WP/02/149

IMF Working Paper

Sovereign Defaults: The Role of Volatility

Luis Catão and Bennett Sutton

INTERNATIONAL MONETARY FUND

 WP/02/149

IMF Working Paper

Research Department

Sovereign Defaults: The Role of Volatility

Prepared by Luis Catão and Bennett Sutton[1]

Authorized for distribution by Tamim Bayoumi

September 2002

Abstract

While the relationship between volatility and credit risk is central to much of the literature on finance and banking, it has been largely neglected in empirical macro studies on sovereign defaults. This paper presents new econometric estimates for a panel of 25 emerging market countries over 1970–2001, breaking down aggregate volatility into its external and domestic policy components. We find that countries with historically higher macroeconomic volatility are more prone to default, and particularly so if part of this volatility is policy-induced. Reducing policy volatility thus appears to be key to improving a country's credit standing.

JEL Classification Numbers: F34, H63

Keywords: Sovereign Debt, Macroeconomic Volatility, Emerging Markets

Authors' E-Mail Addresses: Lcatao@imf.org; Bsutton@imf.org

[1] We thank Tamim Bayoumi, Sandeep Kapur, Carmen Reinhart, and David Robinson for comments on an earlier version of this paper, and Carlos Végh for helpful conversations on the topic. We are also grateful to Gian Maria Milesi-Ferretti for sharing with us his debt data, and to Laura Leon for her assistance with the preparation of this paper. The usual caveats apply.

Contents Page

I. Introduction

The past three decades have witnessed a higher incidence of sovereign defaults in the developing world (Figure 1). In more recent years in particular, despite significant improvement in macroeconomic fundamentals in many emerging markets, debt crises continued to strike in the form of either outright defaults or eminent defaults that were only averted by emergency multilateral bail outs of unprecedented magnitudes. Since the systemic impact of such events can be considerable in a globalized world, it is natural that proposals to tackle the problem now rank high in the multilateral policy agenda.[2] However, as recent proposals to redesign sovereign debt contracts and establish new mechanisms for promoting orderly debt restructuring continue to be debated, crisis anticipation and early prevention remain crucial.

This raises the question of how satisfactory existing models of sovereign risk are in predicting debt crises. The empirical literature on the topic has highlighted the role of several variables in this connection, with a few solvency and liquidity indicators topping the list (see, for example, McDonald, 1982; Cline, 1995; and Obstfeld and Rogoff, 1996 for useful surveys). However, when these variables are put together in large cross-country panel regressions on default probabilities, their overall predictive performance is relatively poor.[3]

One plausible reason is the neglect of non-economic factors. The causes of sovereign defaults are, after all, multifaceted in most cases, encompassing economic as well as legal and political factors. One other reason, however, is that the poor predictive power of existing models stems from other forms of misspecification. In particular, the standard practice in the empirical literature has been to enter the various solvency and liquidity variables in *levels* or *first differences* in probit or logit regressions,[4] while the theory of sovereign debt also postulates

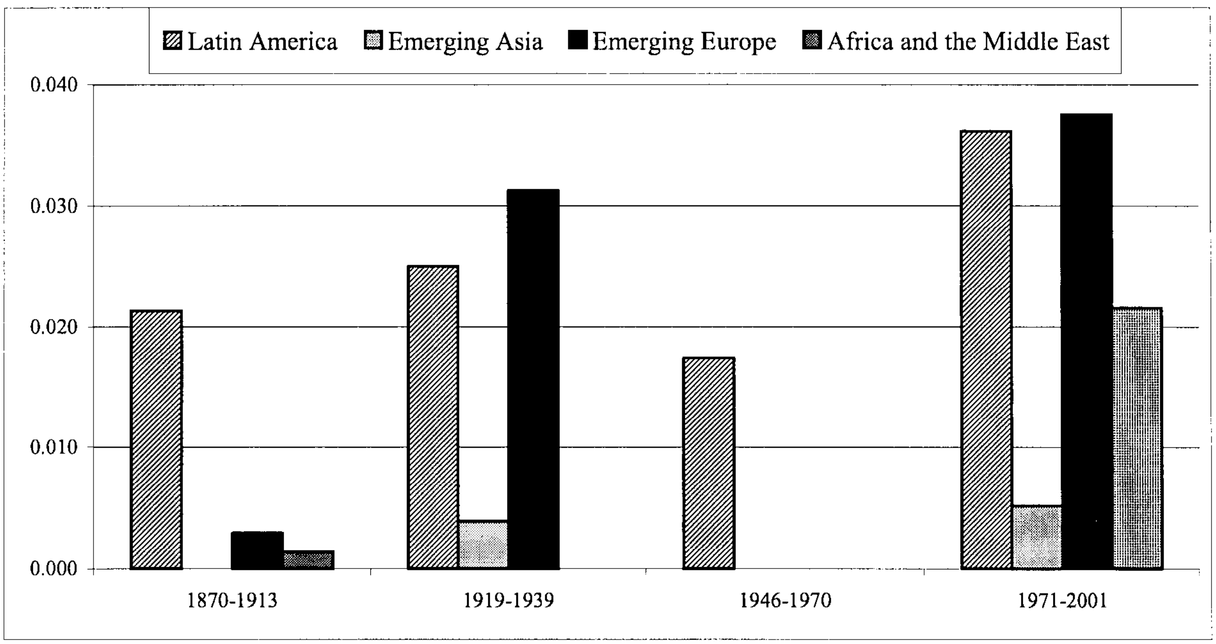
---

[2] See Krueger (2002) and the *Economist* April 7-14, 2002 for an overview.

[3] For instance, in a recent study on debt crises spanning 69 developing countries, Detragiache and Spilimbergo (2001) report pseudo R-squares in the 0.13 to 0.25 range. Using sovereign credit ratings as a catch all indicator and probit regressions to measure its capacity of predicting sovereign defaults, Reinhart (2001) reports even lower pseudo R-squares and mixed results on their statistical significance

[4] As discussed below, one exception is Eaton and Gersovitz's own empirical estimates presented at the end of their 1981 paper. Specifically, they estimate a disequilibrium model of the supply and demand for foreign loans to sovereigns where the level borrowing is, *inter alia*, a positive function of the percent variability of export earnings. Their model is not used to estimate default probabilities, however. In an earlier paper, Feder and Just (1977) consider the percent variability in export earnings as a potential determinant of default risk in a logit specification, but drop the variable from their reported estimates on the grounds that it yielded implausible results (*Ibid*, p. 32).

Figure 1. Sovereign Defaults
(Number of events per country per year in region)



Sources: Lindert and Morton (1989); Reinhart (2001); and IMF staff estimates.

a key role for the second moments, or volatility, of macroeconomic aggregates. For instance, in their seminal paper on the determinants of debt repudiation, Eaton and Gersovitz (1981) show that macroeconomic volatility plays a crucial role in sovereigns' decisions to either default or continue servicing their debt. In the standard version of their model, where income variations are assumed to be predictable and capital markets strictly punish bad borrowers with no access to future credit, higher income volatility increases the cost of defaulting by preventing countries from smoothing consumption through international borrowing once they default. All else constant, this implies that the incidence of default should be lower in countries with higher income volatility. However, in an extension of the model where income variations are stochastic, their paper shows that an unpredictable succession of bad shocks may turn the net marginal utility of defaulting positive, in which case one may obtain a positive relationship between default and macroeconomic volatility for a given credit ceiling. Either way, volatility emerges as a key determinant of default risk.

In general, whether volatility is positively or negatively related to default risk depends on the relative balance between the country's *willingness to pay* (which in the Eaton and Gersovitz framework is a function of volatility) *versus* the country's *capacity to pay* (which will depend not only on the debt stock but also on the *ex-post* realization of shocks). As noted in Eaton, Gersovitz, and Stiglitz (1986), the effectiveness of the willingness-to-pay effect depends on the model's horizon. In the Eaton and Gersovitz (1981) infinite horizon set-up with reasonably low discount rates, the willingness-to-pay or "reputation" motive is expected to prevail. But if governments are short-lived and do not fully internalize the costs of fiscal profligacy, so that they heavily discount the cost of limited future access to capital markets by future administrations, the relevant time-horizon will tend to be shorter and the willingness-to-pay motive weaker. In this case, capacity-to-pay considerations and the strength of current period sanctions imposed by foreigner lenders, such as trade embargos and seizure of the country's international assets, are likely to prevail.[5] Under these circumstances, higher macroeconomic volatility will be positively related to default risk simply because countries that face a greater dispersion of macro shocks will tend to experience output ranges which make it difficult or impossible to amass enough resources to meet contractual debt obligations.[6] Under less-than-perfect capital markets, the sovereign is more likely to default in these ranges the greater the role of liquidity in limiting access to new credit, the larger the country's debt stock, and the more unstable its politics, since the required fiscal adjustments will tend to be more costly to accomplish.[7]

Against this background, this paper empirically examines whether macroeconomic volatility helps explain variations in sovereign default probabilities. Since the bulk of sovereign defaults on private international lending occur on emerging market debt, this paper focuses on a group of 25 emerging economies over 1970–2001, the period during which private lending to sovereigns bounced back with a vengeance from the previous historical trough reached in the 1930s.[8]

---

[5] The role of trade sanctions in sovereign debt enforcement has been emphasised in Bulow and Rogoff (1989). Evidence on their relevance is provided in Rose (2002).

[6] A formal derivation of the positive relationship between volatility and default risk in a credit-in-advance model of bank lending is provided in Agénor and Aizenman (1998). For the operation of a similar mechanism in a consumption smoothing model of sovereign debt, see Catão (2002).

[7] For empirical evidence on the sizeable fiscal adjustment which are often necessary to ensure debt solvency in countries subject to typically large terms-of-trade shocks, see Kletzer (1997).

[8] One important advantage of restricting our sample to middle- to high-income developing countries – the so-called "emerging markets" – is that data problems are not as severe as faced by other researchers who looked at a broader sample of developing countries. This enables us to consider a wider array of explanatory variables and mitigate estimation biases related to measurement errors in the data.

We consider the impact of macroeconomic volatility on sovereign risk by distinguishing between two main sources of income volatility – namely, externally induced volatility (which we associate mainly with terms of trade variability), and policy-induced volatility (which we associated with fiscal, monetary, and foreign exchange control policies).[9] This distinction is important from an analytical as well as from a policy perspective, since the identification of the sources of volatility helps policy makers to address them. However, because all three policy variables mentioned above often respond to macroeconomic developments, they may have a potentially sizable endogenous component. Thus, a main challenge is to measure their "autonomous" contribution to default risk. This paper proposes some straightforward measures and uses them in a logit model to gauge their contribution to default risk.

The paper's main findings are as follows. First, the inclusion of historical volatility measures in a logit cross-country panel regression greatly improves the in-sample predictive power of the model. Second, the statistical significance and signs of the respective coefficients are consistent with the various theoretical models mentioned above which postulate that higher macroeconomic volatility raises default risk, all else constant. Third, we find that much of the impact of macroeconomic volatility on sovereign risk stems from policy-induced volatility and, in particular, from the procyclicality of fiscal policy.

The remainder of the paper is divided into three sections. Section II presents the various volatility measures and documents salient patterns across countries and regions. Section III presents a simple event analysis to document the typical pre- and post-default behavior of the various variables featuring in previous studies, and uses a standard logit model to show that the introduction of external and policy-induced volatility into the picture significantly adds to the model's capacity to predict default events. Section IV summarizes the findings and discusses some policy implications.

II. Volatility Measures

Because EMs are typically small open economies, much of the literature seeking to explain macroeconomic volatility in these countries has focused on the role of external variables, notably on the external terms of trade which are deemed to explain nearly half of output fluctuations in these countries (Mendoza, 1995; IMF, 2001b). Through its impact on fiscal revenues and the real exchange rate, terms-of-trade volatility can also directly affect debt servicing capacity and hence sovereign risk. To the extent that endogeneity issues are

[9] The other main source of aggregate volatility highlighted in the business cycle literature is technological shocks. This is not considered here both because of the difficulty in measuring such shocks using national data for those emerging market countries and because some of their effects has been shown to be captured by terms of trade variations (Kraay and Ventura, 2001). However, to the extent that technological shocks affects countries asymmetrically and have a significant bearing on macroeconomic volatility that are not captured by any other variable, their impact on sovereign risk should not be dismissed in future research.

less of a problem with this variable, causal inferences about its impact of on default probabilities can be more easily drawn using unconditional volatility measures than is the case with other variables to be discussed below.

Table 1 provides period averages of the unconditional standard deviation of the terms of trade for each EM country. Cross-country differences are considerable and suggest that terms of trade volatility has been generally higher in countries where the frequency of default has been higher. This *prima-facie* association between terms of trade and default is at odds with the prediction of a non-stochastic infinite-horizon consumption smoothing model of sovereign debt à la Eaton and Gersovitz (1981). However, as discussed in the introduction, a positive association between terms of trade volatility and the frequency of defaults is consistent with other optimizing models if terms of trade variations are mostly unpredictable. We return to this issue in Section III.

Another source of macroeconomic volatility which is deemed especially important in emerging markets is macroeconomic policy. Among the latter, a key variable is the stance of fiscal policy (see, e.g., IMF, 2001a and 2001b). Unlike terms-of-trade in a small open economy, however, fiscal policy often reflects developments in other variables; so the unconditional volatility of fiscal balances can be misleading indicator of the "autonomous" contribution of fiscal policy to aggregate fluctuations. A better metric is the extent to which the fiscal balance responds to GDP and terms of trade changes, since these two variables have a key bearing on government accounts. Looking at the experience of a group of Latin American countries, Gavin and Perotti (1997) find that government balances are for the most part pro-cyclical, i.e., the fiscal balance is typically negative (or less positive than it should be) during output and terms of trade upswings, and conversely during downswings. In other words, fiscal policy in those countries tends to contribute to, rather than mitigate, macroeconomic volatility. A similar conclusion is reached by Talvi and Végh (2000) using a narrower indicator of the fiscal stance (the ratio of government consumption to GDP) and a broader sample of developing countries. In contrast, Agénor, McDermott, and Prasad (2000) use the ratio of public expenditure to revenues as their fiscal impulse measures find that fiscal policy has been broadly counter-cyclical in 12 middle-income countries.

Since these findings are contradictory and do not cover all the 25 emerging market economies considered, Table 1 presents new measures of fiscal policy volatility for these countries. Since changes in the fiscal balance partly reflect output and terms of trade cycles (particularly in the case of commodity producing small open economies), the "autonomous" component of fiscal policy is measured in a regression of the changes in the ratio of general government balance to GDP on the output gap and the terms of trade cycle:

$$\Delta\left[\frac{(T-G)_t}{GDP_t}\right] = \alpha + \beta OGAP_t + \gamma\, TOTCY_t + \theta \frac{(T-G)_{t-1}}{GDP_{t-1}} + \varepsilon_t \tag{1}$$

where the OGAP and TOTCY stand for the percent deviations of output and terms of trade from their respective (HP-filter) trends. This is a similar specification as that used in Bayoumi and

Eichengreen (1995) and Gavin and Perotti (1997) with the difference that the output gap and terms of trade enter the equation as deviations from trend rather than in the log of first

Table 1. Emerging Markets: Volatility Measures, 1970-2001

	Terms of Trade	Fiscal Impulse Indicators /1				Monetary	FX_res	Default
	σ_{TOT}	β_1	β_2	σ_ε	$\sigma_{G/T}$	$\sigma_{BM/FX}$	σ_{FXC}	Events
ARGENTINA	63.14	-0.25	-0.45 **	0.111	0.283	18.84	1.20	2
BRAZIL	24.68	-0.21	-0.42 *	0.054	0.107	66.51	0.50	1
CHILE	10.24	-0.10	-0.17 *	0.040	0.147	4.05	0.77	2
COLOMBIA	21.67	-0.11	-0.37 **	0.011	0.114	1.12	0.46	0
COSTA RICA	8.68	0.07	-0.04	0.047	0.146	14.09	1.12	1
ECUADOR	39.42	0.17	-0.39 **	0.095	0.168	11.58	0.72	2
MEXICO	33.22	-0.34	-0.40 *	0.061	0.198	12.29	1.52	1
PANAMA	15.46	-0.27 **	0.08	0.050	0.169	0.00	0.00	1
PERU	27.98	0.05	-0.08	0.095	0.201	6.01	1.45	1
URUGUAY	15.94	-0.09	-0.26 **	0.039	0.107	19.26	1.15	1
VENEZUELA	83.22	-0.44 **	-0.32 *	0.067	0.169	0.19	1.09	1
INDIA	16.37	0.02	-0.17	0.013	0.086	5.27	0.00	0
PAKISTAN	10.52	-0.87	-0.16	0.022	0.108	33.39	0.30	1
MALAYSIA	9.96	0.25	-0.27	0.031	0.142	0.20	0.73	0
INDONESIA	27.84	0.03	-0.15	0.018	0.098	2.73	0.61	0
PHILIPPINES	26.01	0.12	0.16 *	0.051	0.108	7.76	0.62	1
THAILAND	24.07	0.08	-0.05	0.017	0.193	0.43	0.40	0
KOREA	10.33	0.13	-0.21 **	0.012	0.082	8.09	0.51	0
TURKEY	11.40	-0.13	-0.07	0.027	0.148	37.44	0.63	1
SOUTH AFRICA	27.65	0.47 *	0.17	0.048	0.079	21.55	0.85	1
EGYPT	12.64	-0.34	-0.01	0.078	0.207	5.38	0.43	1
BULGARIA	18.62	-0.14	-0.29	0.061	0.123	11.20	0.52	1
RUSSIA	27.12	-0.26 *	-0.54 **	0.033	0.097	4.86	0.50	2
HUNGARY	25.99	0.39 **	0.16	0.023	0.072	27.42	0.60	0
POLAND	4.95	-0.19	-0.17	0.089	0.077	17.69	0.26	1
Total Average	23.89	-0.08	-0.18	0.048	0.137	13.49	0.68	0.88
Latin Am. Avg.	31.24	-0.14	-0.26	0.061	0.164	13.99	0.91	1.18
Asia Avg.	17.87	-0.03	-0.12	0.023	0.117	8.27	0.45	0.29
Others Avg.	18.34	-0.03	-0.11	0.051	0.115	17.93	0.54	1.00

1/ β1 and β2 stand for the coefficients on the current output gap and the one-year-lagged output gap, respectively.
* Statistically significant at 10%.
** Statistically significant at 5%

differences.[10] Equation (1) implies that, from an initial position where the lagged government balance term on the right side of (1) is zero, the fiscal stance is neutral when changes in government balance are zero as output and terms of trend are on trend. Otherwise, the fiscal stance is either expansionary or contractionary and the respective fiscal impulse can be measured by the sum of the intercept and residual terms. Estimates of (1) also allow us to infer whether a country's fiscal stance is pro or counter-cyclical. If fiscal policy is counter-cyclical, the coefficients β and γ should be positive, implying that surpluses are accumulated during cyclical upswings and run down during downswings; conversely, negative values for β and γ imply that fiscal policy is pro-cyclical. Thus, the contribution of fiscal policy to macro instability will depend on the coefficients β , γ , as well as on the variance of ε_t .

Table 1 reports three measures of fiscal policy volatility. One is the estimated coefficient β in country-specific regressions using both the current and the one-period lagged output gap. The second measure is the country-specific volatility of the OLS residuals for the full panel, which measure the extent to which fiscal policy responses in each country differ from the average. The third measure is the unconditional volatility of the ratio of government spending to revenues ($\sigma_{G/T}$), which is simply the standard deviation of the "fiscal impulse" metric used in Agénor, McDermott, and Prasad (2000).[11]

Estimates of β indicate that pro-cyclical fiscal policy is more the rule rather than the exception among EMs, since β is negative for most countries.[12] The estimates also show that the extent of fiscal procylicality and the volatility of fiscal impulses vary widely across countries. This is clearly reflected in the volatility of country-specific residuals as well as in the unconditional standard deviation of the government spending/revenue ratio ($\sigma_{G/T}$). In particular, the degree of fiscal policy pro-cyclicality appears to be especially high in Latin

---

[10] This not only minimizes well-known overfiltering problems associated with the first difference operator, but also yields a clear equilibrium interpretation for the coefficient on output. In these calculations, we set the filter's smoothing parameter lambda to 7, as suggested for annual data (see Pesaran and Pesaran, 1998).

[11] Underlying this measure is the assumption that output and terms of trade (or any other relevant macro variable) affect the numerator and the denominator of this ratio symmetrically so that they cancel themselves out.

[12] The estimates reported are for current output gap, but we have also estimated equation (1) using both one-period lags and an instrumental variable for OGAP (available from the authors upon request). This is not only because there may be lags before changes in the output gap impact on the deficit, so the one-year lagged gap may be the most relevant variable, but also because the estimate on the current gap may suffer from an endogeneity bias, as changes in the fiscal balance at time t will also have an effect on the output gap at time t. The broad conclusions are unchanged to these changes in specification.

America, corroborating Gavin and Perotti's (1997) findings. As discussed in Section III, these measures of fiscal procyclicality and volatility appear to make a significant contribution to default probabilities.

Monetary policy is another potentially important source of macroeconomic volatility. As with fiscal indicators, the main difficulty in measuring the independent contribution of monetary policy to default risk is that changes in real money supply often reflect developments outside the control of the country's authorities. This is particularly so in EMs because large short-run variations in money growth are often induced by externally-driven swings in capital flows.[13] Yet, while monetary authorities tend to have very limited control over the money stock in a small open economy, they have far greater control over the ratio of monetary base to international reserves through sterilization policies and reserve requirements on banks.[14] Under a neutral monetary policy stance, the ratio of base money to net international reserves should be unchanged as externally induced capital inflows will be matched by an equivalent increase in base money. Conversely, if monetary policy is expansionary (contractionary), this ratio will increase as the monetary base will grow by more (less) than what is warranted by net capital inflows due to an expansion (contraction) of the central bank's net domestic assets, either in the form of credit to the government or to the private sector. Thus, the ratio of monetary base to net international reserves mitigates some of the endogeneity problems associated with the use of money growth as a measure of the monetary policy stance in countries with reasonably open capital accounts. Measures of the unconditional standard deviation of this ratio are provided in Table 1. While the association between $\sigma_{BM/FX}$ and the frequency of default per country is not one-to-one, most countries that did default at least once in the sample period also displayed a higher-than-average monetary policy volatility.

The third channel through which policy can exacerbate macroeconomic volatility is the variability of regulatory controls on foreign exchange transactions. This variable is especially important policy instrument in emerging markets, being extensively used to try and smooth out the volatility and the composition of capital inflows (see, e.g., de Gregorio, Edwards, and Valdés, 2000; Montiel and Reinhart, 1999). Another motivation for capital controls is to mitigate the impact of technological shocks on wage income (Alfaro and

[13] Passive accommodation of fiscal deficits can also be another source of monetary policy volatility, particularly in high inflation environment such as those which plagued several emerging markets in the 1970s and 1980s. However, the relationship between fiscal deficits and money growth in the short-run is well known to be weak (Fisher, Sahay, and Végh, 2001).

[14] Several studies have shown that those two instruments have been widely used not only to influence current monetary conditions and aggregate demand, but also to affect the volume and the composition of future capital inflows. See, e.g., de Gregorio, Edward and Valdez, (2000), Rojas-Suarez and Weisbrod (1995) for a discussion on the use of reserve requirements as a monetary policy instrument in Latin America.

Kanczuk, 2001). As this motivation tends to be more important under populist governments, swings in foreign exchange controls are likely to respond to the alternance in power between right and left-wing leaning administrations. Thus, as with fiscal and monetary variables, political volatility plays a role.

Using an index of foreign exchange controls based on the IMF's annual report of Exchange Arrangements and Exchange Restrictions, Table 1 reports the respective standard deviation measures by country.[15] One can see that cross-country differences in the volatility of capital control policies have been considerable, with Latin American economies once again displaying more pronounced instability than their other EM counterparts. As is apparent from Table 1, higher incidence of defaults tends, for the most part, to be positively correlated with the volatility of foreign exchange rate restrictions.

A drawback of using changes in this index to measure foreign exchange policy volatility is that those controls may be partly endogenous. A possible way to mitigate this endogeneity consists of using the uncovered interest rate differential between onshore and the offshore financial centers as an instrument for the capital inflow variable in an OLS regression (Cardoso and Goldfajn, 1998). One problem with using such an instrument, however, is that it requires measures of devaluation expectations which are not readily available and that are not themselves entirely exogenous. An alternative and arguably less problematic instrument is total net capital flow into developing countries. This is not only a directly observable variable, but it is also largely exogenous to individual EMs. Accordingly, we measure the autonomous component of capital controls variable from the following regression

$$FX\_RES_{i,t} = \alpha + \theta E(NFI)_{i,t} + \xi_{i,t} \tag{2}$$

where FX_RES stands for the foreign exchange control index and E(NFI) is expected net capital inflows which we instrument by the IMF measure of net foreign capital flows to developing countries. When estimated in a panel without fixed effects, the residual term $\xi_{i,t}$ captures the extent to which a country's response to capital inflows at time t differs from what would be warranted by the average EM response. Accordingly, the "autonomous" volatility of foreign exchange control policies for each country can be measured by the standard deviation of $\xi_{i,t}$. We shall use this measure in the estimates to be presented below.

---

[15] The index takes on discrete value ranging from 0 to 4, where 0 stands for no controls, 1 for restrictions on current account transactions, 2 for restrictions on current account and capital transactions, 3 if multiple exchange rates are added on top of those restrictions, and 4 if all those restrictions are added to restrictions on the repatriation of export procedures. For a discussion of the pros and cons of this index, see Leiderman and Razin (1994).

To sum up, the various measures described above point to a *prima-facie* relationship between macroeconomic volatility and default in EMs and suggest that part of this volatility is induced by domestic policy factors. Next section examines these connections more formally.

III. Logit Estimates

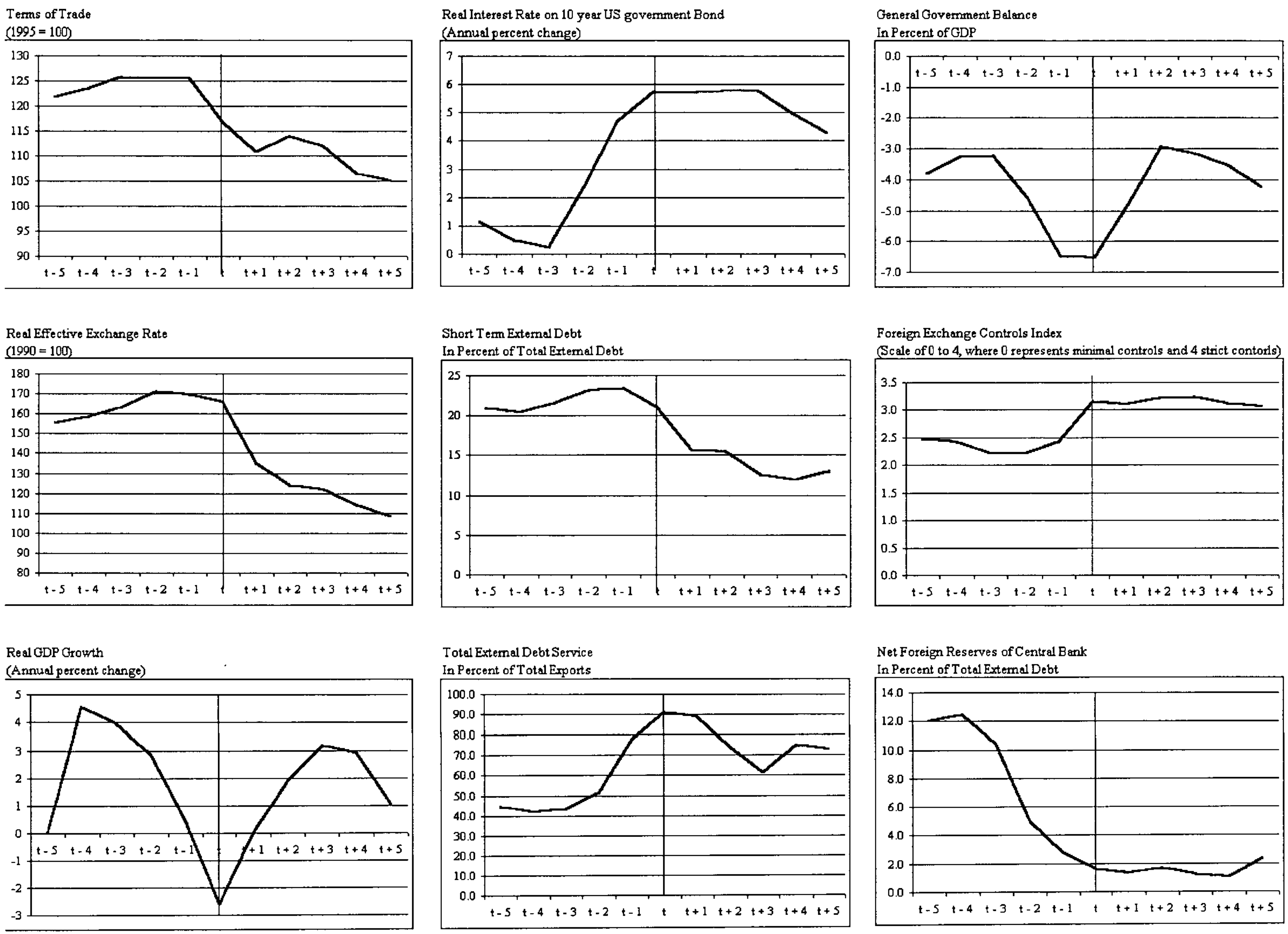
We measure the relative contribution of external and policy-induced volatility to sovereign risk in two steps. First, we examine the statistical significance of the level or the first differences of the various variables considered in previous studies and measure their predictive power in limited dependent variable regressions. We then introduce volatility measures and gauge marginal their contribution to default risk.

The list of potential explanatory variables considered in the empirical literature on sovereign debt is extensive. From a theoretical perspective, they can be usefully classified into four groups. First, there are those that measure the country's external solvency position, such as the ratio of debt to GDP and debt to exports (Feder and Just, 1977; Edwards, 1984; Eichengreen and Portes, 1985, and Cline and Barns, 1997). The second group comprises variables that usually signal the strength of a country's fundamentals, such as the fiscal balance, real GDP growth, and the real exchange rate.[16] The third group comprises those that signal potential debt servicing difficulties in the short-run (liquidity indicators). These include the ratio of debt service to exports, net international reserves (scaled by external debt, by imports, or by GDP), and the ratio of short-term debt to total debt – all of which have been successfully used as predictors of default probabilities in previous work (Edwards 1984; Min, 1998; and Detragiache and Spilimbergo, 2001). Finally, some of the above mentioned papers find that defaults often follow large external shocks, as measured by the U.S. interest rates and terms of trade changes.

Figure 2 provides *prima-facie* evidence on the average behavior of the relevant variables in the run-up to default events and in their aftermath. The various panels, which were constructed as unweighed averages of country observations of the respective variables for a total of 22 default events, clearly show that most variables undergo dramatic swings in the run-up to

[16] It should be noted that findings regarding the statistical significance of the fiscal balance and the exchange rate misalignment indicator are not consistent across studies. Eichengreen and Portes (1985), for instance, find that changes in the central government fiscal balance help explain defaults, while Cline and Barnes (1997) and Detragiache and Spilimbergo (2001) found that it is not statistically significant at conventional levels.

Figure 2. Sovereign Default Indicators



defaults.[17] Second, the direction of these movements is consistent with theory. For instance, defaults are typically preceded by a sharp deterioration in macroeconomic fundamentals, as can be seen from the sharp drops in the fiscal balance and real GDP growth, as well as by an apparent exchange rate overvaluation.[18] Third and perhaps more strikingly, the deterioration in some key indicators is not sudden, but gradual. In particular, both the ratio of debt service to export and that of international reserves to debt begin to deteriorate two to three years preceding the default event; and so does the deterioration in the external environment – as captured by the level of US real interest rates and the country's terms of trade. Among other things, the protracted nature of the process suggests that early warning systems may have an effective role to play in debt crisis prevention.

The relative contribution of each of these variables to default events can be more formally gauged in limited dependent variable regressions where the dependent variable takes the value of either "1" (when default occurs) or "0" (when it does not). Researchers in this area have been traditionally divided between the use of a logit or a probit specification in this connection, with logit being sometimes favored whenever one of the events has a much rarer occurrence than the other.[19] Given that defaults are relatively rare events, comprising less than 5 percent of the observations in our data set, we stick to a logit specification.[20]

Table 2 reports estimates for the variables highlighted above. As standard in the literature, all the regressors are lagged one-period so as to mitigate endogeneity. Also, in order

---

[17] These events were: Argentina (1982, 2001), Brazil (1983), Chile (1973, 1982), Costa Rica (1981), Ecuador (1982, 1999), Mexico (1982), Panama (1983), Peru (1984), Uruguay (1983), and Venezuela (1983) in Latin America; Philippines (1984) and Pakistan (1998) in Asia; Egypt (1984) and South Africa (1986) in Africa/Middle East; Bulgaria (1990), Poland (1981), Russia (1991, 1998), and Turkey (1978) in Emerging Europe. Because of lack of fiscal data for Bulgaria before 1990, Poland before 1981, and Russia before 1991, the fiscal variable chart is an average of the other 19 countries.

[18] Using the HP-filter to detrend the (CPI-based) real exchange rate indices, we find that the real exchange rate typically appreciates by some 10 percent relative to trend in the four years preceding the default event. In Figure 2, we preferred to plot the raw index rather than the deviations of the HP-trend since the former fares better in the regression analysis, as discussed below.

[19] This is because the logit distribution has a fatter tail than the probit one and thus tends to yield a better fit in this context (see Greene, 2000)

[20] We have also undertaken probit estimations of the same model, which yielded very similar results regarding the relative magnitude and statistical significance of the explanatory variables. However, we have found a slight loss of explatory power and generally lower coefficients than with the logit specification.

to preclude reverse causality running from the country's decision to default to the behavior of the explanatory variables, we follow Detragiache and Spilimbergo (2001) and drop from the sample all the observations following the default event until the year the respective debt crisis is deemed "resolved".[21] In doing this, we are also implicitly assuming that sovereign risk dynamics changes radically after a default occurs.

Table 2 estimates confirm that real GDP growth(g_gdpr), the debt service-export ratio (ds_nx), the ratio of net international reserves to debt (fxnet_de), the fiscal balance (ggb_gdp), the US interest rate (USireal), and real effective exchange rate (REER) are all significant determinants of default probabilities.[22] This result is robust to the inclusion of other potential explanatory variables highlighted in the literature such as terms of trade, the debt to GDP ratio, and trade openness (measured as the ratio of exports to GDP), as indicated by the likelihood-ratio tests reported in the Table. However, it appears that the ratio of short-term debt to total debt does add to the model's predictive power and so was incorrectly omitted.[23] Regarding the point estimates, they indicate that the US interest rate is the most powerful single predictor of default risk followed by the fiscal balance. As expected, the marginal effects on default probabilities (dF/dx) change considerably at different sample points, being quite low at sample means (reflecting the fact that defaults are rare events) but rising sharply in the year preceding defaults. For instance, while a one-percentage point in the US interest rate has raises the default probability by only 0.3 percentage points at the overall sample mean (which mostly reflect "tranquil" times), it raises it by as much as 16 percentage points in the year preceding a default

[21] We date the end of debt crises using the periodization proposed in Beim and Calomiris (2001) for the period through 1994 and IMF country desk information for subsequent years. Detragiache and Spilimbergo (2001) base, instead, their periodization on the outstanding arrears of private and public external debt (as published in the IMF's *International Financial Statistics).* The main difficulty with this procedure is that the IFS debt arrears series includes all country's debt, public and private, and not just sovereign debt. As there have been a few situations where sovereign's access to international capital markets is reestablished even through a segment of the domestic private sector continue accumulate arrears for some time, the two periodizations differ somewhat. Since the main focus of this paper is on sovereign debt, rather than on total external debt, our periodization seems preferrable for present purposes.

[22] Regarding the real exchange rate, we also found it to be significant when deviations from an HP-filtered trend was used. However, the fit of the model in the latter case was significantly poorer so we stuck to the index itself normalized to the same base year (1990=100) for all countries.

[23] The main reason as to why we omitted it in the first place is due the fact that we lack of data for this variable for the outer years in our sample (2000 and 2001). The is also the issue as to why this ratio is endogenous and serially correlated with the other variables, as an increase in the ratio may simply reflect debt servicing problems. See Detragiache and Spilimbergo (2001).

(i.e., when the marginal effect is computed taking into account the level deterioration of all the other indicators in that year).

Table 2. Logit Estimates of Default Probabilities Omitting Volatility Variables

	(dF/dx) 1/	z	P[Z]>z	(dF/dx) 2/
constant	-0.04537	-6.070	0.000	-2.618
g_gdpr	-0.06588	-2.624	0.009	-3.801
dS_NX	0.01951	4.659	0.000	1.126
fxnet_de	-0.01228	-2.137	0.033	-0.709
ggb_gdp	-0.06668	-1.988	0.047	-3.848
Usireal	0.27799	4.234	0.000	16.04
REER	0.00611	3.675	0.000	0.353

Pseudo R^2 = 0.55

$\chi2$ all = 90.99 *

LM test for heteroskedasticity = 3.21

Number of Observations = 552

Variable Addition Tests:

LR on openness = 0.047

LR on debt/GDP = 0.045

LR on TOT cycle = 0.35

LR on LA dummy = 1.096

LR on short-term debt = 18.86 *

Prediction Score Matrix

	Predicted 3/		
Actual	0	1	Total
0	532	1	533
1	10	9	19
Total	542	10	552

1/ Overall mean elasticity

2/ Mean elasticity one year prior to crisis

3/ Threshold probability value for crisis prediction: 0.5

* Statistically significant at 1%.

The in-sample predictive performance of the model can be gauged from the score matrix reported at the bottom of Table 2. The latter shows that the model fails to predict 10 out of 19 default events and wrongly predicts one default when there was none. The reported pseudo R-square of 0.55 is quite respectable compared to that of other studies, and the Lagrange Multiplier test does not reject the homoskedasticity assumption across country groups. This is particularly reassuring given that sharp heterogeneity between Latin American countries and the Asian EMs comprising our sample, both in terms of the frequency of defaults as well as the behavior of some key variables, as noted in Section II.

To see how the introduction of volatility improves the model, consider first the role of terms of trade volatility. In order to capture historical cross-country differences as well as the evolving historical pattern of volatility within each country, we measure terms of trade volatility as 10-year rolling standard deviations of the respective index (1995=100).[24] Since terms of trade is a variable for which we have a continuous series going back the early 1960s for all 25 emerging markets countries, using a 10-year window does not entail any loss of degrees of freedom. The results reported in Table 3 indicate that terms of trade volatility are a significant determinant of default probabilities and considerably improves the model's fit. The results are robust to whether short-term debt is included amongst the regressions, although the low t-ratio associated with that variable suggests that it should be dropped from the regression. From the Table's bottom panel, we can see that the inclusion of terms of trade volatility into the model reduces the number of crisis mispredictions from 11 to 7 and raise pseudo R-square from 0.55 to 0.62.The sign of the estimated coefficient is positive indicating that, all else constant, higher terms of trade volatility increases default risk. This result is at odds with the deterministic version of the Eaton and Gersovitz (1981) model which postulates that higher terms of trade (and income) volatility is a key deterrent to debt repudiation, since default would preclude a country from smoothing the impact of such a high terms of trade variability on consumption through international borrowing. However, our result is consistent not only with the stochastic version of the same model, but also with finite horizon models of sovereign debt where unpredictable shocks to a country's income can produce default events (Obstfeld and Rogoff, 1996, ch.6). Our result is also consistent with evidence that consumption smoothing through international borrowing is *not* widely observed in developing countries, as fluctuations in net capital flows to EMs tend to be associated with consumption booms and busts (see, e.g., Calvo and Végh, 1999, for a survey).

As with terms of trade, we introduce policy volatility in the model as rolling standard deviations of the money base coverage and of the capital control variable, as well as the country specific standard deviation of equation (1) residuals, as reported in Table 1. While the length of the money base coverage series allowed us to use a 10-year window without losing any degrees

[24] Since our data set spans over 31 years, the choice of a 10-year seems a reasonable compromise between capturing historical differences across countries and allowing for their variation over time. As a robustness check, we also experimented with 5-year rolling standard deviations, which also yielded statistically significant coefficients but a slightly worse fit.

Table 3. Logit Estimates of Default Probabilities with Terms of Trade Volatility Included

a) Adding Short-Term debt

	(dF/dx) 1/	z	P[Z]>z	(dF/dx) 2/
constant	-0.00657	-5.039	0.000	-3.404
g_gdpr	-0.00995	-3.159	0.006	-4.481
dS_NX	0.00261	3.910	0.000	1.381
fxnet_de	-0.00248	-2.288	0.039	-1.207
ggb_gdp	-0.01318	-2.634	0.020	-5.294
Usireal	0.03543	3.693	0.000	19.912
REER	0.00056	2.940	0.003	0.325
S10_TOT	0.00342	2.105	0.011	2.127
St.debt_de	0.00134	0.590	0.555	0.832

Pseudo R^2 = 0.62 **LM test for Heteroskedasticity. = 0.50**

$\chi2$ all = 103.35* **Number of obs. = 510**

b) Omitting Short-Term debt

	(dF/dx) 1/	z	P[Z]>z	(dF/dx) 2/
constant	-0.0214	-5.730	0.000	-2.962
g_gdpr	-0.0282	-2.750	0.006	-3.900
dS_NX	0.0087	4.520	0.000	1.202
fxnet_de	-0.0076	-2.880	0.039	-1.051
ggb_gdp	-0.0333	-2.330	0.020	-4.608
Usireal	0.1254	4.220	0.000	17.329
REER	0.0020	2.940	0.003	0.283
S10_TOT	0.0134	3.270	0.011	1.851

Pseudo R^2 = 0.61 **LM test for Heteroskedasticity = 0.91**

$\chi2$ all = 102.13 **Number of obs.= 552**

Prediction Score Matrix

	Predicted 3/		Total
Actual	0	1	
0	532	1	533
1	6	13	19
Total	538	14	552

1/ Overall mean elasticity

2/ Mean elasticity one year prior to crisis

3/ Threshold probability value for crisis prediction: 0.5

* Statistically significant at 1 percent.

of freedom, in the case of the capital control variable the use of a 10-year window would lead to severe loss of degrees of freedom since the series for each country was much shorter. So we have instead used a 5-year rolling standard deviation for that variable. As for the fiscal impulse volatility, we enter this variable into the equation as a fixed effect for each country, eliminating the respective debt crisis observations so as to mitigate reverse causality problems as discussed above.

Table 4 shows that all three policy volatility variables appear to make a significant contribution to explaining sovereign default: not only are their estimated coefficients statistically significant at conventional levels but also the fit of the model improves considerably, now mispredicting only 3 out of 552 observations. As with terms of trade, the estimated coefficients on the policy volatility variable are all positive, indicating that, all else constant, a historically more volatile policy environment is more conducive to debt repudiation. This effect appears to be especially significant regarding fiscal policy: all else constant, a one percentage point increase in fiscal impulse volatility is estimated to increase the probability of default by 7 ½ percentage points when the estimates are evaluated at their mean level in the year preceding a default event. Relative to other variables, the marginal effect of fiscal volatility on default risk is only superseded by that of the U.S. interest rate.

Finally, we submit the model to two other robustness checks. One is whether the use of a generated regressor for the fiscal impulse may be biasing the results. Replacing this variable by the *unconditional* standard deviation of the ratio of government spending to revenues ($\sigma_{G/T}$), Table 5 shows that this yields remarkably similar results to those of Table 4—the most noticeable difference being the halving of the coefficient on the fiscal volatility variable "FIMP". Otherwise, all the variables continued to be significant at (or close to) 5 percent and he model's fit is virtually unchanged. The other robustness test pertains to the issue of possible endogeneity of the foreign exchange control variable. Table 6 shows that replacing the unconditional standard deviation of the latter by the standard deviation of the residual in (2) also makes virtually no difference for the inferences drawn above.

IV. Conclusions

While the impact of volatility on credit risk is a central issue in the literature on finance and banking, it had been largely neglected in the macro literature on sovereign risk. This paper's results indicate that this neglect is unjustified. Countries exposed to higher terms of trade and policy volatility do appear to have a higher propensity to default. This finding seems robust to alternative econometric specifications and also when allowance is made for the endogeneity of the various policy variables. In all regressions, the introduction of volatility greatly improve their in-sample predictive performance.

In terms of the existing theoretical literature, one implication of this paper's findings is to call into question the Eaton and Gersovitz (1981) view that terms of trade and income volatility act a deterrant to sovereign defaults to the extent that more volatile countries

Table 4. Logit Estimates of Default Probabilities with Terms of Trade and Policy Volatility Variables Included

	(dF/dx) 1/	z	P[Z]>z	(dF/dx) 2/
constant	-0.0074	-4.810	0.000	-4.58373
g_gdpr	-0.0091	-2.793	0.009	-5.65491
dS_NX	0.0023	3.756	0.000	1.44973
fxnet_de	-0.0029	-3.350	0.033	-1.82168
ggb_gdp	-0.0093	-2.190	0.047	-5.80407
Usireal	0.0401	3.970	0.000	24.98905
REER	0.0008	3.351	0.000	0.49737
S10_TOT	0.0028	2.244	0.025	1.71879
FIMP(σ_ε)	0.0122	1.930	0.054	7.59792
S10_RMFX	0.0000	2.404	0.016	0.00569
S5_FXRES	0.0009	2.566	0.010	0.53687

Pseudo R^2= 0.73 **LM test for Heteroskedasticity = 0.15**

$\chi2$ all 120.41* **Number of obs.= 552**

Prediction Score Matrix

	Predicted 3/		Total
Actual	0	1	
0	533	0	533
1	3	16	19
Total	536	16	552

1/ Overall mean elasticity

2/ Mean elasticity one year prior to crisis

3/ Threshold probability value for crisis prediction: 0.5

* Statistically significant at 1 percent.

Table 5. Logit Estimates of Default Probabilities with Terms of Trade and Unconditional Policy Volatility Measures

	(dF/dx) 1/	z	P[Z]>z	(dF/dx) 2/
constant	-0.0074	-4.780	0.000	-4.64005
G_gdpr	-0.0096	-2.850	0.004	-5.99988
dS_NX	0.0023	3.850	0.000	1.42606
fxnet_de	-0.0029	-3.190	0.014	-1.78041
ggb_gdp	-0.0083	-2.050	0.040	-5.19881
Usireal	0.0388	4.020	0.000	24.20329
REER	0.0007	3.174	0.002	0.46061
S10_TOT	0.0032	2.591	0.010	2.02595
FIMP($\sigma_{G/T}$)	0.0060	1.870	0.061	3.77446
S10_RMFX	0.0000	2.690	0.007	0.00591
S5_FXRES	0.0008	2.220	0.026	0.48277

Pseudo R^2= 0.73 **LM test for Heteroskedasticity = 0.28**

$\chi 2$ all 119.95* **Number of obs.= 552**

Prediction Score Matrix

	Predicted 3/		Total
Actual	0	1	
0	533	0	533
1	3	16	19
Total	536	16	552

1/ Overall mean elasticity

2/ Mean elasticity one year prior to crisis

3/ Threshold probability value for crisis prediction: 0.5

* Statistically significant at 1 percent.

Table 6. Logit Estimates of Default Probabilities with Terms of Trade and Unconditional Policy Volatility Measures

	(dF/dx) 1/	z	P[Z]>z	(dF/dx) 2/
constant	-0.0062	-4.770	0.000	-4.27822
g_gdpr	-0.0076	-2.760	0.006	-5.28901
dS_NX	0.0020	3.660	0.000	1.37621
fxnet_de	-0.0025	-3.290	0.010	-1.71813
ggb_gdp	-0.0075	-2.110	0.035	-5.17147
Usireal	0.0330	3.870	0.000	22.79295
REER	0.0007	3.390	0.001	0.47013
S10_TOT	0.0024	2.280	0.023	1.64547
FIMP(σ_ε)	0.0098	1.835	0.066	6.75283
S10_RMFX	0.0000	2.383	0.017	0.00563
*S5_*ξ	0.0008	2.626	0.009	0.52570

Pseudo R^2= 0.73

χ2 all 119.73*

LM test for Heteroskedasticity = 0.17

Number of obs.= 552

Prediction Score Matrix

	Predicted 3/		Total
Actual	0	1	
0	533	0	533
1	3	16	19
Total	536	16	552

1/ Overall mean elasticity

2/ Mean elasticity one year prior to crisis

3/ Threshold probability value for crisis prediction: 0.5

* Statistically significant at 1 percent.

are precisely those that loose the most from defaulting by not being able to smooth future consumption via international borrowing. In other words, while the classic Eaton-Gersovitz mechanism postulates a *negative* association between macroeconomic volatility and sovereign defaults, we find that this relationship is actually *positive*. Whether this is due to the validity with some ancillary assumptions of their model, such as infinitely living governments or that capital markets strictly punish bad borrowers, is a matter that has been partly addressed elsewhere (see, e.g., Eaton, Gersovitz, and Stiglitz, 1986, Obsteld and Rogoff, 1996) and a further investigation of which is beyond the scope of this paper. As discussed earlier, however, a positive relationship between sovereign defaults and terms of trade and policy volatility is consistent with other existing theories of international borrowing.

From a policy perspective, a main implication of our findings is that less pro-cyclical fiscal policies and less volatile monetary and foreign exchange control policies should help improve a country's credit standing. To the extent that policy volatility stems from political volatility, reducing the latter or at least minimizing its effects on economic policy thus seem crucial to reducing sovereign risk. Many emerging markets have advanced in this direction in recent years – for instance, by granting central banks operational independence, increasing public sector transparency, and enacting fiscal responsibility laws. Yet the mere prospect that these advances may be reversed by a future administration or during a difficult political transition suggests that those institutional reforms still need to be consolidated.

A related implication pertains to the issue of policy insurance in a world where liquidity is important. The higher a country's terms-of-trade volatility or the more volatile its politics, the greater the role of economic policy in ensuring that "bad" shocks and associated liquidity shortfalls do not trigger a default. Whenever full insurance against bad shocks cannot be purchased from third parties, minimizing default risk becomes isomorphic to accumulating enough international reserves, lengthening debt maturities, and running budget surpluses during "good times." Yet when one observes the typical behavior of international reserves and budget balances in the run-ups to debt crises (see Figure 2), it appears that emerging market governments have at times overexposed themselves to such risks. Thus, institutional arrangements – both national and international – that induce governments to more fully internalize default costs and manage their countries' international liquidity and fiscal policies accordingly seem key to lowering sovereign risk.

References

Agénor, Pierre-Richard, and Joshua Aizenman, 1998, "Contagion and Volatility with Imperfect Capital Markets," *Staff Papers*, Vol. 45, No. 2, pp. 207–35.

Agénor, Pierre-Richard, John McDermott, and Eswar Prasad, 2000, "Macroeconomic Fluctuations in Developing Countries: Some Stylized Facts," *World Bank Economic Review*, Vol. 14, pp. 251–85.

Alfaro, Laura, and Fabio Kanuczuk, 2001, "Capital Controls, Risk, and Liberalization Cycles," (unpublished; Cambridge, Massachusetts, and São Paulo: Harvard Business School and University of São Paulo).

Bayoumi, Tamim, and Barry Eichengreen, 1995, "Restraining Yourself: The Implications of Fiscal Rules for Economic Stabilization," *Staff Papers*, Vol. 42, No. 1, pp. 32–48.

Beim, David O., and Charles W. Calomiris, 2001, *Emerging Financial Markets* (New York: McGraw-Hill Irwin).

Bulow, Jeremy, and Kenneth Rogoff, 1989, "Sovereign Debt: Is to Forgive or Forget?" *American Economic Review*, Vol. 79, pp. 43–50.

Calvo, Guillermo, and Carlos Végh, 1999, "Inflation Stabilization and BOP Crises in Developing Countries," *Handbook of Macroeconomics*, Volume C, ed. by John Taylor and Michael Woodford (Amsterdam: North Holland).

Cardoso, Eliana, and Ilan Goldfajn, 1998, "Capital Flows to Brazil: The Endogeneity of Capital Controls," *IMF Staff Papers*, Vol. 45, No. 1, pp. 161–202.

Catão, Luis, 2002, "A Simple Model of the Effects of Macro Volatility on Sovereign Risk," (unpublished; Washington: International Monetary Fund).

Cline, William R., 1995, *International Debt Reexamined* (Washington: Institute for International Economics).

———, and Kevin J.S. Barnes, 1997, " Spreads and Risk in Emerging Markets Lending," IIF Research Paper No. 97–1 (Washington: Institute for International Economics).

Detragiache, Enrica, and Antonio Spilimbergo, 2001. "Crises and Liquidity: Evidence and Interpretation," IMF Working Paper WP/01/02, Washington D.C.: International Monetary Fund.

De Gregorio, José, Sebastian Edwards, and Rodrigo Valdés, 2000, "Capital Controls: Do They Work?" NBER Working Paper No. 7645 (Cambridge, Massachusetts: National Bureau of Economic Research).

Díaz-Alejandro, Carlos F., 1985, "Goodbye Financial Repression, Hello Financial Crash," Journal of Development Economics, Vol. 19, pp. 1–24.

Eaton, Jonathan, and Mark Gersovitz, 1981, "Debt with Potential Repudiation: Theoretical and Empirical Analysis," *Review of Economics and Statistics*, Vol. 48, pp. 284–309.

———, and Joseph E. Stiglitz, 1986, "The Pure Theory of Country Risk," *European Economic Review*, Vol. 30, pp. 481–513.

Edwards, Sebastian, 1982, "LDC Foreign Borrowing and Default Risk: An Empirical Investigation, 1976–80," *American Economic Review*, Vol. 74, No. 4, pp. 726–34.

Eichengreen, Barry, and Richard Portes, 1985, "Debt and Default in the 1930s: Causes and Consequences," CEPR Discussion Paper No. 75 (London: Centre for Economic Policy Research).

Feder, Gershon, and Richard E. Just, 1977, "A Study of Debt Servicing Capacity Applying Logit Analysis," *Journal of Development Economics,* Vol. 4, pp. 25–38.

Fischer, Stanley, Ratna Sahay, and Carlos Végh, 2001, "Modern Hyper—and High Inflations," *Journal of Economic Literature,* Forthcoming.

Gavin, Michael, and Roberto Perotti, 1997, "Fiscal Policy in Latin America," *NBER Macroeconomics Annual*, pp. 11–61 (Cambridge, Massachusetts: National Bureau of Economic Research).

Gavin, Michael, Ricardo Hausmann, Roberto Perotti, and Ernesto Talvi, 1996, "Managing Fiscal Policy in Latin America and the Caribbean: Volatility, Procyclicality, and Limited Creditworthiness," Working Paper No. 326 (Washington: Office of the Chief Economist, Inter-American Development Bank).

Greene, William H., 2000, *Econometric Analysis* (New Jersey: Prentice Hall).

IMF, 2001a, *World Economic Outlook*, Washington D.C.: International Monetary Fund, May.

IMF, 2001b, *World Economic Outlook*, Washington D.C.: International Monetary Fund, October.

Kraay, Aart, and Jaume Ventura, 2001, "Comparative Advantage and the Cross-Section of Business Cycles," NBER Working Paper No. 8104 (Cambridge, Massachusetts: National Bureau of Economic Research).

Kletzer, Kenneth, 1997. "Volatility, External Debt, and Fiscal Risk: Simulations of the Impact of Shocks on Fiscal Adjustment for Thirteen Latin American Countries," Working Paper No. 358 (Washington: Office of the Chief Economist, Inter-American Development Bank).

Krueger, Anne, 2002, *A New Approach to Sovereign Debt Restructuring* (Washington: International Monetary Fund).

Leiderman, Leonardo, and Assaf Razin (eds.), 1994, *Capital Mobility: the Impact on Consumption, Investment, and Growth* (Cambridge: Cambridge University Press).

Lindert, Peter H., and Peter J. Morton, 1989, "How Sovereign Debt Has Worked," *Developing Country Debt and Economic Performance*, ed. by Jeffrey Sachs (Chicago: Chicago University Press).

McDonald, Donogh, 1982, "Debt Capacity and Developing Country Borrowing: A Survey of the Literature," *Staff Papers*, Vol. 29, pp. 603–46.

Mendoza, Enrique, "Terms of Trade, the Real Exchange Rate, and Economic Fluctuations," *International Economic Review*, Vol. 36, pp. 101–37.

Min, Hong G. 1998, "Determinants of Emerging Market Bond Spreads–Do Economic Fundamentals Matter?" Policy Research Paper No. 1899 (Washington: The World Bank).

Montiel, Peter, and Carmen Reinhart, 1999, "Do Capital Controls and Macroeconomic Policies Influence the Volume and Composition of Capital Flows? Evidence from the 1990s," *Journal of International Money and Finance*, Vol. 18, No. 4, pp. 619–35.

Obstfeld, Maurice, and Kenneth Rogoff. 1996, *Foundations of International Macroeconomics* (Cambridge, Massachusetts: The MIT Press).

Pesaran, M.H., and B. Pesaran, 1997, *Microfit 4.0* (Oxford: Oxford University Press).

Reinhart, Carmen M., 2001, "Default, Currency Crises, and Sovereign Credit Ratings," (unpublished; Washington: International Monetary Fund).

Rose, Andrew K., 2002, "One Reason Countries Pay Their Debts: Renegotiation and International Trade," CEPR Discussion Paper No. 3157 (London: Centre for Economic Policy Research).

Talvi, Ernesto, and Carlos Végh, "Tax Base Variability and Procyclical Fiscal Policy," NBER Working Paper No. 7499 (Cambridge, Massachusetts National Bureau of Economic Research).