Testing for Inflationary Inertia Case of Lebanon

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Abstract

Many countries around the globe adopted the policy of fixing the exchange rate as a tool to stabilize for inflation. While the stabilization tool succeeded in changing the direction of the price level in one economy, it failed in another. This paper investigates as to whether the stabilization policy in Lebanon altered the direction of the price level by using advanced empirical analysis. Of great importance is the Edward Model. The model empirically investigates the way in which the adoption of a nominal exchange-rate anchor affected the degree of inflationary inertia conditions under which a disinflation program based on a pegged exchange rate may have a positive effect on the stabilization process. Additional test like the Chow Point Test for structural break at a specific date, the stabilization date, is used as well. Both tests are sufficient to explore whether the stabilization policy was effective in altering the direction of the price level.

Key words: Lebanese Economy, Foreign Reserves, Stabilization Policy, Lebanese Currency.
Classification Code: F 31, F 37, F41

Introduction

Prior to the civil war, the Lebanese economy had a history of great economic performance. It was characterized by low inflation, high rates of economic growth, large balance of payments surpluses, small fiscal deficits, and a floating, stable, and fully convertible domestic currency. Regulations on the functioning of markets for goods and services, labor, capital, and trade were limited, and tax burdens were light in comparison with other countries at a similar stage of development. [1] From 1975 till 1990, The Lebanese civil war exacted a heavy toll in human and material terms and caused fundamental changes in the economy. The economy suffered from the destruction of infrastructure and industrial facilities, while the reluctance to invest resulted in the obsolescence of remaining production capacity. The flow of goods and factors of production in Lebanon was disrupted as a result of the fragmentation of the country.

There was mass emigration, with an accompanying loss in professional and entrepreneurial skills. The emigration of workers was accompanied by a flight of capital, and Lebanon's access to flows of foreign capital was much reduced. Meanwhile, Lebanon's public finances deteriorated significantly owing to the lack of central government authority in the country and the consequent inability of the authorities to collect revenues while continuing to provide a minimum of public services. In addition, large fiscal deficits were financed primarily through the banking system and Lebanon's role as a regional intermediary was greatly reduced. Nevertheless, Lebanon continued to maintain an exchange and trade system that was almost entirely free of restrictions on payments and transfers for current and capital transactions.

Confidence was restored in the last quarter of 1992 following, the first in twenty years, and the installation of the new government. In 1993, improved political stability, increased confidence, and an effective adjustment effort spurred favorable macroeconomics development. Real GDP picked up, inflation decelerated sharply, foreign exchange reserves were built up to a comfortable level, and the exchange rate was stabilized.[2] The paper main goal is to investigate the conditions under which a disinflation program based on a pegged exchange rate may have a positive effect on the stabilization process. It investigates the causes and the degree of inflationary inertia in Lebanon by using two tests: the Chow Point and the Edward's (1999). The Chow Point test is used to test whether there is a structural break at a specific date**.** The Edwards' empirically investigates the way in which the adoption of a nominal exchange-rate anchor affected the degree of inflationary inertia.

[1] Eken, Sena. "Reconstruction and Stabilization-An Overview." Back to the Future: Postwar Reconstruction and Stabilization in Lebanon. Edts. Eken, Sena & Thomas Helbling. IMF, 1999 pp. 1-4
[2] Bisat, A., and M. Hammour, "Economic Prospects for a Post war Lebanon," in The Economics of Middle East Peace, ed. By S. Fischer , D. Rodrick, and E. Tuma MIT Press 1993 pp 155-79

1. Theoretical review

Several theoretical aspects fit well with the Lebanese economy and for this reason it is important to separate them and highlight their importance and their relevance.

1.2 Vulnerability of the currency

It is believed that once an economy follows a fixed-exchange-rate rule or a narrow-band arrangement, it becomes more vulnerable to external shocks than when it follows a floating regime. Since this is the case, credibility becomes a fundamental requirement for the system if it is to survive. Corrective devaluation to restore foreign reserves may seem appropriate, but it may trigger capital flight and currency substitution. Thus, it is important to introduce the proposition that the vulnerability of the Lebanese economy has been largely associated with domestic and regional politics. In the second half of 1997 and the first four months of 1998, following the developments in Asian financial markets, Russia's financial crisis, an intensification of the hostilities in Lebanon's south, and the widely publicized news about unfavorable budgetary and public debt developments in Lebanon, the Lebanese authorities had once again to deal with unfavorable market sentiments and difficulties in rolling over maturing Lebanese pound treasury bills. Dollarization started to rise while the central bank began losing foreign exchange reserves. In addition, regional politics and regional conflicts inflicted a heavy cost on Lebanon, and especially during 2005 and thereafter. Political events shook confidence in the domestic currency and raised the question of whether the authority could sustain the peg. Some suggested devaluation, but the main argument opposing this view was that a devaluation of the Lebanese pound would shake the credibility of the entire stabilization policy.

1.2 Monetary base

Lebanon's monetary base behavior has presented an upward trend since 1991 (Figure 1). This trend has been maintained despite a decline in foreign reserves. This shows that sterilizing open market operations were able to stabilize the monetary base despite continuous pressure on the peg. The expansion of Lebanon's monetary base relative to its foreign reserves during and after 1999 suggests that something had drastically changed even without economic analysts raising the alarm. Through early 1997, issuance of domestic currency treasury bills and bonds for the sterilization of capital inflows was an important monetary policy instrument. Since then, interventions in the foreign exchange market have become more important instruments of monetary policy; the issue of treasury bills for sterilization purposes has been used only occasionally to aid in accumulation of foreign exchange reserves.

1.3 Debt and its relation to pegging the exchange rate

Lebanon has a high and rapidly growing public debt. Since 1991, Lebanon financed its deficit almost entirely by issuing debt, largely denominated in domestic currency, to institutions and agents other than the central bank. Interest payments, which represented about 40.7 percent of government expenditure and absorbed 74.5 percent of budgetary revenue in 1999, will also remain high (Table 1). With a given interest rate necessary to maintain the peg, that is, to sustain sufficient capital inflows, the higher the capital productivity, the lower these costs. Given the significant domestic and regional political risks, nominal interest rates on domestic currency assets have been high and subject to dramatic adjustments. Together, with the rapid accumulation of public debt, this has led to sharp increases in budgetary interest payments (Figure 2). Interest payments, the largest expenditure item in the budget, have been a major factor underlying the growth dynamics of expenditure. Thus, it is important to describe the configuration of the Lebanese debt profile with full consideration of its important relationship with the credibility issue.

The mixture of domestic and foreign currency debt (Figure 3) strongly enhanced the credibility of the exchange rate policy: for increases in domestic prices and devaluations in particular, amount to a type of default of domestic debt especially where held by foreigners. At some point during the Lebanese Exchange-rate-based-stabilization, the inflow of foreign capital declined, credibility was questioned, and discretionary policy was made possible largely due to the commitment to repay the dollar indexed debt in dollars: this commitment restrained the government from the temptation of any devaluation. Dollar-indexed debt clearly penalizes the government when devaluations occur. Furthermore, political uncertainties were associated with pressures on the exchange rate peg, and the central bank had to increase domestic interest rates to prevent excessive reserve losses. Accordingly, the favorable interest rate dynamics reversed, and net public debt started to grow. Public debt increased from a low of 38 percent of GDP at the end of 1993 to an estimated 135 percent of GDP at the end of 1999 and 140 percent of GDP at end of 2000. Given a persistent primary deficit and the high interest rates, Lebanon's fiscal situation has raised concern about the sustainability of the public debt, which means the survival of the pegged rate.

1.4External Shocks

It points to the question of whether the policy is initiated at the right time and right place (i.e., luck). Some of these shocks could be in the form of term of trade deterioration, change in world interest rates, and political stability. The Lebanese case is very unique in the sense that foreign governments, and the Lebanese expatriates are sending money to Lebanon regardless of changes in economic conditions, and especially changes in interest rate. These flows act as an automatic stabilizer. When the economy is hit by unfavorable economical and political shocks, money enters to Lebanon and vise a versa.

1.5Political conditions whether domestic or regional

In general, budget deficits are among the main causes of failure of inflation stabilization programs, and they raise the question of why governments allow budget deficits to persist. Edwards (1991) suggested that the smaller the probability of the current government being reelected, the more inefficient will be the tax system left for future governments and the more money will be borrowed in excess of the optimum. The resulting debt will have to be paid by the next government, and an inefficient tax system would act as constraint on its spending ability in programs the incumbent government may not like. However, for a small open economy like Lebanon subject to internal and regional conflicts, the success or failure of stabilization programs depends heavily on political stability. Any political shock can easily trigger currency substitution and capital outflow, which creates an upward pressure on the domestic currency to depreciate and thus losing foreign reserves.

1.6 Openness of the economy

This is another potentially important determinant of the success or failure of disinflation. Countries with an open capital account tend to be more vulnerable to international interest rate shocks. Romer (1993) explains the link between real openness and low inflation: greater openness reduces the response of output to an unexpected increase in demand. Dornbusch (1991) provides a simple analysis of the role of an open capital account in determining the success of inflation stabilization. He assumes that inflows of capital are proportional to the perceived probability of success of the program. But this brings us to an important question of whether a small open economy like Lebanon can have independent monetary or fiscal policy regardless of the kind of exchange rate regime that exists. Political scientist may play similar argument of whether a small open economy can sustain and handle democracy on its own.

1.7 Initial Conditions

Drazen and Grilli (1993) predicted that "bad" initial conditions are conducive to a successful stabilization. The longer a country has experienced high inflation, the smaller its anti-inflation reputation and the more likely the stabilization to fail. A long history of high inflation may indicate that the government has lost a significant amount of political capital with each failed stabilization. Thus, the marginal political cost of failure is low and the probability of another failure is higher.

The Data

The data are taken from the Central Bank of Lebanon (BDL), International Financial Statistics (IFS). I collected monthly data starting in the month in which the exchange-rate-based-stabilization program was implemented in October of 1992. Data taken from early years like 1990 till late 1992 may not be good indicators of macroeconomic variables due to war recovery efforts, economic fluctuations and political uncertainty that characterized the Lebanese economy during that period. The price level was obtained from the International Financial Statistics (IFS), the Lebanese Pound/US dollar Exchange rate (LL/US$) was obtained from the Central Bank of Lebanon (BDL) and the Lebanese price level was obtained from data provided by the Consultation & Research Institute (CRI) Beirut, Lebanon and from the World Development Indicators (WDI).

The Edwards Model:

It is crucial to examine inflationary inertia in Lebanon empirically, especially after the implementation of the stabilization program. In order to accomplish this, I use The Edwards' Model.

The Edwards' empirically investigates the way in which the adoption of a nominal exchange-rate anchor affected the degree of inflationary inertia in Chile, and Yugoslavia (Table 2). He estimated equation of the following type using quarterly data:

$$\pi_t = \beta_0 + \beta_1 \pi_{t-1} + \beta_2 (D\,\pi_{t-1}) + \beta_3 \hat{\pi}_{t-1} + \beta_4 \hat{Z}_{t-1} + \mu_t \quad \text{(Eq. 1)}$$

- **D** is a dummy that takes the value of one for the period when the nominal exchange anchor is in place and zero otherwise
- π^{*}_{t-1}: Rate of world inflation in period t

- $\hat{Z}_{t-1}$: Rate of growth of domestic credit

If the anchoring program is effective and credible, the estimated coefficient of β_2 should be significantly negative, indicating that this policy successfully reduced the degree of inertia in the system. (Edwards, 1999).

I estimated equation 1 by using the ordinary least square, and I derived the following results:

$$\pi_t = \underset{7.06}{3.522} + \underset{1.24}{1.196}\,\pi_{t-1} - \underset{0.29}{0.45}\left(D\pi_{t-1}\right) - \underset{2.75}{0.977}\,\pi^*_{t-1} + \underset{0.2}{0.212}\,\hat{Z}t-1 + \mu_t \quad (1)$$

Values in parentheses are standard errors.

R^2 =0.34, DW=1.81

The output indicates a poor fit. The R^2 value is 0.34 and the t-test for the dummy is not large enough. For equation (1) to be consistent, unbiass and efficient, several tests were performed. I use the Dickey-Fuller and the Augmented Dickey-Fuller tests (Table 3) to test for the presence of a unit root. The Dickey-Fuller test considers an AR(1) process: $y_t = \mu + \rho y_{t-1} + \varepsilon_t$ where μ_t and $\rho = 1$, y is a non-stationary series (a random walk with drift); The Philip-Perron test (Table 4), which entails less stringent restriction on the error process, is used as well. while ADF test corrects for higher order serial correlation by adding lagged differenced terms on the right-hand side, the PP test makes a correction to the t-statistics of the γ coefficient from the AR (1) regression to account for the serial correlation in ε. For the PP test, I specify the truncation lag q for the Newey-West correction, that is, the number of periods of serial correlation to include.

$$w^2 = \gamma_0 + 2\sum_{v}^{q}\left(1 - \frac{v}{q+1}\right)\gamma_j \quad \text{where} \gamma_{\text{j}} = \left(\frac{\sum_{t=j+1}^{T} \varepsilon\varepsilon_{t-j}}{T} \right)$$

and q is the truncation lag. The pp t-statistic is computed as:

$$\text{t}_{\text{pp}} = \frac{\gamma_0^{\frac{1}{2}} t_b}{\hat{w}} - \frac{\left(w^2 - \gamma_0\right) T s_b}{2\hat{w}s}$$

where t_{b}, s_b are the t-statistic and standard error of β and s is the standard error of the test regression

Furthermore, the ARCH LM test (Table 5) statistic tests for the null hypothesis that there is no ARCH up to order q while White's test is a test of the null hypothesis of no Heteroskedasticity against Heteroskedasticity of some unknown general form. Both the F test and the White test do not reject the null hypothesis of no heteroskedasticity; therefore, heteroskdedasticity is not a threat. In addition, the Durbin-Watson statistic that measures the linear association between adjacent residuals from a regression model has its limitation. First, if there are lagged dependent variables on the right-hand side of the regression, the DW test is no longer valid. Second, the distribution of the DW statistic under the null hypothesis depends on the data matrix x. Third, we may only test the null hypothesis of no serial correlation against the alternative hypothesis of first-order serial correlation. Two tests of serial correlation- the Breusch-Godfrey LM test (Table 6) and the Q-statistic (Table 7) and overcome the limitation of the DW. The test rejects the hypothesis of no serial correlation up to order four at 8.4%; therefore, the LM test indicates that the residuals are serially correlated at less than 8.4%. The Q-statistics on the other hand is a test at lag k for the null hypothesis that there is no autocorrelation up to order k and is computed as $\Phi_{LB} = T(T+2)\sum_{j=1}^{k}\frac{T_j^2}{T-j}$ Where T_j is the j-th autocorrelation and T is the number of observations. If the series is no based upon the results of ARIMA estimation, then under the null hypothesis, Q is asymptotically distributed as a X^2 with degrees of freedom equal to the number of autocorrelations. If there is no serial correlation in the residuals, the autocorrelations and partial autocorrelation at all lags should be nearly zero, and all Q-statistics should be insignificant with large p-values. The Q-statistics are insignificant at all lags, indicating significant serial correlation in the residuals.

First Order Serial Correlation

To correct for serial autocorrelation, I include AR(1) to the right of my regression equation: The estimated equation looks as follow

$$\pi_t = \underset{4.19}{2.95} + \underset{0.74}{2.36}\pi_{t-1} - \underset{0.17}{0.79}(D\pi_{t-1}) - \underset{1.05}{1.02}\pi^*_{t-1} + \underset{0.13}{0.823}\hat{Z}t-1 + \underset{1.4}{10.6}AR(1) \quad (2)$$

R^2 =0.74 DW= 1.93

Having done the necessary correction to equation (1), I conclude that the Lebanese stabilization program, with its nominal exchange-rate anchor component, was very effective in altering the nature of the dynamics of inflation as can be seen: the coefficient of $(D\pi_{t-1})$ is significantly negative.

The Chow Break Point Test

In order to test further whether the adoption of the fixed exchange rate in November of 1992 had an effect on the inflation process, a number of tests on the structural stability of the inflation equations were computed. If indeed the shift from flexible exchange rate regime to fixed exchange regime were credible, it would be expected that the inflation equation would capture a change in the regime. To test for stability, I use Chow's Breakpoint Test. The idea of the Chow breakpoint test is to fit the equation separately to each sub-sample in order to see whether there are significant differences in the estimated equations. A significant difference indicates a structural change in the relationship. Before I proceed with the Chow breakpoint test, I must use the Barlett test (Table 8) to see whether the variance in each subgroups are equal against the alternative that at least one subgroup has a different variance. The Barlett test compares the logarithm of the weighted average variance with the weighted sum of the logarithms of the variances. Under the joint null hypothesis that the subgroup variances are equal and that the sample is normally distributed, the test statistic is approximately distributed as X^2 distribution. By analyzing (Table 7), I conclude that the null hypothesis of having equal variance in each subgroup is not rejected. We conclude that each sub group has equal variance. Furthermore, to carry out the Chow Break point test, I partition the data into two sub-samples. Each sub-sample contains more observations than the number of coefficients in the equation. The Chow breakpoint test compares the sum of squared residuals obtained when separate equations are fit to each sub-sample of the data.

Chow Breakpoint Test: 1993 Q2

F-Statistic	*8.5*	*Probability*	*0.0007*
Log Likelihood ratio	*33.47*	*Probability*	*0.000003*

The data above report two test statistics for the Chow breakpoint test. The F-statistic is based on the comparison of the restricted and unrestricted sum of squared residuals. It is computed as $F = \frac{\left(\tilde{u}'\tilde{u} - (u_1'u_1 + u_2'u_2)\right)/k}{\left(u_1'u_1 + u_2'u_2\right)/(T-2k)}$ = 8.5 where $\tilde{u}'\tilde{u}$ is the restricted sum of squared residuals, $u_i'u_i$ is the sum of squared residuals from sub-sample (i), T=8, is the total number of observations, and k=5, is the number of parameters in the equation. The log likelihood ratio statistic is based on the comparison of the restricted and unrestricted maximum of the (Gaussian) log likelihood function. The LR test statistic has an asymptotic x^2 distribution with degrees of freedom equal to (m-1)k=5 under the null hypothesis of no structural change, where m=2 is the number of sub-samples. As the test above shows, the dynamic of inflation in Lebanon experienced a structural break in the second quarter of 1993, 3 months after the Exchange-rate-based-stabilization program was enacted. The x^2 (5) statistics for structural stability turned out to be equal to 8.5, rejecting the null hypothesis that there was no structural break in the second quarter of 1993. Therefore, the implementation of the exchange rate as a stabilization tool changed the direction of the price level.

Concluding remarks:

The empirical analysis I derived confirms the results that in an economy like Lebanon that is associated with inertial forces, reducing the degree of exchange rate adjustment will reduce the degree of inflationary persistence. If the Lebanese government maintains good credibility, the success of the program is inevitable. However, if the fixed rate does not discipline fiscal behavior of the Lebanese government, it will be more difficult for the policy to succeed. Despite the fiscal imbalances presented by the Lebanese government, the stabilization program was a success. This could be attributed to the fact that the authority complemented the fixing of the exchange rate with income policies or an overvaluation of the currency. However, income policies, as the Mexican experience shows, may not eliminate inflationary inertia.

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Figure 1 Lebanon: Domestic Credit, Base Money and Foreign Reserves (91-2000)

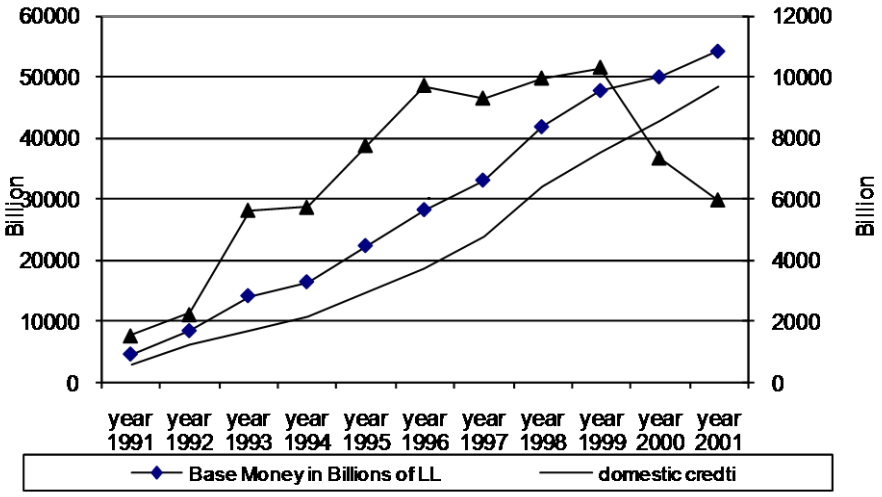

Figure 2 Lebanon: Interest Payments

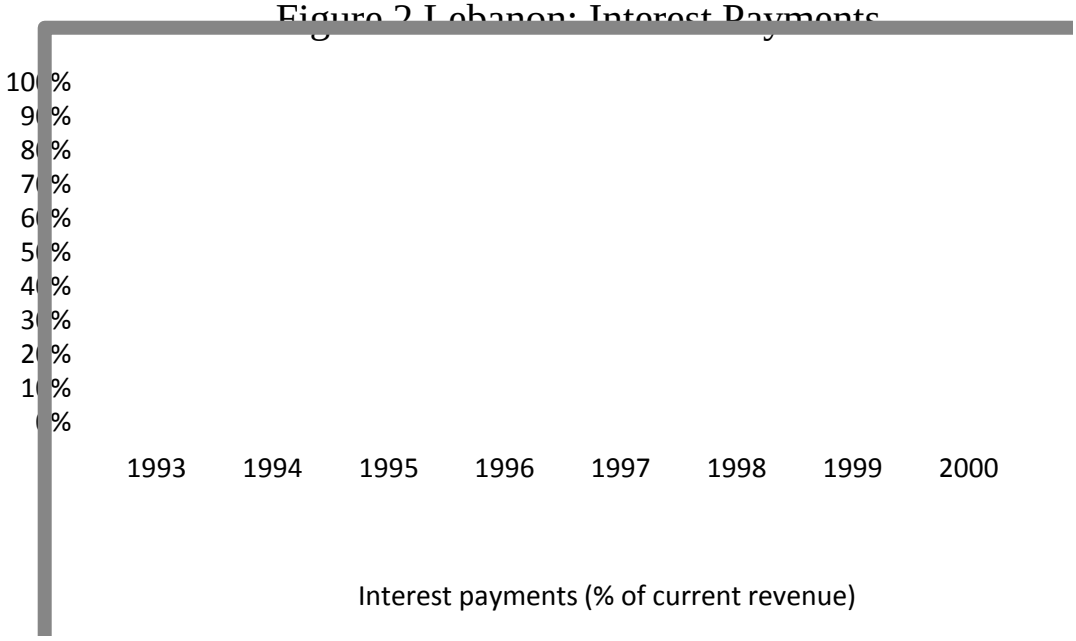

Figure 3 Lebanon: Composition of Public Debt. 91-2000

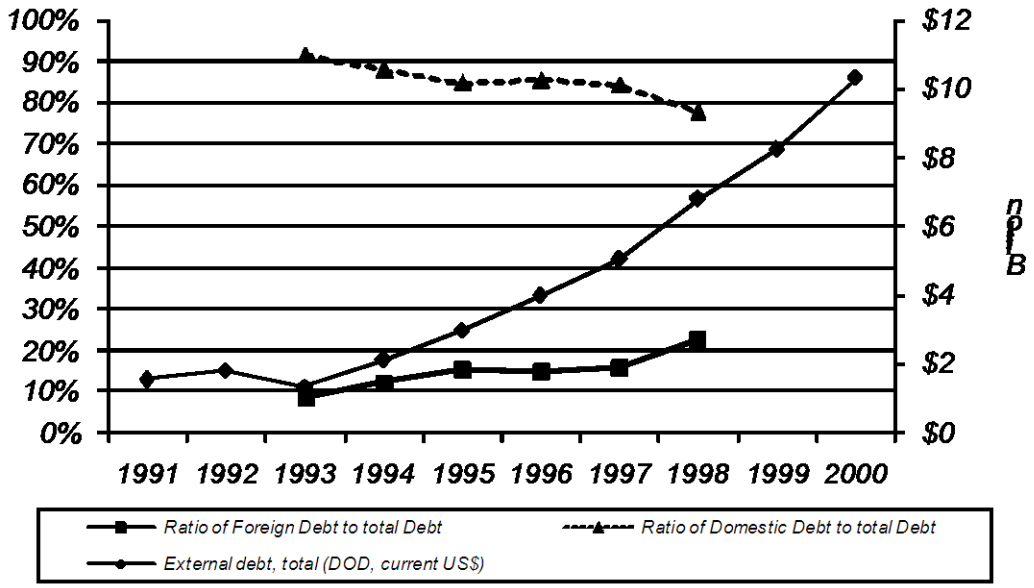

Table 1.

Year	debt (% of total external debt)	Total debt service (% of GNI)	millions (TDS, current US$)	Central government debt, total (% of GDP)
1991	78.37	2.34	112.8	66.2
1992	83.36	2.38	137.9	49
1993	72.68	1.74	135.3	50.7
1994	63.41	2	184.6	69.48
1995	46.04	1.93	224.3	78.52
1996	41.36	2.25	300.7	98.89
1997	35.64	4.8	733.6	102.72
1998	28.83	3.11	527.6	113.51
1999	26.74	4.42	769.8	135.23
2000	24.64	10.45	1,821.20	140

Table 2: Edwards estimation of Chile and Yugoslavia

	β_0	β_1	β_2	β_3	β_4	R^2	DW
Chile (t-test)	-0.041 (-1.344)	0.75 (12.99)	0.019 (0.688)	0.236 (1.415)	0.288 (4.812)	0.97	2.042
Yugoslavia (t-test)	-0.05 (-3.079)	0.843 (5.509)	-1.41 (-17.168)	0.243 (1.421)	0.861 (5.119)	0.928	2.013

Sources: International Financial Statistics.

Table3 . Dickey-Fuller Unit Root Tests, Jan. 91-Dec. 97

Test Statistics	Variables					Critical Value
	π_t	π_{t-1}	$D\pi_{t-1}$	$\hat{Z}_{t-1}$	$\hat{\pi}_{t-1}$	
DF	-2.20	-1.98	-3.89	-3.7	0.044	-3.72
ADF	-3.24	-2.72	-4.105	-2.88	-1.98	-3.72
ADF(1)	-4.287	-3.77	-5.59	-3.436	-2.811	-3.75
ADF(2)	-3.867	-3.78	-6.84	-5.105	-3.016	-3.72
ADF(3)	-5.19	-5.32	-7.79	-6.22	-3.85	-3.72

Table 4. Phillips –Perron Unit Root Tests, Jan. 91-Dec. 97

Test Statistics	Variables					Critical Value
	π_t	π_{t-1}	$D\pi_{t-1}$	$\hat{Z}_{t-1}$	$\hat{\pi}_{t-1}$	
PP	-2.39	-2.31	-3.768	-3.74	-0.62	-3.70
PP(1)	-2.96	-3.5	-6.75	-6.89	-2.10	-3.70
PP(2)	-4.90	-4.64	-11.4	-12.95	-3.22	-3.70

Table 5. ARCH LM and White's Heteroskedasticity test

	F-Statistic	Probability	Obs*R-squared	Probability
ARCH	0.026	0.877	0.028	0.864
White	1.34	0.29	10.0	0.26

Table 6: Breush-Godfrey Serial Correlation LM Test:

	F-statistic	Probability	Obs*R-squared	Obs*R-squared
Breusch-Godfrey, LM	2.2	0.14	4.94	0.0844

Table 7

AC	PAC	Q-Stat	Prob
0.238	0.238	1.5415	0.214
-0.161	-0.231	2.273	0.321
-0.168	-0.074	3.1155	0.374
-0.458	-0.481	9.6625	0.047
-0.193	-0.016	10.888	0.054
0.086	-0.108	11.145	0.084
0.007	-0.169	11.147	0.132
0.001	-0.281	11.147	0.194
0.167	0.071	12.303	0.197
0.05	-0.138	12.412	0.258
-0.069	-0.173	12.638	0.318
0.028	-0.126	12.679	0.393

Table 8. Bartlett Test:

Method	df	value	Probability
Bartlett	5	0.347	0.9967