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**An Econometric Analysis of Countries' Repayment Performance
to the International Monetary Fund**

Prepared by Lynn Aylward and Rupert Thorne¹

Authorized for Distribution by James Corr and Michael Wattleworth

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Abstract

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 Fund 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 Fund-specific financial variables and a small number of macroeconomic variables yields a highly significant econometric model of the probability of a country incurring Fund arrears.

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Author's E-Mail Address: laylward@imf.org.

¹Lynn Aylward is Assistant to the Director in the External Relations Department of the International Monetary Fund (IMF). Rupert Thorne is a Senior Manager in the Foreign Exchange Division of the Bank of England. Both were economists in the Treasurer's Department of the IMF when this paper was prepared. James Corr provided invaluable and extensive input, guidance, and knowledge of the Fund's arrears policy. The authors also wish to thank Dhruba Gupta, Michael Wattleworth, Orlando Roncesvalles, James Blalock, William Byrne, Gunnar Jonsson, and Helga Treichel for their valuable comments; Krishna Srinivasan provided both valuable comments and econometric advice. However, the views expressed are solely the authors' and do not represent those of the IMF.

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SUMMARY

This paper analyzes empirically the financial and macroeconomic variables associated with the probability of a country incurring arrears in the repayment of its financial obligations to the Fund. Drawing upon the literature on the determinants of external debt repayment problems, logit analysis is applied to a pooled sample of annual observations on 138 developing countries for the period 1976-93. The results indicate that the inclusion of Fund-specific financial variables, indicators of credit history vis-à-vis the Fund and other creditors, and a small number of macroeconomic variables yields a highly significant model of the probability of a country incurring arrears to the Fund. Some important financial and macroeconomic variables are correlated with the probability of a country incurring Fund arrears, such as the level of reserves or the rate of inflation, but the effects of such variables tend to be partially captured by information on a country's past record in repaying the Fund. The amount of use of Fund credit relative to quota and a history of Fund repayment difficulties are positively correlated with the probability that a country will fall into arrears to the Fund, while the level of per capita income and the rate of economic growth are negatively correlated with that outcome.

A state-dependent model of Fund arrears is also developed, based on the conjecture that the factors correlated with the likelihood that a country will meet its future financial obligations to the Fund may differ depending on whether a country had a track record of timely repayments or was already in arrears.

The paper also investigates the differences between models where the dependent variable is the likelihood of arrears to the Fund versus models where it is the likelihood of arrears to non-Fund creditors.

A statistical profile of countries' repayment performance to the Fund is presented in Appendix I.

I. INTRODUCTION

Toward the end of the fourth decade of the Fund's history, around the mid-1980s and a few years after the beginning of the Debt Crisis, the failure of some member countries to repay obligations on time became a matter for serious concern for the Fund. At that time, the duration and magnitude of countries' arrears to the Fund 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 of countries have settled their overdue obligations to the Fund, but they remained at a level of SDR 2.2 billion at end-1996. The number of countries making late payments to the Fund in the course of a single year peaked in 1986 at 63; the trend in the number of countries incurring arrears has also been declining, with 27 member countries making late payments to the Fund in 1996, of which six were in protracted arrears during the year.² Thus, the pattern of Fund arrears in the aggregate can be distinguished by three phases. Until 1983, only one member country had experienced protracted arrears to the Fund, and a handful of others arrears of short duration. Then, every year from 1983 until 1990, the amount of outstanding overdue obligations to the Fund grew substantially. The rate of growth of arrears fell in 1990 and 1991, was negative in 1992 and 1993, and approached zero in 1994. From the end-1994 level of SDR 3.0 billion, overdue obligations to the Fund further declined to SDR 2.2 billion at end-1996. In the period 1990-96, there were only six instances of complaints issued by Fund management to the Executive Board in respect of member countries' overdue financial obligations, compared with 32 in the period 1984-89. A complaint constitutes a formal report by the Managing Director to the Executive Board that the member appears to be in breach of its obligations under the Fund's Articles of Agreement (with the decision that the member is, in fact, failing to fulfil its obligations reserved for the Executive Board). A complaint is issued when arrears have been outstanding for two months, as part of the Fund's timetable of procedures for dealing with overdue obligations. The timetable of procedures is a part of the strengthened cooperative strategy to resolve the problem of protracted overdue obligations to the Fund, which evolved in the course of a series of Executive Board meetings in late 1989 and early 1990 and was endorsed by the Interim Committee at its meeting in April 1990. For a description of the main elements of the strategy and its implementation, see the *IMF Annual Report* (1991 and onward) and Box 1. The timetable of procedures is shown in Box 2.

²The Fund considers arrears protracted when their duration is six months or longer. The members with protracted arrears in 1996 were Afghanistan, Iraq, Liberia, Somalia, Sudan, and the Democratic Republic of the Congo (formerly Zaïre). One nonmember of the Fund, the Federal Republic of Yugoslavia (Serbia/Montenegro), was also in protracted arrears during 1996.

Box 1. Elements of the Strengthened Cooperative Strategy to Resolve the Problem of Protracted Overdue Obligations to the Fund¹

Prevention: The first key element of the IMF's arrears strategy is to prevent new cases of arrears from emerging and to keep existing arrears from becoming protracted. To forestall new arrears, the IMF applies conditionality on the use of its resources; assesses borrowers' medium-term balance of payments viability and capacity to repay; cooperates with donors and other official creditors to ensure that IMF-supported adjustment programs are adequately financed; and provides technical assistance to help members formulate and implement appropriate adjustment programs. The introduction of debt sustainability analyses prepared jointly by the IMF and the World Bank staffs for the heavily indebted poor countries, as well as strengthened surveillance, has reinforced the IMF's ability to assess a member's capacity to repay.

Remedial Measures: The arrears strategy includes a timetable of remedial measures of increasing intensity to be applied when members with protracted arrears do not actively cooperate with the IMF in resolving their arrears problems. The timetable, which appears in Box 2, provides a framework for the consideration of the measures, which are implemented by the Executive Board, taking into account the individual country's circumstances and its cooperation with the IMF in addressing its overdue obligations. The steps can range from a temporary limitation on the member's use of IMF resources through the final and most severe sanction: compulsory withdrawal

Intensified Collaboration and the Rights Approach: Intensified collaboration is designed to coordinate the efforts of the member and the IMF. This collaboration provided a framework for countries in arrears to establish a track record of policy and payments performance, mobilize resources from international creditors and donors, and normalize relations with the IMF, including the clearance of overdue obligations. A country's economic policies might be formulated in the context of a "rights accumulation program" or an IMF- or staff-monitored program. A rights accumulation program shares many of the features of a regular IMF-supported macroeconomic stabilization and structural reform program. It allows a country in protracted arrears to accumulate rights to future drawings of IMF resources in accordance with a phased schedule and in amounts up to the level of arrears outstanding at the beginning of the program. Disbursements are made only after the arrears are cleared and are conditional upon satisfactory conclusion of the rights program and IMF approval of a successor arrangement or arrangements. The availability of the rights approach is limited to the 11 countries that were in protracted arrears to the IMF at the end of 1989. Five of the original 11 eligible countries (Cambodia, Guyana, Honduras, Panama, and Vietnam) cleared their arrears to the IMF without recourse to the rights approach. Peru, Sierra Leone, and Zambia adopted rights accumulation programs and have successfully completed those programs and cleared their arrears. The rights approach remains available for Liberia, Somalia, and Sudan until the end of April 1998.

¹For further information see, Financial Organization and Operations of the IMF (Pamphlet No. 45, Fourth Edition), International Monetary Fund, (Washington, D.C.), 1995 and IMF: Annual Report, various years.

Box 2. Strengthened Timetable of Procedures¹

Time after Emergence of Arrears	Action
Immediately	Staff sends a cable urging the member to make the payment promptly; this communication is followed up through the office of the concerned Executive Director. The member is not permitted any use of the Fund's resources nor is any request for the use of Fund resources placed before the Executive Board until the arrears are cleared.
2 weeks	Management sends a communication to the Governor for the member stressing the seriousness of the failure to meet obligations and urging full and prompt settlement.
1 month	The Managing Director notifies the Executive Board that an obligation is overdue.
6 weeks	The Managing Director notifies the member that unless the overdue obligations are settled promptly a complaint will be issued to the Executive Board. The Managing Director would also consult with and recommend to the Executive Board that a communication concerning the member's situation should be sent to selected Fund Governors or to all Fund Governors in the event that the member has not improved its cooperation with the Fund.
2 months	A complaint regarding the member's overdue obligations is issued by the Managing Director to the Executive Board.
3 months	The complaint is given substantive consideration by the Executive Board. The Board has usually decided to limit the member's use of the general resources and, if overdue SDR obligations are involved, suspend its right to use SDRs.
6-12 months	The Executive Board will review its decision on limitation within three months, with the possibility of a second review if warranted. Depending on the Executive Board's assessment of the specific circumstances and of the efforts being made by the member to fulfill its obligations to the Fund, a declaration of ineligibility is to be considered, to take effect not more than twelve months after the emergence of arrears. The sending of communications to all Fund Governors and the heads of selected international financial institutions regarding the member's continued failure to fulfill its financial obligations to the Fund is to be considered at the same time as the declaration of ineligibility.
Up to 15 months	A declaration of noncooperation is to be considered within three months after the dispatch of the communications.
Up to 18 months	A decision on suspension of voting and representation rights is to be considered within three months after the declaration of noncooperation.
Up to 24 months	The procedures on compulsory withdrawal are to be initiated within six months after the decision on suspension or nine months after the declaration of noncooperation.

¹Adapted from Selected Decisions and Selected Documents of the International Monetary Fund, Twenty-First Issue, International Monetary Fund (Washington, D.C.), 1996, pp. 87-89.

Appendix I presents a brief historical and statistical profile of members' repayment performance vis-à-vis the Fund. The present paper seeks through econometric analysis to identify empirically the financial and macroeconomic variables most closely correlated with these repayment performances. To the authors' knowledge, there have been no previous empirical studies of Fund arrears. There is an extensive related body of literature, though, on external debt repayment problems by sovereign debtors to creditors other than the Fund. One question, therefore, is whether it is in fact possible to distinguish econometrically between countries that seek financial support from the Fund and the small subgroup of those countries that eventually encounter difficulties in repaying these and other resources. Since the Fund extends its resources only to countries that have problems with their balance of payments or international reserves position ("maladjustments" in their balance of payments, in the language of the Fund's Articles of Agreement), 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 Fund are similar to the factors influencing countries' repayment behavior vis-à-vis other creditors. Although the individual circumstances and economic performances of countries varied widely, those that have experienced large and protracted arrears to the Fund have been almost without exception countries with prolonged problems of economic management, including external payment arrears, that were evident, and a source of active concern to the Fund, before their overdue obligations to the Fund per se 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 Fund 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 Fund, it does not seem that the Fund's experience with arrears has simply been part and parcel of the Debt Crisis: some distinctions are, first, that the number of countries that have incurred protracted arrears to the Fund 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 and second, that political instability seems to play a more prominent role among the most protracted cases of Fund arrears than it does among countries with non-Fund specific repayment problems.⁴

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

⁴ As noted in Appendix I, if one considers the 12 countries with protracted arrears as of November 30, 1992, all but one could be said to have had markedly troubled political

(continued...)

The Fund'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 Fund than to other official bilateral or commercial creditors. Since the Fund 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 Fund are less sensitive to changes in certain indicators of creditworthiness than are variations in countries' repayment performance vis-à-vis other creditors.

The rest of the paper is organized as follows. Section II reviews the literature on the empirical estimation of countries' external debt repayment problems. Section III presents the methodology of this study, reviewing logit analysis, the construction of the data base, and the selection of explanatory variables. Section IV presents and discusses the results of the empirical analyses. Three particular issues are examined. First, we investigate which financial and macroeconomic variables might affect the likelihood of a country incurring arrears to the Fund, including in particular, the roles of Fund-specific financial variables and countries' credit histories with the Fund. Second, we construct a state-dependent model that differentiates between countries according to whether they are current with the Fund or are already experiencing difficulties making repayments to the Fund. Third, we investigate the differences between models that predict the probability of arrears to the Fund versus other models that predict the probability of arrears to non-Fund creditors. In Section V, the key results are summarized and concluding remarks are made.

II. REVIEW OF THE LITERATURE ON THE ESTIMATION OF 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 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

⁴(...continued)
environments.

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) provide an excellent review of the development of empirical estimations of country risk up to 1982, which traces the emergence of probit and logit models as the preferred estimation techniques.⁶ Subsequent key papers, discussed below, are McFadden et al. (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 emphasize the distinction of ability versus 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 et al. (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 the present results, which are formally presented in Section IV.⁷ Avramovic et al. (1968), at the World Bank, carried out an important

⁵Some studies (McFadden et al.(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 et al. (1995)) use a creditworthiness index as the dependent variable.

⁶Probit 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 non-binary 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 incurrence 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.

⁷In 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. A "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. Summary Results of Empirical Investigations of External Debt Repayment Problems 1/

Studies, Identified by Author(s) and Year of Publication

Variable	Frank, Cline 1971	Sargen 1977	Saini, Bates 1978	Euh 1979	Feder, Just, Ross 1981	Edward 1984	Feder, Uy 1985	McFadden et al. 1985	Berg, Sachs 1988	Solberg 1988	Hajivassiliou 1989	Elmore, McKenzie 1992	Li 1992	Haque et al. 1995	Arrears to the Fund, LDV not included 2/	Arrears to the Fund, LDV included 3/	Aylward, Thome
	Debt/GDP						+	+		+				+	+	NS	NS
Debt/exports				+				+	NS								
Debt services/exports	+	+	NS	+	+	+	NS	NS	+	+	NS	+	+		NS	NS	NS
Reserves/imports	-	NS	NS	NS	-	-	-	-	-	-	-	-	-	-	-	-	-
Exports/GDP	NS	NS	NS	NS	-	-	NS	NS	-	-	-	NS	NS	NS	+	NS	-
Imports/GDP	NS	NS	NS	NS	NS	NS	NS	+	-	-	NS	+	+	NS	-	NS	NS
Current account/GDP						+								NS			
Investment/GDP						-											
Government expenditure/GDP						NS									+	NS	+
Terms of trade									NS					NS			
Net noncommercial or non-debt creating inflows																	
Per capita income	NS	NS	NS	NS	-	NS	-	NS	-	-	NS	NS	NS	-	-	-	NS
GDP growth rate						NS	-	NS						-	NS	-	NS
Rate of inflation		+	+	NS		NS					NS			4/	+	+	NS
Money supply growth rate		+	+														
Exchange rate overvaluation indicator		+				NS			+	NS				NS			
History or amount of use of Fund resources								+			+				+	+	-
Political variables tested; found significant?				No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country heterogeneity tested; found significant?					Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Repayment history tested; found significant?					Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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. A "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.

2/ I.e., results when the lagged dependent variable (LDV), an indicator of repayment history, was not included. Note that repayment history to creditors other than the Fund was tested.

3/ I.e., results when the lagged dependent variable (LDV) was included. These results relate to Model 2A in the present paper.

4/ In the analysis of Haque et al., a country's rate of inflation was a determinant of its credit rating only if it was a relatively low-inflation country.

systematic study of the factors that influence a country's balance of payments and its 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 Avramovic et al. For example, in the model of McFadden et al. (1985), arrears result when new loan demand by developing countries exceeds new loan supply by the industrial countries. External loan demand is determined by a country's intertemporal welfare function, which takes into account the benefits of consumption and investment financed by current account deficits, the cost of the concomitant capital inflows, and the penalties associated with the option of not repaying these inflows on time. Selecting just part of the McFadden model as an illustration, external loan demand is modeled as a function of debt service due, net international reserves, and the current account—all variables employed by Avramovic et al. and other studies on less rigorous theoretical bases.

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). 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 repayment behavior specifically to the Fund. Two other aspects of the empirical analysis of external debt repayment problems are discussed below.

⁸The current account/GDP ratio was significant with the "wrong" sign in Edwards (1984), i.e., a larger surplus was associated with a higher probability of arrears.

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 results of McFadden et al. highlight the limits in explaining country differences in repayment behavior as long as this heterogeneity is not adequately accounted for.

The analyses of McFadden et al. (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. The inclusion of such information incorporates the supply side, reflecting the reactions of suppliers of credit to debtors' past repayment performance and also reflects the possibility that debtors' own attitudes to repayment will be influenced by their debt servicing history: for example, a country may regard a first instance of repayment difficulties as more of a watershed than subsequent instances. Given that a creditworthiness indicator, whether the lagged dependent variable or another, is to some extent summarizing the information provided by the other macroeconomic variables that it renders insignificant, one might prefer a richer specification to the sparser one that features repayment history. On the other hand, the latter specification better models the autoregressive nature of the dependent variable.

III. METHODOLOGY

A. Methodological Issues

The main dependent variable in this study is a binary indicator ($IMFARR_t$) signifying whether or not a country was in arrears to the Fund in a given year. $IMFARR_t$ takes the value 1 if a country was in arrears to the Fund in year t , and 0 otherwise.⁹ A second binary dependent variable $EXTARR_t$ is also tested. $EXTARR_t$ indicates whether a country was in arrears to creditors other than the Fund 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 Fund versus to other external creditors.

⁹Specifically, the variable takes the value 1 if country I was in arrears to the Fund 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 in arrears to the Fund 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 Fund's standard usage of protracted arrears refers to overdue obligations of six months or longer duration.

For the analysis, a data base was constructed covering the 138 developing countries (with the exception of Cambodia) that had payment obligations to the Fund in any year during the period 1976-93. The data were drawn from the Fund's World Economic Outlook data base and Treasurer's Department's records of members' financial obligations and payments to the Fund. Since, before 1982, the only country to have experienced a period of arrears to the Fund lasting three months or more was Cambodia,¹⁰ the data base includes all protracted arrears cases that emerged before 1994. 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 Fund falling due in the year, since in those cases there is no test to make of whether Fund repayments were made on time.

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

Since the dependent variables have only two possible outcomes, 0 and 1, we use a bivariate logit model where: for country i in year t , in which 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 specific-country 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, but informal tests for the presence of country-specific effects were carried out and are described in Section IV.

¹⁰Cambodia was in arrears to the Fund from 1975 to 1993. The unavailability of sufficient historical data for Cambodia necessitated its exclusion from the estimation process. Also, for each particular logit model tested, the sample of country-year observations was restricted to include only those for which data for all the necessary explanatory variables were available. The sample size therefore varies for different models, and is indicated in the tables of results.

The models tested were all of a standard logit form.¹¹ All the explanatory variables were lagged by one year, reflecting the assumed direction of causality, except REPAX, which was lagged by two years.¹²

B. Selection of Explanatory Variables

Our selection of explanatory variables was influenced by the related literature on external debt repayment performance, as reviewed in Table 1, and by the desire to test for differences between the determinants of repayment performance to the Fund versus to other creditors. We included Fund-specific financial variables, based on the assumption that these would substitute for the traditional debt ratios. Finally, our selection of variables was determined also by data availability and reliability.¹³

We have grouped the variables included in our analysis into five categories: debt burden (debt stock and service), repayment history, availability of financial resources, domestic economic conditions and policy stance, and external developments.

¹¹For year t , $REPAX_{t-1}$ represents the amount of arrears to the Fund at the end of year $t-2$ (divided by exports in year $t-1$). If the amount of arrears at the end of year $t-1$ had been used instead, then a reasonably large value for REPAX would have almost by definition implied that at the opening of year t the country had been in arrears to the Fund for at least three months, and so the model would have had a simultaneity problem.

¹²For year t , $REPAX_{t-1}$ represents the amount of arrears to the Fund at the end of year $t-2$ (divided by exports in year $t-1$). If the amount of arrears at the end of year $t-1$ had been used instead, then a reasonably large value for REPAX would have almost by definition implied that at the opening of year t the country had been in arrears to the Fund for at least three months, and so the model would have had a simultaneity problem.

¹³As detailed in Section III, in order to extract the maximum amount of information available from the Fund's repayment history, we constructed a data base covering 138 countries and 18 years, and ended up with 1,871 potential observations. Data availability considerations for the set of variables we included cut down the number of actual observations to a maximum of 1,410. Similar to most studies of reschedulings and arrears on external debt, there are a relatively small number of "positive," i.e., arrears, observations in our data base, and a large number of "negative," or nonarrears, observations. It thus was especially important to avoid bad data, since the models had to extract information by, inter alia, comparing 1,317 "negative" observations with just 93 "positive" ones. Thus, 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.

Debt burden

Two debt burden variables cover financial obligations to all external creditors including the Fund: debt/GDP (identified as EDTGDP) and debt service due/exports (TDSX). As a measure of Fund financial obligations, use of Fund credit/Fund quota (UFCQU) is included. UFCQU measures total Fund credit outstanding to a country, both from the Fund's General Resources Account and under other Fund facilities, such as the SAF, ESAF and Trust Fund, expressed as a proportion of a country's quota. We hypothesize that this variable could be related to Fund arrears in a straightforward fashion, so that as the sheer weight of Fund obligations increases, so does the likelihood of a country not meeting all of those obligations on time, *ceteris paribus*. UFCQU could thus be regarded as a measure of Fund-specific indebtedness. However, UFCQU may also represent the depth or intractability of a country's external imbalance problems, since Fund resources are only extended to countries with balance of payments problems.

A second Fund-specific debt variable employed is Fund obligations/exports (REPX), which can be regarded as a Fund-specific debt service ratio. This variable comprises total obligations (principal and charges or interest) due from a country to the Fund 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: current Fund obligations/exports (REPCX) and overdue Fund obligations/exports (REPAX).

C. Debt Repayment History

As noted in Section II, a country's credit history has been found to be one of the strongest correlates of future performance in repaying external debt. We use external arrears/debt (ARREDT), the level of arrears to all external creditors relative to external debt, as one credit history indicator.¹⁴ It is of interest whether this quantitative indicator of arrears to other creditors will help distinguish likely cases of arrears to the Fund, as some countries have had large external debt repayment problems vis-à-vis other creditors without developing arrears to the Fund, e.g., only one of the Baker 15 countries incurred protracted arrears to the Fund.

The amount of arrears to the Fund (REPAX), described above as a Fund-specific debt service ratio, is of course also an indicator of past Fund repayment performance. We also use $IMFARR_{(t-1)}$ and $EXTARR_{(t-1)}$, the lags of the two dependent variables analyzed in our study, as credit history indicators. To the extent that lagged values of IMFARR have explanatory

¹⁴While the measure benefits from simplicity of definition, it should of course be noted that the extent of debt service difficulties and the level of arrears are not synonymous; in particular, the process of debt rescheduling has an uncertain effect on the level of reported arrears.

power additional to any provided by REPAX, it would suggest that the emergence of Fund arrears marks a step break in a country's financial circumstances and relations with the Fund. This would tend to be the case if there were a hysteresis-type effect whereby countries tended to make greater efforts to avoid an initial instance of protracted Fund arrears, perhaps because they have more to lose in terms of international reputation in such a situation than those nations which already are known to have a history of late payments to the Fund.

D. Availability of Financial Resources

Because of the Fund'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 Fund, or to other creditors. If the Fund'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 reserves/imports (RESM); exports of goods and services/GDP (XGDP), and imports of goods and services/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

Most of the variables described above can be regarded as leading if not coincident indicators of debt service difficulties. While they may point to the unsustainability of a country's debt burden in relation to its resources, they do not necessarily explain what underlying economic weaknesses may have led more fundamentally to the overreliance on debt or the inadequacy of resources to service it. Consistency among arrears countries as to the nature of these weaknesses is unlikely, since such a wide variety of causes can lead to external imbalance, including some that do not lend themselves readily to economic analysis, such as political and security conditions. However, two suitable areas to examine, which are key policy elements of Fund adjustment programs, are the fiscal position and the price environment. In addition to being an indicator of adherence to a macroeconomic adjustment program, the level of public savings will also have an impact on the amount of resources available to meet external obligations. To allow for the possibility that changes in the level of government spending may be qualitatively different in their impact on debt

sustainability from changes in the level of government revenue, so that the fiscal position could not be adequately represented simply by the budget surplus or deficit, we examine both central government spending/GDP (EXPGDP) and central government revenue/GDP (REVGDP). The measure of inflation is the adjusted log of the rate of change in the consumer price index (INFL).¹⁵

We also have used two summary indicators of economic conditions, the log of U.S. dollar real per capita income (PCI)¹⁶ and the rate of change in this variable (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 Fund 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 Fund. Such a relationship would be in contrast to the performance of numerous middle-income countries, i.e., the Baker 15 countries, involved in the Debt Crisis.

External developments

We investigate whether the shifts in the frequency and magnitude of arrears to the Fund described in the introduction reflect changes in the environment external to the individual debtor countries that 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 Fund, perhaps because the loss of international reputation a country suffered when it failed to meet its financial obligations to the Fund was perceived by it as being diminished as more countries experienced external debt repayment crises, or because the negative implications of Fund 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 Fund 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. The Fund's strengthened cooperative arrears strategy in a sense may have simultaneously raised the penalties associated with incurring Fund arrears, through its remedial steps, while lowering the cost of becoming current on Fund obligations, through

¹⁵Because 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.

¹⁶The specific series used was the IMF World Economic Outlook purchasing power parity-based per capita income series.

the availability of the rights approach for certain members and other arrears clearing procedures. For this purpose, 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.¹⁷ Since the dependent variable takes the value 1 if Fund arrears occur, and 0 if they do not, it is hypothesized that DUM84 will bear a positive sign, and DUM90 a negative one.

IV. RESULTS

A. Fund-Specific Variables

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

Model 1A includes no Fund-specific debt indicators. It thus attempts to explain the incidence of Fund arrears without reference to a country's financial relations and credit history with the Fund. In Model 1A, all but three of the independent variables are significant and of the hypothesized sign.¹⁸ Debt/GDP, the economic growth rate, and the 1990 dummy variable have no explanatory power for Fund arrears in the specification of Model 1A. Both the amount (ARREDT) and the existence (EXTARR_{t-1}) of arrears to creditors other than the Fund are correlated with the likelihood of incurring Fund arrears. The coefficient on imports, the expected sign for which was ambiguous, is negative, indicating that a higher share of imports in GDP makes Fund arrears less likely. The regression correctly classifies 1,297 of the 1,307 occurrences of timely repayment to the Fund, but misses about half of the cases of arrears.

¹⁷The 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 Fund arrears observations in the sample before 1982.

¹⁸All 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 or three asterisks indicate significance at the level of 95 percent or higher.

Table 2. Tests of Fund-Specific Debt and Repayment History Indicators 1/2/

Model Identification Number	1A	1B	1C	1D	1E
Country-Year Observations	1410	1410	1410	1410	1410
Log Likelihood	-194	-140	-126	-97	-99

Variable (Description)	Coefficient (Statistical significance)				
Constant	1.11	0.79	-0.09	-1.15	-1.35
EDTGDP (Total debt/GDP)	0.15	0.06	0.24	0.24	0.11
TDSX (Total debt service/exports)	0.32 **	0.12	-0.34	-0.35	-0.04
UFCQU (Use of Fund credit/quota)	--	0.52 **	0.59 ***	0.75 ***	0.89 ***
REPX (Total Fund obligations/exports)	--	7.70 ***	--	--	--
REPCX (Current Fund obligations/exports)	--	--	4.08 **	1.53	--
REPAX (Fund obligations in arrears/exports)	--	--	46.63 ***	11.70	--
IMFARR _{t-1} (Binary indicator of Fund arrears, lagged one year)	--	--	--	4.16 ***	4.75 ***
ARREDT (Total non-Fund arrears/debt)	2.25 **	2.91 **	1.95	1.19	1.24
EXTARR _{t-1} (Binary indicator of non-Fund arrears, lagged one year)	3.32 ***	2.19 **	1.97 **	1.48 **	1.39 *
RESM (Reserves/imports)	-0.80 ***	-0.45 **	-0.57 **	-0.30 *	-0.29 *
XGDP (Exports/GDP)	5.26 **	5.27 **	5.29 *	2.99	1.95
MGDP (Imports/GDP)	-5.47 ***	-4.73 **	-5.73 **	-4.33	-3.36
PCI (Per capita income)	-1.00 ***	-0.93 ***	-0.86 ***	-0.75 **	-0.79 **
GROWTH (Rate of change of PCI)	-0.03	-0.24	-0.73	-6.53 **	-7.13 **
EXPGBP (Expenditure/GDP)	4.27 **	7.84 **	10.03 ***	8.06 **	6.81 *
REVGDP (Revenue/GDP)	-7.34 **	-9.83 **	-13.32 **	-10.75 *	-8.61 *
INFL (Inflation rate)	0.64 **	0.78 ***	0.68 **	0.44	0.42
DUM 84 (1984 dummy)	2.82 ***	2.38 ***	2.03 ***	1.73 **	1.85 **
DUM 90 (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 non-arrears observations	1,307	1,307	1,307	1,307	1,307
Of which: number of predicted cases of non-arrears	1,297	1,299	1,302	1,296	1,295
Type 1 error (in percent) 3/	50	34	31	23	20
Type 2 error (in percent) 4/	1	1	0	0	1

1/ 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.

2/ 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 independent variables are given the "t-1" subscript, to distinguish that they appear on both the left- and right-hand side of the logit equations.

3/ Type 1 error represents the occurrence of false negatives, i.e., actual arrears cases classified by the model as non-arrears cases.

4/ Type 2 error represents the occurrence of false positives, i.e., actual non-arrears cases classified by the model as arrears cases.

Model 1B adds UFCQU and REPX, Fund-specific variations of, respectively, the debt burden and debt service due ratios, to the regression.¹⁹ These two variables are both highly significant and positively correlated with the probability of arrears to the Fund. TDSX loses significance when these Fund-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 Fund's preferred creditor status, along with the relatively small share of total debt and debt service owed to the Fund by most countries, the likelihood of a country meeting its obligations to the Fund in a given year is not greatly dependent on the amount of obligations due to other creditors. Including the Fund-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).²⁰

Model 1C tests what information is provided by separating Fund 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 event of past protracted arrears to the Fund, rather than the amount of arrears, which best captures the impact of Fund 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, MGDGP, REVGDP, INFL) or are less significant ($EXTARR_{t-1}$, PCI, EXPGDP, DUM84). In contrast, economic growth becomes significant once the likelihood of future Fund arrears is also conditioned on the event of past Fund arrears. Also, UFCQU's explanatory power is undiminished. That only one variable related to non-Fund debt ($EXTARR_{t-1}$) remains significant may reflect the distinctiveness of Fund 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

¹⁹The reader is reminded that REPX includes both current and overdue obligations to the Fund.

²⁰ 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, i.e., actual nonarrears cases classified by the model as arrears cases.

likelihood of Fund arrears confirms that REPCX and REPAX may be omitted from the model.

The results shown in Table 2 suggest that the use of Fund credit, repayment history both to the Fund and to other creditors, per capita income, and economic growth are determinants of the likelihood of a country incurring Fund arrears in the future. The non-Fund-specific debt service ratio, reserves, exports and imports, fiscal indicators, and inflation appear to be correlated with the likelihood of Fund arrears, but they do not provide significant explanatory power once information on a country's past record in meeting Fund financial obligations is included. The Fund repayment history indicator is the most significant of the explanatory variables in Model 1E, and use of Fund credit is the second-most significant correlate of Fund arrears. Of course, the lagged dependent variable is to some extent capturing and summarizing the impact of those macroeconomic variables which it renders insignificant; the role of members' past performance in repaying the Fund is further addressed in Section 3 through the formulation of a state-dependent model. It is noteworthy that per capita income has explanatory power in modeling Fund arrears, in contrast to the results of several studies of non-Fund arrears summarized in Table 1. The results for the dummy variables suggest that the likelihood of Fund arrears rose across the board—i.e., 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.

B. Country Heterogeneity

So far the analysis has not dealt with the possible existence of country heterogeneity. Unfortunately, it was not computationally feasible in the present study to conduct a satisfactory panel data test for the presence of fixed country effects.²¹ Two alternative approaches were therefore used to test informally for fixed effects.

First, we tested whether the lagged dependent variable may to some extent be acting as a proxy for fixed country effects, rather than state dependency, by substituting

²¹The number of calculations involved in such a procedure for logit analysis is very large, and rises geometrically with the number of years used in the sample; the LIMDEP program used for the logit analysis is not able to perform the test for a sample involving more than five years of data. Even then, the nature of the test excludes all those countries for which the value of the dependent variable is constant throughout the sample. So, for the period 1985-89, for instance, the test for fixed effects would involve only the eight countries which either go into or come out of arrears during the second through to fifth years of the period. Probably because of these severe restrictions on sample size, the panel fixed effects model run for this five-year period was not able to converge satisfactorily. Even if convergence had been achieved, the fact that the test was based on a small subsample would have cast doubt on its applicability to the overall sample.

With these considerations in mind, the same logit model was run for two different subsets of the data base, the first consisting of observations where the country had not been in arrears to the Fund 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 Fund ($IMFARR_{t-1} = 1$), designated the "exit" subset. Table 3 shows the results when the whole data base and the two subsets were tested against all valid independent variables; variables insignificant in all three of the specifications were sequentially eliminated, with any variable significant in at least one of the three samples being retained.²² 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 in the first column of Table 3, which are for the whole data base, are similar to the results for Model 1E, Table 2. The results for the entry model, Model 2B, are fairly close to those for the whole data base model, which is not surprising since the 1,317 observations for the subset of countries that did not have Fund arrears in the previous year represent 93 percent of the 1,410 observations in the restricted or "joint" model. The results of Model 2B indicate that in the absence of a history of earlier Fund repayment problems, the Fund-specific financial ratio, UFCQU, is the most significant determinant of the probability of a country incurring Fund arrears, with the likelihood of Fund arrears also influenced by per capita income, economic growth, reserves, and inflation. Although Model 2B correctly classifies all 1,296 of the nonarrears observations, it identifies only two of the 21 "new" incidences of arrears. This result reflects that the model is much less likely ever to classify a country as an arrears outcome (i.e., assign a probability of greater than 50 percent), which results from the fact that the vast majority of observed outcomes in the data base are country-years of nonarrears. Put another way, the result reflects the large amount of information provided by a member's Fund repayment history (as measured by $IMFARR_{t-1}$), which is explicitly missing from the entry model.

The model for countries already in protracted arrears, Model 2C, appears quite different from Model 2B. Model 2C has only one significant variable in common with Models 2A and 2B, UFCQU. Whether the use of Fund credit indicator simply represents the burden of debt owed to the Fund or is a proxy for the depth and intractability of a member's

²²Model 2A is properly designated the restricted model, since the coefficients are restricted to be the same for the two subsets of country-year observations from the two states, "entry" and "exit"; however, we also refer to it as the joint model, since it covers both states. Note that for models 2B and 2C, which test the entry and exit subsets, respectively, the variable $IMFARR_{t-1}$ cannot by definition be tested. $EXTARR_{t-1}$ and the dummy variables DUM84 and DUM90 were not included in the specifications because their inclusion caused instability in Model 2C, probably because of the relatively small number of observations in the exit model and the limited variability of these binary indicators in the exit subset.

Table 3. Test of a Common Specification for the Restricted and Unrestricted Models 1/2/

	Restricted Model ARR _{t-1} =0,1	Unrestricted Models	
		Entry Model ARR _{t-1} =0	Exit Model ARR _{t-1} =1
Model Identification Number	2A	2B	2C
Country-Year Observations	1,410	1,317	93
Log Likelihood	-108	-76	-21
<u>Variable (Description)</u>		<u>Coefficient (Statistical significance)</u>	
Constant	0.88	3.92 *	0.09
UFCQU (Use of Fund credit/quota)	0.86 ***	0.92 ***	0.77 **
IMFARR _{t-1} (Binary indicator of fund arrears, lagged one year)	5.29 ***	--	--
ARREDT (Total non-Fund arrears/debt)	1.81 *	-0.42	7.78 **
RESM (Reserves/imports)	-0.27 *	-0.56 **	-0.02
PCI (Per capita income)	-0.86 ***	-1.25 ***	-0.22
GROWTH (Rate of change of PCI)	-7.21 ***	-8.09 **	-3.31
INFL (Inflation rate)	0.71 **	0.79 **	1.02
Number of actual arrears observations	103	21	82
of which: number of predicted cases of arrears	81	2	79
Number of actual non-arrears observations	1,307	1,296	11
of which: number of predicted cases of non-arrears	1,296	1,296	2
Type 1 error (in percent) 3/	21	90	4
Type 2 error (in percent) 4/	1	0	82

1/ 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.

2/ 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 left- and right-hand side of the logit equations.

3/ Type 1 error represents the occurrence of false negatives, i.e., actual arrears cases classified by the model as non-arrears cases.

4/ Type 2 error represents the occurrence of false positives, i.e., actual non-arrears cases classified by the model as arrears cases.

economic imbalance, a high amount of Fund credit outstanding influences both the likelihood of newly falling into Fund arrears and of remaining in arrears. The results for the exit model may also reflect the relatively small sample size.

The only other independent variable that is significant in Model 2C is the amount of external arrears to all creditors expressed in relation to total external debt. The significance of ARREDT declined and then disappeared in the whole data base models when information on Fund-specific arrears was added (see Models 1A to 1E), so its significance in the exit model could result from the fact that Model 2C does not include such information. However, it could also reflect the fact that the external arrears of countries cooperating with the Fund in seeking a solution to their overdue obligations generally fall, either because these countries become eligible for debt rescheduling following the establishment of a Fund-monitored adjustment program, or because such a program stipulates the stabilization of external arrears.

A maximum likelihood test of the null hypothesis that the entry and exit models are not significantly different from each other confirms that the models are distinct with a confidence level of 99 percent.

D. The Determinants of Arrears to Other Creditors

Table 4 presents the results of investigating whether the likelihood of two distinct types of external debt repayment problems—arrears to the Fund versus arrears to other creditors—is rooted in the same economic and financial variables. Model 3A is comparable to Model 1A: it tests all the independent variables included in Table 2 and 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, DUM84,²³ and DUM90. In contrast to the results for Fund arrears, the export and import variables have the expected signs, i.e., higher imports (exports) are associated with a higher (lower) likelihood of arrears to other creditors.

Model 3B 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 Fund arrears, the lagged dependent variable is highly significant, and its inclusion causes the significance of many of the independent variables in Model 3A to either decline (XGDP) or disappear (EDTGDP, TDSX, UFCQU, MGDGP, PCI, GROWTH, INFL). Model 3C presents the more parsimonious specification that emerges when insignificant variables are sequentially

²³As noted earlier, DUM82 was the preferred dummy indicator of the Debt Crisis, but was not used in tests of Fund arrears because of the few incidences of Fund arrears in the data base 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.

excluded according to the absolute value of their t-statistic. The external debt burden, current Fund debt service, non-Fund-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 Fund. It is noteworthy that while UFCQU is not significant in the models in Table 4, REPCX is, and bears a negative sign. This indicates that the higher the ratio of current Fund 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 Fund's preferred creditor status implies that other creditors get paid only after Fund obligations are met. It may be a consequence of the small ratio of Fund debt service to total debt service for most countries, which means that in most cases timely payments to the Fund are unlikely to preempt payments to other creditors. Another interpretation could be that higher current Fund obligations are indicative of a past Fund adjustment program, and, *ceteris paribus*, 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 joint model of Fund arrears, both Type 1 and Type 2 errors in Model 3C 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.

V. 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 Fund. 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. For the joint or whole data base models, Type 1 error rates are acceptable and Type 2 error rates are minimal. Thus, even though countries that seek and obtain a Fund-supported financial arrangement tend to exhibit common economic characteristics related to the balance of payments problems that lead them to request Fund assistance, it is possible econometrically to distinguish, *ex post*, between the financial and economic characteristics of those countries that use Fund financial resources and the much smaller subgroup of countries that subsequently encounter difficulties in repaying those resources on time. A larger use of Fund credit relative to quota, a higher rate of inflation, 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 Fund.

Three other implications of the results may be highlighted. First, when Fund-specific financial indicators are omitted, a broader set of variables are correlated with the likelihood of a country incurring Fund arrears, and this set bears considerable overlap with the variables identified in other studies as correlates of non-Fund repayment problems. Adding Fund-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,

Table 4. Tests Using Arrears to Other Creditors as the Dependent Variable 1/2/

Model Identification Number	3A	3B	3C
Country-Year Observations	1398	1398	1398
Log Likelihood	-502	-248	-255

Variable (Description)	Coefficient (Statistical significance)		
Constant	0.06	-0.49	-1.44 **
EDTGDP (Total debt/GDP)	1.08 ***	0.71 *	1.08 **
TDSX (Total debt service/exports)	1.72 ***	0.96	--
UFCQU (Use of Fund credit/quota)	0.30 ***	0.08	--
REPCX (Current Fund obligations/exports)	-8.05 ***	-10.77 **	-4.59 **
REPAX (Fund obligations in arrears/exports)	-5.07	17.08	--
IMFARR _{t-1} (Binary indicator of Fund arrears, lagged one year)	1.96	1.06	--
ARREDT (Total non-Fund arrears/total debt)	24.64 ***	-2.03 *	--
EXTARR _{t-1} (Binary indication of non-Fund arrears, lagged one year)	--	5.77 ***	5.71 ***
RESM (Reserves/imports)	-0.19 ***	-0.30 **	-0.30 **
XGDP (Exports/GDP)	-3.43 ***	-3.61 **	-2.98 ***
MGDP (Imports/GDP)	1.67 **	1.47	--
PCI (Per capita income)	-0.28 **	-0.15	--
GROWTH (Rate of change of PCI)	-1.92	-0.98	--
EXPGDP (Expenditure/GDP)	3.76 **	4.72 **	5.75 ***
REVGDP (Revenue/GDP)	-4.42 **	-7.37 **	-8.11 ***
INFL (Inflation rate)	1.21 ***	0.81	--
DUM 84 (1984 dummy)	0.24	-0.18	--
DUM 90 (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 non-arrears	74	754	753
Type 1 error (in percent) 3/	23	8	8
Type 2 error (in percent) 4/	4	3	3

1/ Asterisks appearing underneath coefficients indicate significance: no asterisk indicates the coefficient was not sufficient; 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.

2/ 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.

3/ Type 1 error represents the occurrence of false negatives, i.e., actual arrears cases classified by the model as non-arrears cases.

4/ Type 2 error represents the occurrence of false positives, i.e., actual non-arrears cases classified by the model as arrears cases.

adding the lagged dependent variable as an indicator of past Fund 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 et al. (1985) and Hajivassiliou (1989) on external debt repayment to non-Fund creditors; i.e., the best predictor of whether a country will go into arrears to the Fund in the future is whether it has been in arrears to the Fund in the past, with the impact of the dependent variable IMFARR still highly significant when lagged five years.

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 Fund, it has begun a new phase in its external financial relations, and the likelihood that it will be in arrears to the Fund in subsequent years may be determined by different factors than when it was still current with the Fund. Notably, for a country current with the Fund in year t , the level of its reserves and the rate of inflation are correlated with its repayment behavior in year $t+1$. In contrast, for a country already in arrears, these variables seem unimportant for determining whether it will remain in or exit arrears in the coming years, while the share of the country's total (Fund and non-Fund) debt that is in arrears appears statistically relevant. However, the state-dependent model also reflects the large amount of information provided by a country's past Fund repayment behavior. The state-specific models will almost always be "right" if they follow the simple rule of predicting that countries remain in their present state of either current or in arrears to the Fund.

The third set of results we would like to highlight involve the comparative results for Fund versus non-Fund arrears. When both Fund-specific and non-Fund credit history variables are included and parsimonious specifications are used, the macroeconomic correlates of Fund arrears found in this analysis tend to reflect a country's overall economic circumstances and policy stance—i.e., per capita income, economic growth, and inflation (Model 2A). In contrast, the correlates of non-Fund 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. These results could be indicative of the Fund's preferred creditor status: a country may repay the Fund 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 Fund are distinguished by low income and slow growth, suggesting that the intractability of the macroeconomic imbalance problems may be a major factor. Another comparative result is that Type 1 error rates tend to be lower for the model of arrears to creditors other than the Fund than for the model of Fund arrears. Fund arrears may be more difficult to model simply because they occur with less frequency than arrears to other creditors. Alternatively, the special nature of Fund resources and of member countries' financial and other relationships with the institution may mean that additional and possibly more complex factors than those captured by the macroeconomic and financial variables

A STATISTICAL PROFILE OF COUNTRIES' REPAYMENT PERFORMANCE TO THE FUND

Prior to undertaking the econometric analysis presented in the main body of this paper, one of the authors undertook a statistical comparison of Fund members' repayment performance seeking to establish whether there were identifiable characteristics distinguishing countries that incurred arrears to the Fund from those that made timely repayments.²⁴ Based on the literature on country risk analysis (see Section II of the main paper), a number of financial and economic indicators were selected for analysis and, in addition, an examination of the political environment in the two sets of countries was made. The results are presented in this appendix.

I. INTRODUCTION

The discussion below presents a brief history of overdue obligations to the Fund and a statistical profile of countries according to their repayment history to the Fund. It compares countries that experienced arrears of six months' duration or longer during the period 1980 to 1992²⁵ with those countries that consistently met their financial obligations to the Fund in a timely fashion, in terms of a number of financial and macroeconomic indicators. The comparison is made at an early stage, when the countries that went on to evidence arrears to the Fund were making the purchase or loan drawing that they would eventually fail to repay on time; at an intermediate stage, when the countries were increasing their use of Fund resources; and at a late stage, when the arrears that were to become protracted actually emerged.

The results indicate that countries may be distinguished ex post according to their repayment performance to the Fund. On average, the group of countries that experienced arrears to the Fund have a higher share of total external debt (i.e., to non-Fund creditors) in arrears, a higher use of Fund resources relative to quota, and a higher Fund-specific debt ratio. The arrears group is also characterized by a level of reserves and per capita income that is about half of that for the nonarrears countries, and by a lower rate of economic growth.

²⁴This appendix was prepared by Lynn Aylward.

²⁵This period captures the bulk of the emergence of the Fund's arrears cases to date. It is unlikely that the results would be significantly affected by inclusion of data on more recent years, where, as noted in Section 1 of the main paper, the number of cases of arrears to the Fund have declined sharply.

These differences are evident not only at the point when the countries' repayment problems emerged, but about five years before, when the countries were drawing the Fund resources that they would eventually be unable to repay. In contrast, the arrears group and the group of members that made timely repayments are not distinguishable by their average fiscal and current account positions.

The profiles of the two groups of countries in terms of political environment are also investigated. Although almost all of the countries in protracted arrears to the Fund in late 1992 evidenced difficult political circumstances, the results of the statistical analyses are inconclusive.

II. THE FUND'S EXPERIENCE WITH ARREARS, SOVEREIGN CREDITWORTHINESS, AND FUND REPAYMENT ISSUES

A. Brief History of Overdue Obligations to the Fund

The level of overdue financial obligations to the Fund rose from SDR 34 million in 1981 to SDR 3.6 billion in 1991, equivalent to 13.6 percent of total Fund credit outstanding, before falling to SDR 2.2 billion at the end of 1996 (Table 5). Table 5 also provides information on the duration of arrears to the Fund, and the number of members involved. Until 1986, arrears of comparatively short duration—i.e., of less than six months—accounted for half or more of outstanding arrears. Since then, arrears of six months or longer have dominated total arrears. The evolving composition of arrears by duration largely reflects the intractability of the arrears problems of a few countries. At the end of 1996, 86 percent of the outstanding arrears to the Fund were overdue for more than three years, and four members (The Democratic Republic of the Congo, Liberia, Somalia, and Sudan) accounted for 95 percent of the total. Table 6 lists the incidences of arrears of six months or longer duration (which will be referred to as incidences of protracted arrears) that emerged over the period 1980 to 1992 relative to countries' use of Fund resources.^{26 27} The table indicates that from 1980 to 1992, 20 countries experienced arrears of six months or longer, accounting for 30 occurrences of such arrears. Incidences of arrears emerged most frequently from 1984 to 1986.

²⁶One country that incurred protracted arrears only in the SDR Department and on SDR assessments is not included.

²⁷Cases of late payments of a relatively short duration are likely to reflect mainly technical or very temporary difficulties. Also, the Fund makes public only selected information on instances of arrears by its members, and only since 1990 has identified members with arrears of more than six months' duration in its annual reports.

Table 5. Overdue Financial Obligations to the Fund by Duration, 1981-96 1/
(SDR millions; End of period)

Year	Total		0-1 Month		1-3 Months		3-6 Months		6 Months-1 Year		1-2 Years		2-3 Years		3 Years or More	
	Amount	No. of Members	Amount	No. of Members	Amount	No. of Members	Amount	No. of Members	Amount	No. of Members	Amount	No. of Members	Amount	No. of Members	Amount	No. of Members
1981	34.4	20	6.3	19	5.0	3	0.2	1	0.4	1	0.8	1	0.7	1	21.0	1
1982	29.3	16	5.3	15	0.2	1	0.2	1	0.4	1	0.7	1	0.8	1	21.8	1
1983	60.3	14	18.0	11	5.4	5	7.2	4	5.8	3	0.8	1	0.7	1	22.5	1
1984	178.2	24	28.8	22	43.3	7	51.7	4	21.0	4	9.4	3	0.8	3	23.3	1
1985	621.2	25	66.6	24	136.9	12	152.2	11	146.9	9	88.8	4	5.8	2	24.0	1
1986	1,035.6	21	85.0	19	135.2	9	204.3	8	253.9	7	239.4	6	88.0	4	29.8	2
1987	1,752.4	26	79.4	24	157.3	11	182.9	9	361.5	8	616.0	7	239.2	6	116.1	4
1988	2,611.9	17	65.0	12	171.2	15	230.0	11	422.4	11	754.8	10	615.0	7	353.5	6
1989	3,099.4	14	29.8	8	100.5	10	171.9	11	338.0	11	758.6	11	737.0	10	963.5	7
1990	3,420.8	15	24.5	8	104.3	10	107.4	8	230.9	8	597.4	9	737.6	9	1,618.7	9
1991	3,624.5	13	7.4	9	62.0	10	97.3	9	190.1	9	335.4	9	591.1	9	2,341.0	9
1992	3,595.6	20	23.2	15	29.7	12	54.8	12	95.6	9	347.5	10	312.6	8	2,732.2	8
1993	2,970.0	12	9.8	10	36.9	10	41.7	10	117.4	10	185.0	9	338.3	8	2,241.0	6
1994	2,975.2	11	13.5	7	32.6	7	26.5	7	67.1	7	184.9	7	173.9	7	2,476.7	6
1995	2,179.2	8	10.0	3	21.6	7	14.2	5	50.0	6	129.5	6	174.5	6	1,779.3	6
1996	2,212.1	10	10.8	7	23.6	7	15.5	7	40.9	7	94.9	6	129.4	6	1,896.9	6

1/ Overdue financial obligations include repurchases, charges, and assessments in the General Resources Account, net SDR charges; repayments and interest on Trust Fund, SAF and ESAP loans, and special charges. The Federal Republic of Yugoslavia (Serbia/Montenegro), although it has not yet completed arrangements for succession to membership in the Fund, is included.

Table 6. Countries with Arrears to the Fund of Six Months or Longer Duration, 1980-92 ^{1/}

Member	Type and Date of Purchase or Borrowing That Eventually Gave Rise to the Emergence of Protracted Arrears (i.e., When Its Repurchase or Repayment Fell Due)	Date of Last Purchase or Borrowing, Before the Emergence of Protracted Arrears	Date of the Emergence of Protracted Arrears
Cambodia	GT purchase, September 1971	CCFF purchase, April 1973	May 1975
Chad	TF loan, January 1978	CCFF purchase, January 1981	January 1984
Congo, Dem. Rep. of (1) (2)	CCFF purchase, December 1983	CT purchase, September 1987	June 1988 November 1990
Dominican Republic	CT purchase, August 1983	CT purchase, April 1985	August 1990
Gambia (1) (2)	CCFF purchase, June 1981	CT purchase, April 1984	December 1984 June 1985
Guyana	CCFF purchase, July 1978	CCFF purchase, November 1982	May 1983
Haiti (1) (2) (3)	CT purchase, April 1984	SAF loan, July 1987	May 1988 November 1988 November 1991
Honduras (1) (2)	CCFF purchase, November 1982	CT purchase, August 1983 ^{2/}	November 1987 November 1988
Jamaica	CT purchase, April 1981	CT purchase, March 1986	April 1986
Liberia	CCFF purchase, December 1979	CT purchase, December 1984	December 1984
Nicaragua	CCFF purchase, May 1979	CCFF purchase, August 1979	May 1983
Panama	CCFF purchase, June 1983	CT purchase, March 1987	December 1987
Peru	CCFF purchase, June 1982	CT purchase, June 1984	September 1985
Sierra Leone (1) (2)	CT purchase, February 1980	CT purchase, April 1984	January 1985 ^{3/} January 1987
Somalia (1) (2) (3) (4)	CT purchase, May 1982	CT purchase, March 1985	July 1985 ^{4/} May 1986 November 1986 February 1987
Sudan	CCFF purchase, April 1981	CT purchase, July 1984	July 1984
Tanzania	CCFF purchase, September 1980	CCFF purchase, June 1981	March 1985
Vietnam	TF loan, August 1978	CT purchase, January 1981	February 1984 ^{5/}
Yugoslavia ^{6/}	CT purchase, March 1986	CT purchase, March 1990	September 1992
Zambia (1) (2)	CCFF and CT purchases, April 1980 ^{7/}	CT purchase, December 1984	April 1985 May 1986

1/ The following abbreviations are used in the table: CT-Credit Tranche; CCFF-Compensatory and Contingency Financing Facility; GT-Gold Tranche; SAF-Structural Adjustment Facility; TF-Trust Fund. Numbers in parentheses after a country's name refer to multiple incidences of protracted arrears.

2/ Augmentation of existing stand-by arrangement.

3/ Quarterly charges fell overdue for Sierra Leone in January 1985; the repurchase referred to above fell overdue in February 1985.

4/ Semiannual charges fell overdue for Somalia in July 1985; the repurchase referred to above fell overdue in August 1985.

5/ Net SDR charges and quarterly charges also fell overdue for Vietnam in February 1984, somewhat earlier than the Trust Fund repayment referred to above.

6/ Yugoslavia refers to the Socialist Federal Republic of Yugoslavia before its dissolution in 1992.

7/ Both CCFF and CT purchases were due to be repurchased by Zambia on the date of protracted arrears emergence.

The table also provides additional information concerning the incidences of protracted arrears. It lists the type of use of Fund resources that gave rise to the first overdue obligation of principal that signaled the emergence of protracted arrears for a country and the date when the purchase or loan drawing was made.²⁸ The table also lists the type and date of the last drawing by a country or Fund supported arrangement approval for a country, whichever is later, that occurred before the emergence of protracted arrears (such additional information is provided only for the first incidence of arrears, in cases where countries experienced multiple incidences of protracted arrears). The information in Table 6 is drawn upon in Section III.

III. STATISTICAL ANALYSIS

A. Financial and Macroeconomic Variables

Based on the literature on country risk analysis, a number of indicators were selected for the purpose of comparing countries that incurred arrears to the Fund with those that made timely repayments. (Data availability was also a consideration.) The selected variables include four standard financial ratios that are indicators of indebtedness and creditworthiness: external debt (to all creditors, including the Fund) relative to GDP; total debt service due (current debt service to all creditors including the Fund plus arrears) relative to exports; total external arrears as a share of the country's debt, and reserves expressed in terms of months of imports. Two Fund-specific financial indicators are used: use of Fund credit relative to quota and current obligations due to the Fund relative to exports. Four macroeconomic variables were also selected, two that summarize a country's internal and external macroeconomic balance: the fiscal balance (government revenue less expenditure) and the current account payments balance, respectively, both expressed in relation to GDP; and two that describe its basic economic circumstances: the level of purchasing power parity-based per capita income and its rate of change, or the real economic growth rate. A data base was constructed using IMF World Economic Outlook (WEO) and International Financial Statistics (IFS) data for all countries that owed financial obligations to the Fund in any year during the period 1976 to 1992.²⁹ Of this group, countries that experienced arrears of six months or longer on at least

²⁸In the terminology of the Fund, a member making use of Fund resources exchanges its currency for the currency of a member in a relatively strong balance of payments and reserve position. It thus "purchases" the currency of the latter member. Conversely, settlement of the obligation thus incurred is referred to as a "repurchase" of the debtor member's own currency.

²⁹The WEO data series used were: D (debt), NGDPD (nominal GDP in U.S. dollars), DS_T (debt service), DA_T (stock of arrears), BXGS (exports of goods and services), BRA_S (reserves), BMGS (imports of goods and services), CGB (central government balance),
(continued...)

one occasion during the period were designated as “arrears countries” or the “arrears group” (with 20 members), while all others were classified as “nonarrears countries” or the “nonarrears group” (with 107 members).³⁰

The two groups of countries are compared at three different stages.³¹ The relevant information for the countries with respect to these three reference points appears in Table 6. For the arrears group, the early stage, before the actual emergence of arrears, was defined as the year of the purchase or loan disbursement that generated the repurchase or loan repayment obligation that marked a country’s entrance into protracted arrears to the Fund.³² For example, the early stage for Chad is 1978, since the country’s entrance into protracted arrears occurred when it failed to repay the principal it borrowed from the Trust Fund in January 1978, a repayment which fell due in January 1984. As the second point of comparison, an intermediate stage was designated as the year when a country made its last use of Fund resources (whether through a credit tranche, stand-by arrangement, or Compensatory and Contingency Financing Facility purchase or through a loan disbursement), or last had a Fund-supported arrangement approved or augmented, before its protracted arrears emerged, whichever was later (actual or approved use of Fund resources). For the example of Chad, the intermediate stage is 1981. The third stage, designated the late stage, is simply the year when a country actually fell into protracted arrears to the Fund (e.g., 1984 for Chad).

For the nonarrears countries, there is of course no natural reference point comparable to that for the arrears group, i.e., the year of emergence of protracted arrears. Therefore, the relevant reference years for the early, intermediate, and late stages for the nonarrears

²⁹(...continued)

NGDP (nominal GDP in local currency), and BCA (current account). The IFS series for Fund credit outstanding, quota, and current obligations, principal and charges, due the Fund were from the Fund Accounts section of the Economic Information System. The per capita income data are WEO purchasing power parity-based data.

³⁰In practice, one arrears country, Cambodia, and a small number of nonarrears countries were excluded from the analysis due to missing data.

³¹Only the earliest incidence of protracted arrears for countries that had more than one such incidence was included, since including multiple incidences of arrears unduly complicates the process of making comparisons with the nonarrears group at different stages.

³²In three cases the first overdue obligation marking a country’s entrance into protracted arrears was actually a charge rather than a principal repayment, but in all of these cases, a principal repayment fell overdue within a few weeks of the charge, and it is its due date that serves as the reference point and is reported in Table 6.

countries were set by averaging the years represented by the individual arrears countries at each of these three stages. This resulted in 1981 being the reference year for comparison with the early stage, 1984 for the intermediate stage, and 1986 for the late stage.

To test whether the two groups of countries are statistically distinct, the mean and variance of the different variables were calculated for the two groups of countries at the different stages, and a one-sided t-test implemented to test the null hypothesis that the means of the two groups are equal, with a confidence level of 95 percent.³³ The alternative hypotheses are that the mean of the arrears group, μ_A , exceeds that of the nonarrears group, μ_{NA} , for the variables debt/GDP, debt service due/exports, external arrears/debt, use of Fund credit/quota, and Fund debt service due/exports, and that the reverse is true for the case of reserves/imports, the fiscal balance/GDP, the current account balance/GDP, per capita income, and economic growth. Table 7 presents the results of the analysis.

With regard to the standard financial ratios that measure non-Fund-specific indebtedness, the null hypothesis that the average ratio of debt to GDP for the two groups is the same is rejected at the early stage, but accepted for the two later stages. In contrast, the debt service due ratios for the two groups are not statistically different at the early stage, but are found to be so at the two later stages. Thus, while at the early stage the arrears group was more highly indebted, it may be that the distinction between the two groups of countries in terms of indebtedness was overshadowed in subsequent years during the common experience of the Debt Crisis. On the other hand, while the two groups' debt service burdens were comparable at the early stage, it appears that whether because of the debt profile of the arrears countries (their debt may have been of shorter maturity and/or carried higher interest rates, or a rising share of it remained unserviced from year to year) or because of the lower growth rate of their exports, the arrears group experienced a greater deterioration in the debt service ratio in the later stages, even though the relative levels of indebtedness of both groups of members were comparable. Of course, a progressive deterioration in these non-Fund-specific financial ratios is evident for both groups of countries. For example, the debt/GDP ratio increases from 51.1 percent at the early stage to 82.1 percent at the late stage for the arrears group, and from 36.0 percent to 61.5 percent for the nonarrears group. However, the average debt service ratio of the arrears countries rises by almost a factor of three over the period, while that of the nonarrears countries rises by a factor of less than two. For the two other financial ratios, the share of a country's total debt that is in arrears and the level of reserves expressed in months of imports, the null hypothesis that the means for the two groups of countries are the same is rejected with only one exception, which is for the arrears measure at the early stage. While the share of total external debt in arrears to other creditors is relatively stable over the period for the nonarrears countries, for the arrears group it signals

³³This method assumes that the distributions of the two groups of countries with respect to the financial and economic variables approximate a normal distribution.

Table 7. Statistical Profile of Countries

(In percent)

Part I. Financial Variables	Debt	Debt Service	Arrears	Reserves	Use of Fund Credit	Fund Debt Service
	GDP	Exports	Debt	Imports (months)	Quota	Exports
	$u_A > u_{NA}$	$u_A > u_{NA}$	$u_A > u_{NA}$	$u_A < u_{NA}$	$u_A > u_{NA}$	$u_A > u_{NA}$
Alternative Hypothesis H_1 (u_A = mean of arrears group) (u_{NA} = mean of non-arrears group)						
EARLY STAGE						
Mean, arrears group (u_A)	51.1	34.8	5.6	0.9	197.9	4.1
Mean, nonarrears group (u_{NA})	36.0	25.3	3.5	2.3	82.6	1.4
Accept or reject $H_0: u_A = u_{NA}$	Reject	Accept	Accept	Reject	Reject	Reject
INTERMEDIATE STAGE						
Mean, arrears group (u_A)	65.7	54.5	12.9	1.0	221.6	7.7
Mean, nonarrears group (u_{NA})	54.8	35.2	4.9	2.1	100.4	2.5
Accept or reject $H_0: u_A = u_{NA}$	Accept	Reject	Reject	Reject	Reject	Reject
LATE STAGE						
Mean, arrears group (u_A)	82.1	91.8	19.7	1.0	178.7	8.8
Mean, nonarrears group (u_{NA})	61.5	47.6	4.6	2.6	89.6	3.5
Accept or reject $H_0: u_A = u_{NA}$	Accept	Reject	Reject	Reject	Reject	Reject

Table 7 (concluded). Statistical Profile of Countries

(In percent)

Part II. Economic Variables	<u>Fiscal Balance</u>	<u>Current Account</u>	<u>Per Capita Income</u>	Economic Growth Rate
	GDP	GDP	(PPP-based, US\$)	
	$u_A < u_{NA}$	$u_A < u_{NA}$	$u_A < u_{NA}$	$u_A < u_{NA}$
Alternative Hypothesis H_1 (u_A = mean of arrears group) (u_{NA} = mean of non-arrears group)				
EARLY STAGE				
Mean, arrears group (u_A)	-8.2	-6.8	2,145	-4.8
Mean, nonarrears group (u_{NA})	-6.4	-8.6	4,097	-0.1
Accept or reject H_0 : $u_A = u_{NA}$	Accept	Accept	Reject	Reject
INTERMEDIATE STAGE				
Mean, arrears group (u_{NA})	-7.9	-6.0	1,959	-5.4
Mean, nonarrears group (u_{NA})	-7.1	-5.2	3,834	-1.1
Accept or reject H_0 : $u_A = u_{NA}$	Accept	Accept	Reject	Reject
LATE STAGE				
Mean, arrears group (u_A)	-9.7	-5.1	1,731	-3.8
Mean, nonarrears group (u_{NA})	-7.7	-3.8	3,788	-0.4
Accept or reject H_0 : $u_A = u_{NA}$	Accept	Accept	Reject	Accept

a progressive deterioration in repayment behavior vis-à-vis all creditors, doubling from the early to the intermediate stage, and then increasing by another 50 percent between the intermediate and late stages.

For both of the Fund-specific financial measures, use of Fund credit/quota and current Fund obligations/exports, the null hypothesis that the means of the two groups are the same is consistently rejected. The average ratio of Fund credit to quota for the arrears group is about twice as high as that for the nonarrears group at every stage, e.g., 221.6 percent versus 100.4 percent at the intermediate stage. This measure of Fund indebtedness is relatively stable for both groups of countries over time, unlike the progressive increase in the measure of indebtedness to all creditors (i.e., debt/GDP), which likely partly reflects the Fund's access limits policy. In contrast, the Fund debt service ratio rises rather sharply from the early to the intermediate stage for both groups of countries, albeit from a relatively low level in the case of the nonarrears countries (from 4.1 percent to 7.7 percent for the arrears group, and from 1.4 percent to 2.5 percent for the nonarrears group).

The results for the macroeconomic variables are diverse. For two of the economic indicators, the fiscal balance and the current account balance, the null hypothesis is accepted at every stage. Thus, the two groups of countries are not distinguished by these summary indicators of countries' internal and external macroeconomic balance. For the other two macroeconomic variables, the level of per capita income and the measure of economic growth, the null hypothesis is rejected with only one exception, which is for the growth variable at the late stage. The group of countries that eventually evidenced Fund repayment problems had an average per capita income that was about half that of the nonarrears group at every stage, and the average rate of real economic growth for the arrears countries at the three stages was between about -4 percent and -5 percent, while for the nonarrears country it ranged from about 0 percent to -1 percent.

B. Political Environment

Political factors appear to play a large role in the Fund's more recent arrears experience. If one considers the 12 countries with protracted arrears as of November 30, 1992 (i.e., preceding the dissolution of the former Socialist Federal Republic of Yugoslavia (SFRY) and the recognition by the Fund of five successor states), two were countries experiencing conditions of civil war that amounted to a virtual cessation of functioning governments (Liberia and Somalia), four were experiencing marked internal instability (the Democratic Republic of the Congo, Peru, Sierra Leone, and Sudan), three were under international economic sanctions (Haiti, Iraq, and the former SFRY), another faced bilateral sanctions (Vietnam), and one had a government operating under the aegis of the United Nations (Cambodia). Thus, 11 of the 12 countries with arrears as of end-November 1992 could be said to have had a markedly troubled political environment (the exception being Zambia). However, to extend this "snapshot" observation to the Fund's overall experience with arrears requires more investigation. Ideally, the role of political factors in contributing

to arrears should be assessed by comparison with the political situations of countries that maintained timely payments to the Fund. Also, the political environment in the period leading up to and at the emergence of arrears to the Fund should be considered. Because the objective measurement and quantification of political risk, compared to financial or economic risk, presents particular difficulties, three different assessments of countries' political environment were undertaken.

First, the political situations of the arrears and nonarrears countries during the period 1980 to 1992 were compared with regard to the manifestation of certain political events or circumstances. This approach is a simplified adaptation of a methodology used in the literature on political risk in which adverse or irregular political events are defined, and their occurrence recorded, using cross-national data.³⁴ A yearbook of world events³⁵ was used to determine whether a country was reported as having experienced (1) civil unrest directed against the government (e.g., in the form of strikes or riots), (2) conditions of civil war, or (3) frequent or sudden changes of government at the executive or ministerial levels.

While the alternative hypothesis that the arrears countries experienced more instability was accepted for the civil unrest and civil war indicators and rejected for the frequent or sudden changes of government indicator, the starkest result of this analysis was that both the arrears and nonarrears countries were reported as experiencing a high frequency of political instability.

The second approach to characterizing countries with regard to their political circumstances relies on a political risk indicator (PRI) published by a private firm that specializes in country risk analysis.³⁶ The indicator is compiled for both industrialized and developing countries and ranges from 0 (most risky) to 100 (least risky). It is based on ratings with respect to 12 factors that include, inter alia, external conflict risk, civil war risk,

³⁴Euh (1979) provides a review of the measurement of political instability, noting that while the operational definition of political instability can vary from country to country, the following actions are generally considered to be political irregularities: demonstrations, strikes, riots, politically motivated assassinations, coups d'etat, revolts, guerrilla activity, civil wars, and revolutions. See Euh (1979), Brewer and Rivoli (1990), and Li (1992) for applications of the methodology described above to empirical studies of creditworthiness.

³⁵*The Europa World Year Book 1992* (1992).

³⁶See *International Country Risk Guide* (various issues).

corruption in government, political party development, and quality of the bureaucracy. While this analysis was hampered by missing data, the average PRI for the arrears countries was not significantly higher than for the nonarrears countries.³⁷

The third approach to analyzing political conditions was undertaken to search for the existence of temporal links between a country's political circumstances and the interruption of repayments to the Fund, in the form of political events that could have had a potential impact on a country's repayments performance occurring shortly before or coincident with the emergence of arrears to the Fund. A case study-type approach was undertaken for this purpose. This approach was necessarily of a nonstatistical nature since no satisfactory method of constructing a "control" period during which to assess the political circumstances in the nonarrears countries could be determined. For each of the incidences of protracted arrears, the political situation in the country over the period 1980 to 1992 was considered, to provide a context for a more focused review. Then, political developments in the six-month period centering on the month in which Fund arrears emerged were examined to see if a political event (e.g., civil unrest or a disorderly change of government) deemed capable of contributing to a payments interruption was temporally associated with the emergence of arrears to the Fund.

The results of this analysis indicate that in about half of the 30 incidences of protracted arrears, political events that may have influenced a country's external debt repayment performance can be temporally linked to the emergence of repayment problems vis-à-vis the Fund. However, such an association could not be established precisely in many cases for the following reasons. In some cases, the countries exhibited a continuing high level of political instability during the period, but incurred Fund arrears only once or twice, of a duration that did not span all the years under consideration. Moreover, some of these countries went on to become and remain current with the Fund even while the same difficult conditions persisted. In other cases, unstable conditions had persisted for an extended period before the arrears emerged. Hence, it is difficult to identify a "turning point" when it can be judged that the cumulative impact of political difficulties finally contributed significantly to the interruption of payments to the Fund.

IV. CONCLUSIONS

The foregoing analysis has compared countries that incurred overdue obligations to the Fund over the period 1980 to 1992 with those that made timely repayments, according to a number of financial, macroeconomic, and political criteria. The results indicate that these two groups of countries appear distinguishable, ex post, with regard to a number of financial,

³⁷ The inclusion of countries in the sample for this appendix varied over time in the *International Country Risk Guide*.

Fund-specific, and macroeconomic variables, not only at the point when Fund repayment problems emerged but also several years earlier. The group of countries that would eventually evidence repayment problems to the Fund were, even about five years before these problems emerged, relatively more indebted to creditors other than the Fund and failing to service a higher share of that debt. The arrears group had reserves and per capita incomes that were only half the level of the nonarrears group, and a lower rate of economic growth. The connection between political instability and the emergence of Fund arrears, which might at first glance appear significant, is more difficult to establish with acceptable statistical confidence.

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tested in this analysis play a larger role in a country falling into arrears to the Fund than they do in cases of late payments to non-Fund creditors. For example, as pointed out in the introduction, political instability seems to play a more prominent role among the most protracted cases of Fund arrears than it does among countries with non-Fund-specific repayment problems.

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

successively longer lags of IMFARR for $IMFARR_{t-1}$. The results, which are not presented here but are available from the authors, indicate that the incremental effects on the log-likelihood statistic from including lagged IMFARR diminish as the lag lengthens (as would be expected from an autoregressive model). This result suggests that the bulk of the impact of $IMFARR_{t-1}$ on the fit of the model reflects state dependency, rather than country heterogeneity, since the latter effect would not be expected to diminish over time. Nevertheless, $IMFARR_{t-5}$ is still highly significant, and this element of persistence in the effect of repayment history may partly represent a fixed country effect.

A second test of country heterogeneity was attempted using country dummies. This test was informal because only countries for which the dependent variable changes state (from 0 to 1, or visa versa) at least once can be included in the test, so that the test suffers from sample selection bias. The country dummy results, which are not shown here but are available from the authors, indicate that eight of the 17 country dummies are significant. Four countries appear to have heterogeneous characteristics that would lead them to evidence a higher propensity for Fund arrears than would otherwise be predicted based on these countries' economic and financial explanatory variables; dummies for the four other countries suggested the reverse

C. 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 Fund 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 Fund (and may therefore either exit or remain in arrears). For example, for countries with no arrears to the Fund factors relating to current resource availability such as reserves might be important indicators of Fund repayment performance, while for countries already in protracted arrears to the Fund, low levels of reserves may be so widespread that there is not sufficient variation amongst countries and over time for this variable to significantly explain exits from arrears. Such state dependence could also be explainable in terms of the Fund's strengthened cooperative strategy for dealing with overdue obligations. In particular, countries deemed to be cooperating with the Fund in seeking a solution to their Fund arrears may benefit from the rights approach, or other procedures which, inter alia, may allow them gradually to improve their financial and economic situation; in this case, correlation between variables that signal cooperation with the Fund and the probability of exiting arrears to the Fund could result.

A. Debt Ratios Versus Macroeconomic Variables: Precursors or Symptoms of External Debt Repayment Problems?

The use of debt ratios in empirical analyses of the likelihood of arrears raises questions about whether such variables are symptoms of external debt repayment problems rather than causes. 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 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.

B. Country Heterogeneity and Repayment History

McFadden et al. (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 in the affirmative, 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 et al. (1985) and Hajivassiliou (1989) find that a large share of the variation in countries' repayment behavior—for example, 30 percent for Hajivassiliou's data base 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