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Taxing Choices in Deficit Reduction

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and
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To control their deficits, Brazil, Mexico, and Pakistan should try to raise revenues and curtail spending simultaneously. In Argentina and Chile, the first priority should be to control public spending.

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Baffes and Shah use the cointegration approach to determine whether deficits are more effectively controlled by raising taxes or controlling expenditures — or both. They use long-term historical time series data for Argentina, Brazil, Chile, Mexico, and Pakistan.

Many studies have examined causality in the relationships between taxes and spending in developed countries. Some have found evidence that higher spending tends to lead to higher taxes. Some have found that higher taxes lead to more spending. Some find that causality runs both ways.

Baffes and Shah find that Brazil, Mexico, and Pakistan have continuously tried to align revenues and spending to control the deficit and that spending and taxes tend to feed each other in those countries.

In Argentina and Chile, they found the deficit to be explosive — and caused by spending. There was no empirical evidence of efforts to adjust revenues to control the deficit.

They recommend that to control the deficit Brazil, Mexico, and Pakistan should try to raise revenues and curtail spending simultaneously. In Argentina and Chile, however, the first priority should be to control spending.

TAXING CHOICES IN DEFICIT REDUCTION

by

John Baffes and Anwar Shah

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TAXING CHOICES IN DEFICIT REDUCTION

I. Introduction

Government deficits especially in developing countries are rising at an alarming pace. Further, it is believed that chronic deficits often discourage economic growth, and adversely affect other macroeconomic aggregates. Controlling deficits involves raising taxes, or reducing expenditures. Raising taxes has adverse effects on the private sector and on economic growth in general. Reducing expenditures is also a difficult task because it involves long-run commitments. Further, if public spending is primarily devoted to development of basic infrastructure, as in many developing countries, then avenues for reducing spending might be quite limited (see Shah, 1990). In either case however, the problem is that raising taxes may induce higher spending or reducing spending may induce lower taxes, without necessarily affecting the deficit. The latter result obtains if expenditure reduction results in unacceptably low standards of public services and thereby unleash strong anti-public sector sentiment creating political pressures to lower taxes. This paper focuses on qualitative and quantitative effects of spending on revenues and vice-versa for five developing countries.

While many studies have examined relationships between taxes and spending in developed countries from a causality point of view, no common agreement exists as to the direction of the causality. For example, Anderson, Wallace and Warner (1986) and Von Furstenberg, Green, and Jeong (1985) have found evidence that higher spending tends to lead taxes. Manage and Marlow (1986) and Ahiakpor and Amirkhalkhali (1989), on the other hand, have found that causality runs the opposite direction. In a more recent study, Miller and Russek (1990) found bidirectional causality between expenditures and revenues for the U.S. (their study included federal, state, and local level data).[1]

The most important element which differentiates the present study from previous ones is that it carries out a formal test of whether governments make consistent attempts to align revenues with spending. In doing so we are also able to make inferences as to whether non-tax revenues play an important role in determining the level of the deficit.[2] Further, this is the first study of its kind for developing nations.

The specific objectives of this study are: (a) to test whether a long-run relationship between revenues and expenditures exists; (b) if such a relationship exists, what is the direction of the causality; and (c) quantify those causality effects by estimating the error correction representation and subsequently calculating variance decompositions and impulse responses. The paper is structured in the following manner. The next section discusses the theoretical model and the concepts which are required for the development of the test. Section III describes the data, the estimation procedure, and the empirical results. The last section presents conclusions along with some policy implications and directions for future research.

II. Theoretical Considerations

Consider a government whose objective is to maximize welfare by choosing the level of public goods and services to be consumed. The instantaneous indirect welfare function, $V(\mathbf{p},E)$, is defined as:

$$(1) \quad V(\mathbf{p},E) \equiv \max_{\mathbf{x}} \left(W(\mathbf{x}) : \mathbf{px} = E\right),$$

where $\mathbf{x}$ denotes the vector of goods and services, $\mathbf{p}$ represents the exogenously determined price vector, and E denotes expenditures. $W(\mathbf{x})$ is a twice continuously differentiable concave welfare function. In order to finance expenditures the government uses revenues, denoted as T. In general it would be expected that T = E so that the government solely covers expenditures through taxation. In most cases however the governments do not operate on a balanced budget schedule so that $T \neq E$, and hence,

$$(2) \quad D_t = T_t - E_t.$$

The natural question arising at this moment is whether D_t represents short-run deviations from zero or whether it consistently deviates from zero even in the long run.[3]

An intuitive way to test whether revenues and expenditures drift apart in the short run only, would be to form the regression

$$(3) \quad T_t = \beta_0 + \beta_1 E_t + \varepsilon_t,$$

where β_0 and β_1 denote parameters to be estimated. Then test H_0: $\beta_0 = 0$ and $\beta_1 = 1$ against H_1: $\beta_0 \neq 0$ and $\beta_1 \neq 1$, where acceptance of H_0 would imply that the government has been making consistent attempts to equate revenues to spending, at least in the long run. Notice that if H_0 is true, (3) collapses to (2) where $\varepsilon_t = D_t$, which means that the government finances expenditures entirely through revenues.

This test however presents some shortcomings. First, the test is very restrictive in the sense that it is rather unlikely for the governments to run balanced budgets on an annual basis, so H_0 is likely to be rejected. Second, this procedure fails to take into consideration certain properties of time series variables which sometimes may invalidate standard regression results, namely that the variables being considered are stationary. To circumvent those shortcomings we take the alternative of testing whether T_t and E_t are cointegrated. Notice that cointegration not only takes into account stationarity properties of the variables being considered, but also it examines whether T_t and E_t move together in the long run, allowing for short-run deviations.[4]

Cointegration requires that all variables are of the same order of integra.ion. Let us first give an intuitive explanation of the concept of the order of integration. If a series has a finite mean and variance it is called integrated of order zero, and is denoted as I(0). If the series needs to be differenced once to become I(0), it is then called integrated of order one, I(1). In general a series that is required to be differenced d times to become I(0) is called I(d). If two series are I(d) and there exists a linear combination of those series which is I(b) with b < d, then the series are to be cointegrated, denoted as CI(d,d-b). For practical purposes we generally consider I(1) series since most economic variables become I(0) after being differenced once and hence the cointegrated system is CI(1,1). In what follows, the terms stationarity (or stationarity in levels) and I(0) will be used interchangeably.

First, the order of integration of the variables under consideration must be determined. Three prominent procedures to determine the order of integration are: (a) Dickey-Fuller (DF), (b) augmented Dickey-Fuller (ADF), and (c) Durbin-Watson (DW). The DF test is based on the regression: $\Delta X_t = \mu + \beta X_{t-1} + \varepsilon_t$, where X_t denotes the variable of interest and Δ denotes the difference operator; μ and β denote parameters to be estimated. The null hypothesis (H_0) is: X_t is not I(0). H_0 is rejected if the estimate of β is negative and significantly different from zero. The ADF test is based on: $\Delta X_t = \mu + \beta X_{t-1} + \sum_{i=1}^{\tau} \gamma_i \Delta X_{t-i} + \varepsilon_t$, where τ is selected so that ε_t is white noise; μ, β, and γ_i denote parameters to be estimated as before. Again H_0 is rejected if β is negative and significantly different from zero. Finally, the DW test is based on the Durbin-Watson statistic of: $X_t = \mu + \varepsilon_t$. Low DW statistic indicates that X_t is not I(0).

If the variables of interest are all say I(1), to test for cointegration we regress one variable on the other and then test whether the estimated residual is I(0). In other words we estimate (3) and then test for stationarity of ε_t. Notice that since one of the primary objectives of this study is to test whether the government makes consistent attempts to equate revenues with spending, we first test for stationarity of D_t which implicitly imposes the balanced budget constraint as a long-run restriction.[5] Therefore, testing for cointegration between E_t and T_t assuming that a long-run relationship between revenues and spending exists, becomes a simple unit root test in the univariate process (Engle and Yoo, 1987). In the case that D_t is not I(0) we proceed to estimate (3). Notice that since the cointegration parameter is unique in the bivariate case, if we find cointegration by restricting $\beta_0 = 0$ and $\beta_1 = 1$ then the regression in (3) should produce the same outcome.[6]

As a second step we test to see whether there exists causality between expenditures and revenues (Granger, 1969). Notice that if the individual series are I(1) (which is the case as it will be shown in the next section) we have to take differences to induce stationarity. Hence, we estimate the following relationship:

$$\text{(4a)} \qquad \Delta T_t + \beta_0 \Delta E_t = \mu + \sum_{i=1}^{\tau} \alpha_i \Delta T_{t-i} + \sum_{i=1}^{\tau} \beta_i \Delta E_{t-i} + u_t.$$

$$\text{(4b)} \qquad \Delta E_t + \delta_0 \Delta T_t = \nu + \sum_{i=1}^{\tau} \gamma_i \Delta E_{t-i} + \sum_{i=1}^{\tau} \delta_i \Delta T_{t-i} + v_t,$$

where β_0, δ_0, μ, ν, α_i, β_i, γ_i, and δ_i denote parameters to be estimated; τ denotes the number of lags which is not necessarily the same for all variables. u_t and v_t are assumed to be mutually uncorrelated white noise processes. If $\beta_0 = \delta_0 = 0$ and some β_i's and δ_i's have non-zero values, (4a-4b) implies a *simple* causal relation with feedback (*i.e.* simple bidirectional causality). If $\beta_0 \neq 0$ and $\delta_0 \neq 0$ and some β_i's and δ_i's have non-zero values, then (4a-4b) implies *instantaneous* bidirectional causality. Finally, unidirectional causality is implied if the above relations hold for one equation only. In terms of T_t and E_t, simple causality means that past E_t only affects T_t, while instantaneous causality means that both past and current E_t affect T_t and vice-versa. Such causal relationships can be detected with conventional F-tests.

One other important element we consider in this study is the relation between cointegration and causality. If the variables being considered are cointegrated, there exists causality in at least one direction (Granger, 1986). Further, an additional implication of cointegration is that if there exists cointegration then the system can be represented by an error correction mechanism (ECM).[7] The implication of such representation is that we quantify the causality effects by constructing the Vector Autoregressive (VAR) representation of the bivariate system as defined by T_t and E_t and also incorporate the long-run relationship as follows (for a complete characterization of VAR processes see Sims (1980)):

$$\text{(5a)} \qquad \Delta T_t = \mu - \beta_0 D_{t-1} + \sum_{i=1}^{\tau} \alpha_i \Delta T_{t-i} + \sum_{i=1}^{\tau} \beta_i \Delta E_{t-i} + u_t,$$

$$\text{(5b)} \qquad \Delta E_t = \nu - \delta_0 D_{t-1} + \sum_{i=1}^{\tau} \gamma_i \Delta T_{t-i} + \sum_{i=1}^{\tau} \delta_i \Delta E_{t-i} + v_t,$$

where D_{t-1} is the lagged level of deficit. The remaining variables and parameters are defined in (4a-4b). It is interesting to notice that if we replace ΔE_t and ΔT_t by D_{t-1} in the causality regressions (4a-4b) we arrive at the ECM representation; so cointegration unifies ECM and conventional causality models. (5a-5b) is sometimes called restricted VAR, where the restriction is the residual from the cointegration regression (in this case the observed deficit or the error term of (3)). The advantage of the ECM as opposed to the unrestricted VAR is that by including the deficit in the equations we retain information in levels, without distorting the stationarity properties of the variables involved in the system, since, because of cointegration D_{t-1} is I(0). From the estimated VAR system we can then calculate impulse responses and variance decompositions as means of quantification of the causality effects.

III. Data, Estimation, and Results

Data in the current study include total government expenditures and total revenues for the countries of Argentina, Brazil, Chile, Mexico, and Pakistan. The data series for Argentina cover the 1904-1983 time period and were obtained from unpublished World Bank Tables. Data for Brazil cover the 1905-1983 period and were obtained from *Estatísticas Históricas do Brasil*. Data for Mexico cover the 1895-1984 time period and were obtained from *Estatísticas Históricas de México*. Data for Pakistan cover the 1947-1989 period and were obtained from various publications of the *Central Statistical Office, Government of Pakistan*. Finally, data for Chile cover the 1960-1985 time period and were obtained from *Banco Central De Chile*. Because of some missing observations, the data set for Argentina and Mexico contain 71 and 78 observations respectively. All series were adjusted by the respective GDP deflators in view of the high inflation rates experienced by the Latin American counties included in this study. The RATS package was used to estimate the models.

The remainder of this section, which is divided in four parts, will discuss and analyze results regarding cointegration (Table 1), causality (Table 2), as well as variance decompositions (Table 3) and impulse responses (Figures 1, 2, and 3).

(i) Cointegration

The first step regarding cointegration is the determination of the order of integration of revenues and spending. Table 1 reports such results. In all cases both revenues and spending were found to be nonstationary and hence the first differences had to be considered. Stationarity tests for the first differences indicated that both variables in all countries were I(1).

The second step was to determine the order of integration of D_t. For Argentina all three tests indicated that D_t is nonstationary (5% level of significance). This means that the Argentinean government has not been able to equate revenues and spending in the long run. The next step was to test for cointegration by considering the unrestricted version of the cointegration regression (*i.e.* relationship (3)). All three tests indicated that there exists strong evidence of cointegration. (The cointegration regression — not reported here — gave a coefficient of 0.65). To summarize, cointegration tests for Argentina indicate that although revenues and spending move together in the long run there is an unexplained component in spending since revenues account for 65% of spending only.

Cointegration tests for Brazil showed evidence of cointegration. In particular the DW and ADF test indicate mild evidence of cointegration while the DF test indicates strong evidence. In what follows we consider that revenues and spending in Brazil are cointegrated.

For Chile, all three cointegration tests showed that revenues and spending are not cointegrated (5% level of significance). The conclusion was the same even when relationship (3) was estimated (estimates not reported here). The implication of such result is that there exist a nonstationary component (such as seigniorage or borrowing) that causes explosiveness of the deficit which is not being taken into consideration.

For Mexico, the results are the same as in Brazil. Notice that all three tests supported stationarity of the deficit at the 1% level of significance. For Pakistan the results are almost identical. The only difference is that the results hold for the 5% level of significance. Notice that the ADF test for Pakistan indicates that E_t and T_t are I(2). However, the deficit is still I(0), thus supporting cointegration.

(ii) Causality

Table 2 reports causality results. In order to conserve space we do not report parameter estimates and other statistics of the system. To facilitate comparability with other studies we report results for all three types of causality (*i.e.* *simple* causality, *instantaneous* causality, and causality with the *cointegration restriction* imposed).

For all three countries for which cointegration was found instantaneous causality runs both directions (*i.e.* revenues cause spending and spending causes revenues). Notice that the finding of at least one direction causality is consistent with the existence of cointegration between revenues and spending for those three countries. On the other hand, while simple causality runs from spending to revenues for Pakistan no simple causality in any direction was found for Brazil and Mexico. When the cointegration restriction is imposed, Mexico exhibits bidirectional causality. In Brazil, revenues cause spending while the opposite is true for Pakistan.

Since cointegration was not found for Argentina and Chile, the possibility that the deficit causes (or is caused by) expenditures and/or revenues was examined. Thus, we tested all possible causal relations among T, E, and D. Specifically, the results for Argentina show that instantaneous causality runs in all directions (*i.e.* among deficit, revenues, and spending). On the other hand, simple causality runs from spending to revenues and from deficit to revenues.

It is of interest to notice that while simple causality was found in a few cases only, instantaneous causality was found in almost any case examined. The implication of this is that decisions to reduce/increase spending are being made simultaneously with decisions to increase/reduce revenues.

Finally, it should be noticed that the qualitative nature of the causality results did not change wnen other lag structures were considered. Single exception to this constitutes Pakistan, in which case when more than two lags were considered no causality was found in any direction.

(iii) Variance Decompositions

Variance decompositions exhibit the contribution of each source of innovation to the variance of the *k*-year ahead forecast error for each of the variables. Stated otherwise, variance decompositions refer to a breakdown of the change in the value of the variable in a given year arising from changes in the same variable as well as other variables in previous years. Table 3 gives estimates of variance decompositions for Brazil, Mexico, and Pakistan. As it was mentioned earlier, for Chile and Argentina T and E do not fully describe the deficit so we did not form the ECM representation. The results can be summarized as follows. 95% of the variation of expenditures in Mexico is accounted by past expenditures, while only 5% is accounted by past revenues. This pattern seems to be consistent through the whole period examined. The same picture is presented when we consider revenues, *i.e.* 96% of the variation in revenues is accounted by past expenditures while 4% only is accounted by past revenues.

In Brazil, changes in expenditures account for most of the variation in future expenditures as in the case of Mexico. On the other hand, changes in revenues and expenditures equally account for the variance of revenues. Again this pattern is consistent through the whole period examined.

In Pakistan, changes in expenditures account for most of the variation in future expenditures. On the other hand, changes in revenues account for abcut 75% of the variation in future revenues throughout the period examined. To summarize, it appears that in most cases expenditures account for most of the variation in both future expenditures and future revenues.

(iv) Impulse Responses

Impulse responses give the dynamic response of each variable to policy changes affecting this variable as well as of the other variables included in the system. In other words, impulse responses describe whether a shock of one variable has a persistent or transitory effect on the other variables as well as on the variable itself. Figure 1 depicts impulse responses for Brazil. In general all four impulse responses present similar picture. A one-standard deviation shock on spending induces more spending as well as more revenues in the first period while after the third period both spending and revenues return to the pre-shock level. The same picture is presented when we consider the own-effect of revenues. On the other hand revenue shock has no effect on spending in the first period, while after a negative effect in the second period spending returns to its pre-shock level.

Figure 2 gives impulse responses for Mexico. The effect of a shock of spending on both spending and revenues as well as the effect of revenue shock on revenues are similar: after an increase in the first period the variables tend to return to the pre-shock levels following an oscillatory process. Revenue shock on spending however has no effect in the first period, while after a negative effect in the second period it oscillates before it returns to its pre-shock level.

Figure 3 gives impulse responses for Pakistan. Spending shock has the same effect on both revenues and spending. *i.e.* there is a large positive effect in the first period. After that, the variables have a tendency to return to the pre-shock levels. To some extent spending responds the same way to revenues shock. Comparing Pakistan with Brazil and Mexico however we observe that in the Pakistani case the shocks tend to be persistent, that is, it takes longer for the variables to return to the pre-shock level. This result is consistent with the fact that for Brazil no simple causality but strong instantaneous causality was found while both types of causality were found for Pakistan.

To summarize, it seems that both Brazil and Mexico present the same picture in the sense that the shocks have short run effects only. On the contrary, in Pakistan the shocks have persistent effects.

IV. Summary and Conclusions

In this paper an attempt was made to: (a) determine whether governments have continuously attempted to align revenues or spending to control the deficit. (This was done by testing whether there exists cointegration between revenues and spending); (b) test for causality between taxes and spending; and (c) quantify the causality effects by (*i*) estimating an error correction model and (*ii*) calculating variance decompositions and impulse responses. The tests were carried out for the countries of Argentina, Brazil, Chile, Mexico, and Pakistan. The availability of long data series primarily determined the selection of those countries.

The results can be summarized as follows: The governments of Brazil, Mexico, and Pakistan seem to have successfully aligned revenues and spending as means of controlling the deficit over the time period examined while a similar deduction for Argentina and Chile could not be made. For Brazil, Mexico, and Pakistan strong instantaneous causality runs both directions. In Argentina and Chile deficit was found to cause and be caused by expenditures. Impulse responses for Mexico and Brazil were found to have short-run effects only while for Pakistan the effects were more persistent. In terms of variance decompositions it was found that variations in both revenues and spending are explained in most part by past spending. The above results suggest that to control the deficit, Brazil, Mexico, and Pakistan should attempt to raise revenues and curtail expenditures simultaneously. In

Argentina and Chile, on the other hand, controlling public expenditures should be the first priority.

An important qualification is in order here. The results stated earlier, are based on long term relationships that may differ from the present situation. A case in point is Chile, that has succeeded in eliminating the budget deficit since the end of the period of observations in our sample. In contrast, the deficit has increased in Argentina and Brazil in more recent years.

ENDNOTES

[1] Other studies include Furstenberg, Green, and Jeong (1986); Ram (1988a, 1988b); Ahsan, Kwan, and Sahni (1989); Holtz-Eakin, Newey, and Rosen (1989); Miller and Russek (1990). In particular Miller and Russek tested for causality by imposing the cointegration restriction as defined in (3) of this study. The present study makes an explicit distinction between the cointegration restriction defined in (2) and the cointegration restriction defined in (3).

[2] An important element of non-tax revenue, especially in Latin America, is seigniorage (*i.e.* inflation tax). See Kiguel and Neumeyer (1989) for a treatment of seigniorage in Argentina.

[3] To be precise, the government is constrained to run balanced budget in present value terms. So the constraint to test would be, $\sum_{t=0}^{\infty}(1+\delta)^{-t-1}T_t - \sum_{t=0}^{\infty}(1+\delta)^{-t-1}E_t = 0$, where δ denotes the discount rate. We chose to test the balanced budget constraint associated with (2) because it is convenient to form the ECM representation and subsequently carry out the causality tests. See Hamilton and Flavin (1986) for a test regarding the balanced budget restriction in present value terms.

[4] The theory of cointegration is discussed extensively in Engle and Granger (1987), Hendry (1986), and Granger (1986).

[5] Several studies have considered theoretical restrictions in testing cointegration. For example, Campbell and Shiller (1987) tested the term structure of the interest rate; Corbae and Ouliaris (1988) tested the Purchasing Power Parity. Other studies of similar nature include Hall (1986) and Ambler (1989).

[6] It is true that the cointegration regression gives an excellent estimate of the cointegration parameter. However this is the case in large samples only. In small samples the regression does not guarantee that the cointegration parameter will be found.

[7] The equivalence between cointegration and ECM comes directly from Granger representation theorem (Engle and Granger, p. 225). The ECM type of models were first introduced by Phillips (1957).

TABLE 1: Stationarity Tests

	DW	DF	ADF
ARGENTINA (71 observations)			
E_t	0.075	-0.396	-0.511
ΔE_t	1.939	-8.030	-5.786
T_t	0.105	-1.171	-0.946
ΔT_t	2.581	-11.429	-6.199
D_t	0.352	-1.975	-2.047
BRAZIL (78 observations)			
E_t	0.038	0.861	1.926
ΔE_t	2.463	-11.179	-7.816
T_t	0.028	1.430	2.608
ΔT_t	2.481	-11.165	-7.170
D_t	0.625	-3.621	-2.977
CHILE (26 observations)			
E_t	0.318	-1.292	-1.362
ΔE_t	1.979	-4.638	-3.224
T_t	0.114	-0.867	-1.008
ΔT_t	1.402	-3.418	-3.196
D_t	0.636	-2.046	-2.470
MEXICO (78 observations)			
E_t	0.053	0.381	0.206
ΔE_t	1.856	-7.994	-4.889
T_t	0.089	-0.647	-0.388
ΔT_t	2.262	-9.817	-3.174
D_t	0.963	-4.091	-8.289

continued ⟶

PAKISTAN (42 observations)			
E_t	0.024	4.018	3.442
ΔE_t	1.358	-4.420	-2.872
T_t	0.023	6.066	4.744
ΔT_t	1.047	-2.921	-1.027
D_t	0.783	-3.081	-3.257

NOTE: E_t and T_t denote spending and revenues; D_t denotes deficit; Δ represents the difference operator (*i.e.* $\Delta E_t = E_t - E_{t-1}$ and $\Delta T_t = T_t - T_{t-1}$). The critical values for Argentina, Brazil, and Mexico are: DW = 0.259 (5%) and 0.376 (1%) (from Sargan and Bhargava (1983), Table 1); DF and ADF = -2.89 (5%) and -3.59 (1%) (from Fuller (1976), $\hat{\tau}_\mu$ statistic, Table 8.5.2).

The critical vθlues for Pakistan are: DW = 0.493 (5%) and 0.705 (1%) (from Sargan and Bhargava (1983), Table 1); DF and ADF = -2.93 (5%) and -3.58 (1%) (from Fuller (1976), $\hat{\tau}_\mu$ statistic, Table 8.5.2).

The critical values for Chile are: DW = 0.770 (5%) and 1.081 (1%) (from Sargan and Bhargava (1983), Table 1); DF and ADF = -3.00 (5%) and -3.75 (1%) (from Fuller (1976), $\hat{\tau}_\mu$ statistic, Table 8.5.2.). These statistics are based on Monte Carlo experiments made on 100, 50, and 25 observations, respectively.

The number of lags in the ADF test was determined by the Akaike information criterion.

TABLE 2: Causality Tests

	ARGENTINA		CHILE	
	I	II	I	II
T does not cause E	0.07	6.83**	0.18	0.46
E does not cause T	6.47*	10.64**	0.05	0.39
T does not cause D	0.10	28.68**	0.91	1.27
D does not cause T	6.47*	34.58**	0.05	0.83
D does not cause E	0.07	5.49*	0.18	40.02**
E does not cause D	0.10	5.51*	0.91	41.74**

	BRAZIL		
	I	II	III
T does not cause E	0.08	32.67**	4.54*
E does not cause T	0.06	32.65**	0.28

	MEXICO		
	I	II	III
T does not cause E	0.01	660.41**	13.65**
E does not cause T	0.15	661.78**	6.30*

	PAKISTAN		
	I	II	III
T does not cause E	2.65	4.05*	2.34
E does not cause T	3.25*	4.38*	3.52*

NOTE: I means simple causality, II means instantaneous causality, while III means causality with the cointegration restriction imposed. One star (*) indicates rejection of no causality at the 5% level of significance while two stars (**) indicate rejection of no causality at the 1% level. All tests were carried out with one lag.

TABLE 3: Proportion of Forecast Error Variance *K* Periods Ahead Produced by Each Innovation.

		Innovation in:					
		MEXICO		BRAZIL		PAKISTAN	
Error in	*K*	E	T	E	T	E	T
E	1	1.000	.000	1.000	.000	1.000	.000
	2	.946	.054	.966	034	.955	.045
	3	.952	.048	.961	.039	.939	.061
	4	.949	.051	.961	.039	.935	.065
	5	.950	.050	.961	.039	.934	.066
	6	.950	.050	.961	.039	.933	.067
	7	.950	.050	.961	.039	.933	.067
	8	.950	.050	.961	.039	.933	.067
	9	.950	.050	.961	.039	.933	.067
	10	.950	.050	.961	.039	.933	.067
T	1	.966	.034	.496	.504	.207	.793
	2	.954	.046	.494	.506	.250	.750
	3	.954	.046	.494	.506	.262	.738
	4	.953	.047	.494	.506	.265	.735
	5	.952	.048	.494	.506	.266	.734
	6	.952	.048	.494	.506	.267	.733
	7	.952	.048	.494	.506	.268	.732
	8	.952	.048	.494	.506	.267	.733
	9	.952	.048	.494	.506	.267	.733
	10	.952	.048	.494	.506	.267	.733

NOTE: *K* indicates years. E and T denote spending and revenues respectively. One lag was used to estimate the ECM model. No major differences in the results were observed when other lag lengths were considered.

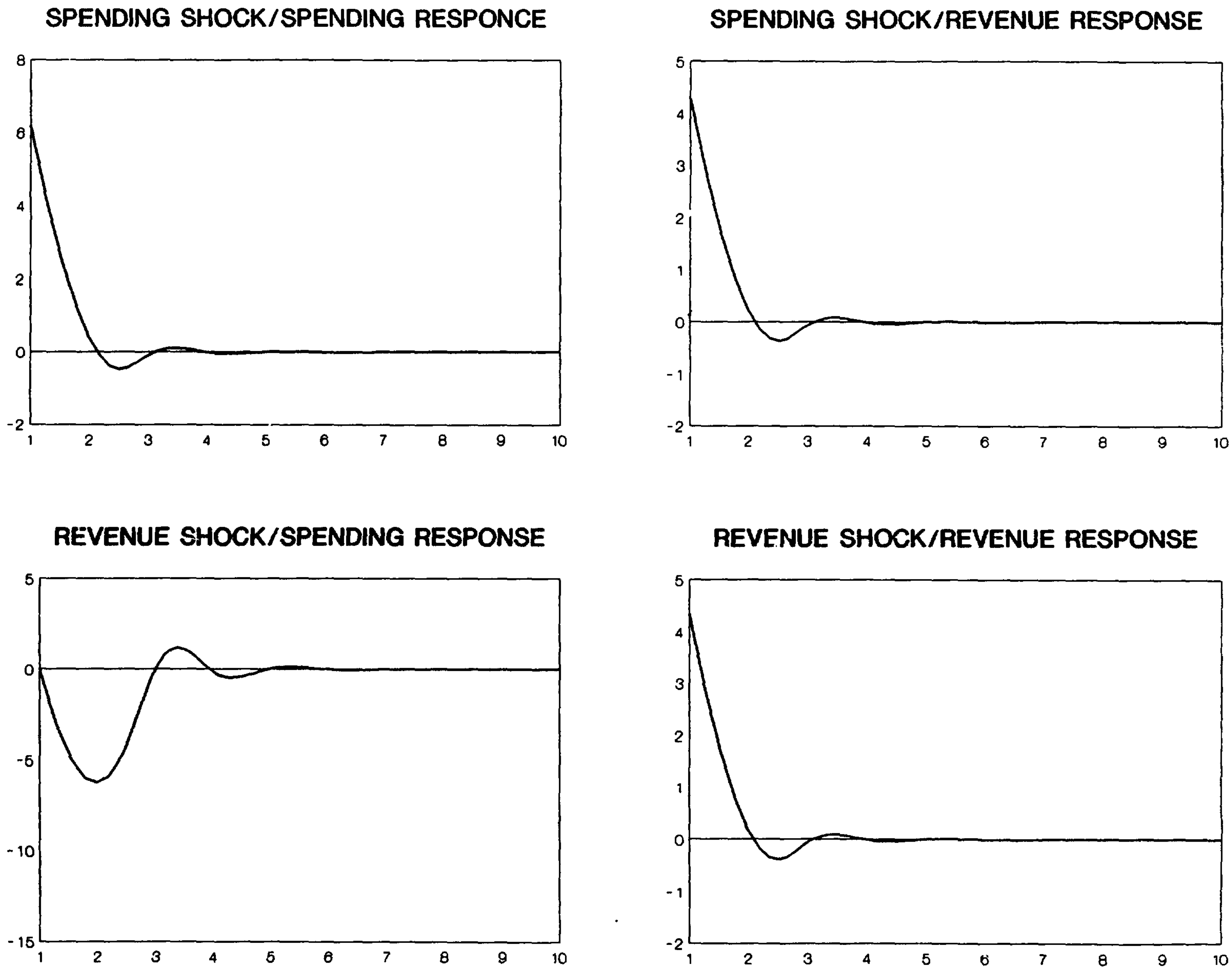

FIGURE 1: Brazil

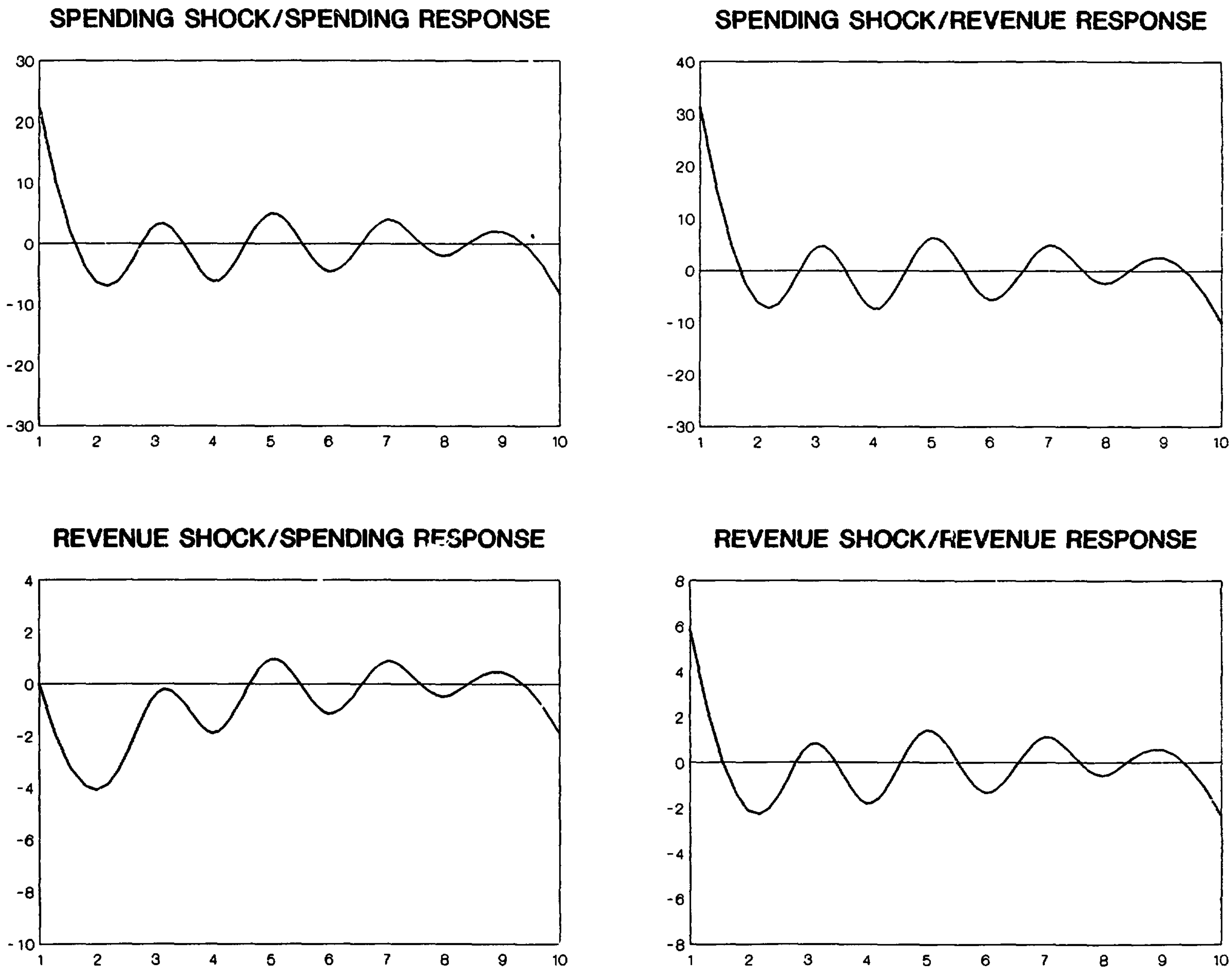

FIGURE 2: Mexico

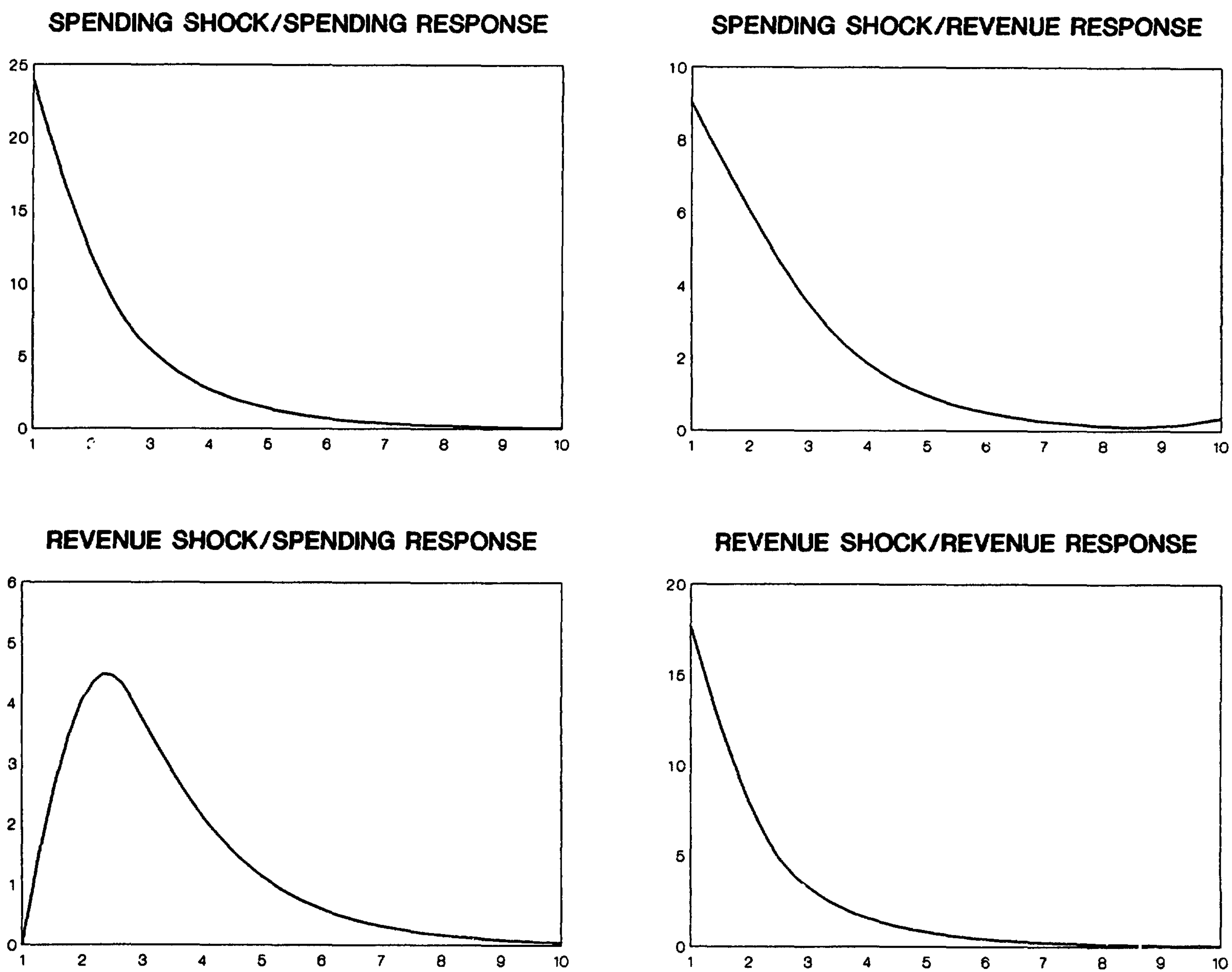

FIGURE 3: Pakistan

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