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Exchange Rate Regime Considerations for Jordan and Lebanon

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Middle Eastern Department

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Abstract

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This paper addresses the issue of the appropriate exchange rate regimes for Jordan and Lebanon in the context of the literature on optimum currency areas and the arguments concerning the use of the exchange rate as a nominal anchor for the economy. It presents some empirical results on the nature of output shocks in Jordan and Lebanon in the recent past, on the price sensitivity of exports from Jordan, and on currency and asset substitution in both countries. It does not directly address the issue of whether the current exchange rate in either country is overvalued or not, nor does it discuss the issue of an appropriate exit strategy from the current peg.

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EXECUTIVE SUMMARY

This paper addresses the issue of the appropriate exchange rate regimes for Jordan and Lebanon in the context of the literature on optimum currency areas and the arguments concerning the use of the exchange rate as a nominal anchor for the economy. It presents some empirical results on the nature of output shocks in Jordan and Lebanon in the recent past, on the price sensitivity of exports from Jordan, and on currency and asset substitution in both countries. It does not, however, address the issue of whether the current exchange rate in either country is overvalued or not, nor does it discuss the issue of an appropriate exit strategy from the current peg.

The early literature on the theory of optimum currency areas suggested that the usefulness of the nominal exchange rate, as an independent instrument of monetary policy, depends mainly on two factors. These are the nature of the shocks hitting the economy and the degree of flexibility of factor markets: the more country-specific the shocks and the more rigid are factor markets, the more important will be the loss of the exchange rate instrument under a fixed exchange rate regime. In the absence of sufficient factor mobility, for instance, any negative demand or supply shock in one country is likely to be transmitted to its trading partners unless exchange rates can be adjusted to offset the disturbance. Adjusting the (nominal) exchange rate may therefore be an important policy instrument in dealing with asymmetric or country-specific shocks if capital and labour are occupationally and geographically immobile (unless there is considerable flexibility of real wages and relative prices).

The more recent theoretical literature on optimum currency areas has, however, emphasized the importance of analyzing the *source* of the shocks facing the economy when deciding among alternative exchange rate regimes. The analysis in this literature shows that, if the aim of economic policy is to stabilize output in the face of transitory shocks, a flexible exchange rate is desirable when shocks originate from the real side of the economy, whereas a fixed rate is preferable if shocks are monetary in origin. A preponderance of domestic nominal shocks, in particular to money demand, strengthens the case for a fixed exchange rate regime, allowing anchoring to a stable foreign country's price level. By contrast, in the face of real shocks the economy would benefit from exchange rate flexibility, which would ease adjustment costs in the presence of stickiness of wages and prices.

Jordan and Lebanon are vulnerable to a number of real and external shocks, including the regional effects of oil price changes, regional political developments, and movements in labor remittances and grants from official donors, and these shocks may increase in importance over time (at least relative to nominal shocks).

At the same time, both countries have faced periods of considerable instability in money demand. In the case of Lebanon, monetary instability was associated with the end of the civil war and the resumption of economic activity, with the consequent need to remonetize the economy in the face of considerable uncertainties regarding developments in money

demand. In the case of Jordan, there were uncertainties regarding holdings of dinars by Palestinians in the West Bank and Gaza, with spillover effects on Jordan proper, associated with the possible introduction of a Palestinian currency.

Results presented in this paper suggest that, over the recent past, output fluctuations in Lebanon have been predominantly the result of aggregate supply or demand shocks (that is, shocks originating from the “real” side of the economy), whereas in Jordan more than 50 percent of the shocks to output have been monetary in origin.

The high concentration of exports in both countries is another argument in favor of a more flexible exchange rate regime, particularly given empirical evidence presented in this paper suggesting that Jordan’s exports—at least nontraditional exports—are price sensitive. Since both Jordan and Lebanon are small economies, with exports concentrated in a few key commodities and markets in the Middle East and Europe, this may strengthen the case for moving towards a more flexible exchange rate regime.

However, it could be argued that the benefits of a more flexible exchange rate regime, in terms of safeguarding competitiveness and providing an effective tool for dealing with shocks that are external or originate from the real side of the economy, are at best uncertain at this point in time. This is because the nominal exchange rate would only be an effective instrument in dealing with output shocks if *nominal* wages and prices are rigid and *real* wages and relative prices are flexible. Unfortunately, there is very little empirical evidence on the flexibility of real wages and relative prices in either country. However, the persistence of high unemployment in both countries implies some labor market rigidity and suggests that real wages may not be flexible in a downward direction. On the other hand, it may be the case that, in countries with very low and stable inflation (such as Jordan and Lebanon at the present time), nominal wage rigidity can give rise to stickiness of real wages in the downward direction; if moving to a more flexible exchange rate regime leads to more variation in inflation, it is possible that real wages would be easier to adjust and become less rigid. This is, of course, an entirely speculative hypothesis.

The exchange rate regime has policy implications, not only for the stabilization of output in the presence of various shocks to the economy, but also for the control of inflation. This is because, in the absence of an exchange rate peg, there is a need for another nominal anchor such as the money supply to achieve some degree of domestic price stability. The choice of an appropriate nominal anchor for the economy depends in part on the degree of currency substitution in the economy.

The higher the degree of currency substitution and the larger the holdings of foreign money in circulation, the more difficult it is for the monetary authorities to control the money supply if the exchange rate is allowed to vary. The basic idea is that the relevant monetary aggregate (i.e., the one which determines the domestic price level and influences economic activity) may be the one that includes foreign-currency deposits expressed in domestic-currency terms. Since the latter cannot be effectively controlled by the monetary authorities, the relevant money supply may become endogenous and the economy may

lose its nominal anchor. From a policy perspective, the endogeneity of the money supply implies that the authorities may be unable to reduce inflation by tightening the domestic component of the money supply.

Moreover, a high degree of currency substitution implies that the exchange rate will be significantly volatile and responsive to credibility issues, thereby strengthening the case in favor of a fixed exchange rate regime. More specifically, the higher the elasticity of substitution between domestic and foreign currencies, the larger the shift from foreign to domestic currency as a result of a fall in expected inflation, and thus the higher the appreciation of the nominal exchange rate.

The high level of dollarization in Lebanon, and empirical evidence presented in this paper indicating a high degree of currency and asset substitution in both countries, suggest that it will be difficult to find an effective substitute to the exchange rate as a nominal anchor for the economy. The possible secondary effects of greater exchange rate flexibility on the domestic financial sector in Lebanon are also uncertain, given that almost 90 percent of bank lending to the private sector is in foreign currency.

Turning now to the case of Jordan, although the extent of dollarization of the economy is much lower, the empirical evidence presented in this paper suggests that the same considerations apply, and that a move to a money-based nominal anchor may be associated with considerable volatility of the nominal exchange rate.

Given the lack of evidence that real wages and prices are flexible, at least in the downward direction, and the likely difficulty—at least in the case of Lebanon—of finding an effective substitute to the exchange rate as a nominal anchor, perhaps the most sensible conclusion to draw is that a fixed exchange rate regime is best for both countries at this point in time. However, given the prevailing trade patterns in both countries and the need for Jordan and Lebanon to penetrate new export markets, the arguments and counter-arguments for a peg to the euro or for a peg linked to a basket of currencies, as opposed to a peg to the U.S. dollar should be carefully considered.

Table 1. Lebanon and Jordan: Summary of Exchange Rate Regime Considerations

Factor for consideration	Lebanon	Jordan
Nature of output shocks	Flexible exchange rate regime	Evidence ambiguous
Export/product diversification	Flexible exchange rate regime	Flexible exchange rate regime
Real wage and relative price flexibility	Lack of evidence on real wage flexibility suggests benefits of moving to a more flexible exchange rate regime may be limited.	Lack of evidence on real wage flexibility suggests benefits of moving to a more flexible exchange rate regime may be limited.
Currency and asset substitution	Fixed exchange rate regime	Fixed exchange rate regime
Overall conclusion	A fixed exchange rate regime, but to a basket of currencies rather than just to the U.S. dollar.	A fixed exchange rate regime, but to a basket of currencies rather than just to the U.S. dollar.

I. INTRODUCTION

The choice of appropriate exchange rate regime is a highly controversial subject that is receiving an increasing amount of attention from both policymakers and academic economists in the context of the growing number of international financial crises since 1994—Mexico in 1994, East Asia in 1998, Russia and Brazil in 1998–99, and Argentina and Turkey in 2000. Many countries in the Middle East have exchange rates that are effectively pegged to the U.S. dollar, and the sharp real appreciation of the latter in the late 1990s and 2000–01 has raised concerns about the appropriateness of individual countries pegging their currencies to the U.S. dollar. Although the Lebanese pound is classified as independently floating, in effect the Banque du Liban has intervened to keep the pound around a midpoint parity of LL 1,507.5 per U.S. dollar since October 1999. And although the Jordanian dinar is a fully convertible currency officially pegged to the SDR, in practice the authorities have tightly linked its exchange rate to the U.S. dollar at US\$1.4104 per JD since October 1995.

The academic literature suggests a number of factors that need to be taken into account when considering the appropriate choice of exchange rate regime for a particular economy at a given point in time. This paper analyzes these issues in the context of Jordan and Lebanon. Section II discusses the nature of output shocks, wage and price flexibility and factor mobility, sensitivity of exports to relative price movements, and product and export diversification in the context of the literature on optimum currency areas. Section III discusses the issue of the appropriateness of the use of the exchange rate as a nominal anchor to control inflation in the two countries. Section IV offers some concluding comments on the choice of appropriate exchange rate regimes for Jordan and Lebanon in the context of the results presented in the paper.

II. OUTPUT/EMPLOYMENT CONSIDERATIONS: THE NATURE OF OUTPUT SHOCKS, WAGE AND PRICE FLEXIBILITY AND FACTOR MOBILITY, AND DIVERSIFICATION OF THE ECONOMY

A. Nature of Output Shocks

The early literature on the theory of optimum currency areas suggested that the usefulness of the nominal exchange rate as an independent instrument of monetary policy depends mainly on two factors (see Mundell (1961)). These are the nature of the shocks hitting the economy and the degree of flexibility of factor markets: the more country-specific the shocks, and the more rigid the factor markets, the more important will be the loss of the exchange rate instrument under a fixed exchange rate regime. In the absence of sufficient factor mobility, for instance, any negative demand or supply shock in one country is likely to be transmitted to its trading partners unless exchange rates can be adjusted to offset the disturbance. Adjusting the (nominal) exchange rate may therefore be an important policy instrument in dealing with asymmetric or country-specific shocks, if capital and labor are occupationally and geographically immobile (unless there is considerable flexibility of real wages and relative prices; see below). The more recent theoretical literature on optimum

currency areas has, however, emphasized the importance of analyzing the *source* of the shocks facing the economy when deciding among alternative exchange rate regimes. As Buiter, Corsetti, and Pesenti (1996, pg. 14) argue, “the transitory difference made by nominal exchange rate flexibility to the real adjustment path of the economy is potentially desirable in the case of shocks to goods market demand, but potentially undesirable in the case of monetary shocks”. They show that asymmetric shocks, far from being an argument against a fixed exchange rate or a common currency, are in fact an argument in favor of a fixed exchange rate or common currency if the shocks in question are predominantly monetary shocks and the degree of international financial capital mobility is very high.

The theoretical basis of this argument derives from an extension of the analysis by Poole (1970) regarding the choice among alternative monetary policy regimes in a closed economy. The analysis shows that, if the aim of economic policy is to stabilize output in the face of transitory shocks, a flexible exchange rate is desirable when shocks originate from the real side of the economy, whereas a fixed rate is preferable if shocks are monetary in origin. A preponderance of domestic nominal shocks, in particular to money demand, strengthens the case for a fixed exchange rate regime, allowing anchoring to a stable foreign country’s price level. By contrast, in the face of real shocks the economy would benefit from exchange rate flexibility, which would ease adjustment costs in the presence of stickiness of wages and prices.

Jordan and Lebanon are vulnerable to a number of real shocks, including the regional effects of oil price changes, regional political developments, and movements in labor remittances and grants from official donors. At the same time both countries have faced periods of considerable instability in money demand. In the case of Lebanon, monetary instability was associated with the end of the civil war and the resumption of economic activity, with the consequent need to remonetize the economy in the face of considerable uncertainties regarding developments in money demand. In the case of Jordan, there were uncertainties regarding holdings of dinars by Palestinians in the West Bank and Gaza, with spillover effects on Jordan proper, associated with the possible introduction of a Palestinian currency.

In this paper a three-equation structural VAR is used to model the joint behavior of real output, real money balances, and CPI inflation in response to three exogenous disturbances (see Appendix I for more technical details on use of this approach). Figures 1a–1d and 2a–2d plot the data for real GDP, CPI inflation, real money balances, and money balances as a proportion of nominal GDP for Jordan and Lebanon respectively. In applying this approach various identifying restrictions are used so that these disturbances can be interpreted as aggregate supply (AS), goods market (IS), and money demand (MD) shocks. The principal objective of the exercise is to get some idea of the relative importance of these three shocks in explaining the variance of output in Jordan and Lebanon at different time horizons, and to look at the dynamic response of their economies to each type of shock.

Typical examples of supply shocks are exogenous changes in energy prices or the terms of trade, productivity shocks or wage shocks. Demand shocks can be thought of as government spending shocks or shifts in investment and consumption functions. An implicit assumption of the SVAR approach, as noted by Gerlach and Smets (1995), is that different supply and demand shocks (e.g., oil price shocks versus productivity shocks, or changes in government spending as opposed to shifts in the consumption function) have similar effects on output, inflation, and real money balances, so that they can be aggregated into a “typical” aggregate supply or demand shock. Money demand shocks are any exogenous shocks to velocity arising, for example, from financial liberalization or from sudden losses of confidence in the ability of the government to maintain an exchange rate peg.

The three main economic assumptions that have been used to identify the model are:

- (i) No long-run effect of aggregate demand (IS) shocks on output;
- (ii) No long-run effect of money demand (MD) shocks on output; and
- (iii) No long-run effect of aggregate demand (IS) shocks on velocity (or on money balances as a proportion of nominal GDP).

The first two long-run restrictions are that aggregate demand and money demand disturbances have no permanent effect on the level of output. This assumption—that only supply shocks have long-run effects on output—is by no means uncontroversial. For example, changes in depreciation allowances or investment tax credits, or permanent increases in government spending, may affect the equilibrium real interest rate and hence the savings rate, and thereby the steady-state level of capital and output (see for example Buiter (1980)). However, this assumption is commonly used—by Blanchard and Quah (1989) for instance. Moreover, as argued in Blanchard and Quah (1989), even if such effects exist, the permanent output effects of demand shocks relative to the permanent output effects of supply shocks are likely to be small. The third long-run identifying restriction that is used is that money demand shocks have no permanent impact on velocity.

Table 2 reports the variance decomposition results for (changes) in real GDP for Jordan and Lebanon, while the impulse response functions are plotted in Figures 3–8. These plot the responses of the levels of the endogenous variables (output, inflation, real money balances as a proportion of output) to a one standard deviation perturbation to each of the three structural shocks. The vertical axis denotes the log of the endogenous variables; the horizontal axis denotes time in years. Note that, in order to make interpretation of the results easier, the plots of the impulse response functions are the paths of the levels of the endogenous variables rather than their growth rates.

Table 2. Decomposition of Forecast Error Variance for (Change in) Real GDP

	Step (years)	Standard Error	Supply	Money Demand	IS
Lebanon					
	1	0.28883	87.91	10.60	1.49
	2	0.29379	85.06	11.26	3.68
	3	0.29969	81.74	12.97	5.28
	4	0.31303	76.44	13.16	10.40
	5	0.31396	76.57	13.09	10.34
Jordan					
	1	0.04864	40.84	51.47	7.69
	2	0.06514	38.34	50.45	11.21
	3	0.06781	38.51	50.40	11.10
	4	0.06883	37.41	51.67	10.93
	5	0.06976	37.05	52.08	10.98

The first striking thing about the variance decomposition results is that the standard errors of the forecasts for real GDP are much higher in the case of Lebanon than in the case of Jordan. Also, the results vary significantly for the two countries: whereas in the case of Lebanon, they suggest that money demand shocks account for less than 15 percent of the variance in output at horizons of one to five years, in the case of Jordan the proportion is much higher, at between 50 percent and 55 percent. Correspondingly, aggregate supply shocks appear to account for between 75 percent and 90 percent of the variance in output in the case of Lebanon, but only around 35 percent to 40 percent in the case of Jordan, over the same time horizon. The impulse response functions are generally sensible and suggest that, whereas in the case of Lebanon the impact of aggregate supply shocks tend to lessen over time, the opposite applies in the case of Jordan. These results are not surprising, given that Lebanon (unlike Jordan) had gone through a civil war for much of the period under study, and is more susceptible than Jordan to regional shocks arising from the Israeli-Palestinian conflict (for example, it has been more exposed to Israeli bomb attacks on important infrastructure).

The results presented here should be interpreted with caution. In the first place, they only show how shocks have affected the two countries in the recent past, and the nature of shocks faced by either or both countries may differ significantly in the future. Moreover, the nature of output shocks and the response of these economies to the shocks, are likely to depend in an important way on the exchange rate regime; in other words, the exchange rate regime may affect both the nature of shocks facing the economy, as well as the manner and extent to which these economies respond to various shocks. However, there is no other available methodology to distangle the effect on output of monetary shocks as opposed to real shocks. Moreover, this methodology has been used in the academic literature, for example to examine whether it is optimal for the EMU countries to have a

fixed exchange rate among themselves (i.e., whether these countries constitute an optimum currency area or not; see for example Bayoumi and Eichengreen (1993) and Bhattacharya and Binner (1998)).

While bearing the shortcomings of this approach in mind, the SVAR results are nevertheless revealing and indicate that, at least over the recent past, money demand shocks have had a significant influence on output in Jordan, accounting for more than 50 percent of its variance, but have had a much smaller influence on Lebanon, accounting for less than 15 percent of the variance of output.

B. Product and Export Diversification

The high concentration of exports in both countries is another argument in favor of a more flexible exchange rate regime. If an economy is sectorally diversified in terms of production and exports, a shock to a particular industry will be less significant to the economy as a whole because that industry represents a relatively small proportion of national output. In this sense the costs of a fixed exchange rate regime are reduced if the economy is sectorally diversified. Thus economically large countries, by virtue of being more diversified across sectors and regions, face fewer aggregate real shocks that could be offset by changes in the nominal exchange rate (even assuming that nominal exchange rate adjustments translate into desired movements in the real exchange rate). Since both Jordan and Lebanon are small economies, with exports concentrated in a few key commodities and markets in the Middle East and Europe, this may strengthen the case for moving towards a more flexible exchange rate regime. In particular, it is possible that a more flexible exchange rate regime would help these countries penetrate new markets, especially given the current strength of the U.S. dollar.

But how sensitive are exports to movements in relative prices? Unfortunately, in the case of Lebanon, data limitations do not allow an empirical investigation of the sensitivity of exports to movements in the real effective exchange rate. However, past studies for Jordan², using annual data up to the mid-1990s, suggest that nontraditional exports are highly price sensitive whereas traditional exports are not price elastic. The results of estimated export equations using data for more recent years did not find a statistically significant effect of the CPI-based real effective exchange rate on exports of either goods or services; better results were obtained using an export price index relative to the CPI, and these results are discussed and presented below.

Data to estimate the export equations were taken mainly from the IFS Statistics or were obtained from the Research Department of the Central Bank of Jordan, except for the trading partner output series (which was obtained from the WEO database) and the real effective exchange rate series (which was taken from the Information Notice System).

² See "Jordan: Selected Issues", International Monetary Fund, 1998.

Unfortunately, a separate price series for export of services is not available, and the same export price index was used for both goods and services. The equations were estimated with annual data over the period 1980–1999. The variables are defined as follows:

XGDS =	(log of) exports of goods from Jordan (in U.S. dollars, divided by the U.S. wholesale price index)
XGDST =	(log of) exports of traditional goods (potash, phosphates and fertilizers) from Jordan (in U.S. dollars, divided by the U.S. wholesale price index)
XGDSNT =	(log of) exports of nontraditional goods from Jordan (in U.S. dollars, divided by the U.S. wholesale price index)
XSER =	(log of) exports of services from Jordan (in U.S. dollars, divided by the U.S. wholesale price index)
GDPPC =	(log of) index of real GDP for Jordan's trading partner countries (export-weighted averages, constructed from GEE assumptions for Jordan).
PXR =	(log of) export price index for Jordan, divided by the CPI for Jordan
DUM89 =	a dummy variable to isolate the period 1986–89, during which there were growing external imbalances leading to a devaluation in 1989.

Augmented Dickey-Fuller tests and Phillips-Perron tests for the stationarity of the variables used in the equations were carried out, but the results for both exports of goods and for exports of services turned out to be on the borderline. In estimating the equations it was assumed that all the export series are non-stationary in levels but stationary in first differences, i.e., $I(1)$. As for the independent variables, the output series for the partner countries and the relative price index for Jordan's exports all appear to be non-stationary. The unit root tests are not presented here for the sake of brevity but are available from the author on request. Given the short sample size, it was decided to follow the Engle-Granger approach (rather than the Johansen procedure) in estimating the long-run price elasticities of exports of goods and of services.

The estimated equations are presented in Tables 3–6 below with the t-statistics (presented in brackets) corrected for the presence of autocorrelation and heteroscedasticity as suggested by Newey and West (1987).

Table 3. Jordan: Estimated Equations for Exports of Goods (Total)

Equation (1)

Dependent Variable: XGDS—Exports of Goods from Jordan, Total

Variable	Coefficient	t-stat.
Constant	-1.414	-1.317
GDPPC	1.612	7.875
PXR	0.157	1.117
DUM89	0.141	3.913

R-squared = 0.9447; Adj. R-squared = 0.9343; Durbin-Watson statistic = 2.1648;
F-statistic = 91.0257; s.e. of regression = 0.0821

Equation (2)

Dependent Variable: Δ XGDS—(Change in) Exports of Goods from Jordan, Total

Variable	Coefficient	t-stat.
Constant	0.049	1.786
Δ GDPPC	1.015	2.125
Δ PXR	0.624	2.172
RES1(-1)	-1.020	-4.357

R-squared = 0.7204; Adj. R-squared = 0.6645; Durbin-Watson statistic = 1.7875; F-statistic = 12.8827; s.e. of regression = 0.0708; Jarque-Bera = 0.4221; Breusch-Godfrey(1) = 0.1294; Breusch-Godfrey(2) = 0.4724; Arch(1) = 2.1821; Arch(2) = 2.9972

Table 4. Jordan: Estimated Equations for Exports of Traditional Goods

Equation (3)

Variable	Coefficient	t-stat.
Constant	5.207	2.116
GDPPC	0.163	0.350
PXR	-0.731	-2.102
DUM89	0.398	5.102

R-squared = 0.8034; Adj. R-squared = 0.7665; Durbin-Watson statistic = 1.6024; F-statistic = 21.7952; s.e. of regression = 0.1551; Jarque-Bera = 1.0274

Equation (4)

Dependent variable: $\Delta XGDST$ —(Change in) exports of goods from Jordan, Traditional

Variable	Coefficient	t-stat.
Constant	0.103	1.260
$\Delta GDPPC$	-1.087	-0.555
ΔPXR	0.494	2.062
RES2(-1)	-0.316	-1.688

R-squared = 0.1975; Adj. R-squared = 0.0370; Durbin-Watson statistic = 1.5803; F-statistic = 1.2303; s.e. of regression = 0.1476; Jarque-Bera = 0.6999; Breusch-Godfrey(1) = 0.7640; Breusch-Godfrey(2) = 1.1988; Arch(1) = 0.6788; Arch(2) = 0.9767

Table 5. Jordan: Estimated Equations for Exports of Nontraditional Goods

Equation (5)

Variable	Coefficient	t-stat.
Constant	-6.976	-6.489
GDPPC	2.579	12.627
PXR	0.759	4.649
DUM89	-0.086	-2.105

R-squared = 0.9357; Adj. R-squared = 0.9237; Durbin-Watson statistic = 2.7242; F-statistic = 77.6685; s.e. of regression = 0.1100; Jarque-Bera = 1.0321

Equation (6)

Dependent variable: $\Delta XGDSNT$ —(Change in) exports of goods from Jordan, Non-traditional

Variable	Coefficient	t-stat.
Constant	0.024	0.200
$\Delta GDPPC$	2.394	0.881
ΔPXR	0.973	1.973
$RES3(-1)$	-1.357	-5.019

R-squared = 0.7319; Adj. R-squared = 0.6783; Durbin-Watson statistic = 2.3441; F-statistic = 13.6525; s.e. of regression = 0.1114; Jarque-Bera = 0.6944; Breusch-Godfrey(1) = 2.1466; Breusch-Godfrey(2) = 2.3406; Arch(1) = 0.2060; Arch(2) = 0.3581

Table 6. Jordan: Estimated Equations for Exports of Services

Equation (7)
Dependent Variable: XSER—Exports of services from Jordan

Variable	Coefficient	t-stat.
Constant	4.061	10.394
GDPPC	0.635	8.449
PXR	0.199	3.951

R-squared = 0.7730; Adj. R-squared = 0.7463; Durbin-Watson statistic = 2.5803; F-statistic = 28.9449; s.e. of regression = 0.0509; Jarque-Bera = 0.3488

Equation (8)
Dependent variable: Δ XSER—(Change in) Exports of Services from Jordan

Variable	Coefficient	t-stat.
Constant	-0.012	-0.441
Δ GDPPC	1.114	1.712
Δ PXR	0.272	2.978
RES3(-1)	-1.332	-6.760

R-squared = 0.7109; Adj. R-squared = 0.6531; Durbin-Watson statistic = 2.0636; F-statistic = 12.2945; s.e. of regression = 0.0498; Jarque-Bera = 1.3468; Breusch-Godfrey(1) = 0.9275; Breusch-Godfrey(2) = 1.0992; Arch(1) = 0.3624; Arch(2) = 2.4458

Most of the estimated equations have a high R-squared and Adjusted R-squared, except for the estimated equations for traditional exports. Note that the t-statistics for the estimated long-run equations (1), (3), (5), and (7) are not valid, given the non-stationarity of the variables, and also that the coefficient on the relative export price in equation (3)—the estimated long-run equation for traditional exports—is the opposite sign from what one would expect. Phillips-Perron unit-root tests on the residuals from these equations (RES1, RES2, RES3, and RES4 respectively) rejected the null hypothesis of a unit root at all the standard significance levels, except for RES2, where the results were on the borderline at the 1 percent level. These unit-root test results, together with the statistical significance of the residual terms in the estimated short-run dynamic equations (2), (6), and (8), validates the use of the Engle-Granger approach, except in the case of traditional exports since the coefficient on RES2 is insignificant at the 10 percent level. Moreover, the residuals from all the short-run dynamic equations pass the Jarque-Bera test for normality, the Breush-Godfrey tests for serial correlation, and the ARCH tests for heteroscedasticity at all the standard significance levels. Rather surprisingly the growth of real GDP of Jordan's trading partner countries does not appear to have a significant effect on the growth of Jordan's exports in the short term at the 5 percent level, either for goods or services. The change the price of exports relative to the CPI is borderline significant at the 5 percent level in the estimated short-run equations for exports of goods, and statistically significant at the 1 percent level in the estimated short-run equation for exports of services.

In short, the empirical evidence presented here provides some support for the claim that exports of both goods and services from Jordan are price sensitive. Moreover it is of interest to note that the estimated relative price elasticities are higher for exports of nontraditional goods than for total exports of goods. This is consistent with the findings of previous studies which, as noted above, found that nontraditional exports are highly price sensitive whereas traditional exports are not price elastic. In a recent paper Megarbane (2000) argues that the appreciation of the Jordanian dinar in real effective terms during the second half of the 1990s did not significantly affect traditional exports but hindered the growth of nontraditional exports and the diversification of export markets, forcing exports to follow its historical pattern (nontraditional exports to the region and traditional exports outside the region). This does not necessarily argue against a fixed exchange rate system; the appreciation of the Jordanian dinar mainly reflected movements in the U.S. dollar, and greater exchange rate flexibility could be achieved by pegging instead to a basket of currencies. The same argument applies in the case of the Lebanese pound.

It could be argued that strong export growth in Jordan in 2001/02, despite a significant appreciation of the real effective exchange rate over this period, indicates that market access may be more important for export performance than price competitiveness. Jordanian exports were given a strong boost through the opening of Qualified Industrial Zones (QIZs) and the signing of the free trade agreement with the United States. These factors may have led to a one-off upward shift in the volume of exports—that is, to a structural break; but it is quite possible that, once the effects of these measures peter out, price competitiveness will have an important bearing on Jordan's export performance.

C. Wage and Price Flexibility and Factor Mobility

Despite the empirical evidence presented above, it could be argued that the benefits of a more flexible exchange rate regime, in terms of safeguarding competitiveness and providing an effective tool for dealing with shocks that are external or originate from the real side of the economy, are at best uncertain at this point in time. This is because the nominal exchange rate will be an effective tool in dealing with output shocks only if *nominal* wages and/or prices are rigid, and *real* wages and relative prices are flexible. If nominal wages are flexible while real wages adjust more slowly, the real effects of movements in the nominal exchange rate are likely to be short-lived, unless wage-bargainers respond differently to price increases from different sources (imports versus non-imports). In this case the costs of giving up an independent monetary policy and adopting a fixed exchange rate regime may be relatively small. Real wage rigidity and stickiness of relative prices imply that adjustment to output shocks will be protracted, either with or without an independent monetary policy.

Limited labor market data for Jordan and Lebanon make an assessment of labor market flexibility in either country difficult. However, as Erickson von Allmen (2001) notes, the labor market in Jordan lacks some of the features that would typically be associated with inflexibility, such as tight regulations, strong unions, and generous unemployment benefits, and the same applies to Lebanon. Both countries have a minimum wage (at present LL 300,000 per month in Lebanon, and JD 80 per month in Jordan), but it is not clear whether this has had any noticeable effect of wage formation in either country. Lebanon was able, in the first half of the 1990s, to absorb the large numbers of expatriates returning to the country at the end of the civil war, and Jordan too was successful in absorbing the large number of workers returning from the Gulf following the outbreak of the war in 1990/91.

Nevertheless, there is evidence of high reservation wages stemming from alternative employment opportunities abroad and from the relatively ready availability of government jobs, at least until recently. At the same time the persistence of high levels of unemployment in both countries indicate some rigidity of real wages, at least in the downward direction. The fact that real effective exchange rates in both countries closely follow movements in the real effective U.S. dollar also indicate some stickiness in relative prices, which may be due (in part at least) to real wage rigidity. Given the very low rates of consumer price inflation in both Jordan and Lebanon, it may be the case that real wage rigidity is a consequence of nominal wage rigidity; workers may accept—albeit reluctantly—a reduction in real wages associated with a rise in inflation following a depreciation of the exchange rate, while resisting a reduction in nominal wages. If moving to a more flexible exchange rate regime leads to more variation in inflation, it is possible that real wages would be easier to adjust and become less rigid. This is, of course, an entirely speculative hypothesis.

For a given level of wage or price stickiness, the costs of the loss of flexibility associated with a fixed exchange rate regime would be lower the greater the extent of occupational and geographical mobility of labor, both within a country and between partner countries. In the absence of labor mobility, an asymmetric shock reducing the demand for labor in a country or region or industry would lead to an increase in unemployment there. Labor mobility would instead permit—at least in principle—the workers affected by the fall in demand to migrate to a region or industry where demand is higher. Here, it is relevant to note that the high mobility of Lebanese and Jordanian workers, particularly within the region, can lessen the need for exchange rate adjustment in response to country-specific shocks, and to a lesser extent to regional shocks; indeed, Lebanese workers have been especially successful in relocating themselves in most regions of the world.

III. USE OF THE EXCHANGE RATE AS A NOMINAL ANCHOR TO CONTROL INFLATION

The exchange rate regime has policy implications not only for the stabilization of output in the presence of various shocks to the economy, but also for the control of inflation. This is because, in the absence of an exchange rate peg, there is a need for another nominal anchor such as the money supply, to achieve some degree of domestic price stability. The choice of an appropriate nominal anchor for the economy depends in part on the degree of currency substitution in the economy. Section II looked at the role of the exchange rate regime in stabilizing output in the presence of various shocks to the economy. This section discusses its role in controlling inflation and achieving price stability in the domestic economy.

The higher the degree of currency substitution and the larger the holdings of foreign money in circulation, the more difficult it is for the monetary authorities to control the money supply, measured in terms of domestic currency in circulation and defined broadly to include holdings in both domestic and foreign currency, if the exchange rate is allowed to vary. In other words, the higher the elasticity of substitution between domestic and foreign currencies, the more difficult it is for the monetary authorities to control the foreign currency component of broad money and the stronger the case for adopting a fixed exchange rate as a nominal anchor. The basic idea is that the relevant monetary aggregate (i.e., the one which determines the domestic price level and influences economic activity) may be the one that includes foreign-currency deposits expressed in domestic currency terms. Since the latter cannot be effectively controlled by the monetary authorities, the relevant money supply may become endogenous and the economy may lose its nominal anchor (see Sahay and Vegh (1996)). In the extreme case in which domestic and foreign money are perfect substitutes, the economy is left with no nominal anchor and the exchange rate is indeterminate (see Kareken and Wallace (1981)). From a policy perspective, the endogeneity of the money supply implies that the authorities may be unable to reduce inflation by tightening the domestic component of the money supply.

Moreover, a high degree of currency substitution implies that the exchange rate will be significantly volatile and responsive to credibility issues, thereby strengthening the case in favor of a fixed exchange rate regime. This conclusion arises because, in money-based

stabilizations, expectations play a big role in the determination of the exchange rate when there is a high degree of currency substitution. More specifically, the higher the elasticity of substitution between domestic and foreign currencies, the larger the shift from foreign to domestic currency as a result of a fall in expected inflation, and thus the higher the appreciation of the nominal exchange rate.

Unfortunately, there is very little recent work looking at the empirical evidence for currency or asset substitution in Jordan. In the case of Lebanon, Mueller (1994) tries to econometrically model the dollarization process in the country over the period 1982 to 1993. His results suggest that the expected depreciation rate, in addition to the interest rate differential, are significant determinants of the dollarization process in Lebanon. An unusual feature of his model is that he includes a ratchet effect to take into account the limited reversibility of the dollarization process.

An alternative approach is used in this paper to examine the evidence for currency and asset substitution in Jordan and Lebanon. The data to estimate the equations were taken mainly from the website of the Banque du Liban, from the Research Department of the Central Bank of Jordan, and from the IFS Statistics, except for the quarterly GDP series, which were interpolated from the annual data used for the structural VAR using a cubic splining method. The equations were estimated with quarterly data over the period 1982: Q1–2000: Q4 in the case of Lebanon, and over the period 1987: Q2–2000: Q4 in the case of Jordan. The variables in the estimated equations for Lebanon are defined as follows:

- LBVEL = (log of) LL broad money as a proportion of nominal GDP (estimate of quarterly GDP multiplied by the CPI for Lebanon)
- LBINTD = the average interest rate on term and savings deposits denominated in domestic currency
- LBROR1 = the rate of depreciation of the Lebanese pound against the U.S. dollar, defined as $\log s_t - \log s_{t-1}$, where s_t is the (end-of-period) exchange rate of the pound against the U.S. dollar in period t
- LBROR2 = current period inflation differential between Lebanon and the U.S., that is the current quarter CPI inflation rate in Lebanon minus the current quarter CPI inflation rate in the U.S.
- LBROR3 = the 3-month U.S. dollar LIBOR rate plus ROR2
- DUM874 = a dummy variable set equal to one in the fourth quarter of 1987 and to zero otherwise

DUM881 = a dummy variable set equal to one in the first quarter of 1988 and to zero otherwise

DUM924= a dummy variable set equal to one in the fourth quarter of 1992 and to zero otherwise

The variables for Jordan are defined in the same way, but with JO instead of LB as the prefix. Two dummy variables were introduced in the money demand equations for Jordan:

DUM921 = a dummy variable set equal to one in the first quarter of 1992 and to zero otherwise

DUM934 = a dummy variable set equal to zero in the period up to the third quarter of 1993, and to one thereafter, to reflect changes in the definition of broad money.

Figures 9–13 plot LBVEL, LBINTD, LBROR1, LBROR2, and LBROR3, respectively. As Figure 9 shows, there was a sharp fall in real money balances (relative to output) in the second half of 1987, followed by an equally sharp restoration to “normal” levels in early 1988. The sharp fall in the demand for Lebanese pounds is attributed to the deterioration of the public finances and to the steady acceleration of inflation and exchange rate depreciation during the course of the year as the Banque du Liban allowed broad money to grow at a rapid pace to help finance the fiscal deficit. The depreciation of the Lebanese pound stopped in November 1987, partly as a result of policy measures, but also as a consequence of a sharp turn around in expectations by the private sector. By the end of the year, there was a widely held belief that the exchange rate depreciation during 1987 was excessive, which was reflected in a major improvement in the trade balance. In short, there was a pickup in private sector confidence towards the end of 1987. In 1988, the overall balance moved into surplus and the Banque du Liban was able to increase its reserves by US\$750 million. The fall in velocity (rise in money demand) in the fourth quarter of 1992 reflected the return of confidence following the election of Hariri as Prime Minister in October, following a period of domestic political uncertainty, and the adoption of a package of stabilization measures towards the end of the year designed to reduce the fiscal deficit and reestablish financial stability.

Figures 14–18 plot JOVEL, JOINTD, JOROR1, JOROR2, and JOROR3, respectively. Figure 14 shows a trend rise in JD broad money velocity from 1989 to early-1999, and then a steady fall; the latter was associated with the restoration of confidence following the coming to power of a new government after the long illness and eventual death of King Hussein. The first quarter of 1992 witnessed a particularly sharp rise in velocity (fall in money demand relative to output), which may be linked to the regional uncertainties associated with the end of the Gulf War, and in particular to concerns regarding the possible adverse political and economic ramifications of King Hussein having backed the Iraqi President during the war.

Unit-root tests on the variables produced similar results for both countries. Both output y , the domestic interest rate on deposits and real LL money balances ($m^D - cpi$) are non-stationary, i.e., $I(1)$, while Johansen maximum eigenvalue and trace tests for co-integration suggest that these variables are not co-integrated. At the same time, Augmented Dickey-Fuller tests and Phillips-Perron tests for the stationarity of the rate of return variables indicated that all of them are stationary, i.e., $I(0)$. Thus the dependent variable was taken to be $\Delta(m^D - cpi - y)$, i.e., the inverse of velocity. In addition to the (change in the) domestic interest rate and the rate of return variables, quarterly seasonal dummies were included in the estimated equations for Lebanon (but turned out to be insignificant in the case of Jordan). As before, the unit root tests are not presented here for the sake of brevity but are available from the author on request. The estimated equations are presented below in Tables 7 and 8, with the t-statistics (presented in brackets) corrected for the presence of autocorrelation and heteroscedasticity as suggested by Newey and West (1987).

All the estimated equations for Lebanon have a high R-squared and Adjusted R-squared; the estimated equations for Jordan have lower R-squared and Adjusted R-squared, but are still reasonable given that the equations are estimated in first differences. The rate of return variables are all significant at the 1 percent level, except for JOROR1. For both countries, better results were obtained using the inflation differential with the U.S. as a proxy for the expected rate of depreciation, but the lagged dependent variables were all statistically insignificant in the case of Jordan. The statistically significant positive signs on the lagged (first difference) of the domestic interest rate, in the case of Lebanon, are explained by the fact that the domestic interest rate used in these equations represents an own rate of return, while the importance of the lag suggests that a significant share of LL broad money represents time deposits of a maturity greater than three months. The residuals from the equations pass the Breush-Godfrey tests for serial correlation, the ARCH tests for heteroscedasticity and the Jarque-Bera tests for normality at all the standard significance levels.

Thus the results provide empirical support for the presence of both currency substitution and asset substitution in both Jordan and Lebanon. However, they need to be interpreted with caution. As Cuddington (1983) and Savastano (1990) point out, a major problem with this type of standard test is that the inclusion of the expected rate of depreciation in a money-demand equation does not generally suffice to distinguish the occurrence of currency or asset substitution from either imperfect capital mobility or a high elasticity of demand for *all* existing substitutes to domestic money.

Table 8. Jordan: Estimated Money Demand Equations
Dependent Variable: $\Delta \text{JOVEL} - (\text{Change in})$ Ratio of JD Broad Money to Nominal GDP

Variable	Equation (12)		Equation (13)		Equation (14)	
	Coefficient	t-stat.	Coefficient	t-stat.	Coefficient	t-stat.
Constant	0.007	1.088	0.014	2.295	0.039	3.928
$\Delta \text{JOINTD}(-1)$	-0.001	-0.004	0.006	0.328	0.026	1.338
JOROR1	-0.001	-1.666				
JOROR2			-0.007	-3.471		
JOROR3					-0.004	-3.264
DUM921	-0.160	-20.056	-0.156	-20.943	-0.164	-23.653
DUM934	-0.011	-1.196	-0.017	-2.196	-0.022	-2.728
R-squared = 0.3515			R-squared = 0.4890			R-squared = 0.4761
Adj. R-squared = 0.2986			Adj. R-squared = 0.4473			Adj. R-squared = 0.4305
Durbin-Watson statistic = 2.0721			Durbin-Watson statistic = 2.0931			Durbin-Watson statistic = 2.0691
F-statistic = 6.6401			F-statistic = 11.7223			F-statistic = 10.4496
s.e. of regression = 0.0308			s.e. of regression = 0.0274			s.e. of regression = 0.0284
Jarque-Bera = 0.5882			Jarque-Bera = 0.0383			Jarque-Bera = 1.0608
Breusch-Godfrey(1) = 0.0884			Breusch-Godfrey(1) = 0.1218			Breusch-Godfrey(1) = 0.1021
Breusch-Godfrey(2) = 0.1313			Breusch-Godfrey(2) = 0.1249			Breusch-Godfrey(2) = 0.1341
Breusch-Godfrey(3) = 0.5603			Breusch-Godfrey(3) = 0.1340			Breusch-Godfrey(3) = 0.9651
Breusch-Godfrey(4) = 0.5745			Breusch-Godfrey(4) = 2.2565			Breusch-Godfrey(4) = 1.2040
Arch(1) = 0.0490			Arch(1) = 0.3951			Arch(1) = 0.2230
Arch(2) = 0.0931			Arch(2) = 0.4165			Arch(2) = 1.3744

IV. CONCLUDING REMARKS

Over the past few years, the exchange rate peg has helped to maintain stability in both Jordan and Lebanon in the face of nominal shocks and to withstand several shifts in domestic money demand. For Lebanon, monetary instability was associated with the end of the civil war and the resumption of economic activity, with the consequent need to remonetize the economy in the face of considerable uncertainties regarding developments in money demand. In the case of Jordan, there were uncertainties regarding holdings of dinars by Palestinians in the West Bank and Gaza, with spillover effects on Jordan proper, associated with the possible introduction of a Palestinian currency. The nominal stability offered by the peg to the dollar has helped to increase confidence in the local currencies in both countries over the past few years while securing low levels of inflation. However, both Jordan and Lebanon are vulnerable to a number of real and external shocks, which may increase in importance over time (at least relative to nominal shocks).

Results presented in this paper suggest that, during the recent past, output fluctuations in Lebanon have been predominantly the result of aggregate supply or demand shocks, whereas in Jordan more than 50 percent of the shocks to output have been monetary in origin. Empirical evidence for Jordan provides some support for the claim that exports—at least nontraditional exports—are price sensitive, even though the CPI-based real effective exchange rate turned out to be insignificant in export equations estimated using more recent data. At the same time, it could be argued that the high concentrations of exports in both countries strengthen the case for moving toward a more flexible exchange rate regime.

The nominal exchange rate would be an effective instrument in dealing with output shocks, however, only if *nominal* wages and prices are rigid and *real* wages and relative prices are flexible. Unfortunately, there is very little empirical evidence on the flexibility of real wages and relative prices in either country. However, the persistence of high unemployment in both countries implies some labor market rigidity and suggests that real wages may not be flexible in a downward direction. Thus the benefits of a more flexible exchange rate regime, in terms of restoring competitiveness and providing an effective tool for dealing with shocks that are external or originate from the real side of the economy, are at best uncertain.

Another factor that needs to be borne in mind relates to the choice of a nominal anchor to maintain inflation at its current low levels. The high level of dollarization in Lebanon and the empirical evidence presented in this paper indicating a high degree of currency and asset substitution in both countries suggest that it will be difficult to find an effective substitute for the exchange rate as a nominal anchor for the economy. The implication is that it might make sense to continue with the current fixed exchange rate system for the time being until the macroeconomic situation becomes clearer and more stable, and confidence in the Lebanese pound is restored to higher levels. The possible secondary effects of greater exchange rate flexibility on the domestic financial sector in Lebanon are also uncertain, given that almost 90 percent of bank lending to the private sector is in

foreign currency. Although the extent of dollarization of the economy is much lower in Jordan the empirical evidence presented in this paper suggests that the same considerations apply, and that a move to a money-based nominal anchor may be associated with considerable volatility of the nominal exchange rate.

Given the lack of evidence that real wages and prices are flexible, at least in the downward direction, and the likely difficulty—at least in the case of Lebanon—of finding an effective substitute for the exchange rate as a nominal anchor, perhaps the most sensible conclusion to draw is that a fixed exchange rate regime is best for both countries at present. However, given the prevailing trade patterns in both countries and the need for Jordan and Lebanon to penetrate new export markets, the arguments and counter-arguments for a peg to the euro or for a peg linked to a basket of currencies, as opposed to a peg to the U.S. dollar, should be carefully considered.

Finally, it is important to note that the discussion in this paper has focused (somewhat simplistically?) on the arguments for fixed versus floating exchange rates, while in practice there is a wide spectrum of exchange rate regimes, ranging from currency unions to currency boards, a “truly fixed” exchange rate peg, adjustable and crawling pegs, target zones/bands, managed floats, and “completely free” floats. A more detailed discussion of the relative merits of each of these alternatives in the contexts of Jordan and Lebanon is beyond the scope of this paper.

Figure 1. Lebanon: Macroeconomic Variables

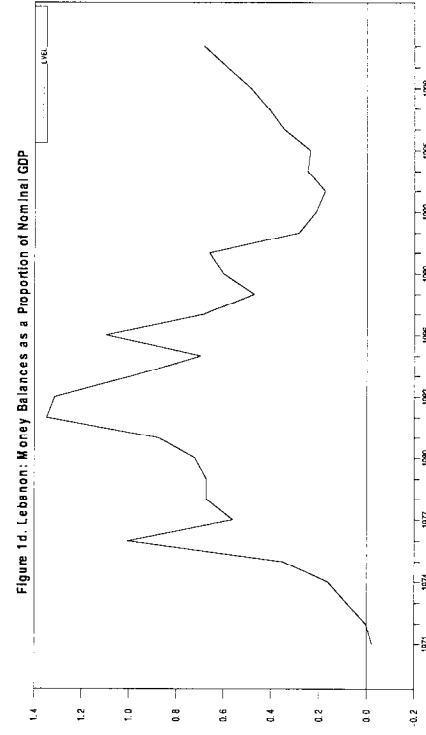
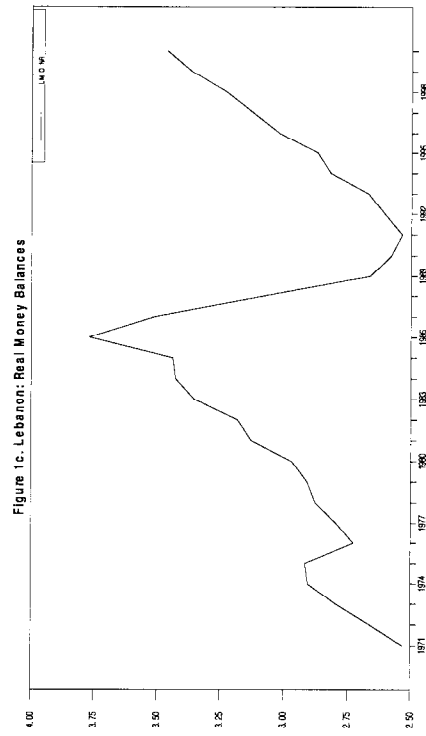
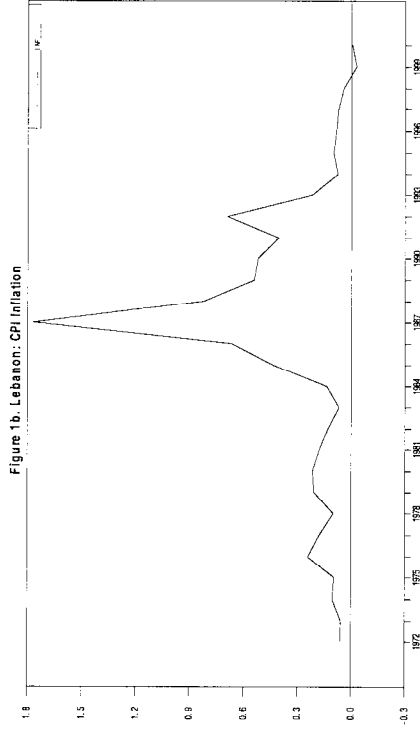
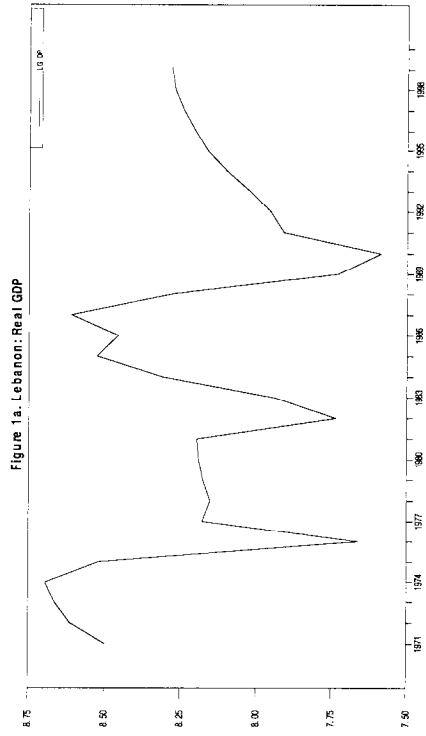


Figure 2. Jordan: Macroeconomic Variables

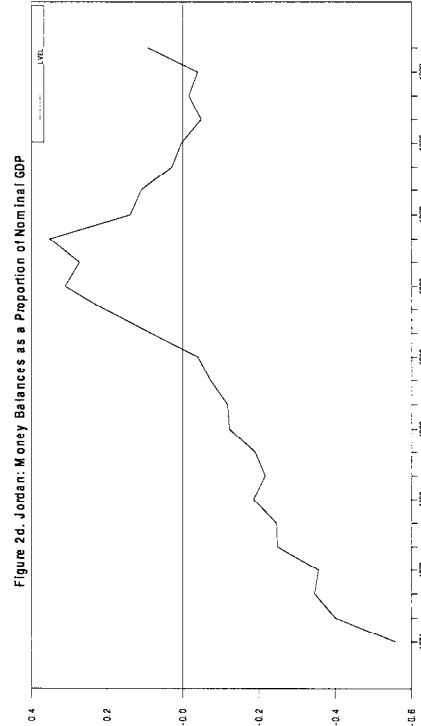
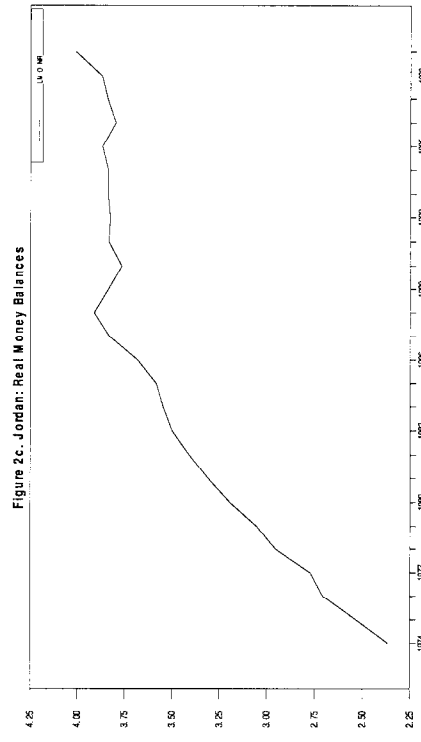
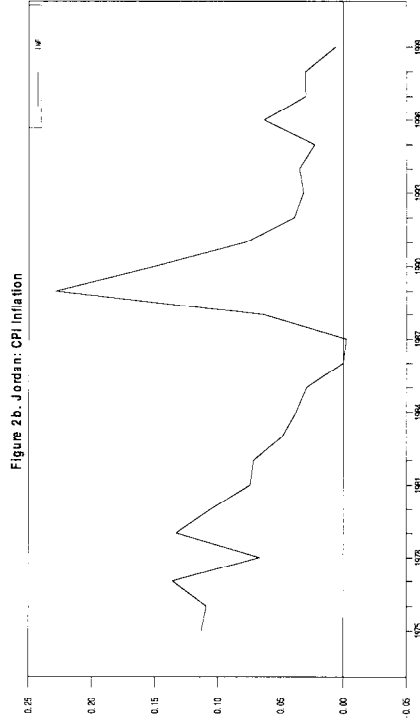
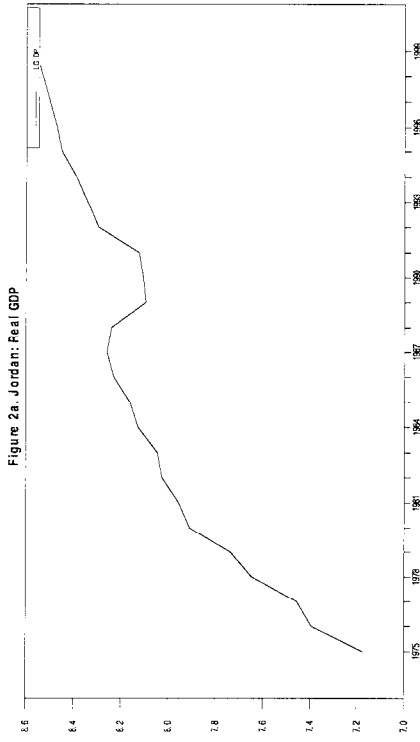


Figure 3. Lebanon: Impulse Response Function for Output

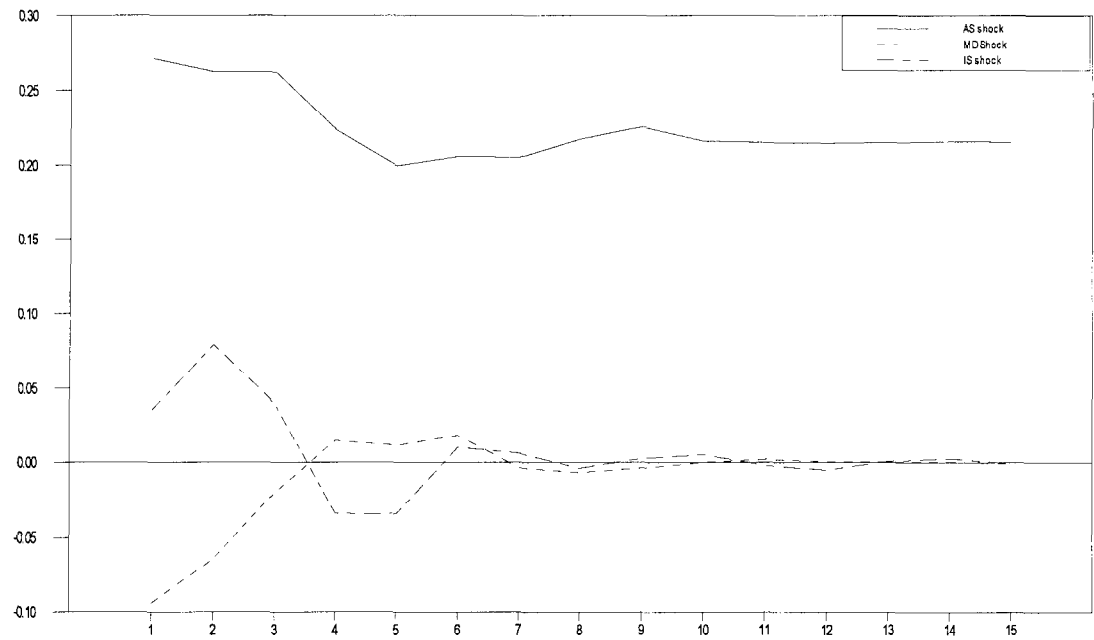


Figure 4. Lebanon: Impulse Response Function for Real Money Balances

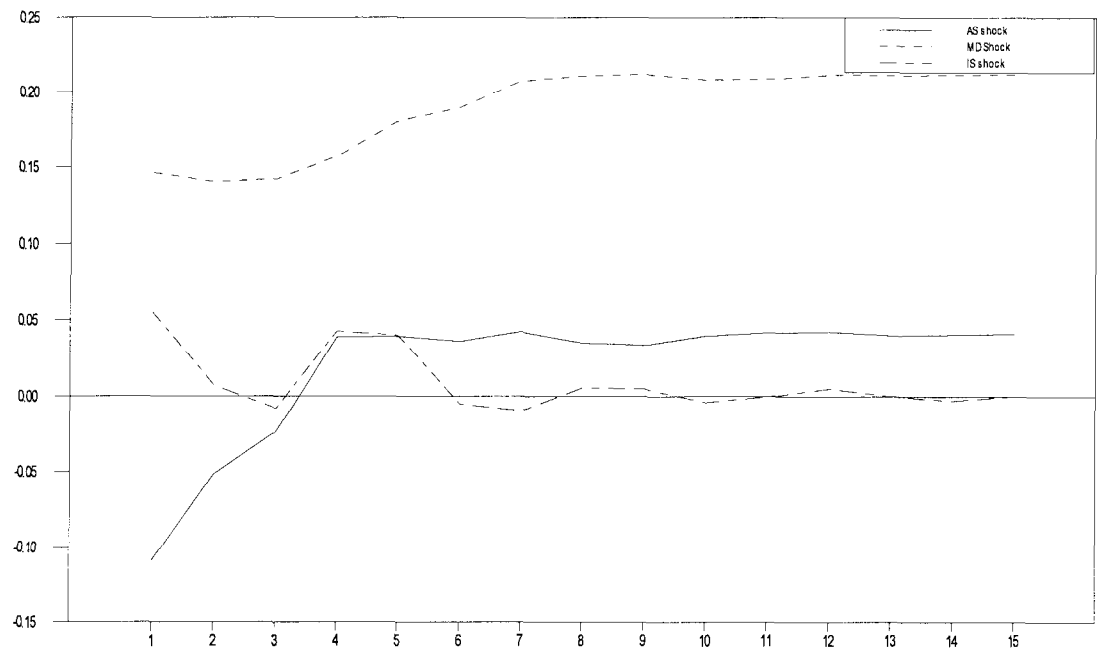


Figure 5. Lebanon: Impulse Response Function for Inflation

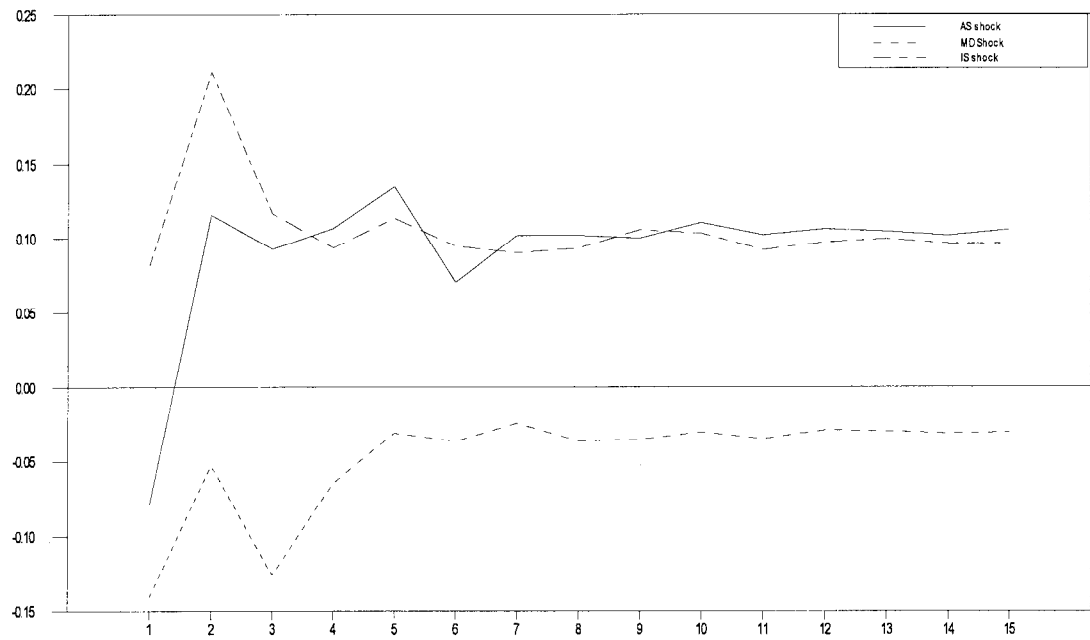


Figure 6. Jordan: Impulse Response Function for Output

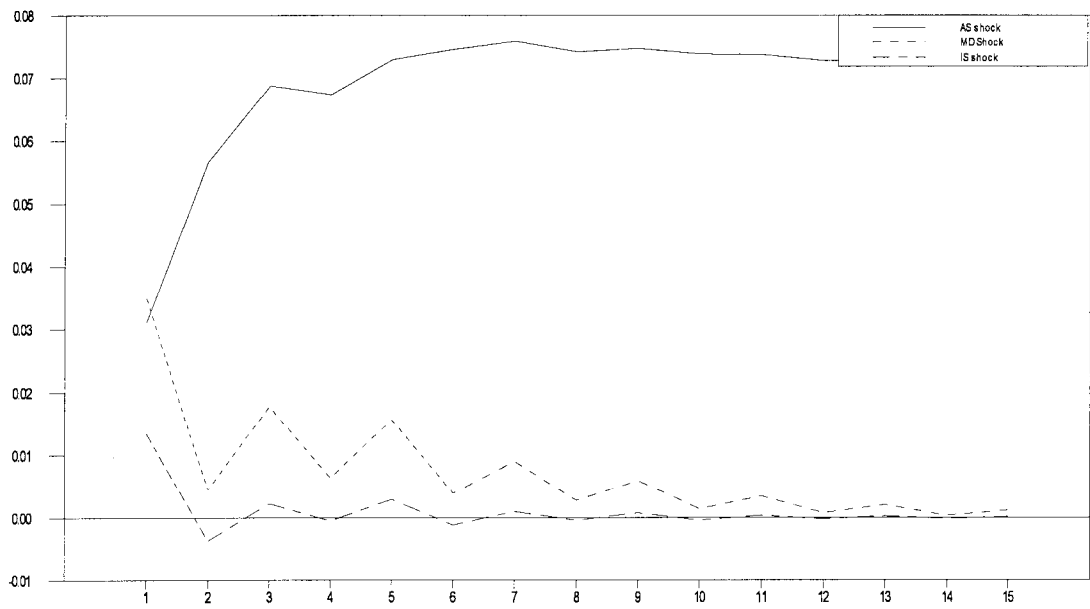


Figure 7. Jordan: Impulse Response Function for Real Money Balances

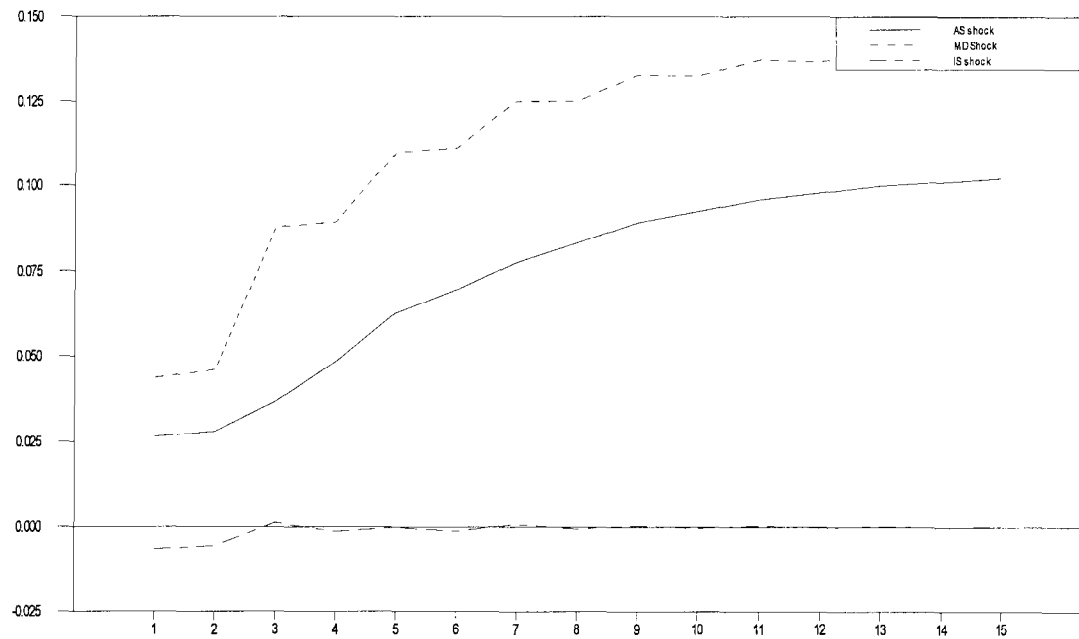


Figure 8. Jordan: Impulse Response Function for Inflation

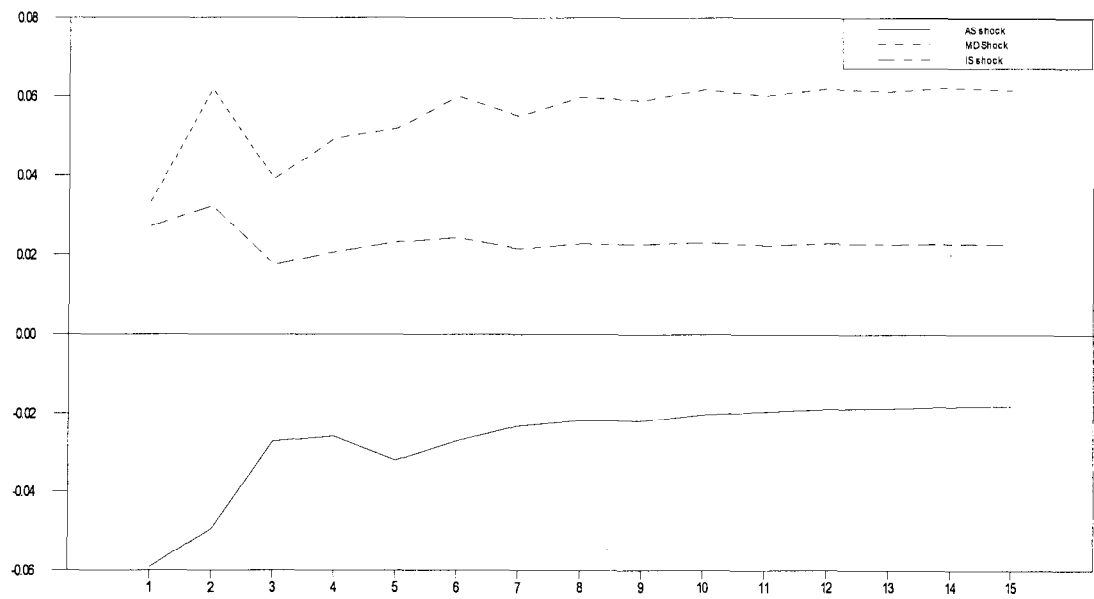


Figure 9. Lebanon: Velocity and Interest Rates

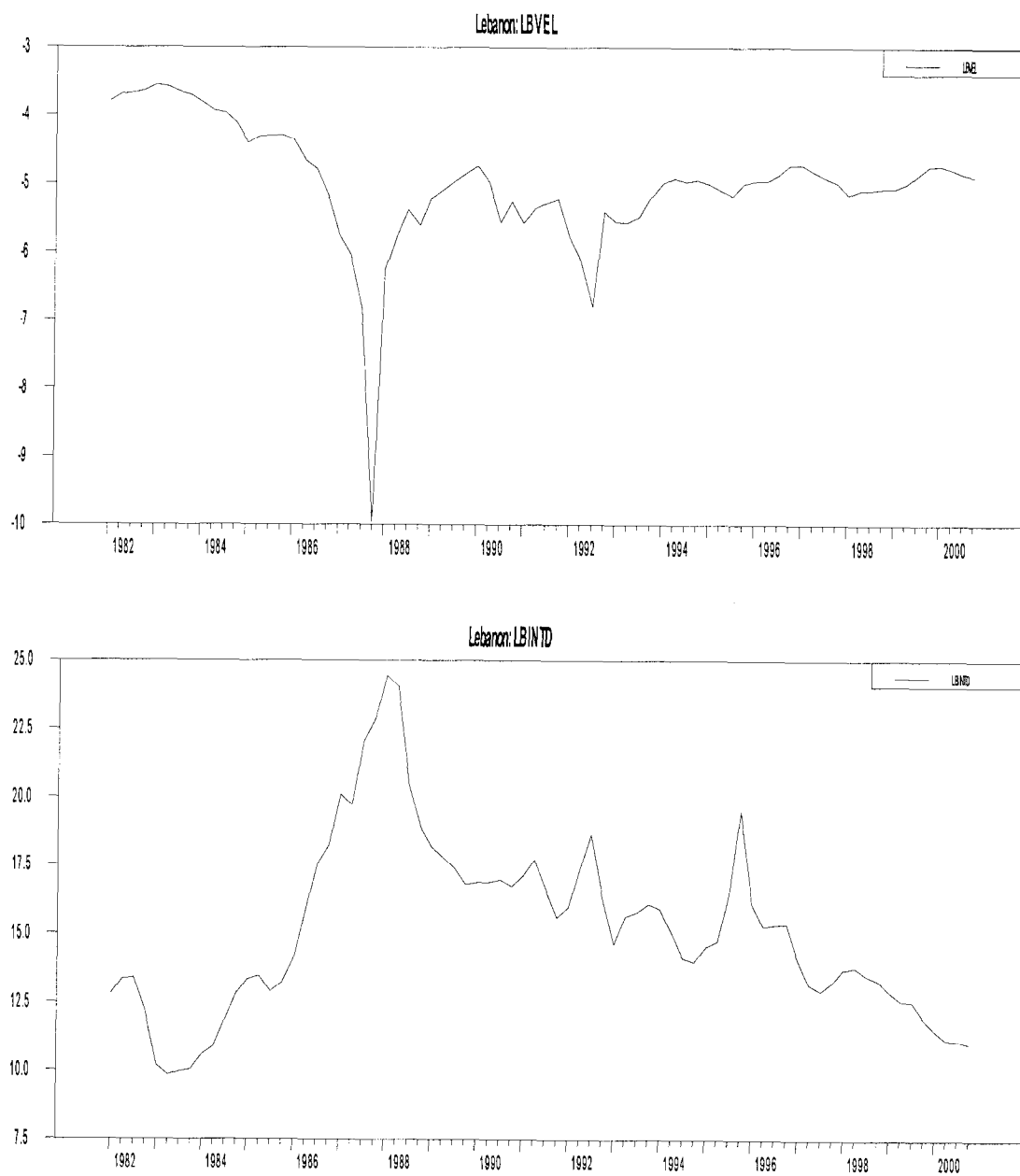


Figure 10. Lebanon: Rate of Return Differentials

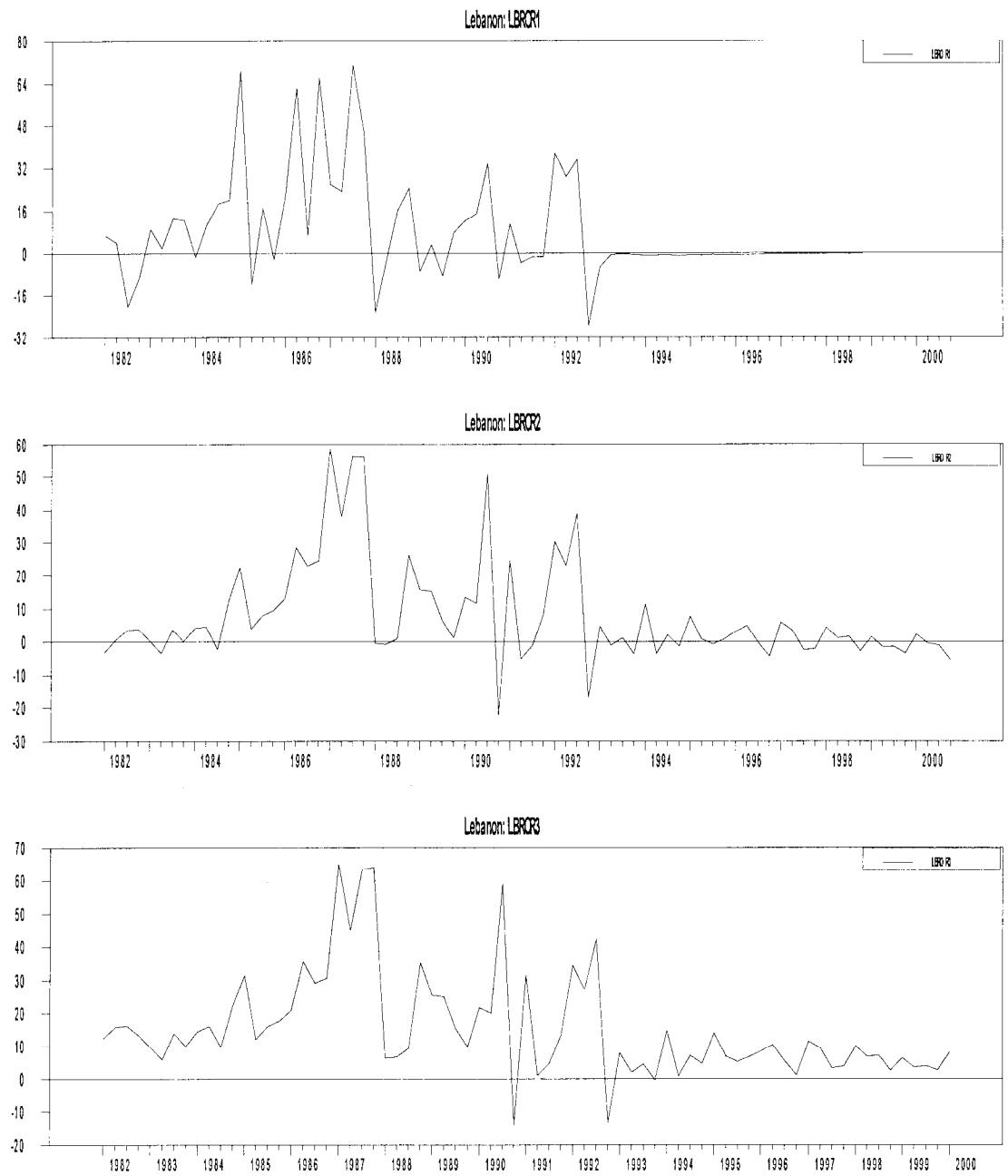


Figure 11. Jordan: Velocity and Interest Rates

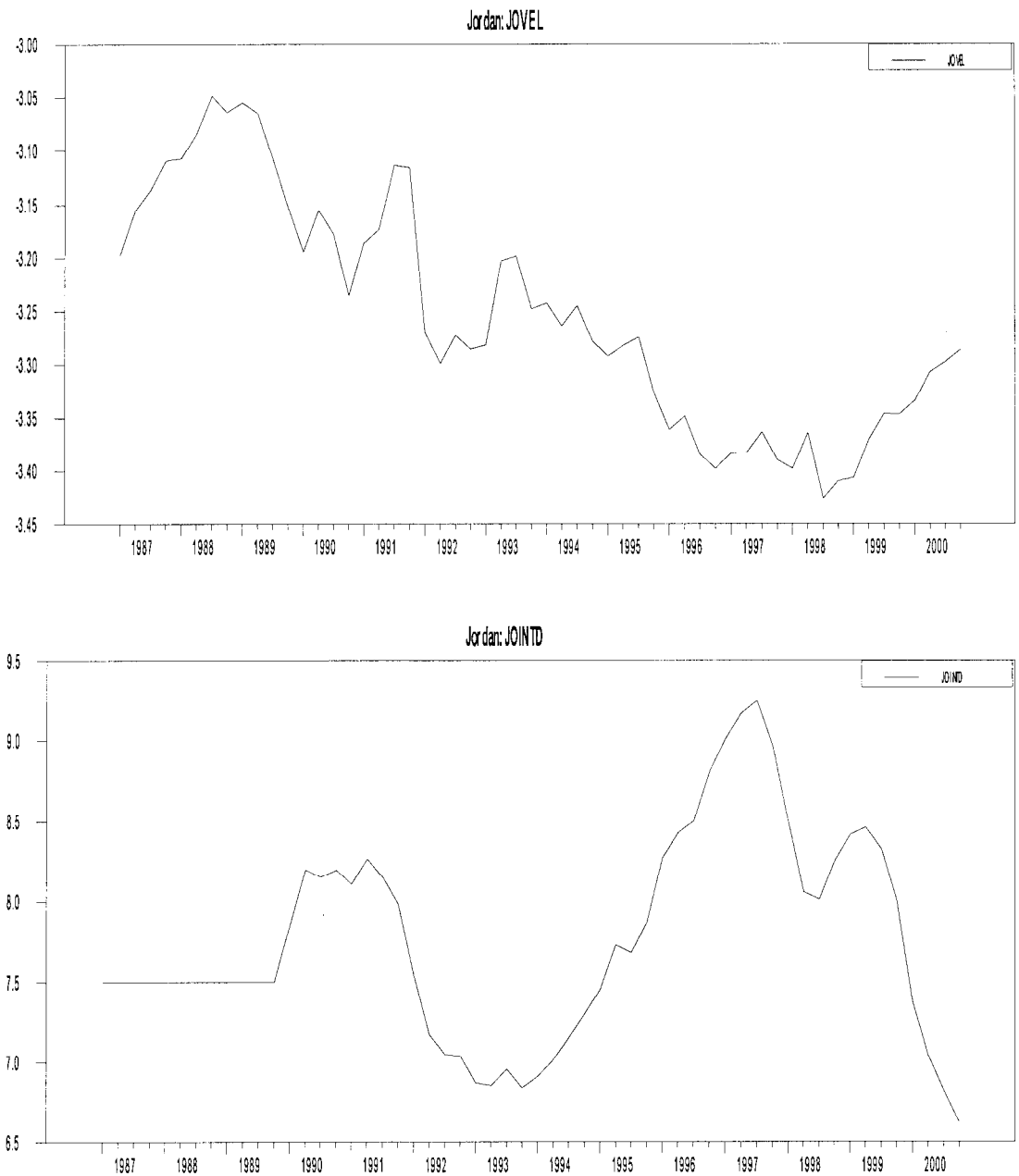
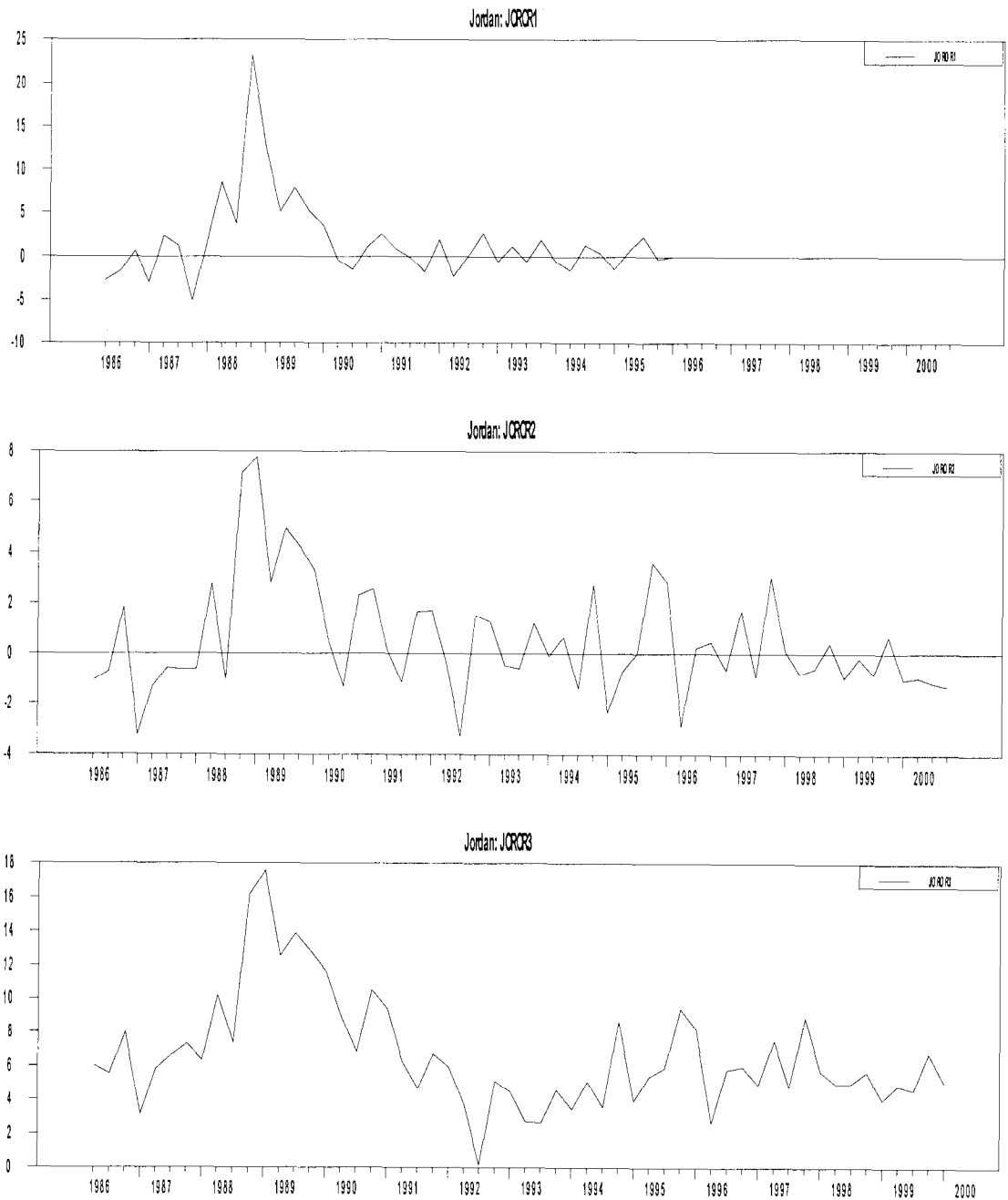


Figure 12. Jordan: Rate of Return Differentials



STRUCTURAL VAR: TECHNICAL DETAILS

A closer look at the data

A preliminary step towards specifying the structural VAR model correctly is to investigate the long-run time-series properties of the macroeconomic variables involved, i.e., their degree of integration and the presence (or absence) of co-integrating relationships among the non-stationary variables. For both countries Augmented Dickey-Fuller and Phillips-Perron tests were carried out to test the null hypothesis of a unit root in y , inf , $m-cpi$ and $m-p-y$, where

y = log of (real) GDP

inf = CPI inflation

cpi = log of the CPI index

m = log of broad money (as defined in the IFS Statistics)

p = log of the GDP deflator.

The sample period is 1971-2000 for Lebanon and 1974-1999 for Jordan. Annual data for the CPI and broad money were obtained from the IFS Statistics. GDP data for Lebanon were obtained from Eken et al (1995), supplemented with data provided by the Lebanese authorities and Fund Staff estimates for more recent years. GDP data for Jordan were obtained from the World Bank database, supplemented with data provided by the Department of Statistics in Jordan from 1992 onwards. Figures 1a-1d and 2a-2d plot the data for real GDP, CPI inflation, real money balances ($m-cpi$), and money balances as a proportion of nominal GDP ($m-p-y$, the inverse of velocity) for Jordan and Lebanon respectively. The unit-root test results are not presented in this paper for the sake of brevity but are available from the author on request. The results indicate that y , inf and ($m-cpi$) are all $I(1)$, while Johansen maximum eigenvalue and trace tests for co-integration suggest that $m-cpi$ is not co-integrated with y . Moreover, ($m-p-y$) appears to be $I(1)$ (i.e., non-stationary) while $\Delta(m-p-y)$ is stationary. In summary, the unit-root tests suggest that $(\Delta y, \Delta inf, \Delta(m-p-y))$ is a covariance stationary process. Having studied the time series properties of the main macroeconomic variables, we go on to specify the Structural VAR model and discuss the identifying restrictions used to disentangle the money demand (MD) shocks from the aggregate supply (AS) and demand (IS) shocks.

Specification of the SVAR model and implementation of identifying restrictions

We assume that $\mathbf{x} = [\Delta y, \Delta(m-p-y), \Delta inf]$ is a covariance stationary vector process for both Jordan and Lebanon. We further assume that each element of \mathbf{x} can be expressed as a linear combination of current and past structural shocks. Formally, \mathbf{x} has a vector moving average representation of the form

$$\mathbf{x} = C(L)\varepsilon \quad (15)$$

where $\varepsilon = [\varepsilon^{AS}, \varepsilon^{MD}, \varepsilon^{IS}]'$ is the vector of serially uncorrelated structural shocks (aggregate supply, money demand, and demand (*IS*) respectively). The structural shocks are assumed to be pairwise orthogonal and the diagonal variance-covariance matrix is normalized to identity ($\text{var}(\varepsilon) = I$).

The 3×3 matrix $C(L)$ is a k degree polynomial in the lag operator L - i.e. $C(L) = 1 + C_1L + C_2L^2 + \dots + C_kL^k$ - and is the object to be estimated. Once we have $C(L)$, a straightforward transformation will allow the recovery of expressions for the levels of the different variables in terms of the current and lagged values of the structural disturbances.

The reduced-form Wold moving average (*MA*) representation of \mathbf{x} is given by

$$\mathbf{x} = E(L)\mathbf{v} \quad (16)$$

where $E(L) = 1 + E_1L + E_2L^2 + \dots + E_kL^k$.

It is assumed that $E(L)$ is invertible. Vector \mathbf{v} is then the vector of one-step ahead linear least squares forecasting errors (innovations) in predicting \mathbf{x} as a linear function of its past values. More formally \mathbf{v} is defined as

$$\mathbf{v} = \mathbf{x} - P[\mathbf{x}_t; \mathbf{x}_{t-1}, \mathbf{x}_{t-2}, \mathbf{x}_{t-3}, \dots] \quad (17)$$

where P is the orthogonal projection operator. Furthermore let Σ be the variance-covariance matrix of the vector of innovations \mathbf{v} , i.e. $\Sigma = E[\mathbf{v}\mathbf{v}']$.

Now define $D(L) = E(L)^{-1}$, where $D(L)$ satisfies $D(L)E(L) = E(L)D(L) = I$. Given the invertibility property of $E(L)$, it is straightforward to derive the reduced-form autoregressive representation of \mathbf{x} as

$$D(L)\mathbf{x} = \mathbf{v} \quad (18)$$

where $D(L) = 1 + D_1L + D_2L^2 + \dots + D_kL^k$.

The innovations in \mathbf{v} are assumed to be linear combinations of the structural disturbances in $\boldsymbol{\varepsilon}$, i.e.

$$\mathbf{v} = S\boldsymbol{\varepsilon} \quad (19)$$

for some 3x3 full rank matrix S .

This in turn implies that

$$C(L) = E(L)S \quad (20)$$

Pre-multiplying both sides of Equation (4) by S^{-1} we obtain the vector autoregressive representation of \mathbf{x} in terms of the structural disturbance vector $\boldsymbol{\varepsilon}$:

$$A(L)\mathbf{x} = \boldsymbol{\varepsilon} \quad (21)$$

where $A(0) = S^{-1}$.

We estimate the model as follows. First, OLS is used to obtain consistent estimates of the coefficients in $D(L)$. Three lags were used in the estimation of the SVAR for Lebanon and two lags for Jordan. Then, by inverting $D(L)$ we derive an estimate of $E(L)$. Using the OLS residuals we obtain an estimate of the variance-covariance matrix Σ .

Although the composite shocks \mathbf{v} are the one-step ahead forecast errors in the endogenous variables, they do not have a structural interpretation. However, we want to obtain impulse response functions and variance decompositions that trace out the effects of the structural shocks (rather than the effects of the forecast errors). Since $\mathbf{v} = S\boldsymbol{\varepsilon}$, the structural model, i.e., the coefficients of $A(L)$ and $C(L)$, will be identified to the extent that we introduce enough restrictions to determine the nine elements of matrix S uniquely. Given S , we can easily recover $C(L)$ by post-multiplying our $E(L)$ estimate by S (see Equation (20)).

The assumption of mutually orthogonal shocks, together with the normalization restrictions whereby the variances of the aggregate supply, IS and money demand are normalized to one, implies that $E[\varepsilon\varepsilon'] = I$. Using Equation (19) we get

$$SS' = \Sigma \quad (22)$$

which provides six non-linear restrictions on the elements of S , given Σ . Just-identification of the structural model requires three additional restrictions. The three additional restrictions that have been used are:

- R1: No long-run effect of aggregate demand (*IS*) shocks on output
- R2: No long-run effect of money demand (*MD*) shocks on output
- R3: No long-run effect of aggregate demand (*IS*) shocks on velocity (or on money balances as a proportion of nominal GDP).

Letting the cumulative long run multipliers be denoted as $C(1) = 1 + C_1 + C_2 + \dots$, the restrictions that neither *IS* shocks nor money demand shocks have any permanent effect on the level of output implies that $C_{12}(1) = C_{13}(1) = 0$. Similarly, the restriction that demand shocks have no long-run effect on velocity implies that $C_{23}(1) = 0$.

The empirical results from applying this model are presented in the main text.

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