way. Alyousha (1997), on the basis of his empirical evidence, has argued that government expenditure is the only macroeconomic variable that determines the non-oil GDP of Bahrain; and that the pursued fixed exchange rate policies of Bahrain have dampened the effects of monetary policy. His conclusion is based on examining the time series properties of domestic variables.[11] Results presented in this paper indicate that, when the foreign shocks are counted, the pursued fixed exchange rate policies of Bahrain not only have dampened the effects of monetary policy but also have dampened the effects of fiscal

policy. We find that the positive multiplier effect of permanent domestic government consumption is substantially neutralized by the negative impact of temporary US government spending on non-oil GDP of Bahrain.

Notes

1. One exception is Barro (1997).
2. El-Khouri (2002) provides a recent overview on the subject. However, his discussion is not much of a help to understand the effect of a foreign fiscal shock on the domestic output and employment. Useful discussions are available in Mankiw (2003).
3. See, for example, Fasano and Iqbal (2003).
4. If index of these two rates are used, these two lines would coincide to each other.
5. Note that one unit increase in G_t is equivalent to one unit increase in (G_t – $\overline{G_t}$) given $\overline{G_t}$.
6. Two measures of Bahrain government spending are used: G is the government consumption and investment and G^C is only the government consumption.
7. First difference of all the series reported in table 1 are found to be stationary.
8. See for example Table C (p. 441) of Enders (2004).
9. We also tried Johanson (1988) procedure and found at least one cointegrating vector among y^n, g^C, and g^*. Overall results were very erratic possibly due to short length of data.
10. With non-zero c estimates to not converge, that is, equation (10) becomes explosive.
11. His sample covered the period 1975:I – 89:IV. Quarterly series for most of macroeconomic economic variables are not available for Bahrain. Quarterly series on government expenditures and non-oil GDP used in his study were extrapolated.

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Figure 1

US dollar and Bahrain Dinar (BD) Against the SDR

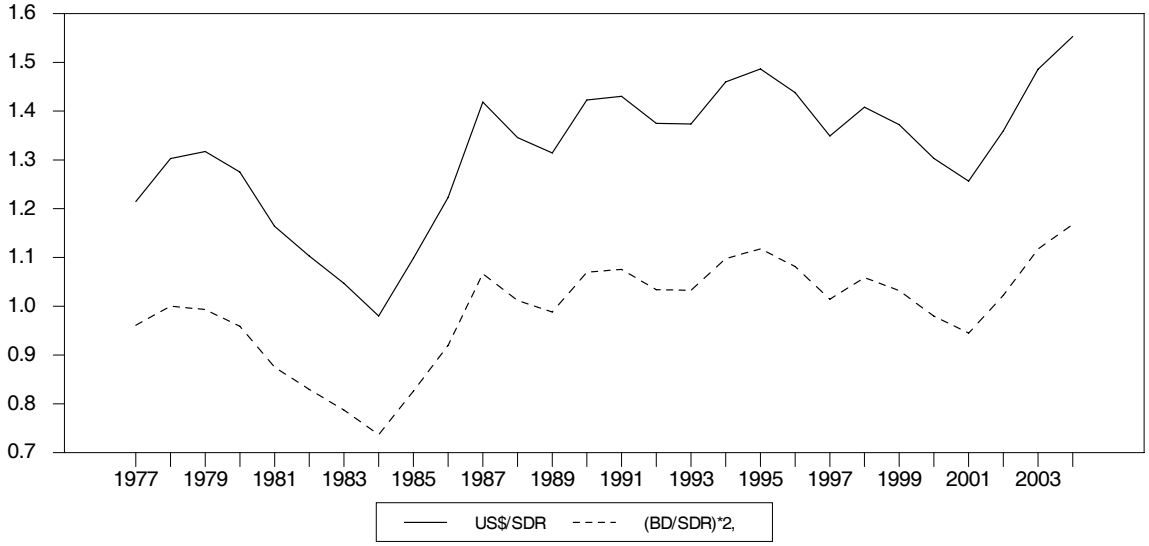

Figure 2

Bahrain Non-oil GDP as a Ratio of GDP (Y^n/Y) and Bahrain Government Consumption and Investment as a Ratio of GDP (G/Y)

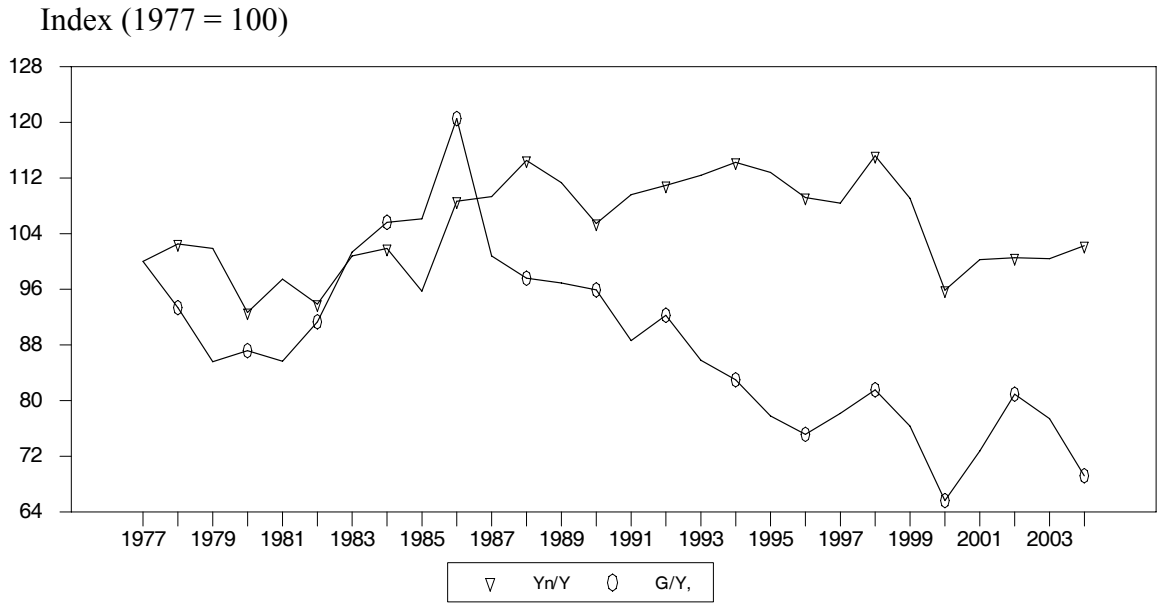

Figure 3

Bahrain Non-oil GDP as a Ratio of GDP (Y^n/Y) and Bahrain Government Consumption as a Ratio of GDP (G^C/Y)

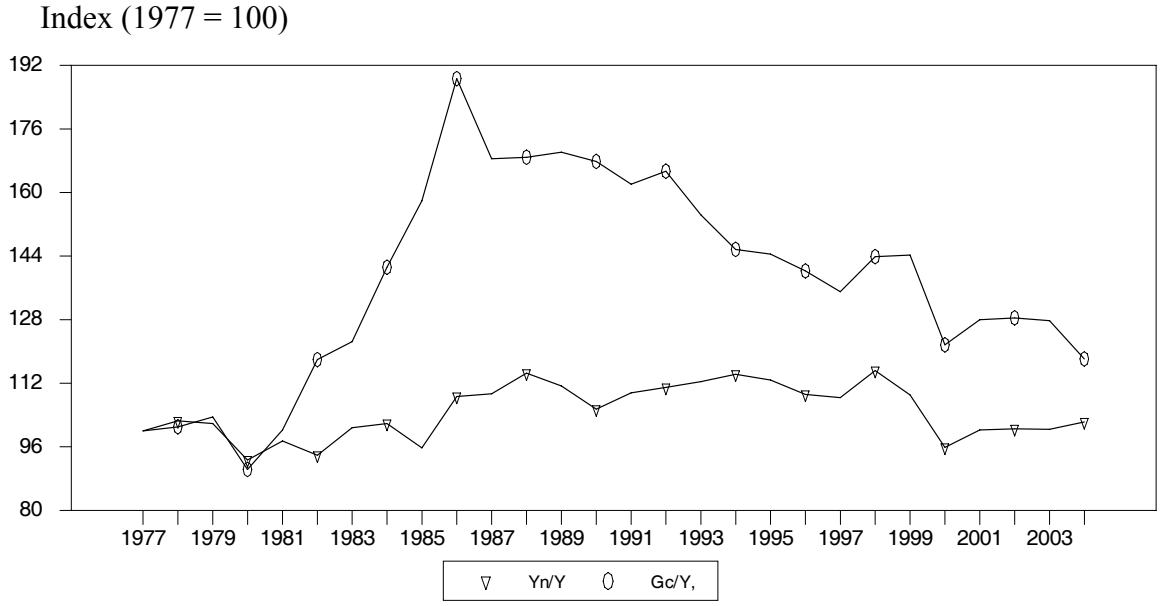

Figure 4

Bahrain Non-oil GDP as a Ratio of GDP (Y^n/Y) and the US Government Consumption and Investment as a Ratio of the US GDP (G^*/Y^*)

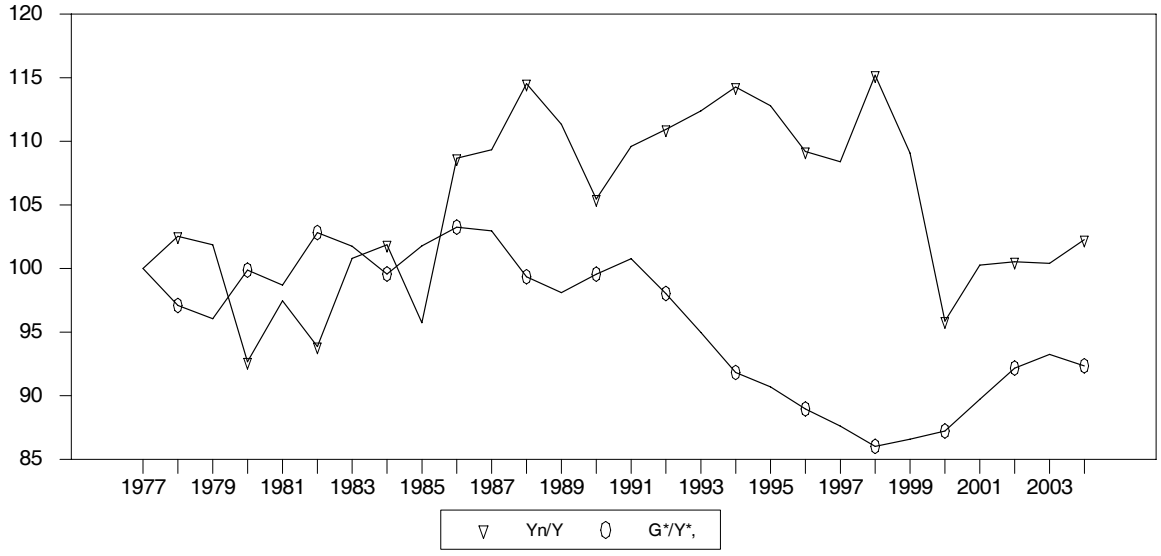

Table 1

Unit Root test Statistics

Variables	n	ADF t-statistics For $\rho = 0$
Bahrain non-oil GDP as a ratio of GDP (y^n)	26	–1.68
Bahrain government consumption and investment as a ratio of GDP (g)	26	–2.08
Bahrain government consumption as a ratio of GDP (g^C)	26	–1.19
Bahrain permanent government consumption and investment as a ratio of GDP ($\bar{g}$)	20	–2.76
Bahrain permanent government consumption as a ratio of GDP ($\bar{g}^C$)	20	–2.16
US government consumption and investment as a ratio of the US GDP (g^*)	26	–2.27
US temporary government consumption and investment as a ratio of the US GDP ($g^* - \bar{g}^*$)	20	–1.99
US permanent government consumption and investment as a ratio of the US GDP ($\bar{g}^*$)	20	–2.17

Notes: Variables are defined as $y_t^n \equiv (Y^n / Y)_t$, $g_t \equiv (G/Y)_t$, $g_t^C \equiv (G^C / Y)_t$, $\bar{g}_t \equiv (\overline{G}/Y)_t$, $g_t^* \equiv (G^*/Y^*)_t$, $(g_t^* - \bar{g}_t^*) \equiv [(G^* - \overline{G}^*)/Y^*]_t$, $\bar{g}_t^* \equiv (\overline{G}^*/Y^*)_t$, Y_t is Bahrain GDP, Y_t^* is the US GDP, G_t is Bahrain government consumption and investment, G_t^C and G_t^* is the US government consumption and investment. Unit root tests were performed using the regression of the form: $\Delta x_t = a_0 + a_1 Time + \rho x_{t-1} + a_2 \Delta x_{t-1} + residual$. Thus equations were estimated with one augmenting lag. n is the sample size available in estimating the regression. The critical value of the t-statistic for the null hypothesis $\rho = 0$ at the 10% level of significance with n = 25 is -3.24.

Table 2

Cointegration Regressions and Test Statistics

Variables	n	$\hat{c}_2$	$\hat{c}_3$	ADF t-statistics For $\rho = 0$
Panel A: Excluding the US variables				
(y^n, g)	27	0.53 (1.78)		–2.26
(y^n, g^C)	27	0.86 (4.25)		–2.91
$(y^n, \bar{g})$	21	-0.21 (0.41)		–2.62
$(y^n, \bar{g}^C)$	21	1.18 (2.98)		–2.39
Panel B: Including the US variables				
(y^n, g, g^*)	27	1.03 (2.27)	–3.10 (2.05)	–2.27
(y^n, g^C, g^*)	27	1.25 (6.43)	–3.49 (–3.75)	–3.25
$(y^n, \bar{g}, g^* - \bar{g}^*)$	21	0.38 (1.28)	63.17 (6.44)	–3.74
$(y^n, \bar{g}^C, g^* - \bar{g}^*)$	21	0.71 (2.88)	51.57 (6.06)	–3.63

Notes: See table 1 for definitions of variables. Each row reports coefficients from two regressions. In panel A, the first regression is of the form: $y_t = c_0 + c_1 Time + c_2 X1_t + e_t$, where e_t is the residual. Thus, $\hat{c}_2$ is the estimated coefficient of the independent variable g of the first regression of panel A. Absolute t-statistics are in parentheses. In panel B, the first regression is of the form: $y_t = c_0 + c_1 Time + c_2 X1_t + c_3 X2_t + e_t$. Thus, $\hat{c}_2$ and $\hat{c}_3$ are the estimated coefficients of the independent variable g and g^* of the first regression of panel B. The second regression of each panel tests for a unit root in the residual of the relevant cointegrating regression and is of the form: $\Delta e_t = \rho e_{t-1}$. n is the number of usable observation in obtaining ADF statistics.

Table 3

Dependent variable is Δy_t^n . Estimation Procedure = system non-linear least squares.

Variables	Model (1)	Model (2)
Constant (b_0)	–0.33 (1.33)	–0.27 (–2.29)**
λ	–0.34 (6.82)***	–0.17 (5.33)***
λ^*	–0.36 (39.42)***	–0.19 (31.09)***
$\Delta(g_t - \bar{g}_t)$	0.09 (0.34)	
$\Delta\bar{g}_t$	0.96 (2.75)***	1.05 (3.77)***
$\Delta(g_t^* - \bar{g}_t^*)$	–1.01 (1.01)	–0.70 (2.33)**
$\Delta\bar{g}_t^*$	0.91 (0.19)	
	se = 0.035 R^2 = 0.32 D-W = 2.08	se = 0.033 R^2 = 0.36 D-W = 2.00

Note: Variables are defined as $y_t^n \equiv (Y^n/Y)_t$, $g_t \equiv (G/Y)_t$, $\bar{g}_t \equiv (\overline{G}/Y)_t$, $(g_t - \bar{g}_t) \equiv [(G - \overline{G})/Y]_t$, $g_t^* \equiv (G^*/Y^*)_t$, $(g_t^* - \bar{g}_t^*) \equiv [(G^* - \overline{G}^*)/Y^*]_t$, $\bar{g}_t^* \equiv (\overline{G}^*/Y^*)_t$, Y_t is Bahrain GDP, Y_t^* is the US GDP, G_t is Bahrain government consumption and investment and G_t^* is the US government consumption and investment. Absolute t-statistics are in parenthesis. (***), (**) and (*) indicate significant at 1%, 5%, and 10% level, respectively.

Table 4

Dependent variable is Δy_t^n . Estimation Procedure = system non-linear least squares.

Variables	Model (1)	Model (2)
Constant (b_0)	–0.31 (1.79)*	–0.23 (1.88)*
λ	–0.19 (6.84)***	–0.19 (6.72)***
λ^*	–0.36 (42.70)***	–0.19 (23.40)***
$\Delta(g_t^C - \bar{g}_t^C)$	0.33 (1.03)	
$\Delta\bar{g}_t^C$	1.17 (2.78)***	1.51 (3.75)***
$\Delta(g_t^* - \bar{g}_t^*)$	–1.11 (1.63)*	–0.58 (1.96)**
$\Delta\bar{g}_t^*$	1.97 (0.41)	
$\hat{\rho}$	–0.06 (0.21)	
	se = 0.042 R^2 = 0.23 D-W = 1.23	Se = 0.034 R^2 = 0.32 D-W = 1.70

Note: where $y_t^n \equiv (Y^n / Y)_t$, $g_t^C \equiv (G_t^C / Y)_t$, $(g_t^C - \bar{g}_t^C) \equiv [(G^C - \overline{G}^C)/Y]_t$ $\bar{g}_t^C \equiv (\overline{G}_t^C / Y)_t$, $g_t^* \equiv (G^* / Y^*)_t$, $\bar{g}_t^* \equiv (\overline{G}^* / Y^*)_t$, $(g_t^* - \bar{g}_t^*) \equiv [(G^* - \overline{G}^*)/Y^*]_t$, G_t^C is Bahrain's government consumption and G_t^* is the US government consumption and investment. Absolute t-statistics are in parenthesis. (***), (**) and (*) indicate significant at 1%, 5%, and 10% level, respectively.