Discussion Papers in Economics

FOREIGN EXCHANGE PRESSURES IN LATIN AMERICA: DOES DEBT MATTER?

By

Graham Bird
(University of Surrey)
&
Alex Mandilaras
(University of Surrey)

DP 13/07

Department of Economics
University of Surrey
Guildford
Surrey GU2 7XH, UK
Telephone +44 (0)1483 689380
Facsimile +44 (0)1483 689548
Web www.econ.surrey.ac.uk
ISSN: 1749-5075

Foreign Exchange Pressures in Latin America: Does Debt Matter?

Alex Mandilaras* University of Surrey

Graham Bird University of Surrey

*** Accepted for publication in the

Journal of International Development

on 19 September 2007 ***

Abstract

Latin American countries have been in the eye of economic and financial storms several times in recent years. Advice from the International Monetary Fund has consistently highlighted the need for sound fiscal policies and lower debt levels. But is public debt relevant? Following a brief discussion of the theoretical issues involved, this paper examines empirically the relationship between public indebtedness and pressures in the foreign exchange market. Alternative measures are used to capture the latter and the analysis controls for a *de facto* classification of exchange rate regimes. Estimations of static and dynamic panels for 28 Latin American and Caribbean (LAC) countries report substantial fiscal effects.

JEL Classification: F30

Keywords: Currency Crises, Public Debt, Latin America

*Corresponding author. Department of Economics, University of Surrey, Guildford, Surrey, GU2 7XH, UK. Phone: +44 (0)1483 682768. Fax: +44 (0)1483 689548. Email: a.mandilaras@surrey.ac.uk.

Contents

List of Tables

List of Figures

1 Introduction

Macroeconomic imbalances culminating in economic crises have been a common feature of many Latin American economies. As a continent, Latin America has a long history of fiscal deficits and unsustainable debt ratios, monetary excesses, rapid inflation and severe balance of payments problems (Cardoso and Helwege, 1992, Bird and Helwege, 1994). Frequently these have resulted in the International Monetary Fund (IMF) becoming involved and offering advice about the design of economic policy.

In the 1970s, the oil crisis conferred some benefits on oil exporting Latin American economies but imposed costs on oil importers. In the 1980s, the whole region was affected by the Third World debt crisis, which was, in fact, very much a Latin American phenomenon. In the 1990s, there was the Mexican crisis in 1994, with its overspill effects on other countries in the region, followed by the crises in Ecuador in 1998 and in Brazil in 1999. In the early 2000s, there have been crises in Venezuela, Argentina and Uruguay as well as in other Latin American economies. Again, the IMF has been heavily involved.

It was largely with Latin American economies in mind that the first generation currency crisis model (Krugman, 1979) was formulated although both second (e.g. Obstfeld, 1996) and third generation crisis models (e.g. Corsetti *et al.*, 1999) also have something to say about crises in the region. Certainly theoretical models of currency crises and their contagion effects have found ample application in Latin America.

Against this background, our paper sets itself a modest objective. We aim to examine empirically the association between public debt and foreign exchange (FX) market pressures. Following debt default episodes that have had serious ramifications for the FX market, the importance of the stock of debt has received renewed attention. However, despite the focus on fiscal policy and debt reduction, those who believe in Ricardian equivalence have continued to doubt the relevance of debt.

According to this line of thinking higher debt today implies a higher tax-burden tomorrow. Anticipating this, rational agents save an amount equal to the increase in debt thereby offsetting any expansionary macroeconomic effects. If accurate, the confidence of foreign investors in the domestic currency should not be adversely affected. If inaccurate, debt accumulation may undermine confidence and lead to pressure on the domestic currency in the foreign exchange market.

The lay out of the paper is as follows. Section 2 briefly explores the theoretical issues involved in the association between public debt and pressures in the foreign exchange market. The next section discusses features of the LAC region's sovereign market. Following a discussion of the data and methodology in Section 4, Section 5 examines whether a higher stock of debt is empirically linked to increased FX market pressures. The analysis is carried out in a panel data framework consisting of Latin American and Caribbean economies. We also examine whether this relationship is affected by the nature of the chosen exchange rate regime using the classification recently suggested by Reinhart and Rogoff (2004). Other control variables capture the effects of external factors (notably the US interest rate) and monetary factors (e.g. domestic credit to the private sector). Since our emphasis is on the effects of fiscal policy on the domestic currency rather than its persistent effects on relative prices we use the nominal rather than the real exchange rate to gauge conditions in the FX market. Section 6 offers concluding remarks.

2 Does Debt Matter?

Although this paper is primarily empirical, it may be helpful to consider what theory leads us to anticipate about the relationship between public debt and foreign exchange market pressure. The literature on the macroeconomics of public debt offers a number of broad scenarios depending on contingent circumstances. The Ricardian equivalence theorem suggests that the effects of fiscal deficits financed by debt are no different from those financed by additional taxation, since rational non-myopic agents anticipate the eventual increase in taxation and therefore increase saving in order to cover future tax obligations. However, this result depends on a number of restrictive assumptions; taxes are lump sum and do not affect incentives, households have infinite horizons (or engage in intergenerational transfers), there is certainty about future levels of public spending, interest rates and income, and capital markets are perfect.

Keynesian theory, in contrast, assumes that agents are myopic and base their consumption on current disposable income. Within a Keynesian framework, changes in the level of debt have different implications than changes in taxation because they have different effects on disposable income, as well as on interest rates. More detailed investigations into the effects of debt may be found in, for example, Barro (1974 and 1979), Elmendorf

and Mankiw (1998), Seater (1993), and Buiter and Kletzer (1991, 1992). Although these studies are more widely defined, they implicitly offer a number of, sometimes conflicting, routes through which public debt may affect the foreign exchange market and the demand for and supply of a country's currency. Effects working through income, interest rates and wealth may be important, but much ultimately depends on whether investors see debt levels as being sustainable. This in turn will, in part, depend on what they anticipate about private saving and a government's capacity to raise future taxation, as well as the more general effects of debt on economic performance. For example, an increase in debt may be seen as more sustainable where it leads to a compensating increase in private saving, can be serviced by increased taxation and does not adversly affect economic growth.

In this paper we make no attempt to formally model and estimate the various channels through which debt may influence foreign exchange market pressure. However, we do surmise from the inherited theory mentioned above that in a Latin American context, debt build-up will be non-neutral and is likely to have an adverse effect on market pressure. The assumptions upon which Ricardian equivalence is based are generally unrealistic for the region. For example, debt build up may shift spending power to poor groups which have a relatively high propensity to consume, and would otherwise face liquidity constraints. Moreover, saving rates are notoriously low and difficult to increase, taxable capacity is relatively inflexible and the reputation of many countries in the region over the protracted period of this study may be expected to have inspired little confidence about future macroeconomic management. Our a priori assumption is therefore that larger levels of public debt will have exerted an adverse effect on market confidence and on foreign exchange market pressures. However, theory also suggests that these pressures could be affected by contingent conditions. Of particular interest is the nature of the exchange rate regime. Again in principle the relationship is ambiguous. For example, a commitment to maintaining a pegged exchange rate may anchor expectations and exert a beneficial effect. But it may also imply that debt will be less easily sustained since one potentially important instrument is being ruled out. Flexible exchange rates may reinstate this instrument but may, at the same time, create another avenue via which the sustainability of external debt is undermined because of balance sheet and other related effects.

Empirical evidence on the determinants of currency crises also suggests that increasing

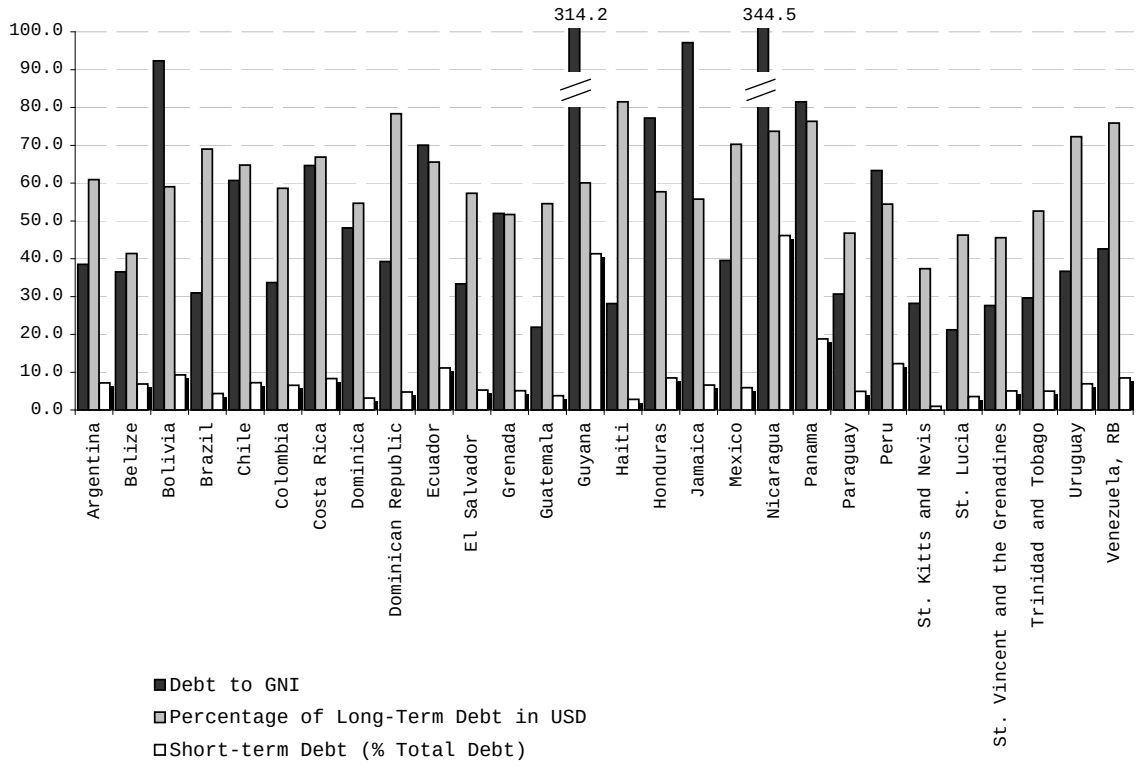

Figure 1: Size, Maturity and Denomination of LAC Debt, Averages 1970–2000

debt relative to international reserves makes crises more probable and this also leads us to anticipate that increasing levels of public debt will tend to create additional pressures in the foreign exchange market.[1]

3 The Latin American and Caribbean Sovereign Market

Latin American and Caribbean economies averaged a debt ratio of 68.8 percent of gross national income in the period 1970–2000. The cross-sectional mean, however, can potentially be a deceptive measure of average indebtedness in the presence of extreme values in the sample. In this case, it seems that the level of borrowing by Guyana and Nicaragua (with mean debt ratios of 314% and 344%, respectively) is uncharacteristic of the region and biases the LAC countries' average upwards; the median value for the region as a whole is a considerably lower 42.2%. The dark columns in figure 1 depict mean debt values for

[1]This of course highlights the importance of international reserves. See Jeanne and Rancière (2006) for a recent discussion on their optimal level.

Table 1: Currency Composition of Latin America's Debt – 5-Year Averages

	1970-75	*1976-80*	*1981-85*	*1986-90*	*1991-95*	*1996-00*
Deutsche Mark	3.28	3.25	2.29	3.17	3.47	2.87
French Franc	1.11	1.15	1.23	2.11	2.85	1.92
Japanese Yen	0.45	2.45	2.55	4.73	6.34	5.13
British Pound	13.41	7.30	4.32	5.74	4.91	2.45
Swiss Franc	0.76	0.62	0.43	0.57	0.37	0.19
US Dollar	59.99	60.63	63.32	56.50	55.21	67.69
SDR	0.00	0.00	0.36	0.49	0.51	0.49
Multiple curr.	15.54	16.30	17.42	21.11	21.96	14.88
All other curr.	5.46	8.30	8.08	5.58	4.39	4.38

Notes: Values are percent of long-term debt. All columns add up to 100. Source: *Global Development Finance.*

the countries in the sample (the mean is an appropriate measure of average indebtedness for the individual time series in our dataset). It can be readily seen that, with the exception of a few economies, debt levels in the LAC region are not excessively high (e.g. compared to some OECD economies).

A notable difference between LAC and OECD economies is that the former typically borrow in foreign currency –and especially in US dollars– and, hence, total debt is essentially the same as external debt. As Tovar (2005) notes, about 40% of Latin American bonds are international issues and nearly all of them are in a foreign currency.[2] Table 1 reports 5-year averages for the sample period of the currency composition of the LAC region's debt liabilities. Despite some variations over time, most of these liabilities are denominated in US dollars –see the grey columns in figure 1 on the preceding page. Other popular currencies for denominating debt over the period we studied were the Japanese Yen, the Deutsche Mark, the French Franc and the British Pound.

In terms of the maturity structure of debt, the average for the region is about 21 years, ranging from an average of 10 years for Venezuela to almost 60 years for El Salvador. The white columns in figure 1 show the percentage of total external debt that is classified as short-term. In most cases, this amount does not exceed one tenth of the total issues in place.[3] LAC countries borrowed on average at an interest rate of 6.7%. Argentina and

[2]A move towards introducing a domestic currency bond market has recently been implemented by Uruguay, Colombia and Brazil. For a discussion, again see Tovar (2005). In the growing debate about the need to introduce local currency markets in emerging economies, Levy-Yeyati (2007) proposes the issuance of domestic currency bonds by international financial institutions with the proceeds being used to *dedollarize* their own loans to these economies.

[3]The definition of short-term debt here includes external liabilities with a maturity of less than one

Brazil seem to have been discriminated against by investors with higher interest rates (8.3% and 8.6% respectively), despite the fact that their debt ratios have been amongst the lowest in the sample (38.5% and 30.9%). However, Brazil ran fiscal deficits of 4.9% of GDP on average and Argentina had amongst the highest rates of increase in its debt ratio.[4]

4 Data and Methodology

As noted in the introduction, the main objective of this paper is to measure the importance of public debt in determining the extent to which LAC countries are exposed to pressures in the FX market. Our focus is on this region, since it has faced severe crisis episodes over a protracted period (e.g. Mexico in 1994 and Argentina in 2001). We need to clarify here that we do not focus on 'crises' as such but rather adopt the wider concept of 'FX pressures' (detailed later in this section). Unlike the discrete binary variables usually seen in probit and logit estimations, our FX pressure measures are continuous variables. The advantage of this approach is that it allows us to extract more information from the data.[5]

Our data are from the *Global Development Finance (GDF), World Development Indicators (WDI)* and *International Financial Statistics (IFS)* databases. The panel contains information on a wide range of macroeconomic and financial variables for the countries represented in the Latin American and Caribbean region classification of the GDF.[6] The time span of the dataset is from 1970 to 2000. As the number of observations available for individual variables differs from country to country, our panel dataset is unbalanced.

The chosen methodology is to estimate static and dynamic panels through least squares dummy variables (LSDV) and generalized method of moments (GMM) respectively (for the latter, see Arellano and Bond, 1991). Given the endogeneity issues that are present, we also estimate the static panel using instrumental variables. Cross-sectional regressions are too restrictive, as averaging the observations over time would prevent us from uncovering interesting dynamics and, in any case, are not appropriate for the analysis of crises. At

year. As a result, quite heavy concentrations of maturities in the region of 1 to 5 years are not included. This definition is in line with international practice.

[4]Variable descriptive statistics for individual countries are not reported in the tables due to space considerations. The dataset is available from the authors upon request.

[5]We do however construct a binary crisis index for comparison purposes; see section 5.

[6]See Appendix 1 for a list of countries.

the same time, given the low frequency of debt-related information and the relatively small time window for which this information is available, time series data for individual countries may lead to unreliable results. In contrast, panel estimations utilize better the available information and allow us to investigate heterogeneity; in other words, we can test for different intercept/slope coefficients across countries, or over time, or both.[7] In this paper, we confine ourselves to testing for cross-country variation of the intercept, as it is an intuitive exercise without the complications that arise from slope heterogeneity tests.

We now turn to the choice of a market pressure index (MPI) as our dependent variable. The use of MPIs is quite common in the literature. Building on the theoretical underpinnings of Girton and Roper (1977) several variations of the index have appeared in the crisis/contagion literature (e.g. Eichengreen et al., 1995). The MPI we construct consists of the first difference of the natural logarithm of the nominal exchange rate against the US dollar plus the first difference of the natural logarithm of the domestic interest rate minus the negative of the first difference of the natural logarithm of international reserves.[8] The weights assigned to the component variables are determined by the corresponding ratios of one over the standard deviation of each variable divided by the sum of all three ratios. This weighting scheme means that a few extreme episodes (e.g. a large increase in the interest rate) cannot dominate the index. In other words, a standard deviation assuming a very high value because of extreme volatility of the variable to which it relates will automatically lead to a smaller weight being allocated to that variable in the index.

In this study we in fact use four measures of FX pressure to check whether our results are sensitive to the particular index used. In addition to the above-mentioned index (*mpi1*), we use a more basic variation (*mpi2*), which excludes interest rates.[9] This omission substantially increases the sample size. We also use the changes in the natural log of the official exchange rate with the US dollar (*dlxr*). Finally, we use the inflation differential with the United States (*infdif*); if we are prepared to assume that PPP holds in the

[7] Large sample studies can be useful in identifying potential crisis-triggering factors. However, pooling observations from regions with different economic, historical and structural characteristics puts in question the general applicability of the model's implications. Hence, there is a need to warrant some homogeneity in the sample –see Bird and Mandilaras (2006).

[8] Data are from the *IFS*.

[9] In fact, Girton and Roper's (1977) index did not include interest rates.

Table 2: Descriptive Statistics of the FX Pressure Indices

	mpi1	*mpi2*	*dlxr*	*infdif*
Mean	0.921	2.222	20.345	8.133
Median	0.188	-0.108	1.561	5.092
Max.	56.625	143.519	787.389	47.728
Min.	-89.067	-105.664	-487.828	-15.122
St. Dev.	15.068	20.749	60.048	10.775
Obs.	458	677	840	689

Notes: Data are from the *IFS*. Variables *mpi1* and *mpi2* are FX market pressure indices, *dlxr* is the change in the natural log of the nominal exchange rate against the US dollar and *infdif* is the inflation differential with the US.

short run, this gives us an indication of devaluation expectations.[10]

Table 2 presents summary statistics for our measures of market pressure. Figure 2 shows their average values across all LAC countries at each point in time. It can be observed that on average LAC currencies were depreciating throughout the sample and inflation differentials were high, particularly in the 1980s. The pressure indices, which gauge conditions in the FX market more comprehensively, also show mounting pressures in the 1980s. The correlations between the pressure indices are high (the correlation coefficient between them is 68%). They are also high between the inflation differential and the depreciation rate (71%). However, the links between the MPIs and *infdif* and *dlxr* appear weaker, with correlations in the vicinity of 25-50%.

Our list of potential determinants of FX pressures includes a range of fiscal indicators (e.g. the debt ratio, maturity structure indicators), which form the focus of this paper. In addition, it includes variables and macroeconomic indicators for which the theory and the literature suggest there is an expected degree of relevance to FX pressures.[11] For example, we have used measures of monetary aggregates (consistent with first generation models), unemployment (consistent with second generation models) and measures of the banking system's health (consistent with third generation models). Table 3 lists the variables in the dataset. The equation we eventually fit to the data meets criteria of parsimony, intuitive relevance and statistical reliability.

An important aspect of this paper is to examine whether the type of exchange rate

[10]Given the hyperinflation incidents in some LAC countries several observations have extremely high values. To prevent these from affecting the results the estimations exclude values of the inflation differential exceeding 50%.

[11]Empirical studies of currency crises include Sachs et al. (1996), Frankel and Rose (1996), Kaminsky et al. (1998), and Kumar et al. (2002).

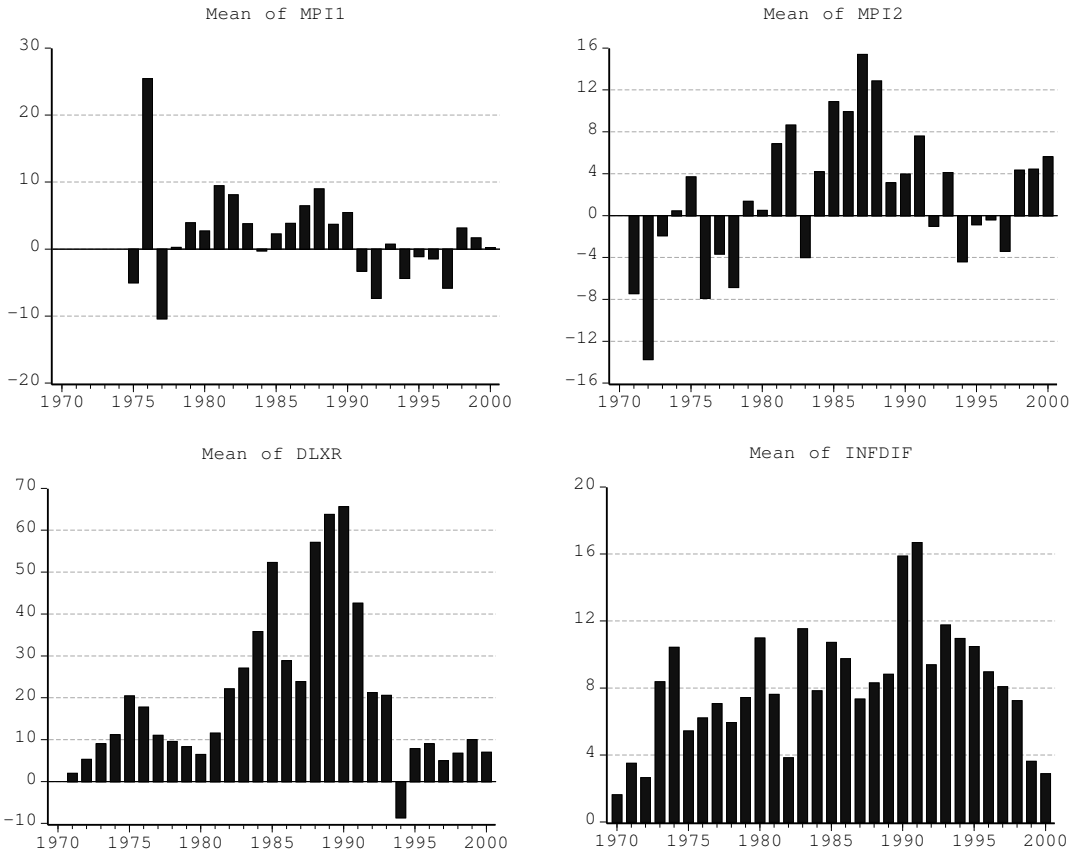

Figure 2: Mean Values of the FX Pressure Indices, 1970–2000

regime is associated with FX market pressures. It is widely accepted that official classifications of exchange rate regimes are not sufficiently accurate to portray the actual policies followed by central banks. Here, we follow Reinhart and Rogoff (2004) and use their 'coarse' index of *de facto* exchange rate regimes. The index ranges from 1 to 6 –see Table 4– progressively allowing for more flexibility. From this index, we have constructed two dummy variables: for the first one, *fixed*, the value 1 has been assigned to the cases of no separate legal tender, pre announced pegs or currency board arrangements, pre announced horizontal bands that are narrower than or equal to +/-2% and de facto pegs. For the second one, *intermed*, the value 1 is allocated to de facto or pre announced crawling pegs, de facto or pre announced crawling bands that are narrower than or equal to +/-5%, moving bands that are narrower than or equal to +/-2%, and managed floats.[12]

[12]Reinhart and Rogoff's (2004) is not the only effort to classify exchange rate regimes. Using cluster

Table 3: List of Variables Used in the Analysis

Fiscal	
avgmat	Average external debt maturity in years
budget	Budget balance (% GDP)
concess	Concessional debt (% Total debt)
debtflgni	Total net flows of debt (% GNI)
debtpriv	Private non-guaranteed debt (% Total debt)
debtgni	Total Debt (% GNI)
debtstflgni	Net flows of short-term debt (% GNI)
stdebtratio	Short-term debt (% Total debt)
stint	Short-term interest payments (% GDP)
ocom	Commitments official creditors (% GDP)
pcom	Commitments private creditors (% GDP)
ltdebt	Total long term debt outstanding (% GDP)
Monetary	
bnkres	Bank liquid reserves (% bank assets)
dcreb	Domestic credit from banks (% GDP)
dcrep	Domestic credit to private sector (% GDP)
domfin	Domestic financing (% GDP)
m2gdp	M2 (% GDP)
Other Macro	
ca	Current account balance (% GNI)
exports	Exports of goods and services in constant 1995 dollars
fdi	Net foreign direct investment (% GNI)
fincons	Final consumption in in constant 1995 dollars
gdp	GDP at constant 1995 dollars
gdpcap	GDP per capita at constant 1995 dollars
unempl	Unemployment rate
External	
usirate	Federal funds rate
Exchange rate regime	
fixed	Dummy variable capturing fixed exchange rate regimes
intermed	Dummy variable capturing intermediate exchange rate regimes

Notes: Data are from the *GDF* and the *WDI*. The dummy variables *fixed* and *intermed*have been constructed using data from Reinhart and Rogoff (2004).

The patterns in the data are interesting. According to the *mpi1* measure greater exchange rate flexibility is associated with increasing FX pressure. Fixers face less pressure than floaters. Similar results are found in the case of *mpi2*, although here there appears to be less pressure under freely floating rates than under managed floating or pre-announced/ de facto crawling bands and moving bands. Fixed exchange rate regimes are associated with falling inflation rate differentials whereas flexible regimes are associated with increasing inflation differentials with the US.[13]

analysis, Levy-Yeyati and Sturzenegger (2005) classify regimes as floating, intermediate or fixed. The correlation between our *intermed* variable and theirs is very low, possibly because of the small number of regimes that they identify as dirty floats or crawling pegs (i.e. intermediate) in the LAC sample. The correlation is almost 60% between the *fixed* regime dummies.

[13]This is a rather different conclusion than that drawn by Bubula and Otker-Robe (2003) who investigate crisis episodes based on severe exchange market pressure across a broad range of countries during 1990-2001. They find that pegged regimes exhibit a higher incidence of crisis than floating regimes. They also find that intermediate regimes are more crisis-prone than either of the extremes, giving some support to the bi-polar view, although they suggest that 'the support is not as overwhelming as one would expect', p 19. They point out that the importance of the exchange rate regime can be overstated and that it is inconsistencies between this and other policies that make countries vulnerable to speculative attack. Our

Table 4: *De Facto* Classification of Exchange Rate Regimes

1	No separate legal tender
1	Pre announced peg or currency board arrangement
1	Pre announced horizontal band that is narrower than or equal to +/-2%
1	De facto peg
2	Pre announced crawling peg
2	Pre announced crawling band that is narrower than or equal to +/-2%
2	De facto crawling peg
2	De facto crawling band that is narrower than or equal to +/-2%
3	Pre announced crawling band that is wider than or equal to +/-2%
3	De facto crawling band that is wider than or equal to +/-5%
3	Moving band that is wider than or equal to +/-2%
3	Managed floating
4	Freely floating
5	Freely falling
6	Dual market in which parallel market data is missing

Notes: Source: Reinhart and Rogoff, 2004.

5 Econometric Estimation

As discussed previously, the panel methodology involving continuous measures of FX pressures enables us to explain movements in the FX markets without the need to classify observations as crisis/non-crisis. In this section we undertake an econometric investigation of the relationship between debt and FX pressures in Latin America and Caribbean countries. The static restricted pooled model is of the form

$$y_{it} = \eta + \beta' X_{it} + \upsilon_{it}$$

with zero mean and constant variance. This model is tested against an unrestricted model that allows the intercept to vary across countries:

$$y_{it} = \eta_i + \beta' X_{it} + \upsilon_{it}$$

The χ^2 and F tests (not reported) clearly reject the restriction and hence we estimate a least squares dummy variable model with fixed country effects. The choice of fixed over random effects is not always uncontroversial. In our case, the Hausman statistics

results are consistent with this view.

clearly indicate that the fixed effects formulation should be used. In addition, our choice of countries is not purely random; Latin American countries may share some characteristics and in these circumstances a random formulation of country-specific effects may be inappropriate.

By eliminating the insignificant variables (Table 3 on page 10 lists all the variables used) we end up with a vector of variables X_{it} that contains: (a) the debt to GNI ratio (as a measure of fiscal stance), (b) the ratio of domestic credit to the private sector relative to GDP (as a measure of monetary conditions), (c) two dummy variables capturing the fixed and intermediate regimes as classified by Reinhart and Rogoff (2004) and (d) the US interest rate (as an indicator of external conditions). Results are reported in Table 5.

The LSDV estimator of the (unbalanced) panel, which is corrected for heteroscedasticity in each panel and cross-country correlation, reports a positive sign for variable *debtgni*; this shows that high debt ratios are associated with increased FX pressures. It is noteworthy that the positive sign and the significance of the estimated coefficient do not depend on the choice of the dependent variable; in other words, the result remains unchanged irrespective of whether we estimate the panel with *mpi1*, *mpi2*, *dlxr* or *infdif* on the left-hand side. There is evidence that those dealing in the FX market have less confidence in the currencies of high debt countries.

The two regime dummies are negatively associated with FX pressures. The estimated coefficient of *fixed* is in all estimations higher in absolute value than the estimated coefficient of *intermed*. The latter, however, is statistically significant at greater confidence levels. In any case, the results indicate that some sort of fix or management of the currency leads to reduced FX pressures. Increases in the US interest rate lead to higher FX pressure in LAC countries. As investors can get a better return than before in the US they repatriate assets leading to pressures on LAC currencies. The estimated coefficient, however, is only significant when we use the *mpi1* and *mpi2* on the left-hand side. The results regarding domestic credit to the private sector are mixed. A credit expansion is indicative of lax monetary conditions that should lead to FX pressure. However, we only get the right sign (and a significant parameter) in the estimation involving *mpi1*.

A valid criticism of the above results regarding the equation with *mpi1* could be the possible endogeneity of the debt variable. As *mpi1* includes the domestic interest

Table 5: LSDV, IV and GMM Estimation Results

	mpi1	*mpi2*	*dlxr*	*infdif*
Panel A: LSDV				
debtgni	0.025*	0.05**	0.202*	0.0175*
	(0.009)	(0.021)	(0.053)	(0.006)
usirate	1.231*	0.717**	0.677	0.03
	(0.317)	(0.341)	(0.856)	(0.198)
intermed	-3.543*	-5.248*	-19.716*	-5.237*
	(1.22)	(1.119)	(3.232)	(0.535)
fixed	-6.615***	-16.007*	-45.048*	-20.178*
	(3.873)	(3.418)	(10.006)	(1.602)
domcrp	0.148***	-0.036	-0.19	-0.177*
	(0.082)	(0.099)	(0.245)	(0.034)
const.	-7.698***	7.346	45.174*	27.692*
	(4.476)	(4.773)	(11.096)	(2.676)
Panel B: IV				
debtgni	0.019***	0.046***	0.15**	0.014**
	(0.011)	(0.025)	(0.065)	(0.006)
usirate	1.054*	0.737**	0.65	0.017
	(0.331)	(0.356)	(0.928)	(0.198)
intermed	-3.671*	-5.308*	-20.11*	-5.183*
	(1.231)	(1.14)	(3.314)	(0.527)
fixed	-6.72***	-16.373*	-48.764*	-20.044*
	(3.956)	(3.625)	(10.746)	(1.59)
domcrp	0.152***	-0.034	-0.137	-0.186*
	(0.083)	(0.1)	(0.246)	(0.034)
const.	-6.097	7.652	49.268	28.304*
	(4.605)	(4.935)	(11.929)	(2.667)
Panel C: GMM				
Lagged Dependent	0.138***	-0.024	0.222**	0.358*
	(0.071)	(0.07)	(0.107)	(0.041)
debtgni	0.022**	0.02***	0.095***	-0.007**
	(0.010)	(0.012)	(0.053)	(0.003)
usirate	-2.832	4.162	15.330	0.639***
	(4.953)	(3.773)	(17.054)	(0.366)
intermed	-2.853***	-4.862**	-22.18*	-4.588*
	(1.493)	(2.375)	(3.932)	(0.989)
fixed	-4.982	-15.533**	-51.155*	-15.473*
	(6.264)	(6.858)	(13.838)	(2.112)
domcrp	0.364**	0.208	0.453	-0.033
	(0.167)	(0.203)	(0.34)	(0.05)

Notes: Panel A reports least squares dummy variable results of unbalanced panels with fixed effects. The standard errors of the estimates (reported in parentheses) are corrected for time-varying variances in each country and contemporaneous correlation. Intercepts vary across countries and are not reported. Panel B reports two-stage least squares results with *debtgni* instrumented with its lag. Standard errors are corrected as above. Panel C reports 1-step White period GMM results of unbalanced panels with period dummies. Independent variables are in first differences (except from the exchange rate regime dummies). The maximum number of GMM instruments for the dependent variable and *debtgni* is 5. (*) indicates significance at the 1 percent level, (**) at the 5 percent and (***) at the 10 percent level. The first three decimal digits are reported.

rate it is possible that a rate increase worsens the debt burden and, hence, the positive association between the index and *debtgni* runs from the interest rate to the debt variable. To deal with this potential problem we estimate the equation with two-stage least squares instrumenting *debtgni* with its one-period lag. The results (reported in panel B of Table 5) remain virtually unchanged, alleviating fears of endogeneity. The endogenous negative relationship between domestic credit and the interest rate is not a reason for great concern, as the coefficient of *domcrp* in the *mpi1* equation is positive –if anything it will be slightly underestimated. This is confirmed if, in addition to *debtgni*, we instrument *domcrp* with its lag: the positive association is not disturbed, but the coefficient increases by 20% to 0.186. The *mpi2* and *dlxr* measures do not contain interest rates and, hence, the above discussion is not applicable for these cases. However, the case of *infdif* is different, as it is correlated with the domestic interest rate. The significant negative coefficient reported in this case is likely to be the negative effect of an increase in domestic credit on the interest rate.

According to the estimations so far reported, rising public debt appears to increase FX pressure. But does this seemingly strong result hold in a dynamic specification? In other words, what happens if FX pressures persist? We address this question using the dynamic specification

$$y_{it} = \alpha y_{i,t-1} + \beta'(L) X_{it} + \eta_i + \upsilon_{it}$$

where $\beta'(L)$ is a vector of polynomials in the lag operator (in our case there is one lag).[14] The GMM estimator is a function of an instrument matrix that contains lags for the dependent variable and first differences for the independent variables. The equation is estimated in first differences (the regime dummies remain untransformed). Panel C of Table 5 reports the results.

Using the same set of independent variables as in the static analysis, but with the addition of the lagged dependent variable, we find strong support for the results obtained earlier. The lagged difference of the dependent variable is positively associated with FX pressures in three of the four estimated equations. The sign is in all cases positive indicating that pressures persist. Debt, as expected, exerts a significant influence over FX

[14]The choice of lag is based on the fact that one would not expect higher-order lags given the annual frequency of the data.

pressures in all four regressions. Undoubtedly, public debt is an important determinant of pressures in the FX market, hence casting doubt on the relevance of Ricardian equivalence in the context of LAC countries. The US interest rate generally loses its explanatory power in this dynamic setting. The *intermed* and *fixed* exchange rate regime dummies are in most cases significant and have the expected sign. Domestic credit to GDP has the expected sign but a significant coefficient only in the *mpi1* regression.

To cross-check these results further we have also performed an ordinary probit analysis. Using the basic *mpi1* variable we have assigned a value of 1 when an observation exceeds the average plus 1.5 times the standard deviation (within a country). All other observations are assigned a 0 value. This procedure creates a 'crisis variable'.[15] Using the same specification we find that the US interest rate and exchange rate regimes have the expected signs and are statistically significant. The debt variable is positive but insignificant. However, when we take the first difference (i.e. when we examine 'flow' rather than 'stock' effects) debt becomes significant at the 10 percent level. The coefficient for domestic credit enters the non-linear equation with a negative sign, possibly driven by the endogenous negative relationship between domestic credit and the interest rate used in the construction of the *mpi1*.

The analysis of this section has provided comprehensive evidence that fiscal policies and related levels of public debt play an important role in determining FX pressures. The intuition is that high levels of debt may trigger a 'flight of capital' –or 'sudden stop'– if investors perceive a threat to debt repayments.[16] It may be in the context of the associated capital account crisis that the IMF provides financial support. The provision of liquidity may restore confidence in the short term. Indeed by providing emergency finance the Fund may be able to prevent a crisis in one country spilling over to other countries in the region, as was envisaged in its abortive Contingent Credit Lines. However, our results also suggest that the Fund should, in addition, exert pressure on countries to deal with the underlying causes of crisis in terms of fiscal deficits and debt accumulation. Our results therefore

[15]The GAUSS programs for this binary transformation as well as for the calculation of the market pressure indices are available from the authors upon request.

[16]The fact that the LAC area's liabilities are dollarized makes real depreciations –which normally ensue such incidents– more painful. More closed economies need sharper real exchange rate increases; and with the combination of dollar liabilities and local currency assets (liabilities' mismatching) the balance sheets of the government and private firms suffer. This is a second round of a sudden stop following the original shock –see Calvo et al. (2003).

build a bridge between first and third generation currency crisis models, since it may be that the accumulation of debt, making countries vulnerable to a capital account crisis, as emphasized in the third generation model, have their origins in fiscal deficits, as stressed in the first generation model. We have opted for a stock approach of fiscal effects, as opposed to a flow approach, to highlight the cumulative effects of deficits. LAC countries need to aim for debt levels that are sustainable. The problem is that the sustainable level of debt may actually be substantially lower than the observed debt ratios in LAC countries (see Mendoza and Oviedo, 2004). In the next section we discuss some of the issues arising from the need to reduce the debt burden.

6 Concluding Remarks

Having briefly explored the theoretical issues in the relationship between public debt and pressures in the foreign exchange market, the empirical results presented in this paper suggest that higher debt levels have indeed led to increased foreign exchange market pressures in Latin America and the Caribbean. We also find that fixed and intermediate exchange rate regimes lead to lower market pressure. Our analysis implies that, in its dealings with Latin American countries, the IMF has been right to emphasize the importance of fiscal policy but may be wrong to push for free exchange rate flexibility, unless other macroeconomic imbalances are reduced.

But it is much easier to identify in broad terms what needs to be done in order to help achieve a given objective than it is to design a detailed policy strategy that will deliver it. Fiscal deficits and debt accumulation are the consequence of a complex matrix of domestic and external economic and political factors. Just to say that they should be reduced without seeking to understand why they are there in the first place is unlikely to be a successful approach. Governments will encounter political constraints that limit their degree of freedom in terms of policy design. Improving tax administration may take a long time, and external shocks may blow off course whatever strategy has been embarked upon. It is difficult to think of issues that are more highly politically charged than taxation and government expenditure.[17]

[17] Just consider some of the issues. There are problems of taxable capacity and tax administration which may take a long time to remedy. Increasing marginal tax rates may lead to more evasion and lower tax

On top of this, there is the complicated, and as yet insufficiently understood, relationship between fiscal deficits and economic growth. Given these considerations it is unsurprising to find that many programs supported by the IMF in Latin America fail to achieve their fiscal targets (Bulir and Moon, 2003, Hutchison and Noy, 2003).[18] Knowing what to do is much different from being able to do it.[19]

References

Arellano, M., and S. Bond (1991): "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *Review of Economic Studies*, 58, 287–297.

Barro, R. J. (1974): "Are Government Bonds Net Wealth?," *Journal of Political Economy*, 82(6), 1095–1117.

——— (1979): "On the Determination of the Public Debt," *Journal of Political Economy*, 87(5), 940–971.

Bird, G., and A. Helwege (eds.) (1994): *Latin America's Economic Future.* Academic Press, London.

Bird, G., and A. Mandilaras (2006): "Regional Heterogeneity in the Relationship between Fiscal Imbalances and Foreign Exchange Market Pressure," *World Development*, 34, 1171–81.

Bubula, A., and I. Otker-Robe (2003): "Are Pegged and Intermediate Regimes More Crisis Prone?," Working Paper 03/223, IMF.

revenue. Using Value Added Tax and expenditure taxes may tend to be regressive. Similarly cutting some elements of government expenditure such as health and education may have a particularly adverse effect on the poor. Cutting subsidies is likely to generate political resistance from those who benefited from them, as will cuts in the wages of government employees. The combination of increases in VAT and reductions in social expenditure will have adverse consequences for income distribution which may result in political instability, which in turn makes it difficult to implement fiscal adjustment.

[18]This then creates yet another policy conundrum. If it is difficult to control fiscal deficits, do governments really want to give up the option of altering the exchange rate? A theoretically first best world may differ substantially from the real world which politicians inhabit.

[19]For a clear and comprehensive discussion of fiscal policy in the context of averting currency crises see Kopits (2000). He argues that 'vulnerability to crises can be mitigated by signalling a phased fiscal adjustment that involves credible implementation of key structural measures, in particular fiscal policy rules', p. 1.

Buiter, W. H., and K. M. Kletzer (1991): "The Redundancy and Usefulness of Public Debt," mimeo, Yale University.

——— (1992): "Deficits: Which, How Much, and so What?," *American Economic Association Papers and Proceedings*, 82(2), 290–294.

Bulir, A., and S. Moon (2003): "Do IMF-Supported Programs Help Make Fiscal Adjustment More Durable?," Working Paper 03/38, IMF.

Calvo, G. A., A. Izquierdo, and E. Talvi (2003): "Sudden Stops, the Real Exchange Rate, and Fiscal Sustainability: Argentina's Lessons," Working Paper 9828, NBER.

Cardoso, E., and A. Helwege (1992): *Latin America's economy: Diversity, Trends and Conflicts.* Cambridge, MA, MIT Press.

Corsetti, G., P. Pesenti, and N. Roubini (1999): "Paper Tigers? A Model of the Asian Crisis," *European Economic Review*, 43, 1211–36.

Eichengreen, B., A. Rose, and C. Wyplosz (1995): "Exchange Market Mayhem: the Antecedents and Aftermath of Speculative Attacks," *Economic Policy: A European Forum*, pp. 249–96.

Elmendorf, D. W., and N. G. Mankiw (1998): "Government Debt," Finance and Economics Discussion Series, Federal Reserve Board, Washington, D.C.

Frankel, J., and A. Rose (1996): "Currency Crashes in Emerging Markets: an Empirical Treatment," *Journal of International Economics*, 41, 351–66.

Girton, L., and D. Roper (1977): "A Monetary Model of Exchange Market Pressure," *The American Economic Review*, 67, 537–48.

Hutchison M., Noy, I. (2003): "Macroeconomic Effects of IMF-Sponsored Programs in Latin America: Output Costs, Program Recidivism and the Vicious Cycle of Failed Stabilizations," *Journal of International Money and Finance*, 22, 991–1014.

Kaminsky, G., S. Lizondo, and C. M. Reinhart (1998): "Leading Indicators of Currency Crises," *International Monetary Fund Staff Papers*, 45, 1–48.

Kopits, G. (2000): "How Can Fiscal Policy Help Avert Currency Crises," Working Paper 00/195, IMF.

Krugman, P. (1979): "A Model of Balance of Payments Crises," *Journal of Money Credit and Banking*, 11, 311–25.

Kumar, M., U. Moorthy, and W. Perraudin (2002): "Predicting Emerging Market Curency Crashes," IMF working paper, International Monetary Fund.

Levy-Yeyati, E. (2007): "Dollars, Debt, and International Financial Institutions: Dedollarizing Multilateral Lending," *World Bank Economic Review*, 21, 21–47.

Levy-Yeyati, E., and F. Sturzenegger (2005): "Classifying Exchange Rate Regimes: Deeds vs. Words," *European Economic Review*, 49, 1603–35.

Mendoza, E. G., and P. M. Oviedo (2004): "Public Debt, Fiscal Solvency and Macroeconomic Uncertainty in Latin America: The Cases of Brazil, Colombia, Costa Rica and Mexico," Working Paper W10637, NBER.

Obstfeld, M. (1996): "Models of Currency Crises with Self-Fulfilling Features," *European Economic Review*, 40, 1037–1047.

Ranciere, R., and O. Jeanne (2006): "The Optimal Level of International Reserves for Emerging Market Countries: Formulas and Applications," Working Papers 229, IMF.

Reinhart, C. M., and K. S. Rogoff (2004): "The Modern History of Exchange Rate Arrangements: A Reinterpretation," *Quarterly Journal of Economics*, 119(1), 1–48.

Sachs, J., A. Tornell, and A. Velasco (1996): "Financial Crises in Emerging Markets: the Lessons from 1995," *Brooking Papers on Economic Activity*, 1, 147–215.

Seater, J. J. (1993): "Ricardian Equivalence," *Journal of Economic Literature*, XXXI, 142–190.

Tovar, C. E. (2005): "International Government Debt Denominated in Local Currency: Recent Developments in Latin America," *BIS Quarterly Review*, pp. 109–18.

A List of countries

1. Argentina 2. Belize 3. Bolivia 4. Brazil 5. Chile 6. Colombia 7. Costa Rica 8. Dominica 9. Dominican Republic 10. Ecuador 11. El Salvador 12. Grenada 13. Guatemala 14. Guyana 15. Haiti 16. Honduras 17. Jamaica 18. Mexico 19. Nicaragua 20. Panama 21. Paraguay 22. Peru 23. St. Kitts and Nevis 24. St. Lucia 25. St. Vincent and the Grenadines 26. Trinidad and Tobago 27. Uruguay 28. Venezuela, RB.