

Countries' Repayment Performance Vis-à-Vis the IMF

An Empirical Analysis

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While the literature on external debt repayment performance by sovereign debtors is extensive, repayment performance vis-à-vis the International Monetary Fund has not been dealt with separately. Given differences between the IMF and other providers of financial resources, this paper considers whether it is possible to distinguish through logit analysis between the countries that make timely repayments to the Fund and those that become overdue. The paper finds that the inclusion of IMF-specific financial variables and a small number of macroeconomic variables yields a highly significant econometric model of the probability of a country incurring IMF arrears. [JEL F33, F34]

THE FAILURE of some member countries to repay obligations on time became a matter for serious concern for the IMF toward the end of the fourth decade of the IMF's history—around the mid-1980s, a few years after the debt crisis began. At that time, the duration and magnitude of countries' arrears to the IMF increased, as did the number of countries involved, in contrast to the rare and brief cases of late payments in earlier years.

Total arrears rose from SDR 25 million in the first quarter of 1981 to a peak of SDR 3.7 billion in 1992. Since then, total arrears have declined as a number

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of countries have settled their overdue obligations to the IMF, but they have remained at SDR 2.2–2.3 billion since end-1995. The number of countries making late payments to the IMF in the course of a single year peaked in 1986 at 63, and declined since then, with 32 member countries making late payments to the IMF in 1997, of which 6 were in protracted arrears during that year.¹

Thus, the pattern of IMF arrears in the aggregate can be distinguished by three phases. Until 1983, only one member country had experienced protracted arrears to the IMF, and a handful of others, arrears of short duration. Then, every year from 1983 until 1990, the amount of outstanding overdue obligations to the IMF grew substantially. From 1991 to 1995, the level of arrears fell sharply, and from 1995 to present, it has changed little. It should be noted that over 1989–90, the IMF's Executive Board developed a strengthened cooperative strategy to resolve the problem of protracted overdue obligations to the IMF.²

This paper seeks through econometric analysis to identify empirically the financial and macroeconomic variables most closely correlated with IMF member countries' repayment performances. To the authors' knowledge, there have been no previous empirical studies of IMF arrears. There is an extensive related body of literature, though, on external debt repayment problems by sovereign debtors to creditors other than the IMF. One question, therefore, is whether it is in fact possible to distinguish econometrically between countries that seek financial support from the IMF and the small subgroup of those countries that eventually encounter difficulties in repaying these and other resources. Since the IMF extends its resources only to countries that have problems with their balance of payments or international reserves position, both the countries that go on to make timely repayments and those that become overdue would be expected to have exhibited common initial characteristics, which might make distinguishing between the two groups statistically difficult.

A further question this study investigates is whether the determinants of countries' repayment behavior vis-à-vis the IMF are similar to the factors influencing countries' repayment behavior vis-à-vis other creditors. Although the individual circumstances and economic performances of the countries varied widely, those that experienced large and protracted arrears to the IMF have been almost without exception countries with prolonged

¹ The IMF considers arrears protracted when their duration is six months or longer. The members with protracted arrears in 1997 were Afghanistan, Iraq, Liberia, Somalia, Sudan, and the Democratic Republic of the Congo (formerly Zaïre). One nonmember of the IMF, the Federal Republic of Yugoslavia (Serbia/Montenegro), was also in protracted arrears.

² For a description of the main elements of the strategy and its implementation, see IMF, *Annual Report* (1991 and onward).

problems of economic management, including external payment arrears, which were evident, and a source of active concern to the IMF, before their overdue obligations to the IMF themselves became an issue. In this regard, one might expect a good deal of overlap between the emergence of repayment difficulties to creditors generally and to the IMF in particular. However, although the global economic events leading up to and culminating in the debt crisis of the 1980s appear to have contributed to the emergence of arrears to the IMF, it does not seem that the IMF's experience with arrears has simply been part and parcel of the debt crisis. One distinction is that the number of countries that have incurred protracted arrears to the IMF is much smaller than the number of countries that have failed to service their debt to other creditors and/or have had to enter into debt-rescheduling arrangements.³ A second distinction is that political instability seems to play a more prominent role among the most protracted cases of IMF arrears than it does among countries with non-IMF-specific repayment problems.⁴

The IMF's status as a preferred creditor, its role as a catalyst in attracting financing for countries from other creditors, and its character as a cooperative financial institution suggest that a country would likely place relatively greater emphasis on meeting its financial obligations to the IMF than on meeting those to other official bilateral or commercial creditors. Since the IMF generally makes its financial resources available to countries only in the context of a macroeconomic adjustment program, the conditionality associated with this support should, in principle, strengthen a country's capacity-to-repay prospects, and could imply that variations in countries' repayment performance with the IMF are less sensitive to changes in certain indicators of creditworthiness than are variations in countries' repayment performance vis-à-vis other creditors.

I. Empirical Evidence on the Determinants of External Debt Repayment Problems

A basic premise of most empirical analyses of external debt repayment problems, country risk, and creditworthiness is that a limited number of financial, macroeconomic, or sociopolitical indicators can be identified as

³ For example, while 23 countries have had protracted arrears on principal obligations to the IMF during its history, 58 countries rescheduled their official debt through the Paris Club in the period 1980–92.

⁴ As noted in the IMF Working Paper version of this study (Aylward and Thorne, 1998), if one considers the 12 countries that had protracted arrears in 1992 (a year chosen because it precedes a period when a significant number of arrears cases were resolved), all but one could be said to have had markedly troubled political environments.

the main determinants of debt repayment behavior. Empirical studies of external debt repayment generally assign a value to the likelihood that a country will repay its debt on time. The studies use the observable event of whether or not a country incurred arrears, rescheduled its debt, or otherwise evidenced external debt repayment difficulties⁵ as the dependent variable, with a country's probability of evidencing repayment difficulties being the true but unobservable underlying dependent variable of interest. Saini and Bates (1984) reviewed the development of empirical estimations of country risk and traced the emergence of probit and logit models as the preferred estimation techniques.⁶ Subsequent key papers are McFadden and others (1985) and Hajivassiliou (1989), the former because it specifies a complete model of loan demand and supply, and both papers because they deal econometrically with country heterogeneity and state dependence. Eaton, Gersovitz, and Stiglitz (1986) suggest theoretical extensions of country risk analysis, including consideration of the significance of the international loan contract and its enforcement, and they emphasize the distinction between ability and willingness to pay. Solberg (1988) estimates countries' propensity to incur arrears as a policy choice based on the costs and benefits of default. Feder and Uy (1985), Berg and Sachs (1988), and Li (1992) account for the large role of sociopolitical factors in repayment behavior. Lloyd-Ellis, McKenzie, and Thomas (1990) attempt to explain both the occurrence and quantity of developing country debt rescheduling.

Table 1 summarizes information on the variables tested in a number of studies of external debt repayment behavior, including this paper's results, which are formally presented below.⁷ Avramović (1964) carried out an important systematic study of the factors that influence a country's balance

⁵ Some studies (McFadden and others, 1985, and Hajivassiliou, 1989) include the use of higher-tranche IMF arrangements as a sign of external debt repayment problems. Others (Euh, 1979, and Haque and others, 1996) use a creditworthiness index as the dependent variable.

⁶ Probit and logit models allow the analysis of qualitative or binary dependent variables. The probit and logit models, in which the probability of a qualitative outcome is related to the standard normal distribution function or the logistic distribution function, respectively, are better suited for dealing with discrete dependent variables than ordinary least squares regression, but are similar to the regression technique in that the probability of the event is related to a vector of independent variables by a functional form that includes a set of nonbinary coefficients. In these cases, the underlying dependent variable is generally the probability of an external debt repayment event such as a rescheduling, versus the alternative outcome of no rescheduling, or the incurrance of arrears, versus the alternative outcome of timely debt servicing. What is actually observed, of course, is not the probability of the event, but the yes/no outcome.

⁷ In Table 1, for all studies, the results are displayed so that a "+" indicates positive correlation of the independent variable with the probability of external debt repayment problems, and a "-", negative correlation. "NS" indicates the variable was tested but found not to be significant at the 95 percent level of confidence. A blank indicates that the variable was not tested in the study.

Table 1. (*concluded*)

		Studies, Identified by Author(s) and Year of Publication								
		Frank & Cline, 1971	Sargin, 1977	Saini & Bates, 1984	Euh, 1979	Feder, Just & Ross, 1981	Edwards, 1984	Feder & Uj, 1985	McFadden & others, 1985	Berg & Sachs, 1988
Variable										
Political variables tested; found significant?					No			Yes	Yes	Yes
Country heterogeneity tested; found significant?								Yes	Yes	Yes
Repayment history tested; found significant?						Yes		Yes		Yes
		Aylward & Thorne								
Variable		Solberg, 1988	Hajivassiliou, 1989	Elmore & McKenzie, 1992	Li, 1992	Haque & others, 1996	Arrears to the IMF, not included ^b	Arrears to the IMF, LDV included ^c	Arrears to other creditors	
Debt/GDP		+			+	+	NS	NS	NS	+
Debt/exports		+		+						
Debt service/exports		+	NS	-	+		NS	NS	NS	NS
Reserves/imports			-	-	-	-	-	NS	NS	-
Exports/GDP				NS			+	NS	NS	-
Imports/GDP		-		+			-	NS	NS	NS
Current account/GDP			NS			NS				
Investment/GDP					-					

Government expenditure/GDP				+		NS	+
Terms of trade non-debt-creating inflows	-						NSNet noncommercial or
Per capita income	NS	NS			-		NS
GDP growth rate						NS	NS
Rate of inflation	NS				^d		NS
Money supply growth rate							
Exchange rate overvaluation indicator	+	NS				NS	
History or amount of use of IMF resources		+			-		+
Political variables tested; found significant?						Yes	
Country heterogeneity tested; found significant?	Yes	Yes					Yes
Repayment history tested; found significant?	Yes	Yes	Yes	Yes	Yes	Yes	Yes

^aFor all studies, the results are displayed so that a “+” indicates positive correlation of the independent variable with the probability of external debt repayment problems, and a “-” negative correlation. “NS” indicates the variable was tested but found not to be significant at the 95 percent level of confidence. A blank indicates the variable was not tested in the study.

^bThat is, results when the lagged dependent variable (LDV), an indicator of repayment history, was not included. Note that repayment history to creditors other than the IMF was tested.

^cThat is, results when the lagged dependent variable (LDV) was included. These results relate to Model 1E in this paper.

^dIn the analysis of Haque and others, a country's rate of inflation was a determinant of its credit rating only if it was a relatively low-inflation country.

of payments and the country's related ability to service its external debt. The results of their work—the identification of short-term liquidity factors (the so-called traditional debt or financial ratios: debt-GDP, debt service–exports, reserves–imports) and longer-term indicators of economic health and growth (GDP growth rate, investment, exports, inflation)—seem to have guided the selection of variables in many of the subsequent empirical analyses of external debt repayment behavior. Even in studies where the independent variables are selected based on formal models of external loan demand and supply or utility maximization, they are, not surprisingly, often similar to those identified by Avramović (1964).

For presentational clarity, Table 1 includes only the variables that have been tested most frequently in empirical studies. The analyses reported in the table used different data sets, dependent variables (e.g., arrears, rescheduling, higher-tranche IMF arrangements), and analytical techniques, and most present a number of versions of their respective models with differences in the significance of some variables (only one of which is reported in the table, again due to presentational considerations). Despite these disparities, some summary observations may be drawn from the studies covered in the table. First, a fairly limited set of variables have generally been found to be significant in empirical analyses of external debt repayment behavior. Second, it is the so-called financial ratios, such as debt-GDP or reserves relative to imports, that seem most consistently to be significant. Third, for most indicators of economic conditions and policy stance (as opposed to financial ratios), the results are mixed: inflation and indicators of exchange rate overvaluation, for example, have been found to be positively correlated with the incurrence of arrears in some studies, but insignificant in others.⁸ Fourth, past repayment history has been found significant in every study in which it has been tested.

These observations go some way toward suggesting variables that might be tested in the present study of correlates of the behavior of repayment to the IMF. Two other aspects of the empirical analysis of external debt repayment problems must also be noted.

First, the use of debt ratios in empirical analyses of the likelihood of arrears raises questions about whether such variables are symptoms or causes of external debt repayment problems. In response, some studies attempt to measure the structural correlates of external debt repayment problems (e.g., unfavorable terms of trade developments or exchange rate overvaluation) rather than proximate, and obvious, indicators such as the

⁸ The current account–GDP ratio was significant with the “wrong” sign in Edwards (1984), that is, a larger surplus was associated with a higher probability of arrears.

amount of debt service a country owes. Berg and Sachs (1988) seek correlates of rescheduling that “are more fundamental than the value of financial variables on the eve of rescheduling,” and find that greater income inequality, lower per capita income, a lower share of agriculture in GDP, and lesser outward orientation of the trade regime are significant predictors of a higher probability of debt rescheduling. As Table 1 indicates, though, and as might be expected, the proximate debt indicators have yielded more consistent results in explaining differences in countries' repayment performance. While the circumstances leading countries toward the brink of balance of payments crises are diverse, once at the threshold of default most nations enter the common ground of a high debt burden and low reserves.

Second, McFadden and others (1985) pose the question whether it is reasonable to expect a macroeconomic pattern that is stable across countries and time to emerge from econometric analysis of repayment problems. Though they find the answer is yes, the results surveyed in Table 1 indicate the importance of the question, since only a very few macroeconomic variables have consistently been found significant, while the significance of other factors varies from one study to another. Hajivassiliou (1989) points out that persistent heterogeneity among countries in their debt repayment behavior may result from colonial histories, types of government, religious institutions, or other attributes not easily captured with macroeconomic time-series data. In practical terms, country heterogeneity reflects the not-easily-measured factors that explain why Country A may default when, say, its reserves are down to three weeks of imports and debt service is consuming 30 percent of export earnings, while Country B may continue to service its debt even when faced with the same reserves and debt service ratio and otherwise evidencing macroeconomic variables similar to Country A. In econometric terms, persistent country heterogeneity with pooled cross-section and time-series data violates assumptions about the randomness of the error term and casts doubt on the measured coefficients and their significance. McFadden and others (1985) and Hajivassiliou (1989) find that a large share of the variation in countries' repayment behavior—for example, 30 percent for Hajivassiliou's database and model—is country specific, rather than attributable to the macroeconomic variables included in their respective models. It is computationally difficult to test for the presence of fixed country effects with panel data in a logit analysis, and many limited dependent variable analyses of external debt repayment behavior, including this one, do not fully deal with this problem.

The analyses of McFadden and others (1985) and Hajivassiliou (1989) also indicate a strong influence of countries' past record in timely servicing of their debt in explaining current repayment behavior. The strength of

this impact is such that, in these authors' studies, inclusion of the lagged dependent variable or other indicators of historical creditworthiness renders insignificant independent macroeconomic variables that otherwise contribute to the explanation of repayment behavior.

II. Methodology

Methodological Issues

For the analysis, a database was constructed covering the 138 developing countries (with the exception of Cambodia) that had payment obligations to the IMF in any year during the period 1976–93.⁹

The main dependent variable in this study is a binary indicator ($IMFARR_t$) signifying whether or not a country was in arrears to the IMF in a given year. $IMFARR_t$ takes the value 1 if a country was in arrears to the IMF in year t , and 0 otherwise.¹⁰ A second binary dependent variable $EXTARR_t$ is also tested. $EXTARR_t$ indicates whether a country was in arrears to creditors other than the IMF and takes the value 1 if a country had external arrears in year t to any external creditors, and 0 otherwise. The two dependent variables allow a comparison between the determinants of the probability of a country incurring arrears to the IMF versus to other external creditors.

Since the dependent variable has only two possible outcomes, 0 or 1, we use a bivariate logit model where

$$P_{it} = \text{Prob}(IMFARR_{it} = 1) = \frac{\exp \sum_{k=1}^K \beta_k x_{kit}}{1 + \left(\exp \sum_{k=1}^K \beta_k x_{kit} \right)}$$

⁹The data were drawn from the IMF's World Economic Outlook database and the Treasurer's Department's records of members' financial obligations and payments to the IMF. From the 138 countries and 18 years studied, the 2,484 possible country-year observations were reduced to 1,871 by excluding all country years for which a country did not have any obligations to the IMF falling due in the year, since in those cases there is no test to make of whether IMF repayments were made on time.

¹⁰Specifically, the variable takes the value 1 if country i was in arrears to the IMF for a continuous period of at least three months including at least part of year t , and the value 0 otherwise. Thus, if country i was continuously due in arrears to the IMF over the period July 1983 to February 1984, and current in its obligations at all other times, then $IMFARR_{it} = 1$ for $t = 1983$ and 1984 , and 0 for all other t . Note the IMF's standard usage of *protracted* arrears refers to overdue obligations of six months or longer duration.

For country i in year t , there are K explanatory variables x_{1it}, \dots, x_{kit} . Parameters β_1, \dots, β_k are then estimated by a standard maximum likelihood procedure, under the assumption that the observations $IMFARR_{it}$ are independent of each other. General background on econometric models of this type can be found in Maddala (1983) and Greene (1993).

In fact, consideration needs to be given to the possibility of country-specific effects and time dependency and autocorrelation between observations. It is not computationally easy to deal with such considerations within the context of the maximum likelihood logit model; informal tests for the presence of country-specific effects were carried out, but were not conclusive.¹¹

The models tested were all of a standard logit form. The explanatory variables, which are described below, were lagged by one year, reflecting the assumed direction of causality (except *REPAX*, which was lagged by two years for technical reasons).¹²

Explanatory Variables

Our selection of explanatory variables was influenced by the literature reviewed in Table 1 and by the objective of testing for differences between the determinants of repayment performance to the IMF versus that to other creditors.

Debt Burden

Two debt-burden variables cover financial obligations to all external creditors including the IMF: the ratio of debt to GDP (identified as *EDTGDP*) and the ratio of debt service due to exports (*TDSX*). As measures of IMF financial obligations, use of the ratio of IMF credit to IMF quota (*UFCQU*) and the ratio of IMF obligations to exports (*REPX*) are used. The latter variable comprises total obligations (principal and charges or interest) due from a country to the IMF in a given year, both those obligations newly falling due and those in arrears. It is also separated into its current and overdue components to form two other variables: the ratio of current

¹¹ These results are reported in Aylward and Thorne, 1998.

¹² To extract the maximum amount of information available from the IMF's repayment history—since, similar to most studies of external debt repayment problems, there were a relatively small number of “positive” or arrears observations in our data base, and a large number of “negative” or nonarrears observations—our variable selection was guided to some extent by the practical considerations of whether time series of certain variables were unavailable for large numbers of countries or years, and whether other series seemed to be less reliable in terms of accuracy or of comparability across countries.

IMF obligations to exports (*REPCX*) and the ratio of overdue IMF obligations to exports (*REPAX*).

Debt Repayment History

As noted above, a country's credit history has been found to be one of the strongest correlates of future performance in repaying external debt. We use as credit history indicators the level of arrears to all external creditors relative to external debt (*ARREDT*); the amount of arrears to the IMF (*REPAX*), described above as an IMF-specific debt-service ratio; and *IMFARR*_(*t-1*) and *EXTARR*_(*t-1*), the lags of the two dependent variables analyzed in our study.

Availability of Financial Resources

Because of the IMF's preferred creditor status, differences in the explanatory power of measures of the resources available to service external obligations may occur depending on whether the dependent variable is the likelihood of arrears to the IMF, or to other creditors. If the IMF's preferred creditor status were respected, available foreign exchange would tend to be directed toward repaying the Fund even if the debt burden to other external creditors were high. The three measures relating to resource availability used here are the ratio of reserves to imports (*RESM*); the ratio of exports of goods and services to GDP (*XGDP*); and the ratio of imports of goods and services to GDP (*MGDP*).

There are alternative, and opposite, interpretations of the potential impact of the size of exports and imports on the likelihood of external debt repayment problems. The more traditional view is that the stronger a country's current account position and the more foreign exchange it has available from the sale of exports, and the less it must expend on noncompressible imports, the lower the probability that it would default on external debt service. Alternatively, it has been argued by Solberg (1988) that the weaker a country's current account is, and the more it must rely on imports, the more dependent it is on continued capital inflows, and so the more incentive it has to make whatever financial or political sacrifices are necessary to avoid incurring arrears.

Domestic Economic Conditions and Policy Stance

We use two summary indicators of economic conditions: the log of U.S. dollar real per capita income (*PCI*)¹³ and the rate of change in this variable

¹³ The specific series used was the IMF World Economic Outlook purchasing power parity-based per capita income series.

(*GROWTH*). Even though PCI has been found not to be correlated with non-Fund repayment performance in a number of studies, it may have explanatory power for IMF arrears. Such a result could reflect the unique role of the Fund, indicating greater likelihood that poorer countries, with the fewest options for raising resources or cutting expenses when faced with external imbalances, tend to incur arrears to the IMF. Such a relationship would be in contrast to the performance of numerous middle-income countries, for example, the Baker-15 countries, which during the debt crisis incurred arrears to non-IMF creditors, but never to the Fund.

Indicators of macroeconomic policy stance that are examined are the fiscal position and the price environment. We test both the central government spending–GDP ratio (*EXPGDP*) and the central government revenue–GDP ratio (*REVGDP*). The measure of inflation is the adjusted log of the rate of change in the consumer price index (*INFL*).¹⁴

External Developments

We investigate whether the shifts in the frequency and magnitude of arrears to the IMF described in the introduction reflect changes in the environment external to the individual debtor countries that could have made it first more likely (between 1982 and 1989) and then less likely (after 1989) across the board that countries would incur arrears to the Fund. More specifically, we hypothesize that the onset of the debt crisis lowered the cost to countries of arrears to the IMF, perhaps because the loss of international reputation that a country suffered when it failed to meet its financial obligations to the Fund was perceived by the country as being diminished as more countries experienced external debt repayment crises, or because the negative implications of IMF arrears for potential flows from other creditors receded as those flows were curtailed in any event. We also test whether the likelihood of countries incurring IMF arrears fell after 1989. While this could have occurred because of the implementation of the Fund's strengthened cooperative arrears strategy, the easing of the debt crisis, or other factors, we do not attempt to distinguish econometrically among these. Two dummy variables, one that takes the value 1 in and after 1984 and 0 before (*DUM84*), and a second that takes the value 1 in and after 1990 and 0 before (*DUM90*), were tested.¹⁵ Since the dependent variable takes the value 1 if

¹⁴ Because a number of observations of negative rates of inflation and hyperinflation had to be dealt with, the series *INFL* is actually the log of one plus the percentage change in the consumer price index.

¹⁵ The earlier dummy could not be constructed to change value in 1982, the year generally regarded as the beginning of the debt crisis, because there were so few IMF arrears observations in the sample before 1982.

IMF arrears occur, and 0 if they do not, it is hypothesized that *DUM84* will bear a positive sign, and *DUM90* a negative one.

III. Results

IMF-Specific Variables

First, a group of models was tested to determine whether the selected explanatory variables are correlated with the probability of a country incurring IMF arrears, and to investigate the impact of the different IMF-specific debt indicators in general and the role of past repayment behavior in particular. Table 2 presents the results of Models 1A through 1E.

Model 1A includes no IMF-specific debt indicators. It thus attempts to explain the incidence of IMF arrears without reference to a country's financial relations and credit history with the IMF. In Model 1A, all but three of the independent variables are significant and of the hypothesized sign.¹⁶ Debt-GDP, the economic growth rate, and the 1990 dummy variable have no explanatory power for IMF arrears in the specification of Model 1A. Both the amount (*ARREDT*) and the existence (*EXTARR_{t-1}*) of arrears to creditors other than the IMF are correlated with the likelihood of incurring IMF arrears. The coefficient on imports, the expected sign for which was ambiguous, is negative, indicating that a higher share of imports in GDP makes IMF arrears less likely. The regression correctly classifies 1,297 of the 1,307 occurrences of timely repayment to the IMF, but misses about half of the cases of arrears.

Model 1B adds *UFCQU* and *REPX*, IMF-specific variations of the debt burden and debt service due ratios, respectively, to the regression.¹⁷ These two variables are both highly significant and positively correlated with the probability of arrears to the IMF. *TDSX* loses significance when these IMF-specific debt measures are included, and the significance of several of the other independent macroeconomic variables falls. The change in significance of the *TDSX* variable may mean that, given the IMF's preferred creditor status, along with the relatively small share of total debt and debt service owed to the IMF by most countries, the likelihood of a country meeting its obligations to the IMF in a given year is not greatly dependent on the amount

¹⁶ All references to significance in the text are to significance at the 95 percent confidence level, unless otherwise noted. In the tables of results, one asterisk indicates significance at the 90 percent level; two asterisks, significance at the 95 percent level, and three, significance higher than 95 percent.

¹⁷ The reader is reminded that *REPX* includes both current and overdue obligations to the IMF.

of obligations due to other creditors. Including the IMF-specific variables greatly improves the overall fit of the model, as indicated by the lower Type 1 error of Model 1B (34 percent, versus 50 percent with Model 1A).¹⁸

Model 1C tests what information is provided by separating IMF debt service into current and overdue obligations by substituting *REPCX* and *REPAX* for *REPX*. Model 1C shows improvement over Model 1B through the smaller absolute value of its log-likelihood ratio.

Model 1D adds the lagged dependent variable, *IMFARR*_{*t*-1}, to the measure of arrears, *REPAX*, to test the hypothesis that it is the *existence* of past protracted arrears to the IMF, rather than the amount of arrears, that best captures the impact of IMF repayment history on the likelihood of future arrears. The results of Model 1D show that *IMFARR*_{*t*-1} is a more powerful explanatory variable than *REPAX*; its inclusion renders *REPAX*, as well as *REPCX*, insignificant. In this fourth specification, many of the variables that had previously been significant are either no longer so (*RESM*, *XGDP*, *MGDP*, *REVGDP*, *INFL*) or are less significant (*EXTARR*_{*t*-1}, *PCI*, *EXPGDP*, *DUM84*). In contrast, economic growth becomes significant once the likelihood of future IMF arrears is also conditioned on the event of past IMF arrears. Also, *UFCQU*'s explanatory power is undiminished. That only one variable related to non-IMF debt (*EXTARR*_{*t*-1}) remains significant may reflect the distinctiveness of IMF obligations from the bulk of a country's external debt.

Model 1E indicates that omitting *REPCX* and *REPAX* from the model while retaining *IMFARR*_{*t*-1} actually improves the model's predictive power, with the number of correctly classified arrears cases increasing from 79 to 82. A likelihood ratio test of whether *REPCX* and *REPAX* provide additional information to *IMFARR*_{*t*-1} in determining the likelihood of IMF arrears confirms that *REPCX* and *REPAX* may be omitted from the model.

The results shown in Table 2 suggest that the use of IMF credit, repayment history both to the IMF and to other creditors, per capita income, and economic growth are determinants of likelihood of a country's incurring IMF arrears in the future. The non-IMF-specific debt-service ratio, reserves, exports and imports, fiscal indicators, and inflation appear to be correlated with the likelihood of IMF arrears, but they do not provide significant explanatory power once information on a country's past record in meeting IMF financial obligations is included. The IMF repayment history indicator is the most significant of the explanatory variables in Model 1E, and use of IMF credit is the second-most significant correlate of IMF arrears. Of

¹⁸ Type 1 error in this analysis is the proportion of actual arrears cases that are incorrectly classified as nonarrears cases, that is, as false negatives. A Type 2 error represents the occurrence of false positives, that is, actual nonarrears cases classified by the model as arrears cases.

Table 2. *Tests of IMF-Specific Debt and Repayment History Indicators*

Model	1A	1B	1C	1D	1E
Number of country-year observations	1,410	1,410	1,410	1,410	1,410
Log likelihood	-194	-140	-126	-97	-99
Variable (Description)	Coefficient (Statistical significance)				
Constant	1.11	0.79	-0.09	-1.15	-1.35
<i>EDTGDP</i> (total debt/GDP)	0.15	0.06	0.24	0.24	0.11
<i>TDSX</i> (total debt service/exports)	0.32 **	0.12	-0.34	-0.35	-0.04
<i>UFCQU</i> (use of IMF credit/quota)	—	0.52 **	0.59 ***	0.75 ***	0.89 ***
<i>REPX</i> (total IMF obligations/exports)	—	7.70 ***	—	—	—
<i>REPCX</i> (current IMF obligations/exports)	—	—	4.08 **	1.53	—
<i>REPAX</i> (IMF obligations in arrears/exports)	—	—	46.63 ***	11.70	—
<i>IMFARR</i> _{<i>t</i>-1} (binary indicator of IMF arrears, lagged one year)	—	—	—	4.16 ***	4.75 ***
<i>ARREDT</i> (total non-IMF arrears/debt)	2.25 **	2.91 **	1.95	1.19	1.24
<i>EXTARR</i> _{<i>t</i>-1} (binary indicator of non-IMF arrears, lagged one year)	3.32 ***	2.19 **	1.97 **	1.48 **	1.39 *
<i>RESM</i> (reserves/imports)	-0.80 ***	-0.45 **	-0.57 **	-0.30 *	-0.29 *
<i>XGDP</i> (exports/GDP)	5.26 **	5.27 **	5.29 *	2.99	1.95
<i>MGDP</i> (imports/GDP)	-5.47 ***	-4.73 **	-5.73 **	-4.33	-3.36
<i>PCI</i> (per capita income)	-1.00 ***	-0.93 ***	-0.86 ***	-0.75 **	-0.79 **
<i>GROWTH</i> (rate of change of PCI)	-0.03	-0.24	-0.73	-6.53 **	-7.13 **
<i>EXP GDP</i> (expenditure/GDP)	4.27 **	7.84 **	10.03 ***	8.06 **	6.81 *
<i>REVGDP</i> (revenue/GDP)	-7.34 **	-9.83 **	-13.32 **	-10.75 *	-8.61 *

Table 2. (concluded)

Model	1A	1B	1C	1D	1E
Number of country-year observations	1,410	1,410	1,410	1,410	1,410
Log likelihood	-194	-140	-126	-97	-99
Variable (Description)	Coefficient (Statistical significance)				
<i>INFL</i> (inflation rate)	0.64 **	0.78 ***	0.68 **	0.44	0.42
<i>DUM84</i> (1984 dummy)	2.82 ***	2.38 ***	2.03 ***	1.73 **	1.85 **
<i>DUM90</i> (1990 dummy)	-0.57 *	-0.47	-0.99 **	-0.79	-0.45
Number of actual arrears observations	103	103	103	103	103
Of which: number of predicted cases of arrears	51	68	71	79	82
Number of actual nonarrears observations	1,307	1,307	1,307	1,307	1,307
Of which: number of predicted cases of nonarrears	1,297	1,299	1,302	1,296	1,295
Type 1 error (in percent) ^a	50	34	31	23	20
Type 2 error (in percent) ^b	1	1	0	0	1

Notes: Asterisks appearing underneath coefficients indicate significance: no asterisk indicates the coefficient was not significant; one asterisk, that the coefficient was significant at the 90 percent confidence level; two asterisks, that it was significant at the 95 percent level; and three asterisks, that it was significant at the level of 0.998 or higher.

As explained in the text, all independent variables are lagged one year, except for REPAX, which is lagged two years by construction. However, only the two dependent variables are given the " $t-1$ " subscript, to distinguish that they appear on both the left- and right-hand side of the logit equations.

^aType 1 error represents the occurrence of false negatives, that is, actual arrears cases classified by the model as nonarrears cases.

^bType 2 error represents the occurrence of false positives, that is, actual nonarrears cases classified by the model as arrears cases.

course, the lagged dependent variable is to some extent capturing and summarizing the impact of those macroeconomic variables that it renders insignificant; the role of members' past performance in repaying the IMF is further addressed below through the formulation of a state-dependent model. It is noteworthy that per capita income has explanatory power in modeling IMF arrears, in contrast to the results of several studies of non-IMF arrears summarized in Table 1. The results for the dummy variables suggest that the likelihood of IMF arrears rose across the board—that is, for a given set of outcomes for financial and economic indicators—after 1983, but did not necessarily fall after 1989, even though the actual number of arrears cases declined.

A State-Dependent Design for the Model

An implicit assumption in this and other econometric creditworthiness studies using pooled time-series and cross-sectional data is that each country-year observation represents an independent event in which the outcome—in this case either the incurrence of arrears or the timely meeting of debt service due—is not correlated with the outcome in previous country years. However, factors related to the likelihood that a country incurs arrears to the IMF in a coming year may differ depending on whether a country has a track record of timely repayments, or instead already has overdue obligations to the IMF (and may therefore either exit or remain in arrears). For example, for countries with no arrears to the IMF, factors relating to current resource availability such as reserves might be important indicators of IMF repayment performance, while for countries already in protracted arrears to the IMF, low levels of reserves may be so widespread that there is not sufficient variation among countries and over time for this variable to significantly explain exits from arrears. Such state dependence could also be explainable in terms of the IMF's strengthened cooperative strategy for dealing with overdue obligations. In particular, countries deemed to be cooperating with the IMF in seeking a solution to their Fund arrears may benefit from the IMF's rights approach, or other procedures that, *inter alia*, may allow them gradually to improve their financial and economic situation; in this case, correlation could result between variables that signal cooperation with the IMF and the probability of exiting arrears to the IMF.

With these considerations in mind, the same logit model was run for two different subsets of the database, the first consisting of observations where the country had not been in arrears to the IMF in the previous year (i.e., where $IMFARR_{t-1} = 0$), designated the "entry" subset, and the second consisting of observations where the country was already overdue to the IMF ($IMFARR_{t-1} = 1$), designated the "exit" subset. The whole database and the two subsets were tested against all valid independent variables, and then variables insignificant in all three of the specifications were sequentially eliminated. The purpose of this process was to derive a common specification, so that a formal test could be made of whether the entry and exit models are in fact distinct. The results indicated that for members that have no recent history of IMF repayment problems, the use of IMF credit, reserves, per capita income, growth, and inflation are correlated with the probability that they will fall into arrears in the coming year. For members that are already incurring overdue obligations to the Fund, only *UFCQU* and *ARREDT* are significant in determining whether they will remain in or exit a state of arrears. A maximum likelihood test

indicates with a confidence level of 99 percent that the entry and exit models are distinct.¹⁹

The Determinants of Arrears to Other Creditors

Table 3 presents the results of investigating whether the likelihood of two distinct types of external debt repayment problems—arrears to the IMF versus arrears to other creditors—is rooted in the same economic and financial variables. Model 2A is comparable to Model 1A: it tests the same independent variables but omits the lag of the dependent variable, which in this case is $EXTARR_{t-1}$. Most of the financial and economic variables are significant, the exceptions being $REPAX$, $IMFARR_{t-1}$, $GROWTH$, $DUM84$,²⁰ and $DUM90$. In contrast to the results for IMF arrears, the export and import variables have the expected signs, that is, higher imports (exports) are associated with a higher (lower) likelihood of arrears to other creditors.

Model 2B adds the lagged dependent variable, $EXTARR_{t-1}$, to the regression. Similar to the results of Model 1D when $IMFARR_{t-1}$ was added to the regression on IMF arrears, the lagged dependent variable is highly significant, and its inclusion causes the significance of many of the independent variables in Model 2A to either decline ($XGDP$) or disappear ($EDTGDP$, $TDSX$, $UFCQU$, $MGDP$, PCI , $GROWTH$, $INFL$). Model 2C presents the more parsimonious specification that emerges when insignificant variables are sequentially excluded according to the absolute value of their t -statistic. The external debt burden, current IMF debt service, non-IMF-specific repayment history, reserves, exports, and both government expenditure and revenue are significant determinants of the likelihood of the incurrence of arrears to creditors other than the IMF. It is noteworthy that while $UFCQU$ is not significant in the models in Table 3, $REPCX$ is, and bears a negative sign. This indicates that the higher the ratio of current IMF obligations to exports in year t , the less likely are arrears to other creditors in year $t + 1$. This result might seem counterintuitive, given that the IMF's preferred creditor status implies that other creditors get paid only after IMF obligations are met. However, it could reflect the small ratio of IMF debt service to total debt service for most countries, which means that in most cases timely payments to the IMF are unlikely to preempt payments to other creditors. Another interpretation is that higher current IMF obligations are

¹⁹ The full results are reported in Aylward and Thorne (1998).

²⁰ As noted earlier, $DUM82$ was the preferred dummy indicator of the debt crisis, but was not used in tests of IMF arrears because of the few incidences of IMF arrears in the database before 1982. Both a $DUM82$ and a $DUM84$ variable were tested against the probability of arrears to other creditors, and both were found to be insignificant.

Table 3. *Tests Using Arrears to Other Creditors as the Dependent Variable*

Model	2A	2B	2C
Number of country-year observations	1,398	1,398	1,398
Log likelihood	-502	-248	-255
Variable (Description)	Coefficient (Statistical significance)		
Constant	0.06	-0.49	-1.44 **
<i>EDTGDP</i> (total debt/GDP)	1.08 ***	0.71 *	1.08 **
<i>TDSX</i> (total debt service/exports)	1.72 ***	0.96	—
<i>UFQQU</i> (Use of IMF credit/quota)	0.30 ***	0.08	—
<i>REPCX</i> (current IMF obligations/exports)	-8.05 ***	-10.77 **	-4.59 **
<i>REPAX</i> (IMF obligations in arrears/exports)	-5.07	17.08	—
<i>IMFARR</i> _{<i>t</i>-1} (binary indicator of IMF arrears, lagged one year)	1.96	1.06	—
<i>ARREDT</i> (total non-IMF arrears/total debt)	24.64 ***	-2.03 *	—
<i>EXTARR</i> _{<i>t</i>-1} (binary indication of non-IMF arrears, lagged one year)	—	5.77 ***	5.71 ***
<i>RESM</i> (reserves/imports)	-0.19 ***	-0.30 **	-0.30 **
<i>XGDP</i> (exports/GDP)	-3.43 ***	-3.61 **	-2.98 ***
<i>MGDP</i> (imports/GDP)	1.67 **	1.47	—
<i>PCI</i> (per capita income)	-0.28 **	-0.15	—
<i>GROWTH</i> (rate of change of PCI)	-1.92	-0.98	—
<i>EXP GDP</i> (expenditure/GDP)	3.76 **	4.72 **	5.75 ***
<i>REVGDP</i> (revenue/GDP)	-4.42 **	-7.37 **	-8.11 ***
<i>INFL</i> (inflation rate)	1.21 ***	0.81	—

Table 3. (concluded)

Model	2A	2B	2C
Number of country-year observations	1,398	1,398	1,398
Log likelihood	-502	-248	-255
Variable (Description)	Coefficient (Statistical significance)		
<i>DUM84</i> (1984 dummy)	0.24	-0.18	—
<i>DUM90</i> (1990 dummy)	0.12	-0.19	—
Number of actual arrears observations	622	622	622
Of which: number of predicted cases of arrears	478	572	572
Number of actual non-arrears observations	776	776	776
Of which: number of predicted cases of nonarrears	74	754	753
Type 1 error (in percent) ^a	23	8	8
Type 2 error (in percent) ^b	4	3	3

Notes: Asterisks appearing underneath coefficients indicate significance: no asterisk indicates the coefficient was not significant; one asterisk, that the coefficient was significant at the 90 percent confidence level; two asterisks, that it was significant at the 95 percent level; and three asterisks, that it was significant at the level of 0.998 or higher.

As explained in the text, all independent variables are lagged one year, except for REPAX, which is lagged two years by construction. However, only the two dependent variables are given the " $t-1$ " subscript, to distinguish that they appear on both the left- and right-hand side of the logit equations.

^aType 1 error represents the occurrence of false negatives, that is, actual arrears cases classified by the model as nonarrears cases.

^bType 2 error represents the occurrence of false positives, that is, actual nonarrears cases classified by the model as arrears cases.

indicative of a past IMF adjustment program, and, all things being equal, the conditionality attached to such a program improves the member's creditworthiness and makes timely debt service to other creditors more likely.

In contrast to the models of IMF arrears, both Type 1 and Type 2 errors in Models 2B and 2C are low. The lower incidence of Type 1 errors in part reflects the higher proportion of arrears cases in the sample for the models of arrears to other creditors.

IV. Conclusions

The results presented above provide evidence that there are a small number of financial and macroeconomic factors that are leading indicators of the likelihood of a member country falling into arrears to the IMF. The

coefficients on the significant variables are generally stable in terms of sign and magnitude from one model specification to the next, the exception being the distinct entry and exit models. Type 1 error rates are acceptable and Type 2 error rates are minimal. Thus, even though countries that seek and obtain an IMF-supported financial arrangement tend to exhibit common economic characteristics related to the balance of payments problems that lead them to request IMF assistance, it is possible to distinguish econometrically, *ex post*, between the financial and economic characteristics of those countries that use IMF financial resources and the much smaller subgroup of countries that subsequently encounter difficulties in repaying those resources on time. A larger use of IMF credit relative to quota, a lower level of per capita income, and a slower rate of economic growth are correlated with a greater likelihood of a country failing to meet current financial obligations to the IMF.

Three other implications of the results may be highlighted. First, when IMF-specific financial indicators are omitted, a broader set of variables is correlated with the likelihood of a country incurring IMF arrears, and this set bears considerable overlap with the variables identified in other studies as correlates of non-IMF repayment problems. Adding IMF-specific financial variables to the specifications improves the performance of the models (i.e., more arrears cases are correctly predicted as such, for a lower Type 1 error). In particular, adding the lagged dependent variable as an indicator of past IMF repayment behavior lowers the Type 1 error rate, as well as rendering some of the macroeconomic variables insignificant (and allowing for the model's autoregressive properties). This result confirms in particular the relevance for this study of the work of McFadden and others (1985) and Hajivassiliou (1989) on external debt repayment to non-IMF creditors—that is, the best predictor of whether a country will go into arrears to the IMF in the future is whether it has been in arrears to the IMF in the past.

Second, the results provide support for a state-dependent model of repayment performance. This specification of the model was based on the conjecture that once a country enters protracted arrears on its obligations to the IMF, it has begun a new phase in its external financial relations, and the likelihood that it will be in arrears to the IMF in subsequent years may be determined by different factors than when it was still current with the IMF.

The third set of results we would like to highlight involves the comparative results for IMF versus non-IMF arrears. When both IMF-specific and non-IMF credit history variables are included and parsimonious specifications are used, the macroeconomic correlates of IMF arrears found in this analysis tend to reflect more a country's overall economic circumstances and policy stance—that is, per capita income and economic growth (Model 1E), while the correlates of non-IMF arrears seem rather to be indicators relating to the availability

of and claims on the financial resources that could be used to service debt, namely, reserves, exports, and government expenditure and revenue (Model 2B or 2C). These results could be indicative of the IMF's preferred creditor status: a country may repay the IMF even when its reserves and financial resource flows have diminished to levels where it has decided to slow or cease repayments to other creditors. Instead, countries that fall into arrears to the IMF are distinguished by low income and slow growth, suggesting that the intractability of the macroeconomic imbalance problems may be a major factor.

There are two possible explanations for the fact that the amount of debt and debt service due to creditors other than the IMF has no explanatory power for the likelihood of IMF repayment problems, once information on IMF-specific financial variables is included. It may reflect the IMF's preferred creditor status. Alternatively, it may be a result of the conditionality attached to the use of IMF resources, in that while the probability of a non-IMF creditor being repaid falls as debt or debt service due rises, the likelihood that the IMF will be repaid is less sensitive to these traditional key creditworthiness indicators. Another implication of the results with regard to IMF conditionality may be drawn from the finding that a higher ratio of current IMF financial obligations to exports is associated with a lower probability of arrears to non-IMF creditors. As indicated in Table 1, some researchers have found that IMF financial support is associated with a lower probability of external debt repayment problems, while others have found the reverse. These earlier studies tested the impact of the existence or not of a higher-tranche IMF adjustment program as a binary qualitative variable, rather than the impact of the amount of IMF financial obligations, on the likelihood of repayment problems to other creditors. Our result—that additional debt service owed to the IMF makes it more, rather than less, likely that other creditors will be repaid—could reflect the efficacy of IMF conditionality leading to a positive shift in the fundamental creditworthiness of the country.

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