ON THE DETERMINANTS AND RESILIENCE OF BOND FLOWS TO LDCs, 1990 - 1995 EVIDENCE FROM ARGENTINA, BRAZIL AND MEXICO

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ABSTRACT.

Bond flows to Less Developed Countries (LDCs) proved more resilient than expected to the rising U.S. interest rates during 1994, raising hopes that the current episode of private capital flows to LDCs may not end in a widespread crisis as its predecessors in the 1920s and 1970s did. This paper attributes the surprising resilience of the flows to the fact that global bond issuance was a significant determinant of them, independently of U.S. (and world) interest rates. Briefly, global issuance, which recovered quickly from the shock of the first interest-rate rise in February 1994, helped offest the adverse impact of the rising interest rates. The paper also documents the existence of some speculative component in the flows and of regional contagion effects, both of which warn of a possible crisis in the future. Compared with previous studies, the paper identifies an additional determinant of bond flows, i.e., global issuance, documents a remarkable stability of the estimated coefficients during the period of rising interest rates and in the aftermath of the "Peso crisis", and makes a better assessment of the impact of global and country-specific determinants for each sample country.

J.E.L. Classification Numbers: F21, F32, F34

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1 INTRODUCTION

The surge of private capital flows to Less Developed Countries (LDCs) in the early 1990s did not occur in a vacuum. Like its predecessors in the 1920s and 1970s, it was triggered by developments in the borrowing LDCs, as well as economic conditions in the lending industrial countries. In particular, the post-World War I boom in commodity prices in the 1920s encouraged direct investment in the resource-rich LDCs, and international bond issues to finance related infrastructure projects. In addition, the reduction in the U.S. interest rates, which started in 1924, intensified investors search for higher yields and led to the rise of U.S. bond investments abroad (Eichengreen [1996]). The strong growth in the 1960s and early 1970s, trade liberalization and the adoption of export-promoting policies, along with the low real interest rates in the industrial countries and the flood of OPEC's petro-dollars recycled through money-center banks, encouraged the explosion of syndicated bank loans to LDCs in the late 1970s. Lastly, the adoption of sound economic policies and market-oriented reforms, and the restructuring of the external debt left over from the "debt crisis" of the previous decade, along with the recession and the low interest rates in the industrial countries, helped stimulate bond and equity flows to Latin American (L.A.) and East Asian LDCs in the early 1990s (Calvo et al. [1992], Chuhan et al. [1993], Doley et al. [1996], Fernandez-Arias [1996]).

The upshot of all three episodes is that developments in the industrial countries, and especially a rise in interest rates, could adversely affect capital flows to LDCs and precipitate an external financing crisis. This grim possibility is amply illustrated by the traumatic experience from the first two episodes. The rise in U.S. interest rates in 1928 increased the debt-servicing burden of the borrowing LDCs and brought U.S. lending to a virtual stop (Eichengreen [1996]). With their external financing difficulties exacerbated by the global depression of the 1930s, several of these LDCs defaulted on their foreign bonds and, paying a heavy price, did not regain access to the international financial markets for almost forty years (Fernandez-Ansola and Laursen [1995]). In the late 1970s, the steep rise in real U.S. interest rates set in motion a similar sequence of events which culminated in Mexico's suspension of debt-servicing in August 1982, the starting point of the "debt crisis".

The possibility of a similar traumatic experience in the 1990s was stressed by the studies mentioned above, which noted the parallels among the three episodes. These studies essentially documented that the cyclically low world interest rates[1] at the beginning of the decade were instrumental in motivating the flows and improving the creditworthiness of the borrowing LDCs. Thus, as they implied, a rise in world interest rates, caused by the eventual upturn of economic

[1] In these studies, as well as in the present one, world interest rates are proxied with U.S. interest rates.

activity, could trigger a capital outflow and cause another external financing crisis even in LDCs which had adopted sound economic policies.

Fortunately, and to the surprise of many informed observers, this has not happened so far, the "Peso crisis" of December 1994 not withstanding.[2] Following the Fed's first tightening in February 1994, bond flows to L.A. fell to $2.1 billion in the second quarter of the year, down from $5.9 billion in the first and $8.8 billion in the last quarter of 1993 (Figure 1). They recovered, however, to $2.4 billion in the third quarter and further to $5.9 billion in the fourth, despite the continuing increases in the U.S. interest rates throughout 1994. As it seems, bond flows to L.A. during the entire period since the beginning of the surge have followed the ups and downs of global bond issuance more closely than the changes in U.S. interest rates. This observation is further supported by the plots of global issuance and bond flows to Argentina, Brazil and Mexico, the biggest L.A. borrowers, along with the U.S. Treasury-bill rate, for the period January 1990 to December 1995 (Figure 2).

This visual evidence suggests that global issuance may have been a significant determinant of bond flows to the three L.A. countries, independently from and perhaps more important than world interest rates, thus explaining the surprising resilience of the flows. Taking also into account that bonds constitute by far the most important borrowing instrument for L.A. countries in the 1990s (see Table A-1 for related figures), the visual evidence further suggests that the current episode of private capital flows to LDCs may represent a break with the boom-bust cycles of the past. In short, as long as L.A. countries can issue international bonds, they may be able to weather temporary external financing difficulties even when other channels of flows which they have no control over dry-up. Such a channel is equity flows. As a reminder, the dramatic decrease of

[2]The element of surprise is still echoed, almost three years after the Fed's first tightening in February 1994, in authoritative analyses of recent developments in the international financial markets. For example, referring to capital flows to Latin America, the *Financial Times* wrote on September 13, 1996: "There were no indications of any exit of short-term capital, although an eventual increase of US interest rates could lead to an outflow in the second half of this year. This unexpected increase in capital flows....". Also, in the September 1996 issue of the IMF's *International Capital Markets: Developments, Prospects, and Key Policy Issues* (p. 7) it is stated that "A year ago few observers expected that by the end of 1995 capital flows would have surpassed their previous peak reached in 1993."

Last but not least, the following passage from the *International Banking and Financial Market Developments* (Bank for International Settlements, August 1996, p. 23) not only captures the element of surprise, but also underlines the significance of this paper's findings: "The global bond market reversal of early 1994, the Mexican crisis and the turbulence seen in financial markets at the beginning of 1996 have had no more than a temporary and localized influence on issuance. Whereas in recent years there has been a close inverse correlation between the level of interest rates in major industrialized countries and the volume of new international bond issues by developing country borrowers, the sharp increase in US interest rates and in their volatility in the first quarter of 1996 failed to have any major impact on such issuance. ..... ***This suggests that broader forces have been at play recently.***" (emphasis added)

syndicated loans to L.A. countries in the aftermath of Mexico's suspension of debt-servicing in August 1982 turned what could have been a manageable recession into a major development crisis (Diaz-Alejandro [1984]).

It appears, therefore, that a re-examination of the determinants of bond flows to L.A. countries[3] is a worthwhile endeavor. In further support of this argument, it is necessary to analyze the evidence over a complete interest-rate cycle, not just over a period of falling interest rates and rising flows as most of the existing studies have done. To be fair though, these studies were conducted before the first rise in U.S. interest rates in February 1994. From a policy point of view, the value of such an endeavor is highlighted by the potentially disastrous effects of a sudden capital-flow reversal and the associated need for early warning signs.

In undertaking this endeavor, the present paper tries to avoid the data-related weaknesses of its precursors. In particular, the paper uses well-defined monthly data on international bond flows for a period, January 1990 to December 1995, which spans a complete cycle in U.S. interest rates. This period is long enough for a country-by-country examination of the empirical evidence, and thus allows a better assessment of the impact of country-specific developments and global economic conditions on each borrowing LDC. (As discussed below, most existing studies pool the data for the sample countries to get enough degrees of freedom for the econometric analysis.) Further, the paper uses Tobit estimation to account for the fact that for several months there were no bond flows.

The paper is organized as follows. To put the results into perspective and also highlight their significance, Section 2 begins with a brief literature review. It then proceeds with the presentation of a general reduced-form model which encompasses the economic variables usually associated with bond flows. Section 3 analyzes the empirical evidence for Argentina, Brazil and Mexico, the three L.A. countries for which there are enough non-zero observations for a meaningful estimation. Section 4 summarizes the evidence and discusses briefly its implications, while an appendix describes the data.

[3]The focus on bond flows reflects the fact that bonds are the primary borrowing instrument for L.A. countries in the current episode, and the empirical finding that portfolio flows –bond and equity– behave differently from direct investment and debt flows (Chuhan et al. [1996]).

2 THE DETERMINANTS OF BOND FLOWS

2.1 Brief Literature Review

As noted in the introduction, the surge of private capital flows to LDCs in the 1990s was triggered by both country-specific developments and economic conditions in the industrial countries, "pull" and "push" factors in the descriptive terminology of Fernandez-Arias (1996).

For several reasons, however, the contribution of country-specific developments has been extremely difficult to measure consistently. As several authors have noted, factors like sound fiscal and monetary policies, debt-servicing restructuring under the Brady Plan, and market-oriented reforms cannot be readily quantified. Introducing another complication, some countries started receiving flows long before they introduced economic reforms or completed a Brady Plan (see Dooley et al. [1996] for an extensive discussion). Also, changes in government policies make it unlikely that a stable relationship might exist between capital flows and domestic quantifiable factors. Such factors are the secondary-market price of a country's debt, the country's credit rating, the return on the domestic stock market, the black market exchange rate premium (all of which are used by Chuhan at al. [1993]), and domestic interest rates. For example, reducing the reserve requirements on foreign currency deposits can –everything else equal– induce higher flows. Further, changes in the degree of sterilization, which most likely have occurred as suggested by the reserve accumulation in the sample countries documented in Figure 3 below, would further undermine the stability of the relationship between bond flows and domestic quantifiable factors.

As far as it concerns conditions in the industrial countries, global factors in the terminology of many studies, attention has primarily focused on interest rates and, to a lesser extent, economic activity, both of which are usually proxied with some appropriate U.S. variables. Specifically, Dooley et al. (1996), using annual data from 1986 to 1992 for a panel of twenty LDCs, find that the ten-year U.S. bond yield is an important determinant of the secondary-market price of sovereign debt. Interpreting a rising price as an improvement in a country's creditworthiness, they conclude that the decline in the U.S. interest rates was the dominant factor behind the renewed access of highly-indebted LDCs to international financial markets in the 1990s. Fernandez-Arias (1996) reaches the same conclusion using quarterly data for a panel of thirteen middle-income LDCs, from the first quarter of 1989 to the first quarter of 1993. After adjusting for the favorable impact of falling international interest rates on the debtor-countries' creditworthiness, he finds that changes in the U.S. ten-year bond rate can account for 86 percent of the post-1989 increase in portfolio flows to the sample countries.

Further, Calvo et al. (1993) find that global factors account for between thirty and sixty percent of the variance of reserves in ten L.A. countries over the period 1988 to 1992. Lacking appropriate data, they use monthly movements in reserves as a proxy for movements in total flows. Also, to capture the effect of global factors, they use the first two principal components of various U.S. interest rates, deviations from the trend of the U.S. real disposable income, and indices on U.S. stock and real estate markets. Finally, Chuhan et al. (1993) find that global factors explain about half the bond and equity flows from the U.S. to a panel of six L.A. countries for the period January 1988 to September 1992. Their proxies for the global factors include the deviation of the U.S. industrial production index from a time trend, to account for the cyclical variation in economic activity, and five U.S. interest rates (three short rates, one medium and one long-term) and their first principal component.

2.2 Modeling Bond Flows

The present study differs from the above in several respects. First, the extended sample period, January 1990 to December 1995, covers a complete cycle in the U.S. and international interest rates, not just a period of falling rates and rising flows. Thus, it provides a better framework to analyze the determinants and resilience of bond flows. The sample period also includes the turbulent for Mexico years of 1994 and 1995, during which the attitude of international investors towards L.A. must have changed. As a reminder, the Chiapas revolution in January 1994, the assassination of the presidential candidate Colosio in March, the presidential elections in August, and another political assassination in September culminated in the "Peso crisis" in December 1994, which required an extraordinary international rescue operation to avert another "debt crisis" (sparked –like the previous one– by Mexico, the country which led the way back to the international financial markets in the 1990s for the highly-indebted LDCs).

Second, the relatively large number of observations allows a country-by-country analysis and, thus, a better assessment of individual-country experience. It also facilitates testing for parameter stability and structural breaks in the wake of major policy changes and political events (a chronology of such changes and events is presented in Table A-2, in the appendix). Third, the bond-flows data, also described in the appendix, are well-defined. Notably, they exclude flows related to debt-restructuring. Thus, one does not have to use dummies for the months Brady bonds were issued, as Chuhan et al. (1993) had to do. Moreover, the data cover total bond flows, not only from the U.S.. Fourth, noting that for several months the flows were zero, the paper uses Tobit estimation. Fifth, to avoid difficulties in interpreting the results, it does not implement complex data transformations, such as, constructing principal components.

Most importantly though, the paper tries to account for both the demand and supply conditions. In contrast, the existing literature reports results which stress primarily the role of the latter.

The extensive list of variables considered is presented in Table 1. These variables are divided into the descriptively named groups *Market Access, Supply of Funds, Demand for Funds–Need, Demand for Funds–Cost, Contagion Effects, Creditworthiness, International Liquidity, Policy Changes and Major Events*, and *Quality of Economic Management*. The first two groups have not been considered in previous studies, despite their economic and statistical significance which is documented in this paper. For each variable, Table 1 reports a brief description, the symbol used, the expected sign, and related comments. For brevity, more detailed comments are discussed in the text as need arises.

The paper follows a "general-to-specific" modeling approach, which proceeds in three steps. Initially, the very general reduced-form Tobit model described by equations (1) through (3) is estimated for each country. In equation (1), every right-hand-side term corresponds to one group in Table 1.

$$\begin{aligned} BOND_t^* \;=\; & \alpha + \sum_{i=1}^{n} \beta_i BOND_{t-i} + \sum_{i=0}^{p} \gamma_i WBOND_{t-i} + \sum_{i=1}^{q} \delta_i NEED_{t-i} \\ & + \sum_{i=1}^{m} \epsilon_i COST_{t-i} + \zeta LABOND_{t-1} + \theta CRED_t + \lambda RES_{t-k} \;(k \geq 2) \\ & + \sum_{j} \mu_j DUM_{t,j} + \eta \; QUALITY_{t-k} (k \geq 1) + u_t \end{aligned} \tag{1}$$

$$BOND_t = \begin{cases} 0 & \text{if } BOND_t^* \leq 0 \\ BOND_t^* & \text{if } BOND_t^* > 0 \end{cases} \tag{2}$$

$$u_t \sim N(0, \sigma^2) \tag{3}$$

$NEED_t$ can be any of the CA_t, $\%\Delta R_t$ or $\%\Delta R_t^{cum}$, while $COST_t$ can be any of the i_t, r_t, i_t^* or $E_t \Delta i_{t+1}^*$ (twelve permutations). For the first four groups of potential explanatory variables, more than one lag is used in order to capture their delayed effects. In most cases, however, two lags were enough.

Next, insignificant variables are identified with a series of Wald tests for joint significance and dropped, while competing models are evaluated in terms of the goodness-of-fit (measured by the log-likelihood). In fact, the only competing models involved the U.S. Treasury Bill rate and the ten-year Government Bond yield for Argentina and Brazil. The two rates are strongly correlated and produced similar results. For brevity though, the paper reports the results with the

higher values for the log-likelihood. In addition, the parsimonious model thus arrived is tested for normality in the residuals using a moments-based test whose statistic is distributed as $\chi^2(2)$.

Finally, to evaluate the impact of the rising U.S. interest rates and of Mexico's difficulties during 1994, the first two steps are performed for both the whole sample and the sub-sample ending in December 1993. The corresponding parsimonious models are then estimated sequentially with samples ending in each of the months between December 1993 and December 1995.

Two aspects of the modeling approach are of particular interest. First, equation (1) encompasses global bond issuance and various interest rates. Thus, it is left to the data to determine whether the observation that the former is more significant than the latter is true. In addition, the sequential estimation can help determine whether the direction of influence of variables whose sign is not certain a priori has changed during the sample period. For example, as discussed in Table 1, lagged bond flows, $BOND_{t-k}$ $(k \geq 1)$, may have a positive or negative sign. It is also possible that $BOND_{t-k}$ $(k \geq 1)$ changes sign over time. However, a relative stable coefficient over time would be strong evidence against that. The sequential estimation can also detect the impact of policy changes which are not captured by the dummy variables.

At this point, it should be noted that the correlation between global issuance and bond flows to individual countries discussed in the introduction could, under certain conditions, be puzzling. To begin with, changes in global issuance may reflect changes in the supply of funds the borrowing countries face. (This is a reasonable assumption as L.A. countries account for a small fraction of total bond issuance. See Table A-1 in the appendix for detailed figures). Consequently, global issuance should be positively correlated with flows to individual countries, resulting in positive γ_k $(k \geq 0)$ coefficients. In the case the borrowing countries face a binding external financing constraint, they would borrow as much as they could regardless of the cost of funds. But when the constraint is not binding, factors like the cost of funds and the need to borrow should also affect bond flows. If not, it would appear that, contrary to any notion of rationality, the borrowing countries receive some fraction of global bond flows irrespective of their needs and policies, or the prevailing conditions in the creditor countries. It would also imply that, contrary to past experience and the findings of earlier studies, international interest rates are not even a factor determining bond flows.

For the L.A. sample countries, the rising foreign exchange reserves (Figure 3) suggest that the external financing constraint was not binding. Hence, other factors besides global issuance should affect their bond flows. The case of Mexico is telling. Despite the substantial and widening current account deficits, reserves continued accumulating until March 1994, an indication that total flows were exceeding the country's external financing needs. Mexico's reserves started

falling only after the assassination of presidential candidate Colosio undermined foreign investors' confidence in the country's political stability, which was already shaken by the Chiapas revolution in January 1994. At the other extreme, Brazil started accumulating reserves in 1992 at a faster pace than its modest current account surpluses would suggest. Further, countries like Chile and Colombia had to resort to extensive controls to stem excessive capital inflows and avoid the policy dilemmas such inflows create (see Calvo et al. [1993] for a detailed discussion of these dilemmas).

3 EMPIRICAL EVIDENCE

Table 2 summarizes the empirical evidence. Starting from the left, the first column exhibits the explanatory variables, while each additional column reports one model. In addition to the estimated coefficients and their t-statistics (in parentheses), Table 2 reports the standard error of the residuals, σ, the log-likelihood, Log L, and the $\chi^2(2)$ statistic for the moments-based test for normality of the residuals. The discussion begins with Mexico, which presents the most puzzling evidence, and continues with Argentina and Brazil. For easy reference, a number is provided for each model, while the best model for each country and sample period is indicated by an equation number in bold face.

3.1 Mexico

Table A-2 indicates that the likely months for a structural break in the Mexican model are January, March, September and December (when the "Peso crisis" erupted) of 1994, as well as the first months of 1995, when the international rescue operation was launched. Several dummies were tried to capture these events, such as, $DUM_{Chiapas} = 1$ from January to March 1994, $DUM_{Colosio} = 1$ from April to September, $DUM_{Massieu} = 1$ from October to December, and DUM_{Peso} from January 1995 onwards. Since all were insignificant, a new approach was taken; during the sequential estimation, DUM_{1994} and DUM_{1995} were set equal to one for all months of the respective years, and their significance was evaluated at each iteration. Surprisingly, the best results were obtained for a dummy set to one from January to May 1995. Yet, in a remarkable demonstration of the robustness of the estimated models, the coefficients for the main explanatory variables are the same with or without this dummy (equations [4] and [5]).

But the surprising results do not end with the lack of evidence of a structural break during the tumultuous 1994. As the first equation in Table 2 indicates, lagged bond flows, $BOND_{t-1}$, and

contemporaneous global bond issuance, $WBOND_t$, are the only determinants of the Mexico's flows for the period January 1990 to December 1993. Neither any measure of the need for or the cost of funds, nor any measure of creditworthiness, international liquidity or quality of economic management was significant. Also, the hypothesis of normality in the residuals cannot be rejected, as the $\chi^2(2)$ statistic is not significant at any conventional level.

To illustrate the extensive effort to estimate a model in which other variables are significant, two more equations are shown. In equation (2), reserves lagged three periods, RES_{t-3}, and the cumulative real exchange rate appreciation lagged once, $\%\Delta R^{cum}_{t-1}$, are significant at the 10 percent level, while the coefficients and significance of $BOND_{t-1}$ and $WBOND_t$ decline slightly. Yet, the Wald test for the hypothesis that the coefficients of the two additional variables are both equal to zero is only $\chi^2(2) = 3.16$, which is significant at the 20 percent level. In equation (3), the lagged yield of the U.S. ten-year bond, $USBOND_{t-1}$, is significantly negative when $WBOND_t$ is not included. However, the log-likelihood, which is substantially lower than that in equation (1), and the $\chi^2(2)$ statistic for normality in the residuals, which is significant at the 5 percent level, indicate that equation (3) is not the best model. This conclusion is further supported by the fact that $USBOND_{t-1}$ becomes insignificant when $WBOND_t$ is included in equation (3). The same applies to $USBOND_t$, the contemporaneous yield on ten-year U.S. government bonds. In short, global issuance renders the cost of funds insignificant, instead of the other way around.

Overall, the evidence presented so far confirms the observation that global bond issuance was a significant determinant of bond flows to Mexico for the period January 1990 to December 1993. It also suggests that the flows were primarily supply-driven. This, in conjunction with the fact that Mexico was borrowing more that it needed, provides some justification for Dooley's assessment, although Dooley presents no hard evidence, that the current surge "may have little to do with the economic fundamentals we usually associate with private capital flows." (Dooley, 1995, p.6). Instead, as he concludes, the flows may reflect foreign investors' belief that they can earn high returns for a predictable period, by exploiting an implicit government guarantee on private financial transactions.

In light of the above, and taking into account Mexico's difficulties after January 1994, it is not surprising that market access, $BOND_{t-1}$, and global issuance, $WBOND_t$, remain the sole determinants of bond flows for the whole sample period (equations [4] and [5]). It seems that Mexico, facing a sharp drop in foreign exchange reserves in the wake of these difficulties, was borrowing as much as it could, and thus domestic and foreign interest rates were even less important than before (for a detailed account of this experience, see Sachs at al. [1995]).

What is astonishing though is the stability of the three estimated coefficients. Figure 4 ex-

hibits them for samples ending between December 1993 and December 1995 (solid line) ± two standard errors (dashed lines) for equation (1). As Figure 4 shows, these coefficients remain well within two standard errors, i.e., within the five percent bounds, of their estimates in equation (1). In fact, for most of the time they remain within one standard error only. For the best model, equation (5), which includes the dummy, the coefficients are also within one standard error from their estimates in equation (1) and are essentially the same as in equation (4). The dummy, as expected, has a negative sign.

One specification whose results seem spurious should also be mentioned. In equation (6), the inclusion of $USBOND_{t-1}$, which is significant at the 1 percent level and negative, renders the $Constant$ and $BOND_{t-1}$ insignificant. But it only lowers the value and the t-statistic of $WBOND_t$, which remains significant at the 1 percent level. Yet, the sequential estimation reveals that $USBOND_{t-1}$ becomes significant for the first time in November 1994, when Mexico was well on a crisis path with dwindling reserves and a high CA deficit. It seems unlikely that international interest rates became at that junction more important than before, when Mexico did not need to borrow urgently, and so more important as to prevent borrowing which was necessary to avert the fast-approaching crisis.

3.2 Argentina

For Argentina, the likely months for a break are March 1991, when the unified exchange rate system was replaced with a peg to the U.S. dollar, January 1993, when checking accounts denominated in U.S. dollars were allowed to be opened by residents and used for domestic and international financial transactions, January 1995, following the Mexican crisis, as well as the months of a change in the credit rating. It turns out that a dummy variable that takes the value one from January 1995 to June 1995 gives the best results. To avoid an unnecessary proliferation of dummies, Table 2 shows the essentially similar results obtained with Mexico's dummy (which takes the value one from January to May 1995). In addition, a variable based on the S&P credit rating seemingly captures sufficiently the improvements in Argentina's creditworthiness. This variable takes the value zero before August 1993 and four thereafter (four corresponds to BB- rating, with one corresponding to B-, the lowest rating in the S&P scale, and zero corresponding to no rating at all. See Cantor and Packer [1996] for details). Finally, it should be noted that long delays in the publication of current account data preclude the use of CA as a measure of external financing needs. For example, as of July 1996, the *International Financial Statistics* reports CA data up to the second quarter of 1994.

Table 2 reports five equations for Argentina, two with the sample ending in December 1993,

and three for the whole sample. In the first, equation (7), $WBOND_t$, $USTBILL_{t-1}$ and $CREDIT_t$ are significant at the 1 percent level and have the expected sign. But $BOND_{t-1}$ and $REGION_{t-1}$ are not significant at any conventional level, while a Wald test indicates that the hypothesis that their coefficients are both zero cannot be rejected at any conventional significance level. Equation (8) reports the corresponding more parsimonious equation. There is, however, strong evidence against the normality hypothesis for the residuals, as the $\chi^2(2)$ statistic is significant at the 1 percent level.

Both $BOND_{t-1}$ and $REGION_{t-1}$ are significant for the whole sample with (equation [9]) or without (equation [11]) the dummy for the first five months of 1995, while the normality hypothesis cannot be rejected. Further, as Figure 5 indicates, once the sample is extended beyond December 1993, $BOND_{t-1}$ is mostly significant at the 5 percent level and $REGION_{t-1}$ at the 10 percent level. Dropping them form the model, as in equation (10), does not affect significantly the coefficients of the remaining variables, $WBOND_t$, $USTBILL_{t-1}$ and $CREDIT_t$. However, it worsens the fit of the model relative to equation (9), while the $\chi^2(2)$ statistic for the normality test becomes significant at the 10 percent level.

Overall, the Argentinean evidence is consistent with the economic fundamentals associated with private capital flows and the presumed role of regional contagion effects. Briefly, both the supply conditions, $WBOND_t$, and the cost of funds, $USTBILL_{t-1}$, affected bond flows. Also, lagged regional flows and Mexico's difficulties are significant and have the expected sign. Moreover, the downward trend in the coefficient of $USTBILL_{t-1}$ indicates that the interest-rate sensitivity of Argentina's flows was increasing over time. A possible explanation is that, as the country was accumulating reserves and the external financing constraint was becoming less relevant, cost-of-funds considerations were becoming more important. Lastly, the precipitous decline of the coefficient of the credit rating in early 1994 suggests that, as foreign investors became more familiar with and confident about the country, the rating declined in significance as an indicator of Argentina's creditworthiness.

3.3 Brazil

For Brazil, the most likely months for a break are March 1994, when the automatic authorization for issuing bonds, commercial paper and other fixed-income instruments abroad was terminated; November 1994 following the increase in the financial transaction tax on foreign investment in fixed-income instruments from 5 percent to 9 percent; and the months the credit ratings changed. From all of them, a dummy set to 1 from November 1994 onwards produced the best results. Its positive sign suggests that S&P's upgrade of Brazil's credit rating in November 1994, which was

followed by Moody's upgrade the following month, dominated the negative effect of the increase in the financial transaction tax. Hence, the dummy variable is denoted as $CREDIT_t$.

Since the results for Brazil are consistent with both the economic fundamentals usually associated with bonds flows and the findings of other studies, only two equations are reported: equation (12) for the sample ending in December 1993, and equation (15) –which includes the dummy– for the whole sample. In both, lagged bond flows, $BOND_{t-1}$, have a significantly positive coefficient, while the lagged U.S. Treasury Bill rate, $USTBILL_{t-1}$, has a significantly negative coefficient. There is, however, evidence against the normality hypothesis, as the $\chi^2(2)$ statistic is significant at the 1 percent level for equation (12), and at the 10 percent level for equation (13). On the other hand, the lack of any regional contagion effect attests to the significance of country-specific factors.

Finally, as with Mexico and Argentina, the estimated coefficients exhibit remarkable stability over time. As Figure 6 indicates, they mostly remain within one standard error from their estimates for the sample ending in December 1993. Worth also pointing out, the interest-rate sensitivity of the Brazilian bond flows increased in 1995. But so did the constant term, despite the inclusion of the dummy for the post-November 1994 period.

4 EPILOGUE

Essentially, the empirical analysis explains why the rise in U.S. interest rates in 1994 failed to have any major and lasting impact on bond issuance by LDCs, and identifies one of the "broader forces at play", to use the terminology of the Bank for International Settlements (in footnote 1). This "force", global bond issuance, recovered quickly from the shock of the first interest-rate rise in February 1994, and thus helped offset the adverse impact of the rising throughout-the-year interest rates and of Mexico's difficulties. This is the case for Argentina. For Mexico, and possibly other LDCs not included in the sample, U.S. interest rates were not even a determinant of the flows; global issuance, together with lagged flows, was the only quantifiable determinant, suggesting the existence of some speculative component in these flows. For Brazil though, for which global issuance was not significant, the adverse impact of the rising rates was seemingly offset by the positive effect of the improvement in the country's credit rating.

The empirical analysis also documents a remarkable stability of the estimated coefficients during the period of rising U.S. interest rates and in the aftermath of the Peso devaluation, and illustrates the uniqueness of each country's experience. This uniqueness, which justifies

the paper's country-by-country estimation, is reflected on the significance of the credit rating for Argentina and Brazil, the fact that Mexico's difficulties –the so-called "Tequilla hangover"– affected Argentina's bond flows but not Brazil's, and the different levels and starting time of the flows to each country.

In addition to explaining the surprising resilience of bond flows to LDCs, the significance of global issuance provides ample ex-post justification for the extraordinary rescue operation launched after the Peso devaluation. This operation gave Mexico some breathing space until it could tap the international bond market again; and reassured international investors who, otherwise, might have withdrawn from the country and the region as a whole turning a temporary liquidity crisis into another development crisis. Moreover, the stability of the estimated coefficients suggests that the rescue operation could have been justified ex-ante as well.

Yet, although the significance of global issuance leaves some hope that the current episode of capital flows to LDCs may not end in a crisis as its two predecessors did, it cannot rule out this possibility. On the one hand, as long as the process of international diversification continues to fuel global issuance, bond flows to LDCs may withstand the shocks of cyclical interest rate rises and country-specific difficulties. On the other hand, however, external financing difficulties in a major LDC may lead to a downward shift in the supply of funds for all of them and, eventually, to a drying-up of flows even when global bond issuance continues expanding. Strengthening the case for caution, there is evidence that several LDCs borrowed in the early 1990s more than they needed, an allusion to some "over-borrowing syndrome" (McKinnon and Pill [1994]) and a warning of future debt-servicing difficulties. Consequently, policy makers must remain watchful despite the positive influence of rising global issuance and the adoption of sound economic policies in the borrowing LDCs.

APPENDIX: Data Description

With the exception of bond flows, all data are retrieved from the *International Financial Statistics* (IFS) database. The average exchange rate (line *rf* in IFS), end-of-period foreign exchange reserves minus gold (line *1L.d*), consumer prices (line *64*), and interest rates are available at monthly intervals, while the current account (line *78ald*) is available at quarterly intervals. The interest rates used are determined by data availability. These are the lending rate (line *60p*) for Argentina, the bank rate (line *60*) for Brazil, and the average cost of funds (line *60n*) for Mexico. In line with previous studies, the U.S. Treasury bill rate (line *60c*) and the ten-year government bond yield (line *61*) are used as proxies for international interest rates.

Monthly bond flows come from the OECD's *Financial Statistics Part I* and include gross public and private placements of euro-bond and foreign bond issues, with a maturity of one year or longer. Table A-1 shows bond flows and syndicated bank loans for the years 1990 through 1995, for the world, Latin America, and the sample countries. As Table A-1 indicates, bonds are the primary borrowing instrument for L.A. countries in the 1990s. They account though for a small share of global issuance, an indication that the latter is a good proxy of the supply of funds L.A. countries were facing.

Finally, Table A-2 presents a chronology of the major post-1989 events which might have affected bond flows to individual countries. This chronology guides the construction of the dummy variables used in the econometric estimation.

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TABLE 1.

Potential Explanatory Variables for Bond Flows

Description	Symbol	Expected Sign	Comments
1. Market Access			
Lagged Bond Flows	$BOND$	Not Certain	High $BOND_{t-k}$ $(k \geq 1)$ may indicate high access to the international financial markets and, thus, better familiarity of international investors with the borrowing country. In this case, $BOND_{t-k}$ $(k \geq 1)$ should have a positive sign. On the other hand, high $BOND_{t-k}$ $(k \geq 1)$ may reflect excessive borrowing in previous periods which may be compensated for by lower current borrowing, $BOND_t$. Here, $BOND_{t-k}$ $(k \geq 1)$ should have a negative sign.
2. Supply of Funds			
Global Bond Issuance	$WBOND$	+	As Table A-1 in the appendix documents, L.A. borrowers account for a small fraction of the funds raised in the international financial markets. Consequently, $WBOND$ constitutes a good proxy of the supply of funds they face. Since a higher supply would, everything else equal, lead to more bond flows, $WBOND$ is expected to have a positive sign.
3. Demand for Funds – Need $(NEED)$			
Current Account	CA	Likely -	On the demand side, a deteriorating negative CA indicates a higher need for external financing and more flows, suggesting that CA should have a negative coefficient. But, on the supply side, a high and persistent CA deficit may undermine investors' confidence and thus lead to lower flows, in which case CA should have a positive coefficient. Taking into account the optimistic expectations before the "Peso crisis", it seems that a negative coefficient is more likely. Since CA figures are available at quarterly intervals, $CA_t/3$ is used as a proxy of monthly external financing needs.
Real Exchange Rate Appreciation	$\%\Delta R$	Likely +	$\%\Delta R_t = \%\Delta P_t - \%\Delta P_t^* - \%\Delta e_t$ where: • Δ: difference operator • P: domestic Consumer Price Index (CPI) • P^*: U.S. CPI, a proxy of foreign prices • e: exchange rate, local currency per U.S. $. A real exchange rate appreciation may lead to a CA deterioration and higher external financing needs. Thus, according to the previous analysis, $\%\Delta R$ is likely to have a positive coefficient.
Cumulative $\%\Delta R$	$\%\Delta R^{cum}$	Likely +	Cumulative since January 1990. $\%\Delta R^{cum}$ may be a better proxy of the external financing needs than $\%\Delta R$. For its sign, see the discussion on $\%\Delta R$.

TABLE 1. – Continued (a)

Description	Symbol	Expected Sign	Comments
4. Demand for Funds – Cost $(COST)$			
Domestic Interest Rate	i	+	Lower i should lead to lower external borrowing by domestic agents, when the external financing constraint is not binding. Note that the reserve accumulation is an indication that the sample countries were borrowing abroad more than their external financing needs. Not applicable to Argentina and Brazil where bouts of hyperinflation caused wild fluctuations in i during the sample period.
Domestic Real Interest Rate	r	+	$r_t = i_t - \%\Delta P_t$ For its sign, see the discussion on i.
International Interest Rates	i^*	-	Controlling for global bond issuance, $WBOND$, a decrease in i^*_{t-k} $(k \geq 1)$ should lead to higher borrowing, and vice-versa. i^* is proxied by the U.S. Treasury Bill rate and the U.S. ten-year government bond yield, respectively denoted as $USTBILL$ and $USBOND$. Taking into account the time elapsing between the negotiation of a deal and the actual disbursement of funds, i^* should be lagged at least one period. Nevertheless, the results are virtually the same when the contemporaneous rates are used.
Expected Interest-Rate Changes	$E_t\Delta i^*_{t+1}$	+	E is the usual expectations operator. Since countries might rush to borrow before an expected rise in interest rates, its sign should be positive. This variable is proxied by the difference between the U.S. 10-year government bond yield and Treasury bill rate, $USBOND_{t-1} - USTBILL_{t-1}$.
5. Contagion Effects			
Lagged Flows to Region	$LABOND$	+	$LABOND$ is equal to total bond flows to L.A., inclusive of flows to countries like Chile and Colombia which are not in the sample due to insufficient number of non-zero observations for $BOND$. Calvo and Reinhart (1995) model regional contagion effects in a similar way.
6. Creditworthiness			
Credit Rating	$CRED$	+	Everything else equal, an increase in the credit rating should lead to a lower cost and higher supply of funds, both of which imply higher bond flows. Two measures are used: • ordinal: a different dummy variable is used for each credit rating (see Cantor and Packer [1996] for a complete list of credit ratings by Moody's and Standard & Poor's). • cardinal: a value is assigned to each credit rating, starting from zero for no rating and moving up to sixteen for the highest rating at increments of one, as described in Cantor and Packer (1996). The credit ratings of the sample countries are listed in Table A-2, in the appendix.

TABLE 1. – Continued (b)

Description	Symbol	Expected Sign	Comments
7. International Liquidity			
Lagged Reserves	RES	Not Certain	On the demand side, high reserves may mitigate the need for external borrowing. In addition, the fiscal cost of carrying high reserves may tamper the authorities' desire to sterilize the inflows. In this case, the inflows will lead to an expansion of domestic money supply and lower domestic rates, and through the latter to lower foreign borrowing. (The fiscal cost reflects the higher interest rate LDCs pay on their outstanding foreign liabilities (debt) relative to the interest rate they receive on their holdings of foreign-government securities.) But on the supply side, high reserves may enhance foreign investors' confidence and thus lead to higher bond flows. Since reserves correspond to end-of-month figures, while actual flows occur sometime after a deal is negotiated, RES must be lagged at least two periods.
8. Policy Changes & Major Events			
Dummies	DUM	Depends	Dummies are used to capture the impact of major political events and changes in economic policies (especially those pertaining to capital controls), which may affect the supply or the cost of funds to domestic agents. The dummies are based on the chronology of major post-1989 events outlined in Table A-2, in the appendix, and are discussed extensively in the main text.
9. Quality of Economic Management $(QUALITY)$			
Variance of Inflation	var_π_t	-	var_π_t is equal to a moving twelve-month variance of inflation, from month t to month $t-11$. Taking into account the lags in reporting inflation figures, this variable should be lagged at least two periods. As in Edwards (1984), lower variance indicates better macroeconomic management and, thus, should lead to better access to the international financial markets and lower interest rate spreads. Hence, both the demand and the supply sides indicate that var_π_t's coefficient should be negative.
Variance of $\%\Delta e_t$	$var\_\%\Delta e_t$	-	The variance of exchange rate depreciation is constructed in a similar way as var_π_t. Since e is the monthly-average of the exchange rate, this variable must be lagged at least one period.

TABLE 2.

The Determinants of Bond Flows to L.A. Countries, 1990-1995

Explanatory Variables	Mexico						Argentina					Brazil	
	(1)	(2)	(3)	(4)	**(5)**	(6)	(7)	**(8)**	**(9)**	(10)	(11)	**(12)**	**(13)**
Constant	-602.27 (-4.60)***	-244.32 (-1.05)	+1944.8 (4.07)***	-530.49 (-4.24)***	-527.55 (-4.43)***	+702.49 (1.37)						+759.92 (4.03)***	+854.95 (4.17)***
$BOND_{t-1}$	+0.4028 (3.68)***	+0.3741 (2.98)***	+0.2252 (1.41)	+0.3942 (3.94)***	+0.3263 (3.34)***	+ 0.1683 (1.49)	-0.4412 (-1.30)		-0.4432 (-2.42)**		-0.4265 (-2.20)**	+0.4000 (2.03)**	+0.3344 (2.28)**
$WBOND_t$	+0.0264 (5.81)***	+0.0223 (3.90)***		+0.0229 (5.85)***	+0.0246 (6.50)***	+ 0.0189 (4.43)***	+0.0121 (2.60)***	+0.0139 (3.34)***	+0.0130 (2.84)***	+0.0150 (3.53)***	+0.0129 (2.65)***		
RES_{t-3}		-0.0558 (-1.75)*											
$\%\Delta R_{t-1}^{cum}$		+40.986 (1.77)*											
$USBOND_{t-1}$			-237.42 (-3.94)***			-138.30 (-2.44)**							
$DUM_t = 1$ for t=95:1-95:5					-495.11 (-2.83)***	-457.38 (-2.76)***			-672.58 (-2.35)**	-708.20 (-2.44)**			
$USTBILL_{t-1}$							-101.35 (-3.36)***	-107.58 (-3.42)***	-120.10 (-3.94)***	-123.47 (-3.91)***	-135.46 (-4.10)***	-156.36 (-4.08)***	-186.68 (-4.08)***
$CREDIT_t$							193.17 (3.39)***	172.17 (3.85)***	142.41 (3.99)***	132.74 (4.05)***	110.48 (3.18)***		500.35 (3.57)***
$REGION_{t-1}$							0.1127 (1.19)		0.1542 (1.77)*		0.2152 (2.43)**		
Diagnostics													
Sample Ends	93:12			95:12			93:12		95:12			93:12	95:12
σ	263.64	253.12	302.78	321.40	305.40	291.66	328.47	342.99	406.95	434.40	428.90	247.55	341.99
Log L	-271.94	-270.39	-278.72	-433.72	-429.48	-426.62	-187.55	-188.60	-330.45	-333.29	-333.49	-205.89	-363.98
$\chi^2(2)$	1.78	0.66	8.93**	4.63*	1.69	1.85	24.54***	19.23***	1.04	5.52*	1.29	18.92***	5.98*

Notes:

1. For variable definitions, see Table 1.
2. The best model is identified by an equation number in **bold** face.
3. σ: standard error of the residuals; Log L: log-likelihood.
4. t-statistics are shown in parentheses below the estimated coefficients. Significance Levels: 1 (***), 5 (**) and 10 (*) percent.
5. $\chi^2(2)$: from a moments-based test for normality of the residuals. Critical levels: 4.61 at the 10%, 5.99 at the 5%, and 9.21 at the 1% significance levels.

TABLE A-1.

Private Capital Flows – Debt-Creating

	International Bond Issues – US$ Million						Syndicated Loans – US$ Million					
	1990	1991	1992	1993	1994	1995	1990	1991	1992	1993	1994	1995
Global Issuance	229,935.0	308,729.9	333,693.3	480,997.8	428,628.1	460,658.1	124,524.9	116,025.2	117,869.0	136,676.4	236,221.7	408,401.8
of which												
Latin America	972.9	4,942.4	8,112.2	24,709.2	16,251.1	17,489.7	3,217.0	849.6	910.2	2,168.4	1,724.5	4,133.0
of which												
Argentina	0.0	750.0	1,529.2	6,097.1	5,081.2	5,018.1	0.0	0.0	0.0	376.0	634.5	1,513.0
Brazil	0.0	1,461.6	2,830.0	6,120.4	3,782.4	5,883.7	0.0	18.0	180.0	209.0	0.0	351.0
Mexico	622.3	2,149.5	2,923.4	9,531.3	6,515.5	5,358.6	1,580.0	616.6	175.2	400.0	710.0	758.0

Source: OECD Financial Statistics Monthly.

TABLE A-2.

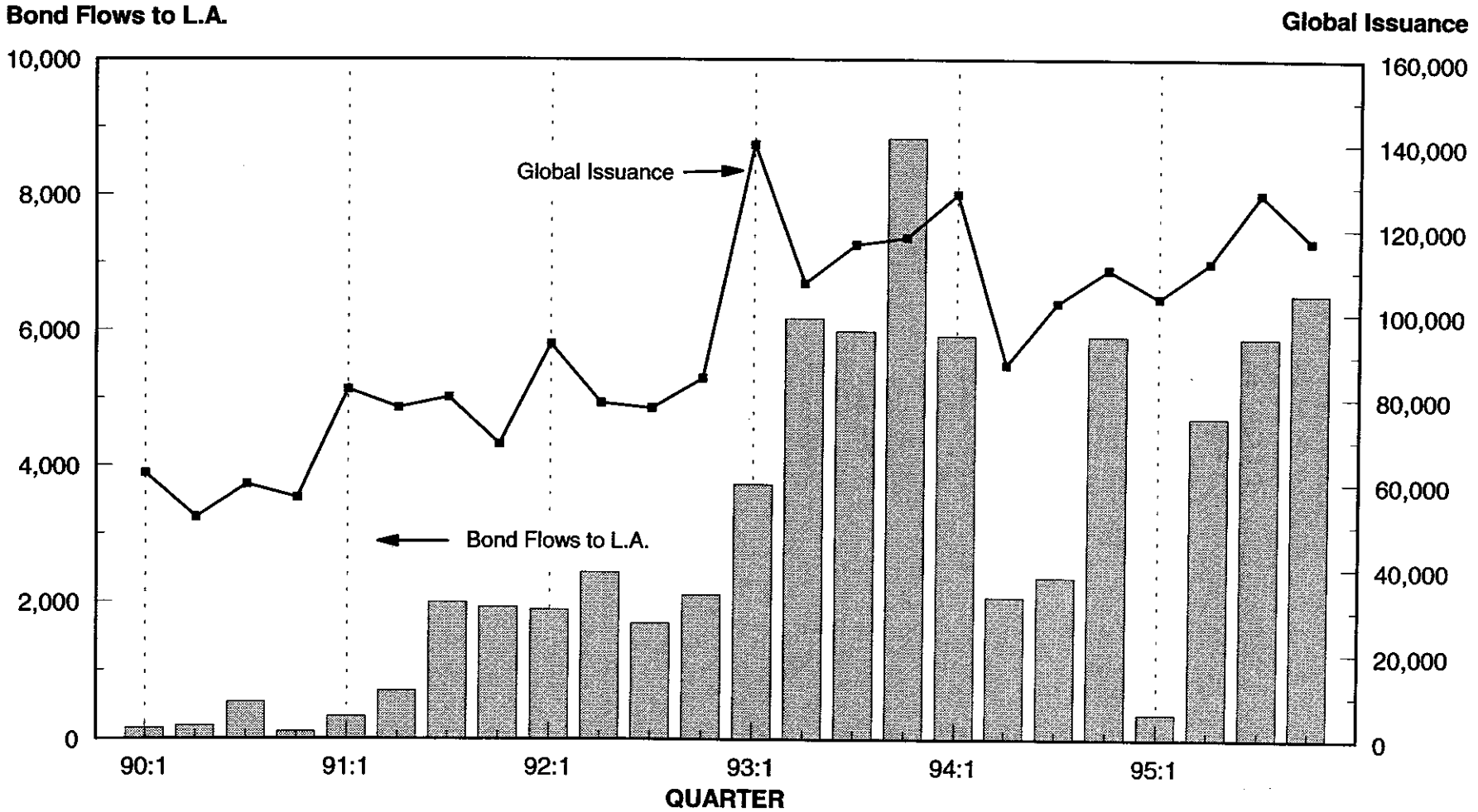
Sample Countries – Chronology of Major, Post-1989 Events

Argentina	Credit Ratings	• Moody's: B3 until July 1992, B1 thereafter. • S&P: BB- from August 1993, none before.
	Exchange Rate Arrangements: Major Changes	• December 12, 1989: The foreign exchange market was unified under a freely floating system; swap transactions and forward exchange operations were permitted. • January 29, 1991: A target range for exchange rate intervention was announced. • March 19, 1991 The unified floating exchange rate system was replaced by a peg to the U.S.$. • January 1, 1992: The Peso replaced the Austral at the rate of 1 Peso to 10,000 Australs. • announced on December 1, 1992, but effective in early 1993: Current account deposits in U.S.$ would be permitted; the same reserve requirements would apply to foreign and domestic currency deposits; domestic financial institutions would be allowed to extend credits in local currency against these deposits, except those in a savings bank or a fixed-term account, up to 25 percent of their capital, subject to the regulations governing their net overall foreign exchange position. • January 1, 1993: Checking accounts denominated in U.S.$ allowed to be opened by residents and used for domestic and international transactions.
Brazil	Credit Ratings	• Moody's: B2 until November 1994, B1 thereafter. • S&P : B on December 1994, B+ after July 1995.
	Exchange Rate Arrangements: Major Changes	• February 28, 1994: The regulations on the financial transactions tax were revised whereby up to 25 percent may be applied on the issue of bonds abroad and on foreign investments in fixed-income securities, when the government considers it necessary to raise the tax rates from the prevailing levels of 3 and 5 percent, respectively. • March 2, 1994: The automatic authorization for issuing bonds, commercial paper, and other fixed-income instruments abroad was terminated. • October 19, 1994: The financial transaction tax on foreign investment in fixed-income instruments was increased to 9 percent from 5 percent.
Mexico	Credit Ratings	• Moody's: Ba2 since 1990. • S&P: BB+ since 1992, BB after February 1995.
	Exchange Rate Arrangements: Major Changes	• May 28, 1990: The rules governing the establishment of the exchange rate of the Peso were modified, whereby the rate would be depreciated daily against the U.S.$ by the pre-announced amount of 0.80 Pesos. • November 12, 1990: The rate of daily depreciation changed to 0.40 Pesos. • November 11, 1991: All controls on exchange transactions were abolished, and the Controlled Exchange Rate Market was eliminated. • June 22, 1992: It was announced that a new Peso, equivalent to 1,000 old Pesos, would be introduced on January 1, 1993. • October 21, 1992: The daily depreciation of the selling intervention point was increased from 0.20 to 0.40 Pesos per U.S.$. • January 1, 1994: NAFTA became effective. • December 20, 1994: The upper limit of the exchange rate band was raised to 3.99 Pesos per U.S.$, representing a devaluation of 15 percent. • December 22, 1994: The Peso was allowed to float, and the exchange rate regime based on the crawling peg was abandoned.
	Major Political Events during 1994	• January: Chiapas revolution. • March: Assassination of presidential candidate Colossio. • August: Presidential elections. • September: Another political assassination (of J.F. Ruis Massieu). • December: President Zedillo takes office.

Note: The information on foreign exchange arrangements comes from various issues of the IMF's annual publication "*Exchange Arrangements and Exchange Restrictions*".

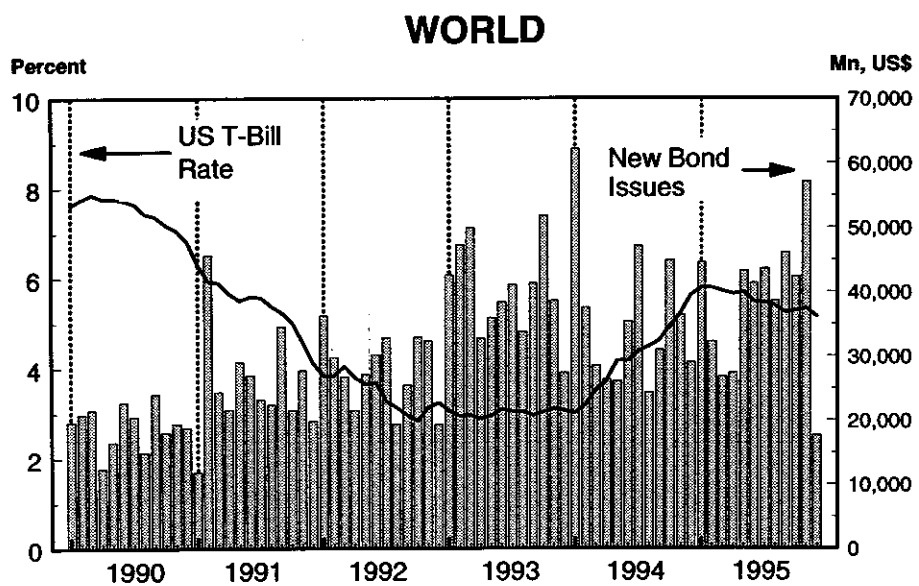
Bond Flows to L.A. & Global Issuance (Million, US$)

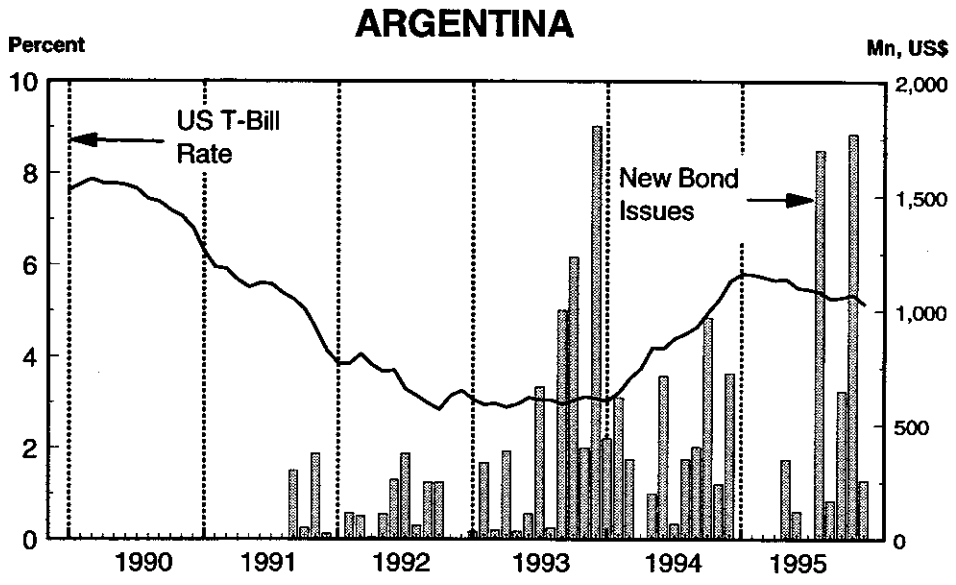
Figure 1.

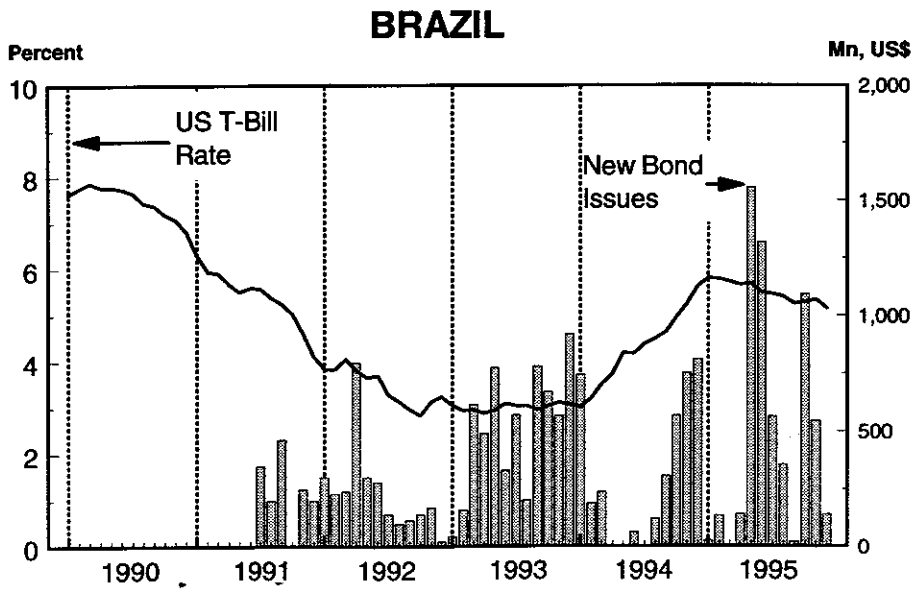


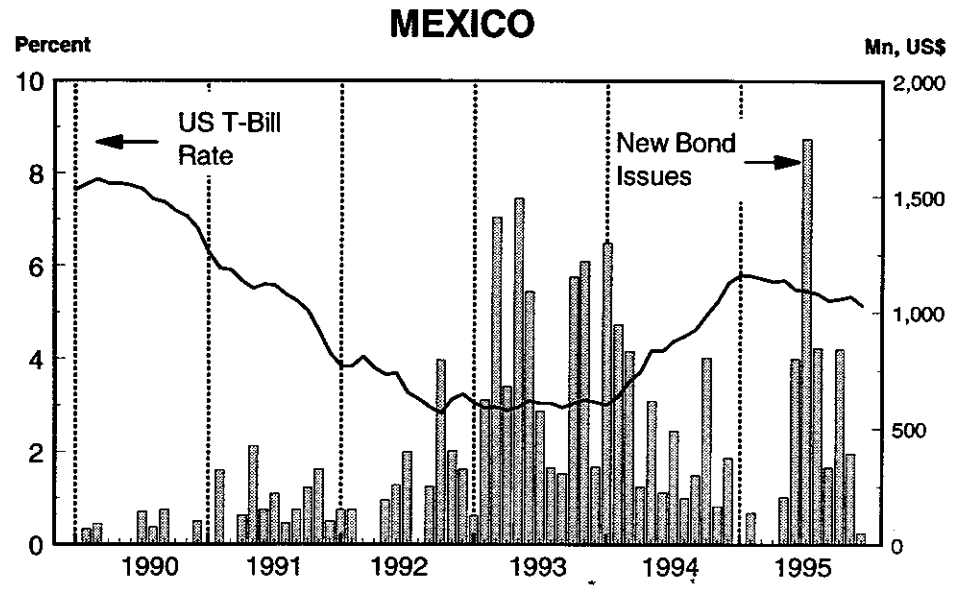
New Bond Issues (Million, $US) & U.S. Treasury Bill Rate (%)

Figure 2.



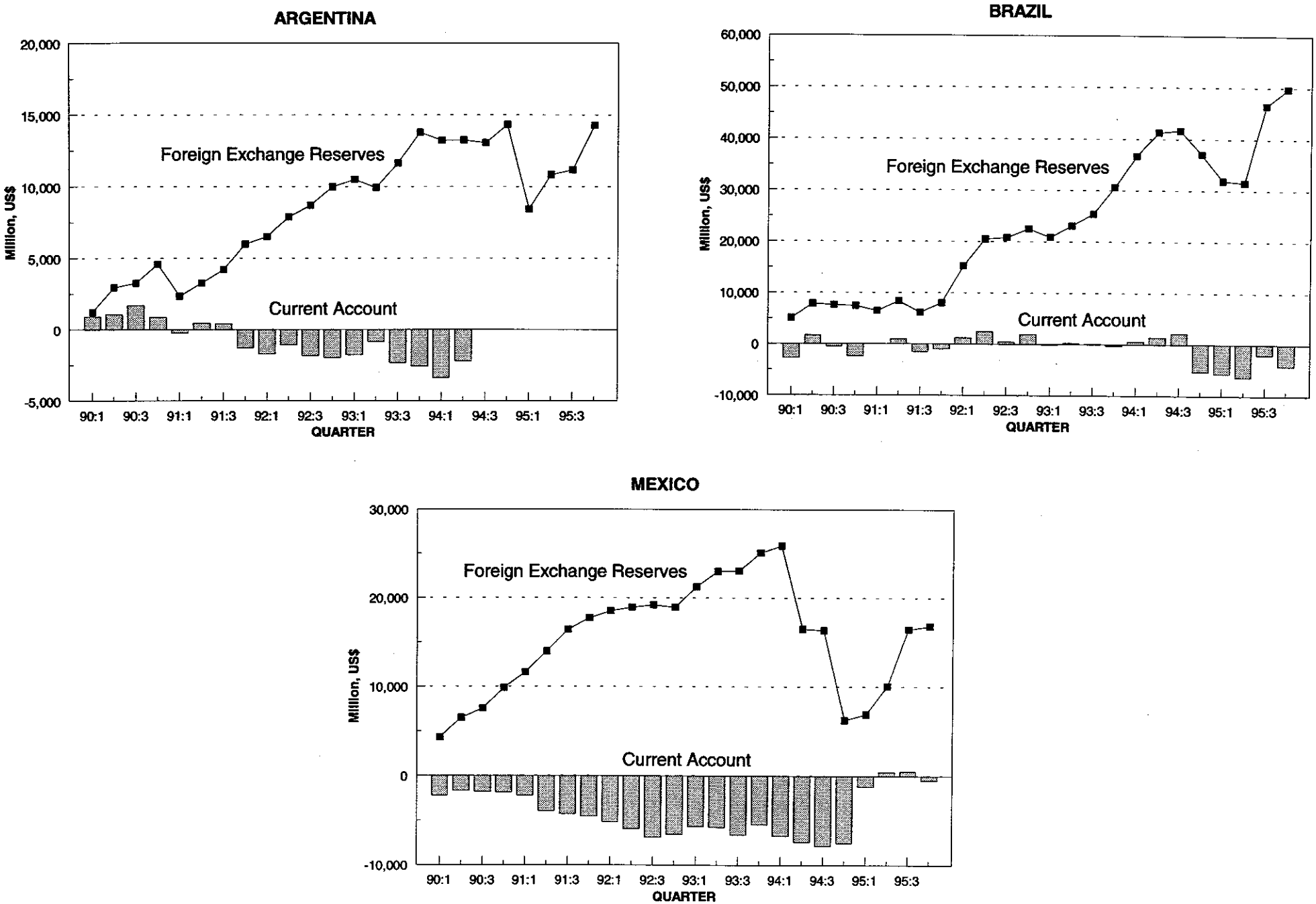






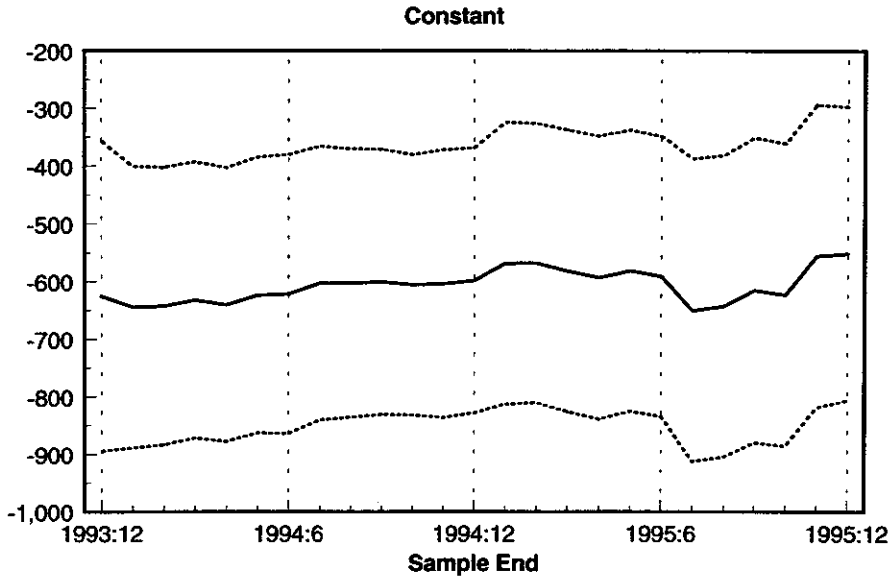
Current Account & Foreign Exchange Reserves (Million, US$)

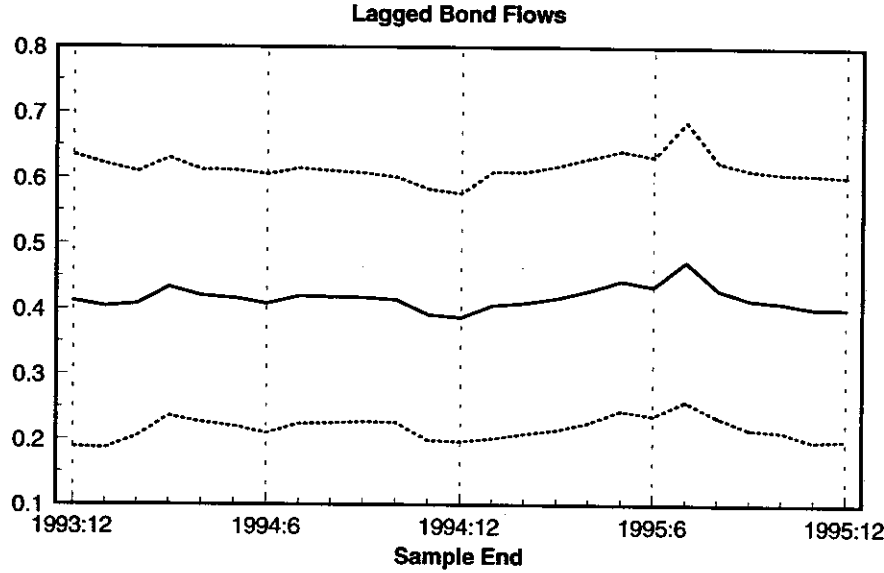
Figure 3.

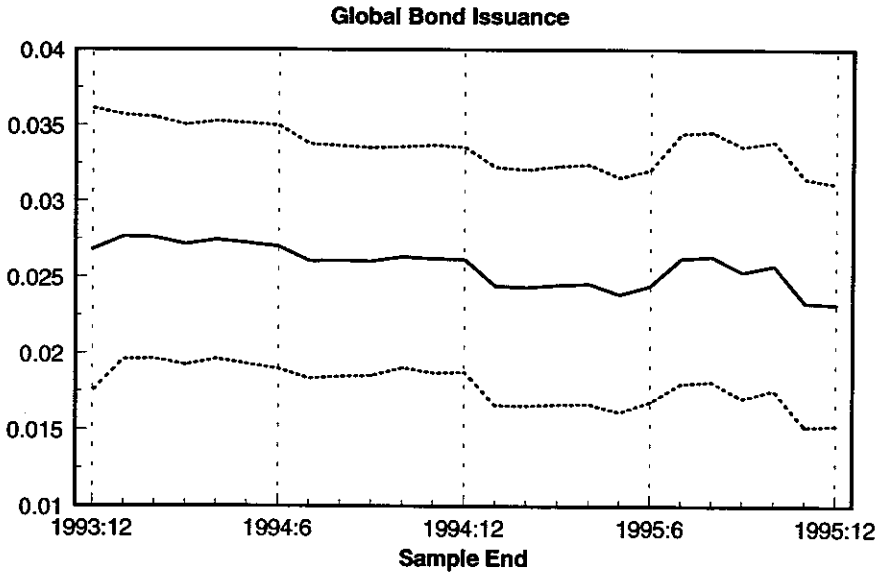


MEXICO -- Sequentially-Estimated Coefficients

Figure 4.



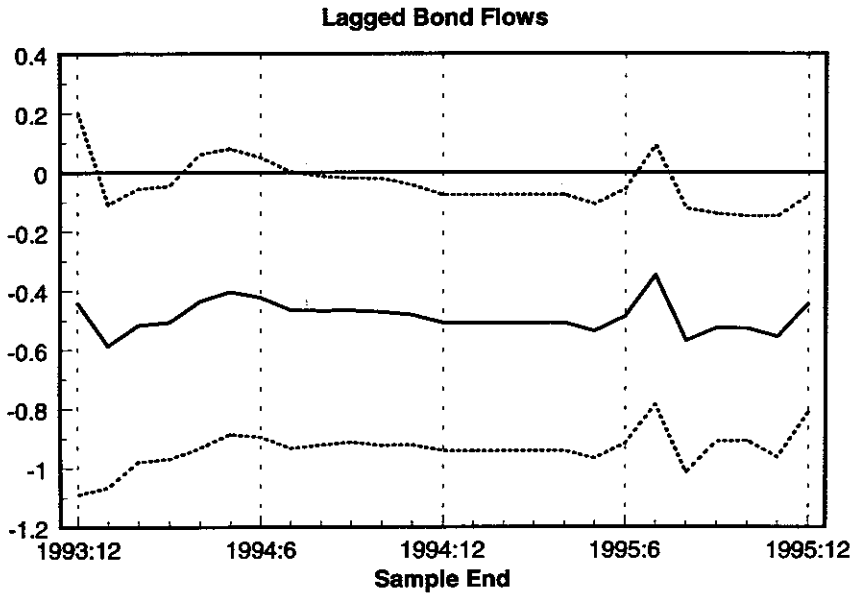


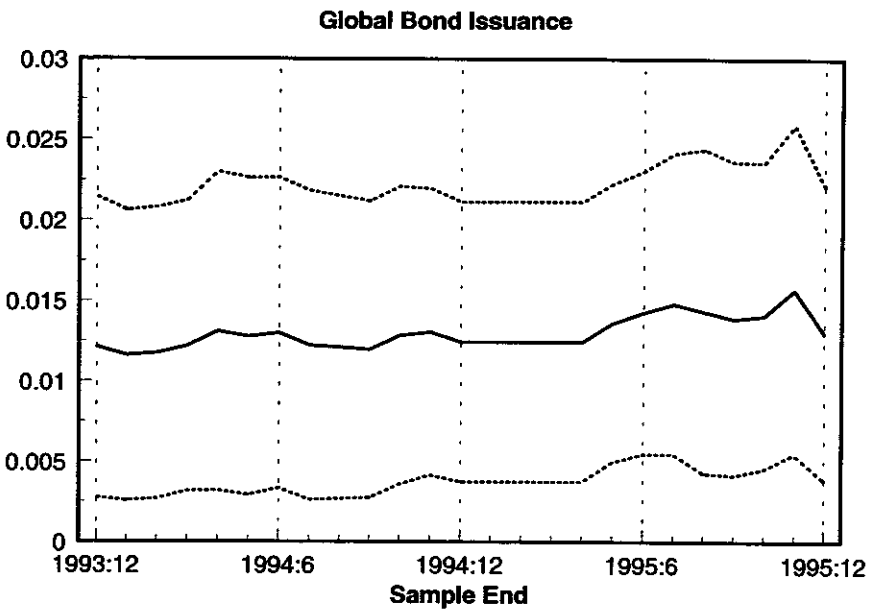


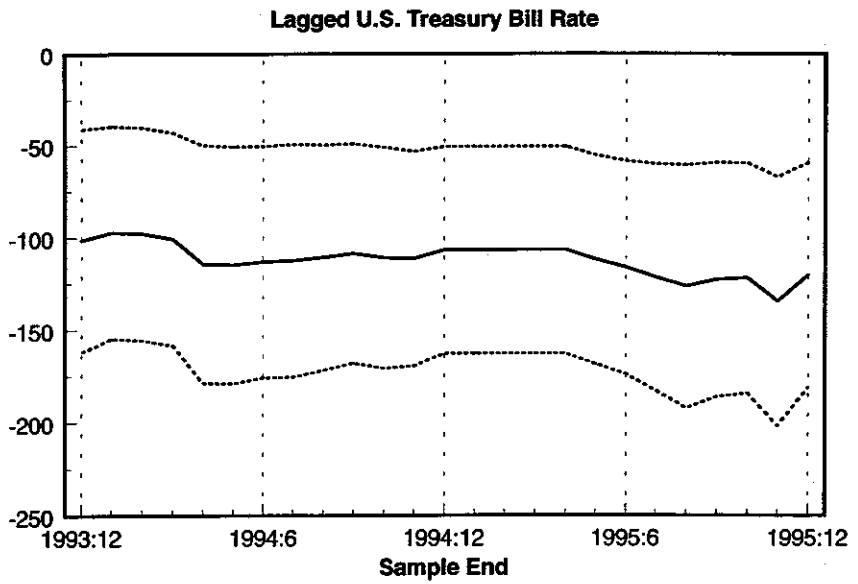
Samples Begin in 1990:1
Dashed Lines show the 95% Confidence Bounds: Coefficient +/- 2 Standard Errors

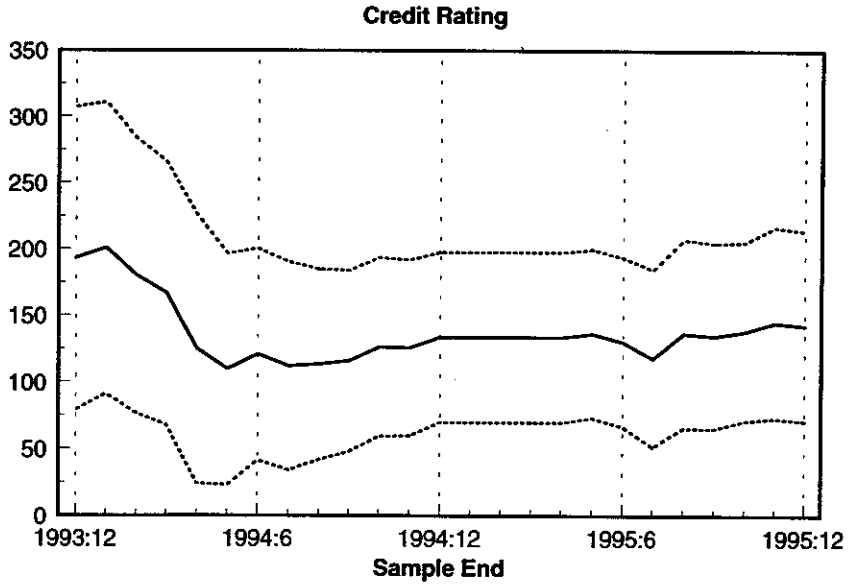
ARGENTINA -- Sequentially-Estimated Coefficients

Figure 5.





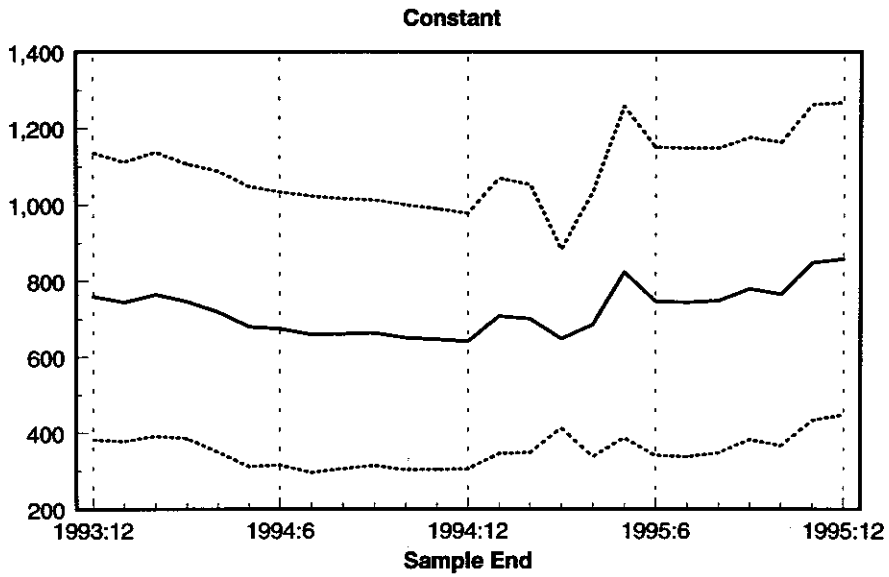


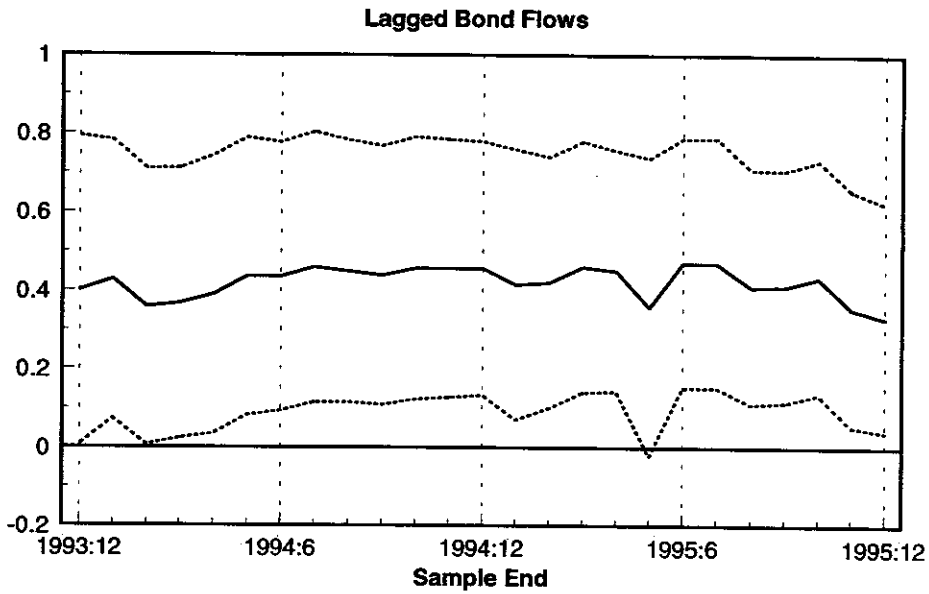


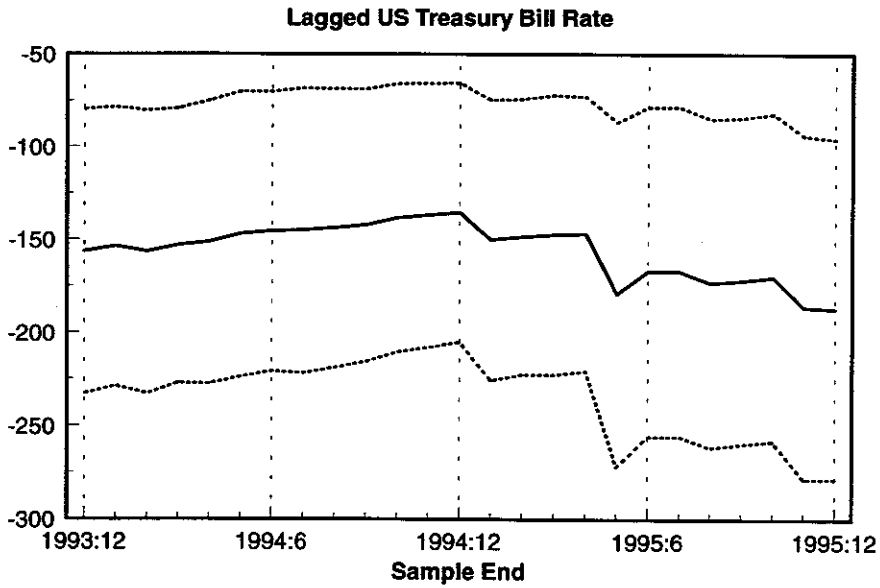
Samples Begin in 1990:1
Dashed Lines show the 95% Confidence Bounds: Coefficient +/- 2 Standard Errors

BRAZIL-- Sequentially-Estimated Coefficients

Figure 6.







Samples Begin in 1990:1
Dashed Lines show the 95% Confidence Bounds: Coefficient +/- 2 Standard Errors

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9701. Chakravarty, Sugato, and Asani Sarkar. "Traders' Broker Choice, Market Liquidity and Market Structure." January 1997.

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