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Abstract

The main aims of this paper are as follows. First, to macro model prospective development in the Lebanese economy for policy analysis and evaluation. This study develops s a dynamic macroeconomic model for Lebanon including the budget deficit and the funding of it (e.g. by monetary accommodation or bond financing), as well as the composition of government expenditures (capital or current). Hence this paper develops behavioural equations not used before for Lebanon. This macroeconomic model is utilised as well to analyse the effects of exogenous shocks arising from increased government expenditures (capital expenditure or consumption expenditure) upon key macroeconomic variables. The second aim of this study is the application of a simulation analysis to the Lebanese economy, which suffers from fiscal deficits and public debt during last few decades. This study conducts a numerical simulation analysis of the macroeconomic model developed, in order to analyse a number of economic policies in the context of the Lebanese fiscal crisis with the aim of improving the country's macroeconomic performance. The major findings from the simulation results presented in this study are that, implementing the policy of expansion in government capital expenditure, for two presumed cases (unanticipated/gradual), produces larger favourable impacts (in comparison with the policy of expansion in government consumption expenditure) upon Lebanese economic development in terms of private sector investment, and in terms of the supply side of the economy (crowding in effects) during the whole adjustment process towards long run steady state. Implementing the policy of an expansion in government consumption expenditure produces unfavourable effects in terms of external developments during the adjustment process. This policy produces, as well, unfavourable effect in terms of private investment and aggregate supply (crowding out effect). However, the simulation results for the two policies show that money deficit financing is inflationary and shows large sensitivity in terms of the interest rate. Bond financing is non inflationary and shows little sensitivity in terms of interest rates. The main finding is that if the government considers a fiscal expansion policy in order to improve macroeconomic performance, the simulation results suggest that the government should adopt the policy of an expansion in capital expenditure because it produces the most desirable outcomes. In addition, it should adopt a gradual approach because this produces considerably less volatility in terms of major macro variables. The main findings from our simulation results dealing with the government approach to the fiscal crisis, does not support the government policy in dealing with the crisis. The results presented here suggest that it produces the most undesirable economic outcomes, and hence will only exacerbate Lebanon's economic difficulties.

* This paper is a part of the author's PhD dissertation supervised by Associate Professor Charles Harvie and Associate Professor Edgar J Wilson at Department of Economics, University of Wollongong, Australia. I would like to thank both my supervisors for their helpful comments and suggestions.

Introduction

This paper develops a dynamic macroeconomic model for Lebanon including the budget deficit and the funding of it, as well as the composition of government expenditures (capital or current). The second aim of this paper is the application of a simulation analysis to the Lebanese economy, which suffers from an unpreceded increase in budget deficits as well as in public debt during the last few decades. Hence this paper conducts a numerical simulation analysis of the macroeconomic model developed, in order to analyse the effects of exogenous shocks arising from increased government expenditures (capital expenditure or consumption expenditure) upon key macroeconomic variables. The current government's policy approach in response to the Lebanese fiscal crisis is analysed as well through the use of this macroeconomic model. The objective being to identify policies that reduce the macroeconomic consequences of these shocks and hence to improve the macroeconomic performance in Lebanon.

The model developed of this study is based on the contributions of the Dornbusch model (DB) (1976), and the portfolio balance model (PBM) (Branson (1977, 1984)) including the work of Dornbusch and Fisher (1980). The model developed combines the contributions of these general models with that of the Harvie and Kearney model (HKM) (1996).

The model developed focuses upon the main aspect of the current Lebanese economic crisis, which is the size and growth of the public sector deficit. The model will remedy the deficiencies in both the DB and PBM models regarding their neglect of the supply side of the economy, the funding of the budget deficit, and the composition of government expenditure. However, many amendments are required of the existing models in order to make them applicable to the case of Lebanon.

First, the model developed distinguishes between two types of public expenditure, capital expenditure and current expenditure. Second, the model developed explicitly incorporates the funding of the budget deficit via bond financing (pure fiscal policy), via money accommodation (pure monetary policy) or a mixture of the two. Third, it incorporates exogenous shocks arising from the increase in the budget deficit, such as through an increase in government expenditure, and the impact of this on macroeconomic variables such as output, prices, the exchange rate, and the interest rate among others.

The model developed assumes that the Lebanese economy operates under a flexible exchange rate and perfect capital mobility. Under a flexible exchange rate regime the nominal exchange rate adjusts so that the balance of payments is in equilibrium, and there will be no effect upon foreign exchange reserves. Hence, the money supply is exogenous and the nominal exchange rate is endogenous. Furthermore, the model is dynamic and focuses upon long run adjustment; and economic agents possess rational expectations (as with the HK model). This is equivalent to the case of perfect foresight. The model developed also assumes that there are four financial assets, domestic money, domestic bonds, foreign bonds, and equities. Assets denominated in domestic currency and foreign exchange are assumed to be perfect substitutes, with arbitrage between them resulting instantaneously in the same expected real rate of return.

This paper is divided into three main sections. Section I examines budget deficits and public debt in Lebanon. Section II specifies the macroeconomic model developed in this study. Simulation and key policy implications are discussed in section III. The paper concludes by listing the main findings from our simulation results in the context of the Lebanese fiscal deficit.

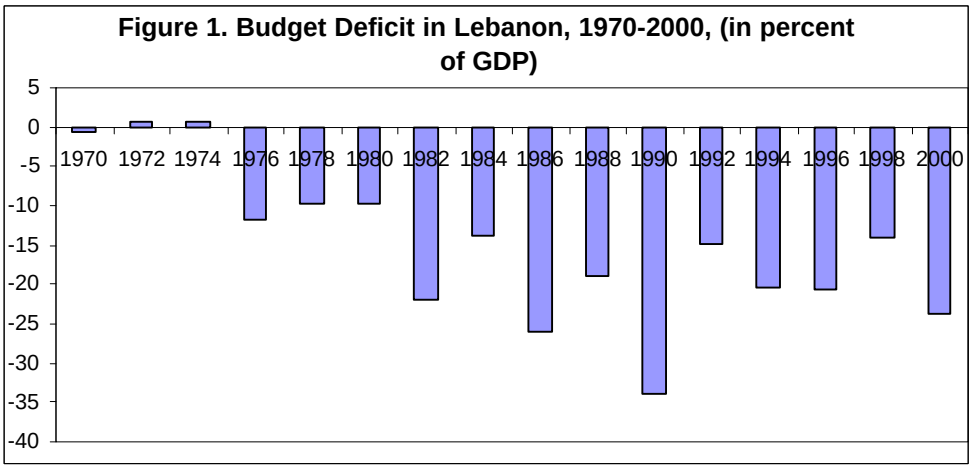
I. Budget Deficits and Public Debt in Lebanon

Prior to 1975 the government budget was always balanced and the government had never resorted to borrowing. Therefore, borrowing and deficits are recent phenomena in Lebanon, and it is of interest to note the creation and evolution of deficit financing. As is the case in any country, the government can borrow from the general public, the central bank, and the commercial banks. It should be noted here that the period of 1975-1990 was the most difficult of the Lebanese crisis, because of the Civil War, political crisis, and the Israeli invasion of Beirut in 1982.

As can be seen from Figure 1 the increase in public deficits in Lebanon occurred after 1974, but the largest increases occurred after 1980 and peaked during the 1980s and 1990s. This was a period (1975-1990) of deepening crisis for the Lebanese economy, as evidenced by the marked deceleration in economic growth and private investment activity. The Budget deficit, as a percent of GDP, increased from only 3% in 1975 to 32.3% in 1989, and was one of the highest amongst the Middle East countries. Increased government expenditure and declining government revenues were both responsible for the steep increase in the public sector deficits. Total government expenditure as a percentage of GDP in Lebanon increased from 15.4% in 1972 to 39.4% in 1990. The dramatic increase in total government expenditure was mainly made up of current expenditure, the generous wages and salaries paid to government employees, and the interest payments on the public debt.

Government revenues, on the other hand, remained very low as a proportion of GDP during the period of 1975-1990 (around 6%), due to the slowdown of economic activity, the inability of the government to collect revenues (Lebanon's Civil War), most of the government's revenues were in the form of indirect taxes, and custom and trade taxes became, a difficult mission with the loss of control over legal ports of entry and a consequent surge in illegal imports. In addition, Lebanon's

budgetary capital expenditure witnessed a decline as well from 6% of GDP in 1980 to 1.7% in 1990, and contributed to the deterioration in Lebanon's public capital stock.

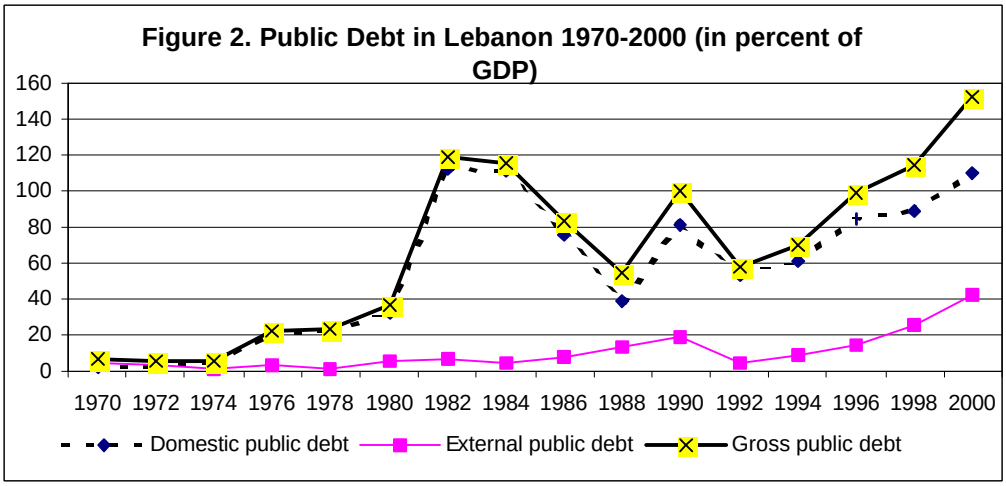


Source: Plotted by the author based on data provided by Banque du Liban (various years); Ministry of Finance (various years); Eken et al. (1995); Eken and Helbling (1999); Author's calculations.

During 1970-1975 the average annual growth of nominal gross public debt registered only 3.5%, and the nominal gross public debt as a percent of GDP averaged 5.4%. Therefore, in the pre-war period public debt was not a major concern for Lebanon. As a result of large budget deficits during 1975-1990 Lebanese public debt started to increase after 1975, but the largest increases occurred after 1980 and peaked during the 1980s and 1990s (Figure 2).

Over the post-war period (1991-2000), and as a result of rebuilding the infrastructure (the government's crucial contribution to the reconstruction effort), the acceleration in the growth of government capital expenditure, together with large and expanding current expenditure and the slow recovery of the revenue-generation capacity, led to sizable fiscal imbalances. Consequently, government budget deficits increased from 9.2% of GDP in 1993 to 20.6% and 23.7% in 1996 and 2000 respectively. This huge increase in the budget deficit led to a sustained growth in government debt during the period 1993-2000 (Figure 2). In addition domestic public debt as a percent of GDP increased from 44.2% in 1993 to 86.5% and 109.5% in

1997 and 2000 respectively. The external public debt as a percent of GDP increased from only 4.3% to 16.4% and 42.3% in 1997 and 2000. Therefore, the majority of the public debt in Lebanon is in the form of domestic public debt. However, money creation remained the primary method of budget financing with the issuance and sale of treasury bills to the private sector. It has been argued that the main effect of the huge budget deficit, and the way it was financed, led to a permanent deficit in the budget, higher interest rates, increases in the money supply, rising inflation, a depreciation of the Lebanese pound, stagnation and a slowing of economic growth.



Source: Plotted by the author based on data provided by Banque du Liban (various years); Ministry of Finance (various years); Eken et al. (1995); Eken and Helbling (1999); Author's calculations.

II. Theoretical Framework - Macroeconomic Model

The model to be developed combines the contributions of these general models (DB model and the PBM model), and also that of Harvie and Kearney (1996). It will be a long-run macroeconomic model, the foundations of which are based on the general models mentioned previously. The DB and PBM models have a number of deficiencies, especially the neglect of the supply side of the economy; they also do not focus on the way of funding the budget deficit and the composition of government expenditure. However, many amendments need to be made to these

existing models in order to make them applicable to the case of Lebanon, especially to analyse the impact of the composition of budget (e.g. monetary accommodation or bond financing) and the composition of government expenditure shocks on macroeconomic variables (such as output, prices, interest rates, among others).

The model developed focuses upon the main aspects of the Lebanese fiscal deficit. First, the model developed distinguishes between two types of public expenditure, capital and consumption. Second, the model developed incorporates various ways of funding the deficit whether via bond financing (pure fiscal policy), via money accommodation (pure monetary policy) or a mixture of the two. Third, it incorporates exogenous shocks arising from increased government expenditures (capital or consumption) and their impact upon key macroeconomic variables such as output, private investment, interest rates, and prices amongst others.

A. The Macroeconomic Model in the Case of Lebanon

The model developed for Lebanon is based upon a number of important assumptions, including the following.

First, the model assumes that the Lebanese economy operates under a flexible exchange rate and perfect capital mobility. Under a flexible rate regime the nominal exchange rate adjusts so achieve balance of payments equilibrium and capital inflows or outflows will have no effect upon foreign exchange reserves and hence the domestic money supply. Therefore, the money supply is exogenous, and the nominal exchange rate is endogenous. An appreciation/depreciation of the exchange rate adjusts the balance of payments to equilibrium. Furthermore, under perfect capital mobility two assumptions need to be addressed. First, freedom of capital movement implies an absence of impediments to capital flows in the form of capital controls, taxes and so on. Second, there is perfect substitutability of assets denominated in

domestic currency and foreign currency. Therefore, the uncovered interest parity condition holds ($\dot{e} = r - r^*$). This is the case where capital is freely mobile and assets are assumed to be perfect substitutes.

Second, the model is dynamic and concentrates upon long run adjustment; economic agents possess rational expectations and possess complete information (as with the HK model). This is equivalent to the case of perfect foresight. Third, financial markets are assumed to be in continual equilibrium. On the other hand non-financial markets do not clear continuously, because they are subject to sticky price and quantity adjustment.

Fourth, the model also emphasises the supply side of the economy, wealth effects, capital stock accumulation, budget deficits and their funding. In addition, there are assumed to be four financial assets, domestic money, domestic bonds, foreign bonds, and equities, which determine the q ratio. Assets denominated in either domestic currency and foreign exchange are assumed to be perfect substitutes, with arbitrage between them resulting instantaneously in the same expected rate of return.

The equations of the model are now presented. The model is divided into four sub headings: product market, assets market, wage-price nexus, and definitions. As shown in Table 1, all equations in the model, except the domestic nominal interest rate and the world interest rate, are reported in log-linear form.

Equilibrium in the model depends upon simultaneous equilibrium in the product market, assets market and external balance. Firstly, equilibrium in the product market will be outlined.

The product market consists of nine equations, which are presented by equations (1)-(9). The demand for real output (y^d) is given by equation (1). So the demand for real output in this study comprises private consumption, private

investment, government expenditure (which is given by equation (6) and is comprised of a weighted average of both government consumption and government capital spending), and the trade balance consisting of exports less imports. Equation (2) describes private consumption, which depends positively on the level of real income (aggregate supply) and real private sector wealth. Equation (3) describes private investment, which equals the change in the stock of private capital, and depends on Tobin's q. Equation (4) describes government consumption spending as being an exogenously determined variable, whilst government investment spending (equation (5)) arises from a gradual adjustment of the actual public capital stock to its policy-determined level. Identification of the role and importance of government expenditure, in the case of the Lebanese economy, is an important objective of this study.

Equation (6), as mentioned before, describes total government expenditure, which depends positively on two components of expenditures: government consumption expenditure (c^g) (exogenous) and government capital spending; and depends negatively on the supply of output. It is worth mentioning here as well that there is another part of government consumption expenditure (endogenous), which depends on the supply of output (y^s). This arises due to welfare/unemployment expenditure. When output is high, unemployment is low and hence welfare expenditure in this area is low and vice versa.

Equation (7) describes the budget deficit, which is government expenditure less tax revenues. The budget deficit as shown in this equation can be financed in three ways, through an expansion in the money supply and/or domestic bonds, or a combination of the two. Equation (8) is tax revenue, which depends positively on the supply of output. Equation (9) describes the trade balance, which depends positively

upon the real exchange rate (the nominal exchange rate deflated by the domestic price (e-p)), negatively on aggregate demand for domestic real output, and positively on world real income.

Table 1. The Macroeconomic Model

Product Market

$$y^d = a_1 c^p + a_2 i^p + a_3 g + a_4 T \quad (1)$$

$$c^p = c_1 y^s + c_2 w^p \quad (2)$$

$$i^p = \dot{k}^p = hq \quad (3)$$

$$c^g = \bar{c}^g \quad (4)$$

$$i^g = \dot{k}^g = y\,(k^{g*} - k^g) \quad (5)$$

$$g = b_1 c^g - b_2 y^s + b_3 i^g \quad (6)$$

$$bd = g - t = a_1(\dot{m} - \dot{p}) + a_2(\dot{b} - \dot{p}) \quad (7)$$

$$t = ty^s \quad (8)$$

$$T = m_1(e - p) - m_2 y^d + m_3 y^* \quad (9)$$

Assets Market

$$m = p + s_1 y^d - s_2 r \quad (10)$$

$$R = g_1 y^s - g_2 k^p + g_3 k^g \quad (11)$$

$$\dot{q} = d_3^{-1}\left[q - d_1 R + d_2(r - p)\right] \quad (12)$$

$$w^P = \Omega_1(f + e - p) + \Omega_2(k^p + q) + \Omega_3(m - p) + \Omega_4(b - p) \quad (13)$$

$$\dot{f} = e_1 T + e_2 r^* f - (1 - e_2)(e - p) \quad (14)$$

Wage/Price Nexus

$$p = dw + (1 - d)e \quad (15)$$

$$\dot{w} = f_1(y^d - y^s) + f_2 p \quad (16)$$

$$y^s = l_1 k^p + l_2 k^g - l_3(w - p) \quad (17)$$

Definitions etc

$$c = e - w \quad (18)$$

$$l = m - w \quad (19)$$

$$\dot{m} = p \quad (20)$$

$$\dot{e} = r - r^* \quad (21)$$

$$B = b - w \quad (22)$$

A dot (.) above a variable signifies its rate of change.

Table 2. Explanation of Symbols Used in the Model

Endogenous Variables

y^d	Aggregate demand for real output
c^p	Private consumption
i^p	Private investment
g	Total government expenditure
T	Trade balance
t	Total tax revenues
r	Domestic nominal interest rate
R	Real profit
f	Foreign asset stocks
e	Nominal exchange rate
b	Nominal Domestic bonds (this variable is endogenous with the condition that $\dot{b} = 0$ in the long run)
p	Domestic price level
w	Domestic nominal wage
y^s	Aggregate supply of output
w^p	Real private sector wealth
k^p	Private capital stock
k^g	Actual public capital stock
q	Tobin's q
c	Real exchange rate
l	Real money balances
p	Inflationary expectations
B	Real domestic bonds

Exogenous variables

c^g	Government consumption
k^{g*}	Desired public capital stock
$y*$	World real income
$r*$	World nominal interest rate (also the world real interest rate since world prices (and hence inflation) is assumed exogenous (constant)
m	Nominal money supply

Asset market equilibrium is given by equations (10)-(14). Four financial assets should be addressed here, domestic money, domestic bonds, foreign bonds, and equities which determines the q ratio. Assets denominated in domestic currency and

foreign exchange are assumed to be perfect substitutes, with arbitrage between them resulting instantaneously in the same expected rate. Equation (10) identifies the demand for real money balances, which depends positively on the level of aggregate demand and domestic real wealth, and negatively on the domestic interest rate.

Equation (11) represents the real return on private capital, which depends positively on the level of real income (measured by output supply), negatively on the stock of private capital due to diminishing marginal returns, and positively on the stock of public capital. The latter holds because public capital and private capital are assumed here to be complementary in nature. The productivity of private capital rises as the government provides more public investment such as in the form of infrastructure (Aschauer, 1989).

Equation (12) identifies the change in Tobin's q ratio. It comes from the arbitrage condition equating the returns on domestic and foreign bonds and equities. Equation (13) describes private sector wealth, which depends positively on the real domestic currency value of domestically held foreign assets (f), on the value of the private capital stock $(k^p + q)$, on real money balances $(m - p)$, and on holding of real bonds $(b - p)$. Equation (14) defines the current account of the balance of payments, which is equivalent to the change in domestic holdings of foreign assets, which depends positively on the trade balance, foreign interest income ($r * f$), and negatively on the real exchange rate. In long run steady state the current account balance must be zero, otherwise further wealth effects will increase which in turn implies further macroeconomic adjustment.

The wage-price nexus and aggregate supply of output is given by equations (15)-(17). Equation (15) describes the domestic price level, which is a weighted average of domestic nominal wages and the world price of the imported good.

Equation (16) describes nominal wage adjustment, which adjusts in line with a simple inflation expectations augmented Phillips curve. Equation (17) identifies aggregate supply, derived from a simple production function relationship, and depends positively on the private capital stock, public capital stock, and negatively on the real wage rate.

Finally, equations (18)-(22) define the following. Equations (18)-(19), define two variables used in this model, the real exchange rate and real money balances respectively. Equation (20) shows that inflationary expectations depend upon the monetary growth rate. Equation (21) identifies the characteristic of a flexible exchange rate and perfect capital mobility. With a flexible nominal exchange rate the money stock is exogenously determined in the model. With perfect capital mobility the risk premium does not exist. Assets are assumed to be perfect substitutes, and arbitrage between them implies the same expected rate of return. Equation (22) defines real bonds. These definitions are useful for the solution of the model.

B. Steady State Properties and Dynamic Stability of the Model

1. Steady State Properties

The model possesses a number of analytically unambiguous properties for its steady-state solution, which are as follows:

$$\dot{m} = \dot{e} = \dot{w} = \dot{p} = 0$$

$$\dot{e} = r - r^* = 0$$

$$\dot{m} = p = 0$$

$$\dot{f} = 0;\ \dot{k}^p = 0;\ \dot{k}^g = 0;\ q = 0$$

$$\dot{b} = \dot{m} = \dot{p} = 0;\ \dot{b} = \dot{p} = 0$$

$$g = t$$

The model must exhibit dynamic properties which are consistent with its underlying behavioural assumptions, hence ensuring, in the context of this rational

expectations model, a stable saddlepath consistent with the attainment of long-run equilibrium. In the macroeconomic model developed there are six dynamic endogenous variables, namely: real money balances (l); foreign assets stocks (f); private capital stock (k^p); public capital stock (k^g); Tobin's q (q); and the real exchange rate (c). Four of which (l), (f), (k^p), (k^g) are assumed to be non jump variables whilst q and e, being determined in financial markets, are assumed to be jump variables.

The stability of the system depends only on the properties of the state matrix A. From matrix A the characteristic equation of the system can be obtained, and from this the characteristic roots (or eigenvalues) of the system derived. The signs of these will determine the stability of the system. With four non-jump and two jump control variables, the system is required to produce four negative (stable) roots and two positive (unstable) roots for a saddlepath solution to long-run steady state.

2. Dynamic Stability of the Model

There is only one unique dynamic saddlepath adjustment consistent with the underlying behavioural assumptions of the model. The stable saddlepath ultimately takes the system to a new equilibrium steady state. The macroeconomic model developed assumes that economic agents possess rational expectations (forward looking). This type of model is characterised by a stable saddlepath property, hence long run equilibrium can only be achieved if the economy is on the relevant stable saddlepath. The model has to exhibit properties that are consistent with the underlying behavioural assumptions of it. The dynamic equations of the model consist of a set of dynamic endogenous control variables, namely real money balances (l), foreign assets stocks (f), private capital stock (k^p), public capital stock (k^g), Tobin's q (q) and the real exchange rate (c). Tobin's q and the real exchange rate are assumed to be jump variables, they make discrete jumps, arising from exogenous shocks in order to put the economy on its unique new stable saddlepath, which will then take the economy to its long-run steady state.

The macroeconomic model operates under the assumptions of a flexible exchange rate and perfect capital mobility. The two jump variables, Tobin's q and the nominal exchange rate, are perfectly flexible and capable of adjusting on impact in order to maintain financial market equilibrium. In addition, the model assumes that financial markets clear instantaneously while non financial markets clear gradually and hence will be in disequilibrium during the adjustment process.

The macroeconomic model developed in this study can be written as a linear approximation of deviations around its equilibrium solution:

$$\dot{x} = Ax' + Bz$$

where z is a vector of exogenous variables, x' represents the deviation of x around its equilibrium value, and $\dot{x}$ is its time derivative. A and B represent parameter matrices.

The stability of the model depends upon the properties of the 'state' matrix (A). Stability of the model depends upon the determinant of matrix A being a particular sign. The determinant of A gives the product of the roots of the system. The long run macroeconomic model developed in this study with six endogenous control variables, will produce six roots, two (Tobin's q, and the nominal exchange rate) of the six control variables are jump variables and will be associated with positive characteristic roots that impart instability into the system. Hence the determinant of A must be positive. The remainder of the dynamic control variables are non-jump variables, which are associated with negative characteristic roots that impart stability to the system. These conditions are satisfied for the simulation results, which will be presented.

III. Simulation Results

The analysis of the steady state and dynamic properties of the model is calibrated through the use of the numerical values of the parameters of the model. The parameter values utilised are those identified in Table 3.

Three scenarios arising from exogenous shocks and their impact upon six macroeconomic variables are presented in this section.

The results of each shock upon the adjustment of key macroeconomic variables are presented in Figures 3 to 5. The horizontal axis contains the time period and the vertical axis indicates the percentage deviation of that variable from baseline, its initial value. Each diagram is divided into four adjustment periods. The impact period occurs immediately on the occurrence of the exogenous shocks. The short run period, which is assumed to occur over a period of two years[1], the medium run period is assumed to occur from two to four years and the long run period is assumed to occur from four years onwards until steady state is achieved.

Table 3. Parameter Values

$a_1 = 1$	$s_2 = 0.2$
$a_2 = 0.1$	$g_1 = 0.5*$
$a_3 = 1$	$g_2 = 0.5*$
$a_4 = 0.1$	$g_3 = 0.5*$
$c_1 = 0.4$	$d_1 = 0.5*$
$c_2 = 0.2$	$d_2 = 0.5*$
$h = 0.7*$	$d_3 = 0.5*$
$y = 0.7*$	$\Omega_1 = 0.7$
$b_1 = 0.02$	$\Omega_2 = 0.6*$
$b_2 = 0.8$	$\Omega_3 = 0.6$
$b_3 = 0.6$	$\Omega_4 = 0.1$
$a_1 = 0.2$	$e_1 = 0.2$
$a_2 = 0.1$	$e_2 = 0.6$
$t = 0.8$	$d = 0.4$
$m_1 = 0.6$	$f_1 = 0.7*$
$m_2 = 0.4$	$f_2 = 1.0*$
$m_3 = 0.4$	$l_1 = 0.2$
$s_1 = 0.2$	$l_2 = 0.2$
$s_2 = 0.2$	$l_3 = 0.2$

* Imposed Parameters, Harvie and Kearney (1996). The rest of above parameters are estimated coefficients, which conducted by the author for the Lebanese economy.

[1] Assumed here to be equivalent to 8 time periods – each time period assumed to be a quarter of a year.

A. Simulation Results Arising from an Expansion in Public Capital Expenditure

The purpose of this section is to analyse the effects of an expansion in capital expenditure on the Lebanese macroeconomy, for two cases:

Case 1. An instantaneous and unanticipated increase in public capital expenditure by 3%, which occurs immediately in the impact period (0').

Case 2. A gradual increase in public capital expenditure. The presumed increase in public capital expenditure is that of a 1% increase from its baseline on impact, then it is assumed to increase to 2% from its baseline in period 8 (the end of the short run period), and then an increase to 3% from baseline in period 12.

In both cases it is assumed that the budget deficit in Lebanon is financed partly through a temporary increase in the monetary growth rate by 2% (monetary growth is assumed to rise to 2% on impact, and then gradually declines and ends in period 12), and through an endogenous expansions of bonds.

The results of both cases are presented in Figure 3. All results for each variable are expressed as percentage deviations from their baseline values. The main finding from the simulation results, for the two cases assumed (unanticipated/gradual increase in public capital expenditure), is that this policy has some positive effects upon Lebanese economic development. The major benefits from such an approach are in regard to an increase in the q ratio, which has a positive impact on private sector investment, resulting in a large accumulation of private capital stock during the adjustment process. This also stimulates the supply side of the economy (crowding in effect). It is noticeable that the simulation results indicate that the private capital stock and aggregate supply increase in both cases during the adjustment process, but with larger volatility in case 1.

This policy has other advantages for the Lebanese economy, implying a gain of competitiveness and a better external performance on the trade and current accounts (due to a depreciation in the real exchange rate) and hence decreasing

external borrowing. It is worth noting here as well that during the adjustment process the real exchange rate depreciates in both cases, but with less volatility in case 2. The disadvantage of this policy appears to be in the first year of the short run period. Here the rate of inflation in both cases is pushed up towards the baseline after an initial downturn due to the increase in aggregate demand being more than aggregate supply, in addition to the financing of the deficit through monetary growth.

The interest rate is higher as well during the first year of the short run period because of the increase in public spending arising from the funding component through bond sales; this increase in public spending stimulates aggregate demand for output and for money. But over the long run period, and where the monetary growth rate ends in financing the deficit in period 12 while maintaining the assumption that the deficit is financed through endogenous expansions on bonds, the rate of inflation falls back towards the baseline. The interest rate falls back as well towards the baseline, and shows little sensitivity to bond financing after period 12. Another important conclusion from this policy, in the context of the Lebanese economy, is that money deficit financing is inflationary, and shows large sensitivity in terms of interest rates. Bond financing a deficit is non inflationary and shows little sensitivity in terms of interest rates. Furthermore, it can be concluded from the simulation results that this policy produces a positive impact upon almost all the key macroeconomic variables under consideration during the adjustment process towards the long run steady state. But it is noticeable that this policy produces the largest positive impact during the first year of the short run period in terms of domestic improvements as well as external improvements. Hence if the government gives priority to short-term policy outcomes this simulation result supports such a policy. The preferred approach by the government should be case 2 (gradual approach), because this produces considerably less volatility in terms of the major macro outcomes.

B. Simulation Results Arising from an Expansion in Government Consumption Expenditure

This subsection will examine the effects of an expansion in government consumption expenditure on key Lebanese macroeconomic variables, by assuming the following two cases:

1. An instantaneous and unanticipated increase in government consumption expenditure by 3%, which occurs immediately.

2. A gradual increase in government consumption expenditure. The presumed increase in government expenditure is 1% on impact, rising to 2% in period 8, and further increasing to 3% in period 12 (the first year of the medium run period).

In both cases it is assumed that the budget deficit in Lebanon is financed through a temporary increase in the monetary growth rate by 2% (the monetary growth is assumed here to increase 2% on impact, and then gradually falls and then ends in period 12), and through bond financing as well (bond financing is assumed to be endogenously determined).

The simulation results in both cases are reported in Figure 4. However, the simulation results arising from an expansion in government consumption expenditure for the two cases assumed, suggests that it could have some advantages and some disadvantages for Lebanese economic development. The advantage of this policy appears to be during the first year of the short run period in terms of domestic improvement, where both the private capital stock and aggregate supply increase. But by the end of the short run period the private capital stock and aggregate supply decline from their initial increase in both cases (to below the baseline in case 2, but above the baseline in case 1). The disadvantage of this policy appears to be during the adjustment process, where the trade balance deteriorates in both cases because of the appreciation in the real exchange rate. This deterioration in the trade balance implies a loss of competitiveness and a deterioration in the external performance, trade and current account balance, hence exacerbating foreign debt. However, as can be seen from these simulation results,

this policy appears to have some positive effects in terms of domestic improvements during the adjustment process towards long run steady state. But in terms of external developments this policy produces adverse effects during the adjustment process towards long run steady state. It is noticeable, as well, that this policy produces a large positive impact during the first year of the short run period in terms of domestic developments. The rate of inflation falls on impact but subsequently rises as aggregate demand increases faster than aggregate supply. Hence, if the government considers a short-term policy in order to improve only domestic developments such as private investment and aggregate supply, this simulation suggests support for such an approach. However, the government should pay particular attention to the adverse effects of this policy in terms of external developments, especially foreign asset stocks which deteriorate in line with exacerbating foreign debt. Another important conclusion from this simulation scenario is that the government should adopt case 2 (gradual approach) because it produces less volatility in terms of the major macro outcomes.

However, a comparison between the simulation results for the first policy option (expansion in capital expenditure) and the second policy option (expansion in government consumption expenditure) indicates a number of suggestions for policy implementation, as follows:

a. Implementing the policy of an expansion in capital expenditure produces a larger favourable impact in terms of private sector investment, and in terms of the supply side of the economy (crowding in effect) during the whole adjustment process towards long run steady state. The policy of expansion in government consumption expenditure does not produce such a positive effect during the whole adjustment process, because this policy produces an unfavourable effect in terms of private investment and aggregate supply (crowding out effect) during periods 7 to 11.

Overall, the policy of an expansion in capital expenditure compared favourably to the other policy during the whole adjustment process. In terms of external developments it resulted in a gain of competitiveness and a better

performance externally, trade and current account (due to a depreciation in the real exchange rate) as well as an accumulation in foreign asset stocks, hence decreasing external borrowing. The policy of an expansion in government consumption expenditure produced an unfavourable effect in terms of external developments during the adjustment process, the trade balance deteriorated in line with a deterioration in foreign asset stocks as a result of current account deficits implying an increase in foreign debt.

b. Implementing the two policies (expansion in capital expenditure/government consumption expenditure) produces a similar outcome in terms of the interest rate and the rate of inflation. However, both policies produce higher inflation during the short run period due to the increase in aggregate demand being more than aggregate supply, in addition to the financing of the deficit through monetary growth. The interest rate is higher as well during the first year of the short run period (lower on impact) due to the increase in public spending arising from the funding component through bond sales; this increase in public spending stimulates aggregate demand for output and money. However, the simulation results for the two policies indicate that money deficit financing is inflationary and shows large sensitivity in terms of interest rates. Bond financing is non inflationary and shows little sensitivity in terms of interest rates.

It can be concluded from the above discussion that if the government considers a fiscal expansion policy in order to improve macroeconomic performance, the simulation results suggest that the government should adopt the policy of an expansion in capital expenditure because it produces the most desirable outcomes. In addition, it should adopt a gradual approach because this produces considerably less volatility in terms of major macro outcomes.

C. Simulation Results Arising from the Lebanese Government's Approach to Dealing with the Financial Crisis

This scenario focuses upon the Lebanese government's policy approach in response to the development of the financial crisis in Lebanon. The policies, or government plan, to deal with this crisis, as assumed here, are as follows.

First, tightening fiscal policy by reducing public capital expenditure as well as government consumption expenditure by assuming a 3%[2] decline. This reduction could occur by assuming two cases: case 1 - an instantaneous and unanticipated decline in capital expenditure as well as government consumption expenditure which occurs immediately in the impact period; case 2 – a gradual decline in these expenditures (1% decline from its baseline on impact, then a further decline by 2% from baseline in period 8, and then a 3% decline from baseline in period 12.

Second, an expansionary monetary policy by assuming an instantaneous and unanticipated increase in the monetary growth rate by 3% (case 1), as well as gradual increase in the monetary growth rate (case 2). The presumed increase in the monetary growth in case 2 is that of a 1% increase from its baseline on impact, then it is assumed to increase to 2% from baseline in period 8, and to further increase to 3% from baseline in period 12

Third, increasing government revenues through increased taxes by assuming an increase in the parameter value for the tax revenue equation (equation 8 in the macroeconomic model developed in Chapter 5) from $t = 0.5$ to $t = 0.8$.

The results of this policy, for these two assumed cases, are reported in Figure 5. As shown in this Figure, implementing the government policy approach for both cases (unanticipated/gradual) results in adverse effects on almost all the key macroeconomic variables under consideration during the whole adjustment process towards long run steady state. This policy produces the largest negative impact during the short run period in terms of private capital stock, aggregate supply and foreign asset stocks. However, over the whole adjustment process,

[2] This study has chosen 3% for the simulation because it is in the middle of the feasible range of 1% to 5%.

towards long run steady state, this policy has adverse effects in regard to a decline in private sector investment and in the supply side of the economy (crowding out effect). It is noticeable from the simulation results that the private capital stock and aggregate supply decline in both cases during the adjustment process, but with less volatility in case 2. Another cost of this policy is that the trade balance deteriorates in both cases during the adjustment process because of the appreciation in the real exchange rate. This deterioration in both cases also results in a deterioration in foreign asset stocks and current account balances, thereby adding to foreign debt. It is worth noting here that the decline in the trade balance in case 1 is slightly larger than that in case 2, due to a larger real exchange rate appreciation in case 2. The rate of inflation in both cases is pushed up despite the decline in aggregate supply, and this is due to the permanent increase in the monetary growth rate. The minor advantage of this policy appears to be over the impact period because aggregate supply improves in both cases with a larger magnitude in case 1 (unanticipated), despite an unchanged private capital stock.

However, it is clear from the simulation results that, in order to minimise the adverse effects of this policy, the government should adopt a gradual approach because it leads to much less macroeconomic volatility. Another important conclusion from such a policy is that if the government in Lebanon considers applying this approach over a short term period, the simulation results indicate that it will have the largest negative impact over the short run period in terms of private investment, aggregate supply, and foreign asset stocks. Another important finding that the government should be aware of is that this policy has the largest problem in terms of higher inflation, and this in turn exacerbates Lebanon's economic difficulties.

Summary and Conclusions

The main focus of this chapter was to simulate the macroeconomic model developed in this paper, and to analyse the adjustment process arising from various exogenous shocks, or scenarios, in the context of the Lebanese fiscal crisis. The

objective being to identify policies that reduce the macroeconomic consequences of these shocks and hence improve the macroeconomic performance in Lebanon.

Because of the complexity of the model, the analysis of the steady state and dynamic properties of the model was conducted through the use of a numerical simulation procedure. Simulations require the specification of values for the numerous parameters in the model. Unfortunately these values are not available for Lebanon, therefore they were estimated by the author and from those imposed (Harvie and Kearney, 1996) because of data limitations or in order to ensure stability of the model.

The main finding from our paper is that if the government considers an expansionary fiscal policy in order to improve macroeconomic performance, the simulation results suggest that the government should adopt the policy of an expansion in capital expenditure because it produces the most desirable outcomes. In addition, it should adopt a gradual approach because this produces considerably less volatility in terms of major macro outcomes.

The main findings from our simulation results dealing with the government approach to the fiscal crisis, does not support the government policy in dealing with the crisis. The results presented here suggest that it produces the most undesirable economic outcomes, and hence will only exacerbate Lebanon's economic difficulties. However, if the Lebanese government is willing to go ahead with this approach, it is advised that, based upon the results presented here, in order to minimise the adverse effects of this policy the government should adopt a gradual approach because it leads to much less macroeconomic volatility. Another important conclusion from such a policy is that if the government in Lebanon considers applying this approach over a short term period, the simulation results suggest that this will have the largest negative impact over the short run period in terms of private investment, aggregate supply, and foreign asset stocks. Another important outcome that the authorities should be aware of is that this policy has the largest problems in terms of higher inflation, and this in turn exacerbates Lebanon's economic difficulties.

It is important to point out that this study is aware that there are other aspects (policy options) such as privatisation, borrowing from abroad (with lower interest rates compared to domestic rates), and income tax which are important in the context of the Lebanese fiscal crisis. But because of the already complex nature of the model, these scenarios are left for further research.

Figure 3. Expansion in Public Capital Expenditure (Case 1 and Case 2)

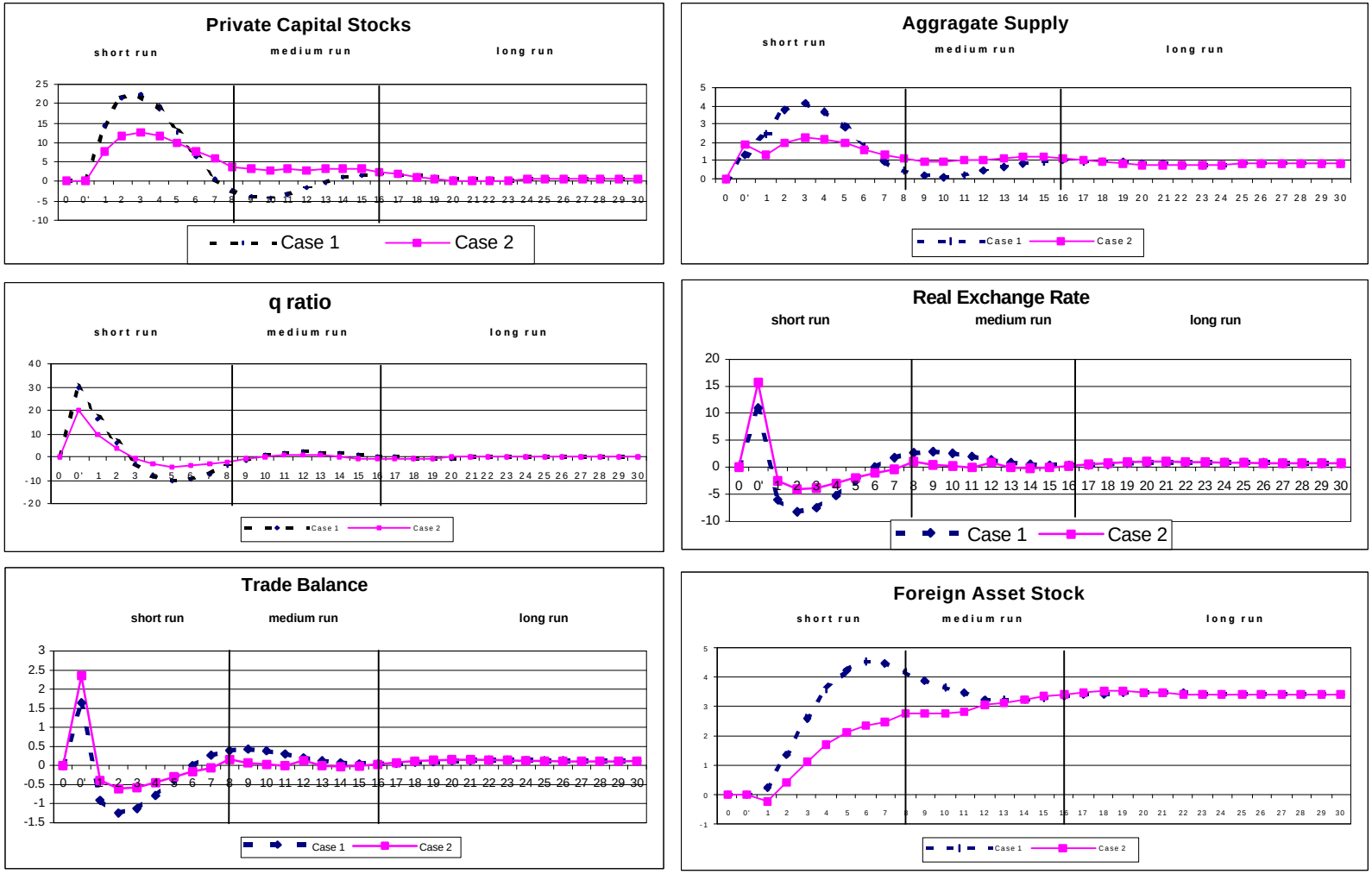


Figure 4. Expansion in Government Consumption Expenditure (Case 1 and Case 2)

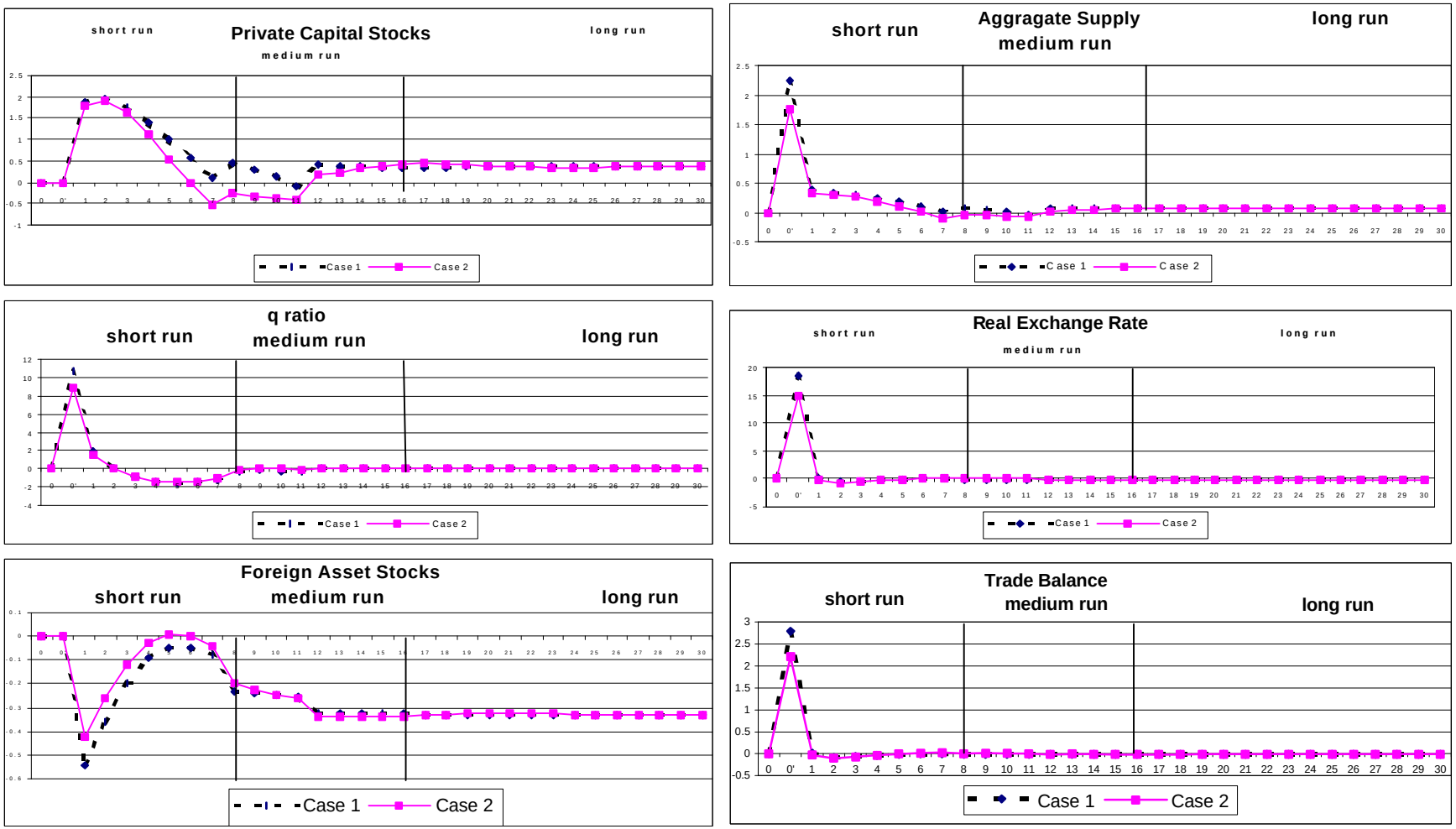
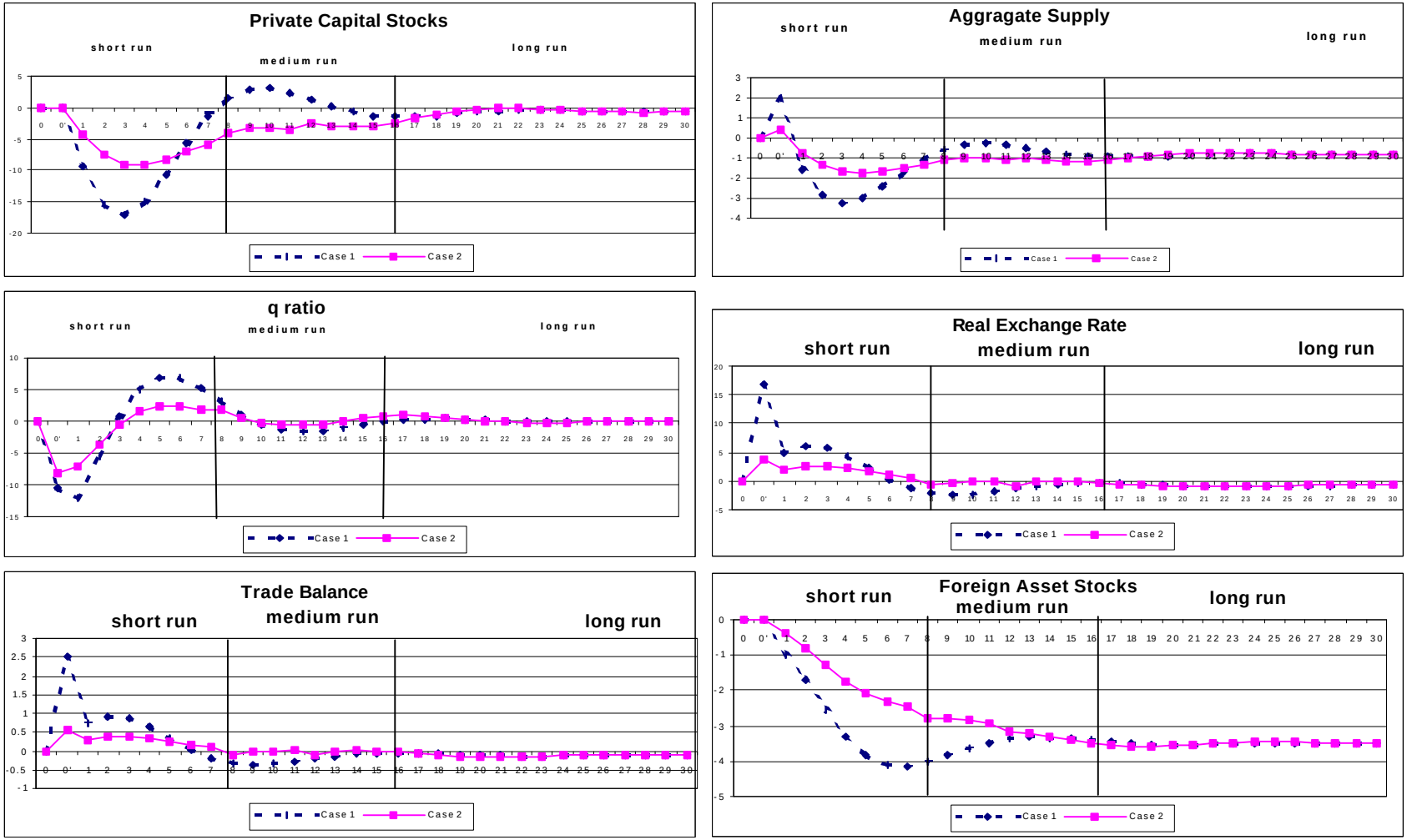


Figure 5. Government Policy Approach (Case 1 and Case 2)



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