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Budget Deficits and Money Growth in Jordan

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ABSTRACT

This study examines empirically the relationship between money growth and budget deficits in Jordan for the sample period 1968–1992, using seemingly unrelated regression technique. The results yield empirical evidence supporting the hypothesis that the relationship between money growth and budget deficits exhibits causation running from money to budget deficits and from budget deficits to money. This result is inconsistent with the fact that monetary and fiscal policy were set independently. Finally, the results show evidence that unrequited transfers and workers' remittances have an impact, which is positive and statistically significant on money growth.

INTRODUCTION

By 1988 Jordan had encountered serious macroeconomic imbalances. The very rapid buildup of external commercial and official debt from 1980 onward has resulted in serious debt service problems. The total value of outstanding external debts had reached little above U.S. $9 billion. More ominously, there were indications that Jordan had reached or even surpassed its capacity to service further debt.

The debt crisis in Jordan attracted a great deal of attention in international aid agencies and policy circles alike. Attempts to correct the macroeconomic imbalances have been assisted by the IMF and World Bank. These attempts aim to trim large budget deficits, bring the money supply under control, and bring foreign payments into balances. The policy tools employed include higher taxes, reduced subsidies, and reduced growth of wages.

The large budget deficits experienced in the past two decades

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employment budget deficits to represent fiscal policy, (c) the unrequited transfers plus workers' remittances to represent policy concerns over external balance,(*) and (d) a dummy variable to identify the impact of supply shocks on the stock of high-powered money or deficit. The basic data come from the International Financial Statistics of the International Monetary Fund and the Central Bank of Jordan Monthly Statistical Bulletins, (1993).(*)

The autoregression model for this process can be expressed as:

$$DMB_t = a_1 + \sum_{i=1}^{11} b_{1i}\, DMB_{t-i} + \sum_{i=0}^{12} c_{1i}\, NDEF_{t-i} + \sum_{i=0}^{13} d_{1i}\, DUT_{t-i} + f_1 D_t + e_{1t} \quad (1)$$

$$NDEF_t = a_2 + \sum_{i=0}^{14} b_{2i}\, DMB_{t-i} + \sum_{i=1}^{15} c_{2i}\, NDEF_{t-i} + \sum_{i=0}^{16} d_{2i}\, DUT_{t-i} + f_2 D_t + e_{2t} \quad (2)$$

Where $DMB_t = \log (MB_t / MB_{t-1})$, MB_t is the monetary base; $NDEF_t = \{def/(P_t^* NRGNP_t)\}$, where def is the difference between government expenditures and central government domestic revenues, P_t is the gross domestic product deflator, and NRGNP is the trend value of real GNP; $DUT_t = \log (UT_t / UT_{t-1})$, UT_t is the unrequited transfers plus workers' remittances; D_t is a dummy variable represents the supply shocks ($D_t = 1$ in 1970, 1988, 1991 and $D_t = 0$ otherwise);(**) e_{1t} and e_{2t} are white noise error terms.

The first step in the analysis is to specify the appropriate lag structure for each equation in the VAR system using the ordinary least squares. In this context, Akaike's Information Criterion (AIC) and Schwarz's criterion (SC) are used. The AIC and SC from a model with k parameter are defined as:

$$AIC(k) = \log (RSS/T) + 2k/T \quad (3)$$

(*) This concern arises from the fact that unrequited transfers as well as workers' remittances are used to help the government to cope with the rise in import prices and meet foreign debt services.

(*) For the sample period 1968–1989, the basic data come from the International Financial Statistics of the International Monetary Fund, Annual Book, 1993. But, for the sample period 1990–1992, the basic data come from the Central Bank of Jordan Monthly Statistical Bulletin, Vol. 29 (12), December 1993.

(**) 1970 was the year of the political instability. 1988 was the year of the foreign exchange deterioration. 1991 was the year of the returnees from Kuwait and other gulf countries.

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$$SC(k) = \log (RSS/T) + k^{*}\log (T)/T \qquad (4)$$

where RSS is the sum of squared errors, and T is the number of points in time. The AIC and SC criteria assume a minimum when the appropriate order of the model is reached. Second, the orders of bivariate regressions are determined in a regression equation consisting of the appropriate own lag and each of the two lags of the remaining two variables, considered one at a time. If none of the AIC or SC values calculated for a particular variable are smaller than the minimum AIC or SC calculated in the first step, that variable is dropped from the equation. The process continues until all variables under consideration have either been added to the model or dropped from the analysis.

The above procedure continues until each of the two equations have been specified. Third, the two equations are combined to form a system of SUR. Finally, on the basis of the SUR estimates, the joint tests of parameter significance is performed using the Wald F-test.

According to Granger, (1969), the government budget deficit is said to Granger-cause monetary base if the error in predicting DMB_t based on the past of DMB_t and current and past values of $NDEF_t$ is smaller than the error in predicting DMB_t based on its past alone. A test of the hypothesis that $NDEF_t$ does not Granger-cause DMB_t can be conducted by testing the null hypothesis that $c_{10} = c_{11} = \ldots = c_{1j} = 0$. This test can be performed by applying the Wald F-statistic of the form.

$$F = \frac{(RSS_r - RSS_u)/J}{RSS_u/(2T - K)} \qquad (5)$$

Is computed, where RSS_r is the error sum of squars from restricted least squares estimation when the above constraint is implied, RSS_u is the error sum of squares from unrestricted estimation, and J is the number of restrictions. When this value exceeds the critical value from an F-distribution with [J, (2T–K)] degrees of freedom, the null hypothesis is rejected.

EMPIRICAL RESULTS

The first step in the analysis begins by using the ordinary least squares procedure to estimate each one of the two equations. Appendix 1 shows estimates of equation (1) with DMB_t as the dependent variable. Both the AIC and SC are found to assume a minimum when DMB_t is regressed on one lag of its own, current and one lag of $NDEF_t$, current and two lags of DUT_t, and

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D_t; see column 8.

In the model in column 8, base money growth (DMB_t) appears to be associated with increases in the variables $NDEF_t$, DUT_t, DU_{t-1}, and D_t. The point estimate is that a one unit increase in $NDEF_t$ is associated with a contemporaneous increase in base money growth of 0.47 unit. This finding provides empirical evidence supporting the accommodation hypothesis at the 5% level of significance.

The impact of unrequited transfers and workers' remittances on the stock of high-powered money also appears to be positive and significant at commonly used significance levels. The point estimate is that a one percentage point increase in the unrequited transfers or workers' remittances is eventually associated with an increase of 0.18 percentage point increase in base money growth. Furthermore, the results make clear that the impact of DUT_t and its lagged value appear to be the same on the stock of high-powered money. Finally, the coefficient on D_t shows that base money growth attained extremely large values during the years of supply shocks. It is quite possible that the monetary authority reacts differently in abnormal years more than in normal ones. The estimated regression model shows high explanatory power ($R^2 = 0.816$).

Similarly, Appendix 2 reports the ordinary least squares results of equation (2) with $NDEF_t$ as the dependent variable. The AIC as well as the SC criteria are found to reach a minimum when the $NDEF_t$ is regressed on one lag of its own, current and one lag of DMB_t; see column 4. The results yield empirical evidence supporting the existence of a contemporaneous positive association between base money growth and budget deficits. The point estimate is that a one unit increase in the base money growth is eventually associated with an increase of 0.18 unit in the budget deficit. However, this positive response does not last long, and then turns to be negative after one year. This result suggests that one cannot reject the reverse (Barro) hypothesis that money growth affects budget deficit. The supply shocks turn out to have a negative impact, which is statistically significant at the 5% significance level. The basic reason for this negative association between supply shocks and budget deficits may be due to the government attempts assisted by the IMF and World Bank to trim budget deficits by reducing government spending and increasing revenue during these abnormal years.

The analysis, now turns, to focus on the results of the autoregressive model estimated on the basis of implementation of a (VAR) modeling technique. Equations 1 and 2 are combined to form a system of seemingly

unrelated regression model. As shown in (Table 1), the efficiency gained by using SUR modeling technique has improved the significance of the parameters*. This efficiency is due to the fact that the SUR technique takes into account the cross-correlation between error terms e_{1t} and e_{2t} that may exist.

The relation between budget deficits and base money growth appears statistically significant at the 1% level of significance. The point estimate is that a one unit increase in the deficit is eventually associated with an increase of 0.17 unit in base money growth. This finding suggests evidence supporting the accommodation hypothesis.

Another important factor which exerted a noticeable impact on the stock of high-powered money was large autonomous inflows of unrequited transfers and workers remittances into Jordan. The relation between base money growth and the unrequited transfers and workers' remittances appear to be positive and statistically significant, and of the same magnitude.

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(*) This can be seen from comparing the results of model 1 in (Table 1) with those obtained in appendix 1 (column 8), and appendix 2 (column 4).

Table 1: Estimates of equations (1) and (2) combined using seemingly unrelated regressions technique.

Estimates	Model 1	Model 2	Model 3	Model 4	Model 5
a_1	0.016	0.049[b]	0.026	0.044[b]	–0.002
	(0.61)	(2.54)	(0.99)	(2.61)	(0.06)
b_{11}	0.405[a]	0.231	0.322[b]	0.309[b]	0.594[a]
	(3.63)	(1.66)	(2.81)	(2.63)	(4.49)
c_{10}	0.680[a]		0.66[a]		0.905[a]
	(5.53)		(3.44)		(6.30)
c_{11}	–0.511[a]		–0.345[b]		–0.649[a]
	(3.36)		(2.16)		(3.39)
d_{10}	0.065[b]	0.102[b]	0.089[b]	0.091[b]	
	(2.31)	(2.67)	(2.88)	(2.63)	
d_{11}	0.067[b]	0.134[a]	0.092[b]	0.100[a]	
	(2.30)	(3.63)	(2.86)	(3.20)	
d_{12}	0.041	0.062	0.057	0.059	
	(1.49)	(1.66)	(1.83)	(1.86)	
f_1	0.183[a]	0.184[a]	0.186[a]	0.187[a]	0.169[a]
	(6.80)	(5.63)	(6.86)	(5.57)	(4.82)
a_2	0.008	0.014	0.013	0.022	0.007
	(0.24)	(0.43)	(0.34)	(0.63)	(0.20)
b_{20}	0.803[a]	0.542[a]			0.886[a]
	(5.06)	(3.29)			(6.30)
b_{21}	–0.503[a]	–0.369[b]			–0.545[a]
	(3.28)	(2.38)			(3.67)
c_{21}	0.763[a]	0.800[a]	0.870[a]	0.828[a]	0.751[a]
	(5.30)	(5.57)	(4.82)	(5.39)	(5.23)
f_2	–0.140[a]	–0.100[a]	–0.011	–0.014	–0.153[a]
	(3.30)	(2.32)	(0.25)	(0.33)	(3.74)
Summary Statistics					
R_1^2	0.791	0.714	0.816	0.702	0.642
R_2^2	0.714	0.723	0.547	0.547	0.704
RSS_1	0.027	0.037	0.024	0.038	0.049
RSS_2	0.045	0.063	0.070	0.070	0.048

Figures in parentheses are t-ratios

a Significant at the 1% level

b Significant at the 5% level

R_1^2 and R_2^2 represent the coefficient of determination of equations 1 and 2, respectively.

RSS_1 and RSS_2 are the error of sum squares of equations 1 and 2, respectively.

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For the previous alternative hypotheses to be tested, 5 models are formed and then estimated. Model 1 represents the unrestricted model; model 2 represents the restricted model in which ($c_{10} = c_{11} = 0$); model 3 represents the restricted model in which ($b_{20} = b_{21} = 0$); model 4 represents the restricted model in which ($c_{10} = c_{11} = 0$, and $b_{20} = b_{21} = 0$); model 5 represents the restricted model in which ($d_{10} = d_{11} = d_{12} = 0$).

Table 2 summarizes a series of specification tests. Test 1 imposes zero restrictions on the non-zero elements of money growth ($c_{10} = c_{11} = 0$). This test implies that budget deficits do not Granger-cause money, which can be performed by computing the Wald F-statistics in equation (5). The 5% critical value of an F distribution with [2, (31)] degrees of freedom is 3.31. The value of the Wald F-statistic computed on the basis of equation (5) is 5.597. This finding provides evidence supporting the reverse (Barro) hypothesis that base money growth Granger-cause budget deficits. Interestingly, when hypotheses 1 and 2 are examined jointly, the Wald F-statistic computed from the data yields evidence suggesting bidirectional causation running from money to budget deficits and from budget deficit to money. This finding is inconsistent with the fact that monetary and fiscal policy were set independently.

Test 4 indicates that the unrequited transfers and workers' remittances affect money growth. This finding shows that there is quite concern on the part of monetary policy for other policy goals such as external balance policies. Finally, tests 5 through 7 examine the impact of supply shocks on money growth and budget deficits individually and jointly. The results obtained in light of these tests indicate the impact of supply shocks on monetary base.

Table 2: Granger Tests Results.

Hypotheses	Wald F-test statistic	Degrees of freedom	Critical F-test statistic 5%
H_1: $c_{10} = c_{11} = 0$	5.597[a]	[2, (31)]	3.31
H_2: $b_{20} = b_{21} = 0$	4.613[b]	[2, (31)]	3.31
H_3: H_1 and H_2	3.909[b]	[4, (31)]	2.68
H_4: $d_{10} = d_{11} = d_{12} = 0$	3.467[b]	[3, (31)]	2.91
H_5: $f_1 = 0$	22.002[a]	[1, (31)]	4.16
H_6: $f_2 = 0$	3.686	[1, (31)]	4.16
H_7: $f_1 = f_2 = 0$	15.220[a]	[2, (31)]	3.31

a Significant at the 1% level.

b Significant at the 5% level.

The data seem to suggest that for the sample period studied here, the apparent positive relation between budget deficit and money growth is due to their common correlation with the level of aggregate economic activity. In addition, the government seems to have expanded the stock of base money some what more rapidly in an attempt to stabilize the level of economic activity. For this one may argue that the resulting positive association between the deficit and money growth may be purely fortuitous rather than the result of a conscious attempt to monetize the deficit.

SUMMARY AND CONCLUDING REMARKS

This study uses a vector autoregression (VAR) analysis to examine the relationship between money growth and budget deficits in Jordan for the sample period 1968–1992. The results provide evidence supporting the accommodation hypothesis as well as the reverse (Barro) hypothesis. This finding is consistent with the notion that the relationship between money growth and budget deficit exhibits causation running from money to deficit and from deficit to money.

The positive and significant association between money growth and unrequited transfers and workers' remittances is consistent with the concern of monetary policy over external balances. This implies that the inflow of the foreign exchange continued to help the Central Bank to maintain the foreign exchange rate of the Jordanian dinar relatively stable against the major foreign currencies. Therefore, the inflow of foreign currencies might encourage the monetary authority to partly finance the government spending by outside money. Moreover, the impact of supply shocks is found to have an impact which is statistically positive on base money growth and negative on budget deficits. This finding suggests that during periods of supply shocks, government expenditures are partly financed by money creation.

The findings of this study appear to be consistent with those applied to the U.S data. However, the lack of data does not allow the researcher to test for the stability of these relations. Future research could specify and estimate the larger structural macroeconomic models that are indicated by the specification tests used throughout this study.

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Appendix 1: Ordinary least square results of equation 1 with base money growth, DMB_g as the dependent variable.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
CONS	0.045	0.044	–0.011	0.023	0.007	0.054	0.032	0.026
	(1.54)	(1.36)	(0.28)	(0.61)	(0.14)	(0.66)	(0.98)	(0.79)
DMB_{t-1}	0.541[b]	0.498[b]	0.541[a]	0.596[a]	0.564[a]	0.513[a]	0.410[b]	0.322[b]
	(2.94)	(2.28)	(3.16)	(3.86)	(3.49)	(3.33)	(2.81)	(2.24)
DMB_{t-2}		0.060						
		(0.27)						
$NDEF_t$			0.297	0.655[a]	0.625[a]	0.640[a]	0.492[b]	0.466[b]
			(2.02)	(3.32)	(3.15)	(3.42)	(2.66)	(2.75)
$NDEF_{t-1}$				–0.541[b]	–0.390	–0.531[b]	–0.432[b]	–0.345
				(2.44)	(1.35)	(2.51)	(2.18)	(1.72)
$NDEF_{t-2}$					–0.019			
					(0.08)			
DUT_t						0.080	0.087	0.089[b]
						(1.72)	(2.07)	(2.30)
DUT_{t-1}							0.093	0.092[b]
							(2.11)	(2.28)
DUT_{t-2}								0.057
								(1.46)
D_t	0.114[b]	0.144[a]	0.123[a]	0.133[a]	0.165[a]	0.147[a]	0.160[a]	0.186[a]
	(2.81)	(2.98)	(3.12)	(3.88)	(4.00)	(4.38)	(5.13)	(3.47)
Summary Statistics								
R^2	0.388	0.438	0.496	0.621	0.663	0.677	0.747	0.816
$\overline{R}^2$	0.327	0.345	0.417	0.537	0.558	0.583	0.683	0.724
RSS	0.078	0.072	0.065	0.049	0.043	0.041	0.032	0.024
T	23	22	23	23	22	23	23	22
F	6.351	4.68	6.24	7.38	6.30	7.14	7.89	8.85
AIC	–5.421	–5.358	–5.528	–5.726	–5.688	–5.799	–5.957	–6.110
SC	–5.273	–5.160	–5.330	–5.479	–5.391	–5.503	–5.612	–5.713

Figures in parentheses are t-ratios.

a is significant at the 1% level.

b is significant at the 5% level.

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Appendix 2: Ordinary least square results of equation 2 with budget deficits, $NDEF_t$, as the dependent variable.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
CONS	0.021	0.016	–0.018	0.006	0.013	0.003	0.004	–0.002
	(0.56)	(0.32)	(0.49)	(0.16)	(0.33)	(0.09)	(0.11)	(0.04)
$NDEF_{t-1}$	0.834[a]	0.886[a]	0.811[a]	0.836[a]	0.851[a]	0.837[a]	0.835[a]	0.818[a]
	(4.97)	(3.46)	(5.28)	(6.01)	(5.00)	(5.98)	(5.76)	(4.68)
$NDEF_{t-2}$		–0.027						
		(0.10)						
DMB_t			0.360[b]	0.581[a]	0.616[a]	0.636[a]	0.624[b]	0.751[b]
			(2.22)	(3.32)	(3.30)	(3.42)	(2.66)	(2.75)
DMB_{t-1}				–0.398[b]	–0.307	–0.384[b]	–0.383[b]	–0.358
				(2.31)	(1.58)	(2.20)	(2.13)	(1.89)
BMB_{t-2}					–0.213			
					(1.16)			
DUT_t						–0.044	–0.042	–0.057
						(0.90)	(0.80)	(1.01)
DUT_{t-1}							–0.005	–0.010
							(0.10)	(0.17)
DUT_{t-2}								–0.046
								(0.89)
D_t	–0.022	–0.011	–0.051	–0.094[b]	–0.103	–0.109[b]	–0.106	–0.138
	(0.61)	(0.23)	(1.41)	(2.51)	(2.10)	(2.65)	(2.10)	(2.06)
Summary Statistics								
R^2	0.558	0.547	0.649	0.730	0.746	0.742	0.742	0.753
$\bar{R}^2$	0.514	0.472	0.594	0.669	0.667	0.657	0.645	0.629
RSS	0.070	0.070	0.056	0.043	0.039	0.040	0.040	0.038
T	23	22	23	23	22	23	23	22
F	12.64	7.25	11.72	12.14	9.41	9.76	7.66	6.08
AIC	–5.530	–5.391	–5.674	–5.847	–5.789	–5.506	–5.719	–5.632
SC	–5.382	–5.193	–5.476	–5.600	–5.491	–5.506	–5.374	–5.235

a is significant at the 1% level.

b is significant at the 5% level.

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عجز الموازنة والنمو النقدي في الأردن

تاريخ استلام البحث ١٩٩٤/٦/٦ تاريخ قبوله ١٩٩٤/٣/١٣

سعيد الخطيب*

ملخص

تختبر الدراسة العلاقة بين النمو النقدي والعجز في الموازنة الأردنية للفترة الزمنية ١٩٦٨-١٩٩٢ باستخدام اسلوب (Seemingly Unrelated Regression). تظهر النتائج ان عجز الموازنة يؤثر إيجابياً على نمو القاعدة النقدية. وكذلك فإن نمو القاعدة النقدية يؤثر بنفس الاتجاه على عجز الموازنة. تتفق هذه النتيجة مع الفرضية القائلة إن هناك اثراً راجعاً بين النمو وعجز الموازنة. إلا ان هذه النتيجة لا تتفق تاريخياً مع حقيقة عدم وجود تنسيق حقيقي بين السياستين المالية والنقدية في الأردن. وأخيراً تظهر النتائج ان حوالات العاملين في الخارج والتحويلات بدون مقابل لها أثر إيجابي على نمو القاعدة النقدية.

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have sparked a heated debate as to their consequences (Friedman, 1983; Kopcke, 1983; Laumas and McMillin, 1984). Since the beginning of 1989, the government has started to realize that these deficits pose a policy problem, which should be corrected by reducing government spending, increasing revenue, or both. This concern stems from the view that large and growing budget deficits result in high inflation rates (Ahking and Miller, 1985; Barnhart and Darrat, 1988; Evans, 1985).

The relationship between deficits and inflation is basically based on the notion that large budget deficits induce the central bank to monetize at least part of the deficit, leading to more rapid growth of the money supply and higher inflation (Grier and Neiman, 1987; Hoelscher, 1983). This theoretical linkage between deficits and money growth is often called "the accommodation hypothesis" (Allen and Smith, 1983; Hoffman et al., 1983; Joines, 1985).

In addition to the accommodation hypothesis, Barro (1979) theorized a notable model suggesting that the relationship between money growth and budget deficits exhibits causation running from money to deficits. This reverse hypothesis is also consistent with a high association between the two variables. The money-to-deficit hypothesis is basically based on the notion that the government is primarily concerned with the real value of its budget deficit. Thus, the government tends to increase nominal deficits in order to keep pace with the rate of inflation. Inflation, however, is primarily the result of excessive money growth. Therefore, it is not surprising to postulate that higher money growth will lead to higher budget deficit, contrary to the implication of the accommodation hypothesis.

The purpose of this paper is to empirically examine the theoretical linkage between budget deficits and money growth in Jordan for the sample period 1968–1992 using seemingly unrelated regression technique (henceforth - SUR). This technique has proven its ability in producing more efficient results (on the average has more precision) than the ordinary least squares. The gain in efficiency is due to the fact that the former incorporates information on the cross-correlation between the errors in different equations. The second reason is that using SUR allows one to conduct testing hypotheses across equations.

This study is designed to test four alternative competing hypotheses regarding the relationship between budget deficits and money growth. These are: (1) that budget deficits cause base money (the accommodation hypothesis), (2) that base money causes budget deficits (the Barro hypothesis), (3) that causality between money growth and budget deficits is bidirectional (hypotheses 1 and 2 together), and (4) that money growth and budget deficits are set independent of each other.

The organization of the rest of the paper is as follows. The next section reviews the empirical studies that are most clearly related to the relationship between government budget deficits and money growth. The third section discusses the empirical methodology. The fourth section reports the empirical findings while the fifth section concludes the study.

PREVIOUS STUDIES

This section reviews the findings of the major empirical studies conducted on the relationship between government budget deficits and monetary growth. To the best knowledge of the author, this study is the first to be conducted on this issue using Jordanian data. Therefore, most of the studies cited in this study are limited to the U.S.A. data.

Hamburger and Zwick, (1981) examine the relationship between federal government budget deficits and monetary growth in U.S.A. for the sample period 1954–1979. They show that budget deficits had a positive and significant effect on money supply growth. This finding appears to be consistent with the accommodation hypothesis mentioned above.

Allen and Smith, (1983) study the relationship between Treasury borrowing and monetary growth using U.S.A. quarterly data. The study produces evidence of a positive and significant impact of total Treasury borrowing upon the growth of monetary base for the 1954.I–1961.II and 1961. III–1974. IV periods, but an insignificant coefficient for the Barro expenditure variable. However, when the coefficient instability during the 1961.III–1980.IV period is corrected by a dummy variable technique, the debt coefficient appears to be positive and significant, and remains stable for this two decade period.

Joines, (1985) reports empirical evidence on the relationship between government budget deficits and the growth of high-powered money in the United States for the sample period 1875–1983. High-powered money growth appears to be positively related to war spending during periods when such spending is a substantial fraction of GNP. There is little evidence that the growth of high-powered money is related to the none-war government budget deficits, measured either in nominal or in real terms after controlling for the level of overall economic activity.

Evans, (1986) tests the hypothesis that large budget deficit affects positively the U.S dollar relative to other currencies(*) over the sample period 1984.II–1984.III. The U.S. dollar is found to appreciate when federal

(*) The currencies investigated are the Canadian dollar, the Belgian franc, the French frank, the Deutsche mark, the guilder, the Swiss franc, and the British pound.

purchases increase, monetary policy tightens or the inflation rate fall, while the U.S. dollar is found to depreciate when the federal budget deficit increases.

Evans, (1986) reports the results of regressing the commercial paper rate, Moody's Aaa bond rate, and the ex post real commercial paper rate on current and past government spending, budget deficits, and real money supplies. The regressions have been fitted to the entire sample of monthly data, spanning the period between June 1908 and March 1984, and to eleven sub-samples. The results show no statistically significant positive association between interest rates and budget deficits.

Barnhart and Darrat, (1989) employ a vector autoregressive technique to test for causality between base money growth and deficits in the United States for the sample period 1961.I–1984.IV. The results consistently reject the accommodation hypothesis and indicate that monetary and fiscal policy actions are set independently.

ECONOMETRIC METHODOLOGY

The empirical methodology used in this study is based on a multivariate vector autoregression modeling technique (henceforth-VAR). As shown by Leiderman, (1984), the VAR technique can be used as a reliable alternative to the conventional structural modeling procedure which restricts the relationship among interrelated variables on the basis of arbitrary considerations. Moreover, the results obtained on the basis of a multivariate VAR technique are much more reliable compared to those obtained on the basis of bivariate time series analysis. That is because the results obtained by using bivariate analysis are suspect due to the omission of variables (Lutkepohl, 1982).

One of the problems with the VAR analysis is that in practice the lag lengths are not known. Thus, the distribution of the final estimates based on the VAR model is only known if the chosen lag length $\hat{N}$ is assumed to be greater than or equal to the true lag length N. As shown by Judge et al., (1988) the estimates are inefficient if $\hat{N} > N$ and biased if $\hat{N} > N$. To overcome this potential problem, the VAR is used in conjunction with Akaike's Information Criterion, (1969) and Schwarz's Criterion, (1978) to select the appropriate lag lengths that appear to be sufficient in detecting the direction of causality between money growth and budget deficits.

The estimated VAR model consists of the following macroeconomic variables: (a) the monetary base to represent monetary policy, (b) the high-