If Life Sends You Lemons: Adverse Selection and Growth under IMF Programs

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Abstract

The dominant approach to studying the effects of IMF programs has emphasized moral hazard, but we find that adverse selection has more impressive effects. We propose a novel strategic selection model to study the growth effects of IMF programs, which allows for the possibility of adverse selection. We find that adverse selection occurs: the countries that are most interested in participating in IMF programs are the least likely to have favorable growth outcomes. Controlling for this selection effect, we find that countries benefit from IMF programs on average in terms of higher growth rates, but that some countries benefit from participation, while others are harmed. Moral hazard predicts that long-term users of Fund resources benefit least from participating in programs, while adverse selection predicts the opposite. Contrary to previous findings, we find that IMF programs have more successful growth performance among long-term users than among short-term users.

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As the shockwaves spread from the international financial crisis of 2008, panic selling leapt seemingly at random around the world, touching down in Russia, Indonesia and Ireland. Caught up in the jet stream of the crisis, a series of countries lined up to request balance of payments support from the International Monetary Fund, including Iceland, Hungary, Ukraine, Pakistan and Latvia, and IMF missions crossed the globe. The resulting programs promised fiscal restraint, contraction of monetary policy, exchange rate corrections and structural reforms, particularly in the heavily affected banking sector. The leaders of these countries apparently believed that IMF assistance would improve their countries' prospects for economic recovery, in spite of the resounding lack of evidence that this is the case.

The International Monetary Fund was not originally intended to promote economic growth, to engage in long-term lending, or to oversee economic reform programs. Its original purpose was to safeguard the system of fixed exchange rates foreseen under the Bretton Woods agreements by pooling resources to provide short-term balance of payments support to deficit countries. As the Fund gradually expanded its sphere of activities, however – conditionality was formally introduced in 1952, medium-term lending was established in 1974, and lending at concessional interest rates for poor countries was introduced in 1986 – it has increasingly been judged according to its success or failure at promoting economic growth. Critics argue that IMF programs in fact retard growth, either by promoting inappropriate economic policies or by creating perverse incentives. A growing concern is that long-term use of IMF resources may be particularly harmful because it creates patterns of dependency. This paper seeks to resolve the debate about the economic-growth effects of IMF programs by introducing methodological innovations.

The 2008 financial crisis illustrates the fundamental problem of assigning effects to IMF programs, which is selection bias. If not for exogenous events – the collapse of the market for mortgage-backed securities in the United States and the consequent meltdown in the U.S. stock market – it is probable that none of these countries would have turned to the IMF for assistance. Indeed, the global bubble economy that lasted through the summer of 2008 had caused demand for IMF loans to dry up, so much so that the Fund was compelled to reduce its staff for the first time in

decades to balance its books. The international market downturn that drove countries once again to seek IMF programs, however, also depressed their growth prospects because it depressed global demand. If we observe declining economic performance in these countries, therefore, it is difficult to determine what to attribute to the financial crisis and what to attribute to the impact of IMF financing and policy guidance.

Scholars acknowledged the problem of selection bias in evaluating the effects of IMF programs long before they succeeded in adequately addressing it (Goldstein and Montiel, 1986). In recent studies of IMF program effects it has become standard practice to use some kind of selection correction, whether a Heckman-type parametric selection model, an instrumental variables approach, or matching (Steinwand and Stone, 2008). Przeworski and Vreeland (2000) point out that program initiation requires the consent of two agents, a government and the IMF, and propose use of a bivariate probit model with partial observability to account for these separate decisions. We propose an alternative approach that incorporates strategic interaction into a partial observability model.

The key implication of our strategic model is that the IMF faces a problem of adverse selection (Akerlof, 1970). Countries that apply to participate in IMF programs have unobservable attributes that are correlated with their future economic performance, which might be related to the policy preferences of the government, to social instability, or to the role of the military in politics. For the sake of simplicity, we will refer to applicant governments as being either of a "good" or a "bad" type, where good governments are expected to promote growth and bad governments are unlikely to do so. The IMF need not offer support to every country that applies, but it cannot separate the worthy from the unworthy applicants, and any observable attribute that it might use to distinguish among them is correlated with the objective need for support. Meanwhile, the best candidates for successful growth are countries that choose not to apply. As a result, the pool of countries available to participate in IMF programs is skewed towards the type that is unlikely to successfully implement reforms and return to growth. Just as the best used cars are rarely offered for sale, the countries with the best growth prospects rarely approach the Fund for assistance. Those that do ask for support tend to be lemons.

Our results indicate that the poor performance of IMF programs is due to adverse selection, and that the failure to find evidence that these programs promote growth in the quantitative literature is due to the failure to adequately model this strategic selection process. We show that the countries that are most strongly interested in participating in IMF programs are in fact the least likely to grow. When we control for this selection effect, we find that IMF programs have a significant positive effect on growth. Furthermore, contrary to concerns about recidivism and long-term use of Fund resources, we find that the selection effects are mitigated and the growth effects are stronger for countries that are already participating in IMF programs. Consistent with our theory of adverse selection into IMF programs, we find that the growth effects are strongest for the countries that have participated for the longest periods of time. This suggests that the IMF gradually discovers the borrower's type by observing its compliance with conditionality and adjusts its programs in ways that compensate for the problems posed by bad governance.

Moral Hazard and Adverse Selection

The literature on IMF programs is replete with discouraging findings. In a review of 24 studies of the effect of IMF programs on growth published through 2000, Stone (2002) reports that only one found statistically significant results that supported the view that IMF programs promote growth; two found significant results that indicated that IMF programs retard growth; the rest were inconclusive. In a review of twelve studies published between 2000 and 2008, Steinwand and Stone (2008) find two statistically significant and positive results, seven significant negative results, and three inconclusive results. These studies use data sets with varying coverage and employ a wide range of methodological approaches. The results are generally discouraging, although the inconsistencies suggest that the question is not yet resolved.

Reasons offered for these disheartening findings differ. A substantial body of scholarly opinion holds that IMF programs are ineffective at promoting economic recovery and laying the groundwork for long-term growth because the IMF promotes an inappropriate mix of policies. As Ngaire Woods bluntly puts it, "There is no incontrovertible evidence that the IMF and the World Bank know what

is good for their borrowing countries" (Woods, 2006). Joseph Stiglitz argues that IMF conditionality follows a uniform pattern of macroeconomic contraction, privatization and deregulation that is inappropriate for most developing countries, and that bad economic policies are responsible for poor growth outcomes (Stiglitz, 2002). The claim that IMF conditionality follows a cookie-cutter pattern that varies little from country to country has been rejected by empirical studies, which find that it varies widely and responds to local circumstances (Ivanova et al., 2003; Gould, 2006; Stone, 2008). Nevertheless, the possibility remains that conditionality is harmful to growth. Vreeland (2003) argues that IMF programs are harmful to economic growth because countries do not participate in order to promote growth. Instead, politicians pursue IMF programs in order to redistribute income from the poor to the rich by depressing real wages. This begs the question, however, of why left-leaning governments that prefer the opposite pattern of redistribution participate in IMF programs.

A broader difficulty with arguments that attribute poor growth results to poor policy advice, however, is that conditionality is frequently not implemented. A recent IMF working paper found that 70 percent of IMF programs are interrupted at some point because of non-implementation (Ivanova et al., 2003). If so much of conditionality is not implemented, it can be difficult to determine whether poor outcomes are due to implementing harmful conditionality or not implementing beneficial conditionality. In the post-Communist countries it was the countries that followed conditionality most closely that most quickly overcame the crisis of the transition and subsequently grew most rapidly (Stone, 2002). Regardless of whether IMF programs themselves promote growth, there is substantial evidence that pursuing the type of policies the IMF promotes does promote long-term growth. IMF programs have been widely criticized for focusing on reducing inflation, but inflation is negatively correlated with growth; the effects are substantial and the results are robust.[1] Similarly, the IMF has sought to dismantle market distortions such as export marketing boards in Africa, which by all accounts have posed substantial obstacles to the economic development of

[1]Kormendi and Meguire (1985), Grier and Tullock (1989), Barro (1991), De Gregorio (1992), Roubini and Sala-i-Martin (1992). Although Levine and Renelt (1992) argue that some of these findings are not robust, other studies find that the negative effect of inflation is one of the most robust findings in the growth literature (Gylfasson and Herbertsson, 1996; Andres, Domenech and Molinas, 1996; Andres and Hernando, 1997).

those economies. Much of IMF policy advice is intended to reduce vulnerability to financial and banking crises, and when these crises occur, the consequences for growth are severe.

A more persuasive argument for the negative effects of IMF programs is the problem of moral hazard. Moral hazard is an incentive problem created by insurance: if agents do not pay for the consequences of their actions because they are insured, they have weak incentives to mitigate them. Concerns about moral hazard have been at the forefront of policy briefs that have called for reining in the Fund and restricting its activities to short-term balance of payments lending rather than long-term development and structural adjustment lending (Hills, Peterson and Goldstein, 1999; Meltzer, 2000). Three kinds of problems have been identified: currency crises, debt rescheduling, and recidivism.

Morris Goldstein argues that the Fund's engagement in long-term adjustment lending, and particularly its support for governments that were committed to defending fixed exchange rates during the 1990s, promotes moral hazard that makes crises more likely (Goldstein, 1998). If countries can rely upon the IMF as a second source of economic reserves and capital market participants come to believe that certain countries are "too big to fail" – as was often claimed for Russia and Argentina until they did fail – the incentives for governments to pursue sensible fiscal policies are weakened. Capital will flow to these countries in spite of their weak fundamentals because of the expectation that a rescue will be forthcoming if the investment climate turns stormy. Governments that benefit from these capital inflows face temptations to defend their currency pegs long after they might have otherwise abandoned them, because this allows them to put off policy adjustment. Defending fixed parities while simultaneously following inflationary policies leads to overvalued exchange rates that result in a decline of competitiveness, which hurts growth and contributes to the eventual collapse of the currency. Indeed, the debates within the Fund about how to respond to crises always balance a concern for containing financial instability with a concern about not promoting moral hazard. For example, IMF Staff and Executive Directors worried out loud and argued during the Mexican crisis in 1995 and the Asian Crisis in 1997 whether an overly aggressive response would promote moral hazard (Blustein, 2001; Copelovitch, N.d.).

The difficulty with this argument is that it presumes that the IMF provides effective insurance against market instability. The growth of IMF resources over the last six decades has not kept pace with the growth of the global economy, however, much less with the scale of international trade or the pace of global financial transactions (Fischer, 1999). The tripling of IMF resources in 2009 recognized this problem and served to regain lost ground, but did not make IMF resources adequate to deal with a crisis in a major economy. The IMF provides only a portion of a borrowing country's financing needs, which must be supplemented by other sources of official, multilateral or private financing in order to close the "financing gap," or the difference between expected capital outflows and inflows (Gould, 2006). In its record-setting bail-out of Greece in 2010, for example, over two-thirds of the necessary financing came from other eurozone members. In a sense, then, an IMF program is more like a calculated risk than an insurance policy. The empirical record is unclear as to whether IMF programs make financial crises more or less likely. There is anecdotal evidence that programs have delayed the inevitable in some cases, but there is little support for the notion that IMF support can prevent misaligned exchange rates from realigning. Breaking public exchange rate commitments, furthermore, significantly shortens a government's tenure in office, so the political incentives to avoid currency crises are potent (Cooper, 1971; Frankel, 2005; Leblang, 2005).

A second concern is that IMF activism in promoting debt rescheduling may encourage banks to lend and countries to borrow in ways that leads to excessive indebtedness, destabilization of the banking industry, and the need to additional rescheduling episodes. The IMF became deeply involved in rescheduling debt during the 1980s debt crisis, making its lending contingent on the agreement of private banks to roll over their loans (Lipson, 1985; Aggarwal, 1996). Every major debt rescheduling operation by the Paris and London Clubs is supported by an IMF program. The Korean crisis in 1997 was finally resolved by linking IMF lending to bank commitments to roll-over their loans (Blustein, 2001; Copelovitch, N.d.). Ex post, these interventions facilitate debt restructuring that is Pareto improving, since exogenous shocks can lower the value of outstanding debt and make existing contracts untenable. However, the IMF role may lower the cost of restructuring sufficiently that it encourages the unwise borrowing and lending practices ex ante that create the

problem in the first place. In addition, IMF intervention may delay the negotiations over rescheduling and transfer most of the benefits to the creditors (Bulow and Rogoff, 1990). To the contrary, some scholars argue that IMF participation in the process helps to overcome informational asymmetries by allowing borrowers to signal their commitment to repayment (Marchesi and Thomas, 1999), and lending in arrears can speed resolution of crises (Wells, 1993). Recent empirical work seems to support a positive evaluation of IMF influence over rescheduling (Easton and Rockerbie, 1999; Marchesi, 2003).

There is a fine line to be walked between stabilizing international financial markets sufficiently to promote the free flow of capital, which is a fundamental IMF purpose, and promoting unwise international lending by lowering its risks. However, the moral hazard problem is mitigated to the extent that debt rescheduling is costly. Debt rescheduling requires creditors to take a "haircut," or a nominal loss to their portfolios, and the experience of the 1980s was costly enough to cause new bank lending to the developing world to dry up temporarily in the early 1990s. Nor did governments find the rescheduling process painless. The sharp fiscal contractions that were required to service Latin American countries' debts caused a wave of regime change in the 1980s and continued to pose the most serious challenge to the survival of the newly elected governments. Debt rescheduling mitigated the costs of financial instability to some degree for creditors and debtors alike, but was not attractive enough for either party to create strong incentives to run up unsustainable debts.

A third concern is that IMF financing may reduce the incentives for governments to solve long-term structural problems that contribute to slow growth and underdevelopment. As the IMF Independent Evaluation Office evaluation of prolonged use of Fund resources concludes, "[T]he drawbacks associated with prolonged use are sufficiently serious to warrant a greater effort to reduce its extent" (Independent Evaluation Office, 2002). Bird, Hussain and Joyce (2004) argue that repeat users of IMF resources constitute an underclass of the international system that has become a clientele dependent on the IMF. "Recidivism," as they label this phenomenon, is associated with extreme poverty, weak external accounts and high levels of foreign debt. This may help to explain the extremely poor growth performance of African countries under IMF programs. Governments

are concerned with survival, and if they depend upon narrow bases of support, they will use free resources to provide private goods that keep them in power rather than public goods that promote development (Bueno de Mesquita et al., 2003). A number of studies have found that countries that have used IMF programs in the past are more likely to use them again, suggesting that recidivism is a real phenomenon (Atoian and Conway, 2006; Jensen, 2004; Pop-Eleches, 2009; Sturm, Berger and de Haan, 2005).

The problem with this view is the assumption that IMF support weakens the incentives to carry out economic reforms. Compliance with IMF conditionality is a severe problem, as we noted above, and this is nowhere more the case than in sub-Saharan Africa. Furthermore, studies of the enforcement of IMF conditionality indicate that it is politicized, which implies that the incentives for countries that benefit from intervention by important IMF shareholders to implement conditionality are weak (Stone, 2002, 2004; Pop-Eleches, 2009). Are these incentives weaker than in the absence of IMF financing, however? This seems unlikely, and has not been demonstrated by any empirical study to date. Even in Russia, where IMF influence was notoriously weak, the IMF influenced the framework of economic policy and convinced policymakers to adopt particular reforms that were politically costly to implement. On the other hand, these studies demonstrate variation in enforcement, which implies that the incentives to implement conditionality are significantly greater for weak countries that lack international influence than for countries that can rely on U.S. support. With few exceptions, countries that have been labeled recidivist are in the former category.

This paper proposes an alternative to the prevailing moral hazard view. Poor economic performance under IMF programs is due to adverse selection rather than perverse incentives. The incentives to avoid currency crises, defaults and long-term development traps are not appreciably weakened by IMF intervention, so the association between these phenomena and IMF programs is not causal. However, the participants in IMF programs differ systematically from non-participants in ways that are not easy to observe but that have significant implications for their future economic performance.

Adverse selection occurs when one partner to a transaction has private information that affects

the other partner's payoff if the transaction occurs. In the classic example, used-car sellers have better information about the value of their wares than used-car buyers. The price that buyers are willing to pay is based on their priors about this private information, so selling is unattractive to the owners of high-quality cars and attractive to the owners of low-quality cars. As a result, the distribution of quality in the cars actually offered for sale is skewed downwards, which depresses the market price. In equilibrium, therefore, mutually beneficial transactions fail to be made.

We argue that a similar problem arises in IMF programs. The potential sellers in this example are the countries that offer to implement economic reforms in return for IMF support, and the buyer is the IMF, which has difficulty separating the credible reformers from the non-credible ones. The price is the degree of conditionality imposed in the adjustment program. The IMF seeks to support successful economic reform programs and avoid failures, and from the IMF perspective, the risk of program failure is a function of the government's type – its level of commitment to economic reform – and of the degree of conditionality. Multiple binding policy conditions that specify detailed procedures rather than general targets increase the likelihood of identifying and preventing policy slippage, but make the program more intrusive and politically risky from the perspective of the borrower.

The problem is that the IMF imposes a relatively high price of participation because it is uncertain of the type of its borrowers. If all of the Fund's borrowers were committed reformers, it could offer less constraining programs, which all of the countries would be willing to accept. Because many potential borrowers are not committed to reform, however, the IMF offers conditionality packages that are intrusive and constraining. This interpretation is consistent with the marked increase in conditionality that occurred in the 1980s – the average number of performance criteria climbed from 7 between 1974 and 1982 to 12 between 1983 and 1990 – as lending expanded in Latin America and Africa (Gould, 2006). Some of the committed types are unwilling to participate when conditionality is intrusive, so the distribution of borrowers is skewed towards the type of government that is not committed to implementing reform. Three factors exacerbate the adverse selection problem: enforcement problems, vulnerability, and capital market expectations.

If IMF programs were enforceable contracts, it might be possible for the IMF to screen potential borrowers by offering schedules of conditionality that ensured that only committed reformers would participate. However, the IMF's only instrument to ensure compliance is to withhold installments of financing, or tranches, and it finds it difficult in practice even to do that for long. Consequently, the borrowers that find IMF conditionality most costly are the ones that actually intend to implement the promised reforms, and the ones that have no such intention find it relatively costless to agree to the IMF's terms. Rather than resolving the IMF's information problem, strategic screening exacerbates it and strengthens the tendency of the worst candidates to step forward.

Second, it might be possible to screen out the less committed if it were the case that committed reformers had greater need for IMF support than faux reformers. The opposite is the case, however. Among the key variables that are difficult for the IMF to observe are the level of usable international reserves (which potential borrowers often disguise through elaborate accounting tricks) and the vulnerability of the domestic banking sector. Poor values on these variables make borrowers highly vulnerable to international financial shocks and therefore eager to participate in IMF programs to shore up their weak external accounts. Governments that underreport their vulnerability, however, are unlikely to be committed reformers, so those countries that are more vulnerable than they seem are likely to be poor candidates for IMF programs.

Third, if committed reformers stood to gain more from participating in IMF programs than other countries, they might tend to apply for programs at higher rates. One such argument that the Fund routinely makes is that IMF programs represent a "seal of approval" for a government's policies, which catalyze private capital flows. By implication, the IMF has superior information that allows it to separate worthy from unworthy borrowers and convey this information to capital markets. However, the recent quantitative literature is virtually unanimous in finding that IMF lending does not catalyze private capital flows (Bird and Rowlands, 2002; Eichengreen, Gupta and Mody, 2006; Jensen, 2004). Instead of representing a "seal of approval," an IMF program appears to signal to markets that a crisis is looming. Instead of promoting capital inflows, IMF programs provide opportunities for private investors to get their capital out of the country on favorable

terms. Once again, this suggests that the best-managed countries should avoid IMF programs, which may sour their capital markets, and that the countries that have the least to lose from accepting assistance are those that have limited access to private international capital markets in any case.

The above argument leads to three testable hypotheses. First, a selection model that allows for the possibility of strategic adverse selection should find that countries that are most interested in participating in IMF programs are the worst candidates for growth. Second, if adverse selection rather than moral hazard accounts for the negative correlation between participation in IMF programs and growth, a selection model that controls for adverse selection should show that the effects of IMF programs are beneficial for growth. Finally, a further implication of the adverse selection view is that – contrary to the critique of recidivism – prolonged use of IMF resources should be more beneficial than short-term use, because over a longer time horizon the IMF is able to screen countries and determine which are willing to commit to policy reform, gradually mitigating the problem of asymmetric information that lies at the heart of the IMF's performance problem.

Method

It has long been recognized that the fundamental empirical problem in assessing the effects of IMF programs is selection, although initial contributions were agnostic as to whether selection made the IMF's effects appear more or less beneficial than they really were (Goldstein and Montiel, 1986). IMF programs are not applied at random, so the sample of program participants differs in systematic ways from the sample of non-participants. This means that any comparison of the two groups may be subject to selection bias (Heckman, 1979). The effects of the bias can be mitigated by using parametric selection-correction or non-parametric matching techniques, and the choice should depend on theoretical expectations about whether selection occurs on observable or unobservable factors. A parametric approach is preferable if we have strong priors about the selection mechanism, particularly if selection is primarily on unobservable factors such as the government's commitment to reform, as argued here. Since our model provides us with expectations about the functional form

of the strategic interaction between the IMF and borrowing countries, exploiting this information improves the efficiency of our estimates.

Assuming that we have data on growth rate (Y), IMF program status (P), and a set of factors that we believe to affect growth rates (X), the first model specification that comes to mind is:

$$Y_i = X_i\beta + \delta P_i + \epsilon_i \tag{1}$$

where ϵ is the error term capturing unobserved factors affecting growth rates of countries, normally distributed with mean zero and variance σ^2_ϵ. This specification makes several important assumptions: first, it assumes that program status affects growth only by changing the intercept, and the effects of the other regressors are unchanged. Second, the assignment of IMF programs to countries is assumed to be random, or not correlated with the dependent variable. If these assumptions are satisfied, this model can be estimated via ordinary least squares (OLS) regression. The second assumption is likely to be violated, however, since IMF programs are not sought and signed randomly, and unobservable factors determining selection into an IMF program are likely to be correlated with unobservable factors affecting growth levels. If such a correlation exists, estimating equation 1 with OLS will result in biased estimates. To deal with this selection problem, we model growth with a "switching regression" growth model described in Maddala (1983):

$$Y_{1i} = X_{1i}\beta_1 + \epsilon_{1i} \quad \text{iff} \quad P = 1 \tag{2}$$

$$Y_{2i} = X_{2i}\beta_2 + \epsilon_{2i} \quad \text{iff} \quad P = 0 \tag{3}$$

where Y_{1i} represents the growth rate for countries that are under a program in a given year, and Y_{2i} represents growth countries not under a program. To estimate the effect of IMF programs on growth, we need to ask the counterfactual question, "what would the growth rate of a participating country have been, had that country not participated in an IMF program"[2]. We consider two

[2]This is the well-known treatment effects problem that has been utilized widely in the econometrics literature, and discussed in Maddala (1983), Greene (2003), and Cameron and Trivedi (2005).

alternative specifications of this counterfactual that are discussed in Maddala (1983) and Cameron and Trivedi (2005): In the first one, the *gross program benefit* participant i can be calculated as

$$GB = Y_{1i} - E(Y_{2i}|P = 1) \tag{4}$$

where we calculate the difference between the observed growth rate of a country under a program and the predicted counterfactual growth rate that would have resulted had that country not been under a program. Second, the estimated expected benefit from an IMF program for participant i is

$$EB = E(Y_{1i}|P = 1) - E(Y_{2i}|P = 1) \tag{5}$$

where we calculate the predicted difference between the growth rates of the country when under and, counterfactually, not under a program.

If selection into programs is not random and is correlated with ϵ_i, the error term of the growth equation, running two OLS regressions to estimate equations 2 and 3 will not result in accurate estimates due to selection bias. We need to calculate appropriate corrections for expectations $E(\epsilon_{1i}|P = 1)$ and $E(\epsilon_{2i}|P = 0)$.

We use a parametric technique because we want to test for the presence of a particular type of selection effect: strategic adverse selection (Akerlof, 1970). Two reasons justify this choice. First, if the source of selection bias is adverse selection due to the private information unobservable to the IMF and to us as analysts, a matching approach that corrects selection based on observable factors will fail to capture this. Second, the interaction between a government and the IMF is strategic: the problem from the IMF's perspective is that some of the countries that it would like to support do not apply, so it never has the opportunity to offer them support. This suggests a particular strategic form to estimate, which is illustrated in Figure 1, below. The potential borrower moves first, deciding whether to apply for IMF support or not, and applies if the expected utility of applying (and possibly being rejected) exceeds the utility of non-participation. The IMF then

decides whether to approve or reject the applicant based on observable factors, conditional on its interim expectation about the set of countries that apply.[3]

[Figure 1 about here.]

Strategic Probit with Partial Observability

In this section, we develop a strategic probit model with partial observability to model selection into IMF programs. This estimator incorporates the strategic interaction hypothesized by our theory into the likelihood function to be estimated, which should improve the efficiency of our results and remove any bias due to strategic misspecification (Signorino, 1999; Signorino and Yilmaz, 2003). We argue that when deciding to seek an agreement with the IMF, the government takes into account the IMF's probability of signing an agreement, and makes a decision strategically based on its expectations about what the IMF will do. This interaction is represented in Figure 1. It is assumed that both the government and the IMF have utilities associated with the outcomes resulting from their choices, and the following two latent equations together determine selection into IMF programs:

$$G^*_{SP} = p_{sign}U_G(Prog) + (1 - p_{sign})U_G(Decl) - U_G(NoApp) + \varepsilon_G \quad (6)$$

$$I^*_{SP} = U_I(Prog) - U_I(Decl) + \varepsilon_I \quad (7)$$

where ε_G and ε_I are normally distributed random variables[4], and p_{sign} is the IMF's probability of agreeing to an agreement with government, estimated using equation 7. The government's and the IMF's utilities are modeled with explanatory variables. We only observe a program when both the

[3] In practice, rejection takes the form of insisting on the adoption of conditions that the borrower is unwilling to fulfill, but in that case the analyst observes only non-participation.

[4] We use the agent error specification of Signorino's (1999) strategic probit. To make estimated coefficients comparable to the bivariate probit specification, one needs to either assume that the stochastic components associated with IMF and Government's expected utilities have standard errors equal to $1/\sqrt{2}$, or be aware that the estimated coefficients represent an estimate for the actual coefficients scaled by $\sqrt{2}\sigma$. This is akin to the problem of unidentified error variance in a probit model, where scholars either assume that $\sigma = 1$ or estimate βs scaled by σs.

government and the IMF are willing to sign one. In other words,

$$\begin{aligned} Pr(P=1) &= Pr(G^*_{SP}>0, I^*_{SP}>0) \\ Pr(P=0) &= 1 - Pr(G^*_{SP}>0, I^*_{SP}>0) \end{aligned}$$

and this results in the following expectation for countries that are under an IMF program:

$$\begin{aligned} E(Y_1|P=1) &= X_1\beta_1 + E(\epsilon|G^*_{SP}>0, I^*_{SP}>0) \\ &= X_1\beta_1 + \rho_G\sigma_\epsilon\lambda^{SP}_G + \rho_I\sigma_\epsilon\lambda^{SP}_I \end{aligned} \tag{8}$$

where $\lambda^{SP}_G = \frac{\phi(\hat{G}^*_{SP})}{\Phi(\hat{G}^*_{SP})}$ and $\lambda^{SP}_I = \frac{\phi(\hat{I}^*_{SP})}{\Phi(\hat{I}^*_{SP})}$. For countries that are not under an IMF program, if we assume that the country did not choose to apply for a program, the expected growth rate is:

$$\begin{aligned} E(Y_2|P=0)) &= X_2\beta_2 + E(\epsilon|G^*_{SP}\leq 0) \\ &= X_2\beta_2 + \rho_G\sigma_\epsilon\lambda^{SP}_{\sim G} \end{aligned} \tag{9}$$

where $\lambda^{SP}_{\sim G} = \frac{-\phi(\hat{G}^*_{SP})}{1-\Phi(\hat{G}^*_{SP})}$. If, instead, the government wanted to participate in a program but was unable to reach an agreement with the IMF,

$$\begin{aligned} E(Y_2|P=0)) &= X_2\beta_2 + E(\epsilon|\{G^*_{SP}>0, I^*_{SP}\leq 0\}) \\ &= X_2\beta_2 + \rho_G\sigma_\epsilon\lambda^{SP}_G + \rho_I\sigma_\epsilon\lambda^{SP}_{\sim I} \end{aligned} \tag{10}$$

where $\lambda^{SP}_{\sim I} = \frac{-\phi(\hat{I}^*_{SP})}{1-\Phi(\hat{I}^*_{SP})}$.

We use the estimated probabilities for each observation from the strategic probit model to decide whether to use equation 9 or 10 to calculate the growth effects of participating in an IMF

program. This approach is superior, for example, to assuming that none of the countries that are not participating in programs applied for support, or that all applied but were rejected. Assigning countries to the most likely case takes advantage of the information we have about country choices from the strategic selection model, and allows us to estimate the differences between these two theoretically distinct groups of countries, which would otherwise bias our results. Furthermore, this allows us to directly test our adverse selection hypothesis.

Dynamic Aspects of IMF Programs and Temporal Dependence. As Vreeland (2003) argues, the processes that determine program participation may depend on whether a country was already under a program in the previous year. We therefore separate the decisions to enter a new program spell and to continue to participate in a program, and estimate the transitions from one state to the other as a dynamic process. We also correct for the potential effect of program duration for countries that are under a program, and non-program duration for countries that consider entering into a brand new program. To model the potentially nonlinear and non-monotonic effects of the two duration variables, we include a set of spline variables into the IMF's and Government's decisions.[5]

Penalized Maximum Likelihood Estimation. To estimate the strategic probit model with partial observability, we employ a penalized maximum likelihood estimation (PMLE) approach. PMLE is first introduced by Firth (1993) as a small sample bias reduction method in maximum likelihood models. It is later offered as a solution to separation and quasi-complete separation problems in binary response models where maximum likelihood estimates either do not exist or are problematic (Heinze and Schemper, 2002; Zorn, 2005). PMLE works by introducing a 'penalty' term to the likelihood function that asymptotically disappears. This penalty term acts as a Bayesian prior on the coefficients, and keeps the estimates from approaching infinity when separation is an

[5]See Beck, Katz and Tucker (1998) on the use of splines in controlling temporal dependence in limited dependent variable models.

issue.[6] The penalized likelihood function we maximize is equal to

$$L_{PMLE}(\beta|P) = L_{MLE}(\beta|P)|I(\beta)|^{\frac{1}{2}} \tag{11}$$

Where $I(\beta)$ is the information matrix (Firth, 1993; Zorn, 2005). The reason we use this approach in estimating the selection model is that we were unable to calculate the MLE estimates of the parameters in some of the specifications for countries that are already under an IMF program, due to the small sample size and the complexity of the partial observability likelihood function.

Results and Discussion

Table 1 presents estimation results from three models of program participation. The first model, a bivariate probit maximum likelihood estimation (MLE) model with partial observability, is a replication of the model estimated by Vreeland (2003). This is a dynamic model that differentiates between decisions to initiate an IMF program and to remain under an existing program by estimating two sets of coefficients. This model does not incorporate the strategic aspect of program participation, however, and we present it here for comparison purposes.

[Table 1 about here.]

The second model in the table is our first attempt to incorporate the strategic interaction that we argue is inherent in IMF program participation. In this strategic probit MLE model, a government's decision to apply for a program is a function of its expectation about the likelihood that the IMF will agree to such a program. This model has a limited ability to differentiate between program initiation and continuation, as the fully dynamic strategic probit model that estimates completely different coefficients for initiations and continuations does not successfully converge. To model the dynamic aspect in this model, we instead include a lagged program participation dummy variable and interact it with some of the regressors. In this specification, we also include splines to control

[6] For the exponential family link functions, the penalty term is equivalent to Jeffrey's Invariant Prior (Firth, 1993; Zorn, 2005)

for duration effects. We also present the results of this model for comparison purposes.

Our preferred model is Model 3, which incorporates both the strategic and dynamic aspects of program participation into our empirical model, while also controlling for temporal dependence using splines. To deal with the convergence problems of the MLE estimators common in partial observability models, we use the penalized maximum likelihood estimator (PMLE) that we discuss in the previous section.[7] Because of its stability and its ability to model the strategic, dynamic and temporal aspects at once, we use this model to calculate the selection corrections used in the growth equations estimated below.

The results of our strategic selection analysis are qualitatively quite similar to the bivariate probit results, although we find no significant effect of the number of years a country has spent under IMF programs or of the number of countries currently participating in such programs on government decisions to apply. Otherwise, both specifications find that countries are more likely to enter when they have low levels of reserves, high fiscal deficits and daunting debt service burdens. In addition, low levels of investment and recent elections make governments more interested in applying for IMF programs. Furthermore, both specifications find that the IMF is more willing to support countries with large balance of payments deficits in absolute terms – that is, imbalances that might be systemically disruptive – and are less willing to extend support when its resources are stretched thin by many other borrowers. This similarity of results is reassuring. We confirm that it is important to distinguish between decisions to enter and decisions to remain under IMF programs, because the pooled model (S2) fails to capture the effect of reserves on the government decision, and fails to capture the opposite effects of the balance of payments and of the number of countries participating on IMF decisions to approve initial programs and to renew them for additional years. Our estimates make use of a more appropriate functional form than bivariate probit and are more precise, however, so they provide a stronger basis for investigating the selection-corrected effects of IMF lending on growth.

[7] Out of 444 countries that are already under a program, only 61 of them fail to stay in the program in a given year. Due to this unbalanced nature of the dependent variable, and the demanding likelihood function of the partial observability model, both the bivariate probit and strategic probit MLE were quite fragile in estimating the decision to remain in a program, with coefficient estimates approaching infinity in many specifications.

To illustrate the substantive implications of our selection equation, in Figure 2 we graph the effects of variables that capture vulnerability to financial crises on governments' decisions to apply for IMF support: central bank reserves, fiscal balances (surplus/deficit) as a percentage of GDP, debt service as a percentage of GDP, and the balance of payments in billions of U.S. dollars. Each variable is normalized by its standard deviation to make the magnitudes comparable, and all other variables are held at their means. As central bank reserves increase, the probability that a government applies for a program steadily declines from about .85 at two standard deviations below the mean to .5 at two standard deviations above. Even more dramatically, when budget balance is below the mean value for IMF program years, the probability of applying for a program is close to one, and it drops precipitously as deficits shrink. As debt service ratios rise from one standard deviation below the mean to one standard deviation above, the probability of applying for an IMF program rises from about .15 to about .9. Each of these effects is quite pronounced, but because crisis variables tend to move in tandem – deficits, debt service ratios, balance of payments crises and dwindling reserves are linked through direct effects and market expectations – the total effect of financial crises largely determines government choices to apply for support.

[Figure 2 about here.]

The effect of the balance of payments on government choices is indirect; it does not appear in our government application equation. We assume, in fact, that the government is not concerned with the absolute size of its balance of payments, but worries instead about variables that are normalized by GDP and of more immediate policy concern. However, the benefit of estimating a strategic selection model is that we can identify the way in which a government's decision to apply for a program depends upon its expectations about whether the IMF will approve one. The IMF's decision is strongly affected by the applicant country's balance of payments, especially when the applicant is an important player in the international economy. Consequently, as the balance of payments deteriorates, countries are more likely to be approved. Indeed, countries that are not running payments deficits are highly unlikely to be granted an IMF program. We find that on average countries prefer not to apply rather than to apply and be rejected. As a result, the

probability of applying increases as the balance of payments deficit rises. The effect is monotonic, but is steepest in the vicinity of the mean, because the probability of IMF approval of a program changes sharply in that region.

Having analyzed the determinants of program participation, we are now in a position to analyze program effects. Table 2 presents the results of our growth regression. Under each coefficient value, p-values are reported in parentheses. The table includes three models: the first model includes program status as an independent variable and is not corrected for selection bias. This model also assumes that the effects of the other regressors in the model are the same for countries that are under and not under a program. Model 2 relaxes this assumption and estimates separate regressions for participants in IMF programs and non-participants. This model also includes selection corrections for the IMF's and the Government's decisions to enter into a program. The selection corrections are calculated from the strategic selection model presented in Table 1. Since it is impossible to observe whether non-participant countries applied for IMF programs, we use predicted probabilities to choose the proper selection correction for non-participants. Finally, Model 3 includes all of the regressors in Model 2 as well as lagged growth and a set of spline variables. In this model, the 'under' case includes four splines for program duration, and the 'not under' specification includes five spline variables for the duration of episodes without an IMF program.

[Table 2 about here.]

We estimate that the average country enjoyed higher growth under an IMF program than it would have had it not participated. The estimated average benefit a country derives from an IMF program is 0.52 percent annual GDP growth. According to our estimated expected benefit criterion, which compares predicted growth under programs to counterfactual predicted growth without participation, countries that participated in IMF programs are predicted to have benefited from the program in 394 out of 465 country-years. Similarly, based on the gross benefit criterion, which compares actual growth rates to counterfactual predicted rates without program participation, countries that participated are estimated to have benefited from participating in an IMF program in 322 out of 465 country years. The average expected benefit is the same under both

criteria, because the error term averages to zero. Table 3 cross-tabulates the sign of the estimated benefit of an IMF program with the sign of the growth rate that program countries achieved. Of the 318 cases in which countries had positive growth under IMF programs, we estimate a positive effect of the program in 298, or in 94 percent of cases. In the 147 cases where GDP declined under IMF programs, we estimate a negative effect of the program in 51, or in 35 percent of cases. In the other 65 percent of cases where GDP declined, our model estimates that the IMF program nevertheless exercised a positive effect. This indicates that the negative simple correlation (-.17) between participating in an IMF program and growth is caused by selection.

[Table 3 about here.]

Figure 3 presents these predicted values in the form of a histogram. There are a number of country years in which IMF programs are predicted to have negative effects, but the mass of the predictions lies in positive territory. There is significant dispersion of effects around the mean, which indicates that IMF programs have highly variable effects. Indeed, although the focus in the literature has been on establishing whether the mean effect of IMF programs is positive or negative, the variability of IMF program effects suggests that explaining the variation in these effects is more important. We turn to this issue next.

[Figure 3 about here.]

We argued above that the poor overall performance of IMF programs is due to adverse selection: countries that earnestly desire to participate in programs tend to be poor candidates for economic reform packages, and the countries that would be likely to succeed in implementing reform are least inclined to participate. We are now in a position to assess this claim quantitatively by comparing countries' propensity to participate in IMF programs with their expected program benefits. Figure 4 presents a quadratic regression fit of the estimated growth benefit on the estimated probabilities that the IMF and the government, respectively, consent to participate in a program. The figure shows a negative relationship between the government's estimated probability of seeking a program

and the estimated growth benefit that it receives from one. This supports our adverse selection hypothesis: the countries that are most interested in participating in IMF programs are the least likely to have favorable growth outcomes. The probability that the IMF approves a program does not appear to have a similar effect.

[Figure 4 about here.]

Figure 5 presents the estimates underlying the adverse selection conclusion in the form of a scatter plot, which captures the same curvilinear relationship. Countries such as Fiji in 1974, Gambia in 1977, Thailand in 1978, and Uruguay in 1975 were highly unlikely to apply for IMF programs, yet did so anyway, and were in strong positions to implement reforms and grow. Other countries, such as the Philippines in 1983, Gambia in 1982, Bulgaria in 1974 and Nicaragua in 1979, were desperate enough that applying for IMF support was virtually unavoidable, and they received negligible benefits or suffered severe economic declines under IMF programs. Table 4 presents a list of program-years with associated probabilities that the government applies for a program, that the IMF approves one, the estimated growth benefit from an IMF program and the observed growth rate. High probabilities of applying were associated with negative growth benefits and in most cases with economic decline, while low probabilities of applying were associated with steadily rising economic benefits from IMF programs that usually implied economic growth.

[Figure 5 and Table 4 about here.]

We can further unpack the selection effect by investigating the indirect effects on growth of factors that make countries more likely to participate in IMF programs. Our model estimates that variables that measure the severity of a financial crisis increase the probability that a government seeks IMF assistance. Since we estimate that an increased probability of IMF program participation reduces the growth effect of an IMF program, we can attribute some of the reduced growth effect to those variables. Figure 6 graphs central bank reserves, debt service as a percentage of GDP, and the budget balance (surplus/deficit) as a percentage of GDP against the estimated effect of an

IMF program. Countries with debt service two standard deviations below the mean for program participants enjoy the greatest benefits from IMF programs, and these benefits turn negative when debt service nears one standard deviation above the mean. Similarly, holding other variables at their means, countries with substantial budget deficits suffer reduced growth under IMF programs, but the expected benefit becomes positive for countries that run unusually large surpluses. Countries with strong foreign reserves expect to benefit from IMF programs, but the benefits disappear for countries with unusually low levels of foreign reserves. In each case, variables associated with the severity of financial crises motivate countries to seek aid from the IMF, but countries with weaknesses of these sorts are unlikely to perform well under IMF programs.

[Figure 6 about here.]

A few cases drawn from our data help to illustrate the logic of our model and spell out the indirect substantive effects on growth exercised by variables that affect participation in IMF programs. The Philippines participated in IMF programs in 1973 and in 1983, in both cases under the authoritarian regime of Ferdinand Marcos, who declared martial law in 1972. However, the Philippines acquired vulnerabilities between 1973 and 1983 that made it much less likely to perform well under an IMF program, and only some of these were visible to the visiting IMF Mission. In 1973 we estimate a moderately low probability of 31 percent that the Philippines would choose to participate in an IMF program, and we estimate a benefit from program participation of 1.93 percent of GDP. The Philippines was in a position to perform well economically in 1973 because it was not highly indebted, and it enjoyed rapid growth during the 1970s that was financed by substantial capital inflows. However, the Marcos regime was very corrupt – Marcos himself is estimated to have embezzled some 15 billion dollars – and political stability was undermined by repression and social unrest. Marcos declared an end to martial law and prevailed in an election held in 1981, but only by engaging in overt fraud, and the major opposition parties boycotted the election. In 1982 the Philippines was one of few Asian countries that was swept up by contagion from the Mexican Peso crisis because it had run up substantial dollar-denominated debt. The Philippines' economic indicators had deteriorated by 1983, and we estimate a probability of 99 percent that the Philip-

pines would turn to the IMF for support. The deficit rose from 2.2 percent of GDP in 1973 to 4.9 percent of GDP in 1983, debt service increased from 4.7 percent of GDP to 9.5 percent, the balance of payments moved from a surplus of 47 million dollars to a deficit of 69 million, and central bank reserves dropped from 4.3 months of imports to 1.8 months. Consequently, we estimate a program benefit of only 0.05 percent of GDP growth. Marcos was eager to obtain IMF financing to shore up his political fortunes, which were deteriorating as a result of his economic mismanagement. Only five months after signing a program with the IMF, Marcos apparently ordered the assassination of the opposition leader Benigno Aquino, which triggered a series of demonstrations that culminated in his removal from power in a peaceful popular uprising in 1986.

Gambia participated in IMF programs in 1977 and 1982, and again this was a case in which financial variables deteriorated in the interim. Gambia was a stable constitutional democracy in 1977 led by President Dawda Jawara, who won reelection five times. Gambia had strong financial variables in 1977, and we estimate that this was a surprising IMF program – the probability that the government would choose to participate in a program was under one percent – and consequently the expected benefit was a robust 5.8 percent of GDP. In 1981, however, a coup attempt destabilized the country and was only put down after Senegal intervened. This appears to be a truly exogenous event: the coup took place in July 1981, when a leftist rebel, Kukoi Sanyang, took advantage of the fact that Jawara was in London to attend the wedding of Prince Charles and Lady Diana. During the crisis, the deficit rose from 2.7 percent of GDP to 12.3 percent and reserves fell from 3.3 months of imports to approximately one week. As a result, the restored Jawara government was desperate for IMF support: we estimate a 99 percent chance of applying for a program in 1982. Under circumstances of high demand for support driven by political instability, the IMF loan had an estimated effect of reducing GDP by 0.3 percent. The Gambian economy continued to grow at a 1.4 percent rate in 1982 but collapsed in 1983, suffering a decline of 14 percent of GDP. Gambia formed a short-lived confederation with Senegal, but its political stability was shaken, and another coup overthrew the democratic regime in 1994.

While these illustrations suggest that the effects of initiating IMF programs depend upon political context and exogenous crises that compel countries to turn to the Fund for support, there is an important thread in the literature that argues that long-term use of IMF resources is responsible for their poor track record. To the contrary, however, it could be the case that IMF programs exercise more positive effects over time, since stabilization involves a trade-off of short-term adjustment for long-term performance and structural reforms take time to bear fruit. In order to investigate the dynamics of how IMF programs affect growth rates over time, we estimated Model 3 with a lagged dependent variable and a series of splines, which are not reported in Table 2. Using the spline variables in Model 3, we can plot the potentially nonlinear effect of program duration on growth. The resulting marginal effect curve is presented in Figure 7. For this plot, we fixed the rest of the regressors to their mean values.[8] The figure shows that the effect of program duration for countries under a program is significant and positive. This indicates that IMF programs have their most positive effects on growth after a country has already participated in programs for several years. The increase in the benefit of participating in a program is quite pronounced in the first couple of years, as demonstrated by the steepness of the curve, and the change due to duration gradually decreases. After the first three years, the growth effect of remaining in IMF programs reaches a plateau. These results contradict arguments about the harmful effects of recidivism, which claim that prolonged use of IMF resources is harmful for growth. To the contrary, we find that IMF programs have more successful growth performances among long-term users (3+ years) than among short term users (0-3 years). This is consistent with the argument that the IMF gradually accumulates experience with its borrowers that allows it to overcome information asymmetries and adjust conditionality to overcome governance problems.

[Figure 7 about here.]

[8]Since our growth model is linear in regressors, fixing the other regressors to other values shifts the plotted curve up or down.

Conclusions

We argue that IMF programs appear to prevent rather than promote economic growth because they suffer from adverse selection. The countries that offer the best prospects of successfully implementing IMF programs are least likely to apply. When the selection process is modeled in a way that explicitly allows for the possibility of adverse selection, the results demonstrate that IMF programs generally have beneficial consequences for growth. The results are statistically significant and substantively important, and indicate that, contrary to the received wisdom, the IMF is in fact an important agent that promotes economic development.

Our results, furthermore, have implications for an on-going debate within the Fund and outside about the policy implications of long-term use of IMF resources. Countries that use IMF resources are more likely to use them repeatedly, and the countries that do so include some of the poorest and worst-managed economies in the world. Using the standard logic of moral hazard, scholars and policy analysts have concluded that long-term use of Fund resources is detrimental to the development of these countries, and have encouraged the Fund to limit itself to its original purpose of providing short-term balance of payments assistance rather than long-term development assistance. The logic of adverse selection suggests the opposite analysis: repeat users of IMF programs would have had poor economic performance without programs as well, but the opportunity to interact with them repeatedly allows the Fund to overcome its information disadvantage and screen out the governments that are not making good-faith efforts to promote reform. Consequently, long-term users of Fund resources should benefit more on average from program participation than short-term users. Our empirical results demonstrate that this is, in fact, the case.

Our analysis suggests ways of mitigating the adverse selection problem, which should improve the effectiveness of IMF programs over time. Each of these mechanisms relies upon efforts to separate worthy from unworthy borrowers. First, in order to mitigate adverse selection, it is essential that the credibility of Fund enforcement of conditionality increase. If conditionality is weakly enforced, it provides no incentives for governments that are not committed to reform to declare themselves by refusing to participate in IMF programs. Second, the Fund should mitigate

the incentive for reform-averse governments to sign programs by front-loading conditionality in the form of prior conditions and back-loading the phasing of loan disbursements. Third, the Fund should increase the incentive for well-governed countries to participate in programs by raising the value of a Fund program as a signal to the market. This requires the IMF to be more selective in approving programs. A program cannot be a seal of approval if it is available to any member that wants one; and if it conveys no positive information to the market, it is likely to convey negative information.

Contrary to a substantial literature that has grown up to criticize the IMF, our analysis finds evidence that IMF programs have contributed to the economic development of most of the countries that have participated in them. Furthermore, our findings indicate that it is possible to estimate which countries have benefitted and which have had their development stunted under IMF programs. In our analysis – as in the process of IMF program design and evaluation – the key factors that lead to success and failure are largely unobservable, and we can estimate them only because they have observable implications for which countries choose to apply for IMF assistance. If they were fully observable, adverse selection would be unproblematic. This indicates a fourth strategy for improving IMF program outcomes, which is to study the political factors that lead to program success and failure in order to reduce the degree of information asymmetry between the Fund and its members.

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A Bivariate Probit with Partial Observability

Our approach is similar to one that has been used by Vreeland (2003), Przeworski and Vreeland (2000), and Przeworski and Vreeland (2002), but differs in several key respects, so this appendix is included to explain the differences. Przeworski and Vreeland argue that selection models for IMF programs should incorporate the fact that two decisions are involved in the selection process: both the borrowing country and the IMF must consent to an agreement before one can be observed. Since only the outcome of the joint decision can be observed, they propose using bivariate probit with partial observability to estimate the unobserved parameters (Poirier, 1980). In the bivariate probit with partial observability approach discussed in Vreeland (2003), the government's and the IMF's decisions are modeled with two latent variable equations:

$$G^*_{BP} = \gamma\omega + \upsilon_G \tag{A.1}$$
$$I^*_{BP} = \alpha\kappa + \upsilon_I \tag{A.2}$$

where ω is the set of factors affecting a government's decision to seek a program, κ is the set of regressors influencing the IMF's decision to enter into an agreement with a government, υ_G and υ_I are standard normally distributed error terms. We only observe a program when both the government and the IMF are willing to sign one. In other words,

$$\begin{aligned} Pr(P=1) &= Pr(G^*_{BP} > 0, I^*_{BP} > 0) \\ Pr(P=0) &= 1 - Pr(G^*_{BP} > 0, I^*_{BP} > 0) \end{aligned}$$

If we allow that υ_G and υ_I are correlated with ϵ, such that $\text{Corr}(\epsilon, \upsilon_G) = \rho_G$ and $\text{Corr}(\epsilon, \upsilon_I) = \rho_I$, then, the expected growth rate for countries that are under an IMF program becomes[9]:

$$\begin{aligned} E(Y_1|P=1) &= X_1\beta_1 + E(\epsilon_1|G^* > 0, I^* > 0) \\ &= X_1\beta_1 + \rho_G\sigma_\epsilon\lambda_G + \rho_I\sigma_\epsilon\lambda_I \end{aligned} \tag{A.3}$$

where $\lambda_G = \frac{\phi(\gamma\omega)}{\Phi(\gamma\omega)}$ and $\lambda_I = \frac{\phi(\alpha\kappa)}{\Phi(\alpha\kappa)}$; and ϕ and Φ are probability density and cumulative distribution functions of standard normal distribution respectively.

For countries that are not under an IMF program, if we assume that neither the IMF nor the country wanted a program, the expected growth rate is:

$$\begin{aligned} E(Y_2|P=0)) &= X_2\beta_2 + E(\epsilon_2|\{G^* \leq 0, I^* \leq 0\}) \\ &= X_2\beta_2 + \rho_G\sigma_\epsilon\lambda_{\sim G} + \rho_I\sigma_\epsilon\lambda_{\sim I} \end{aligned} \tag{A.4}$$

where $\lambda_{\sim G} = \frac{-\phi(\gamma\omega)}{1-\Phi(\gamma\omega)}$ and $\lambda_{\sim I} = \frac{-\phi(\alpha\kappa)}{1-\Phi(\alpha\kappa)}$. If, instead, government wanted a program but the IMF did not grant it,

$$\begin{aligned} E(Y_2|P=0)) &= X_2\beta_2 + E(\epsilon_2|\{G^* > 0, I^* \leq 0\}) \\ &= X_2\beta_2 + \rho_G\sigma_\epsilon\lambda_G + \rho_I\sigma_\epsilon\lambda_{\sim I} \end{aligned} \tag{A.5}$$

[9] for simplicity and for practical difficulties in estimation, Vreeland assumes $\text{Corr}(\upsilon_G, \upsilon_I) = 0$. We also make this assumption for the rest of the paper.

Finally, if it is the case that the IMF wants a program and the government does not,

$$\begin{aligned} E(Y_2|P=0)) &= X_2\beta_2 + E(\epsilon|\{G^* \leq 0, I^* > 0\}) \\ &= X_2\beta_2 + \rho_G\sigma_\epsilon\lambda_{\sim G} + \rho_I\sigma_\epsilon\lambda_I \end{aligned} \tag{A.6}$$

Therefore, depending on which of the equations A.4, A.5, and A.6 is predicted or assumed to apply to the country i, that equation can be used in calculating GB in equation 4 or EB in equation 4.

In effect, the bivariate probit approach assumes that the government and the IMF make simultaneous decisions about whether to initiate a program, and compares the case of program participation to the three logical alternatives: only the country wants a program, only the IMF wants a program, or neither wants a program. In contrast, our strategic model captures the fact that only a borrowing country can initiate an application for a program, so the IMF only faces the option of approving programs when countries have already indicated that they desire to participate. This captures the essence of the problem of adverse selection. Our model generates different estimates for government and IMF utilities, and different selection corrections.

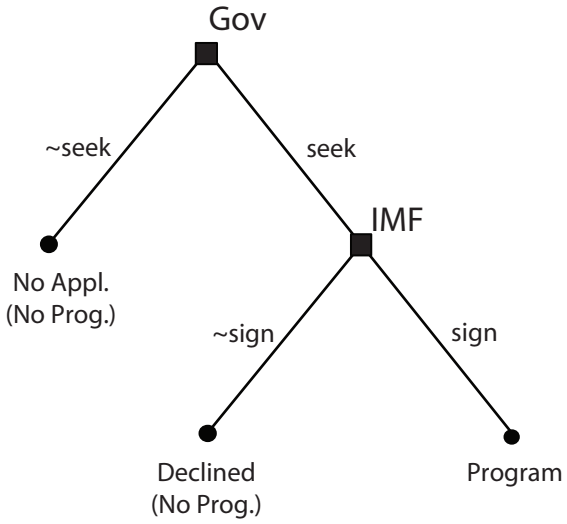

Figure 1: Strategic Selection into an IMF Program

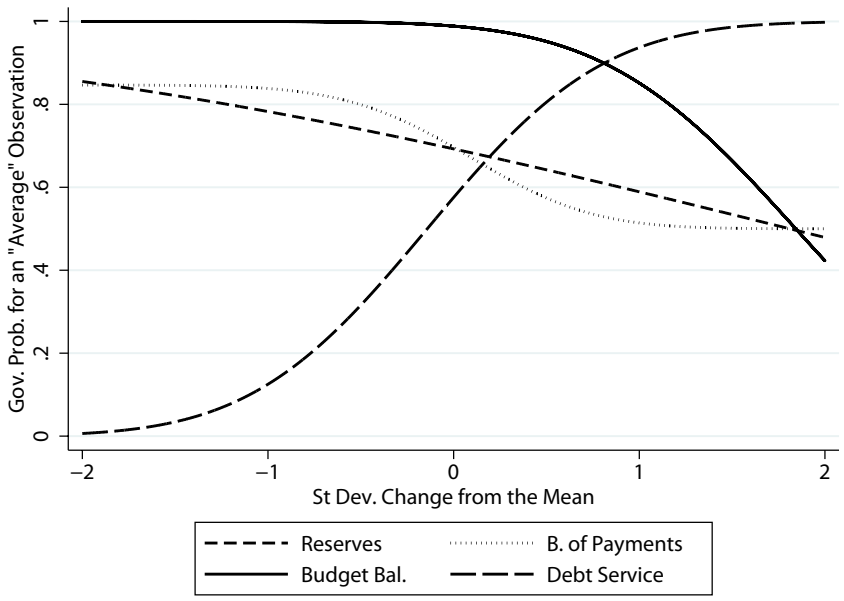

Figure 2: The Effect of Reserves, B.of Payments, Debt Service and Budget Balance on the Government's Choice Probability

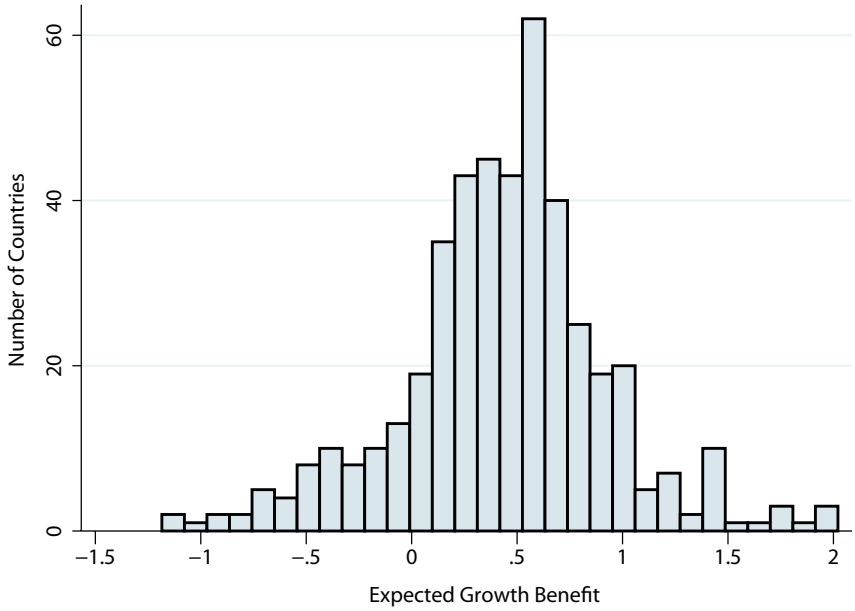

Figure 3: Estimated Growth Benefit for Countries in the Sample

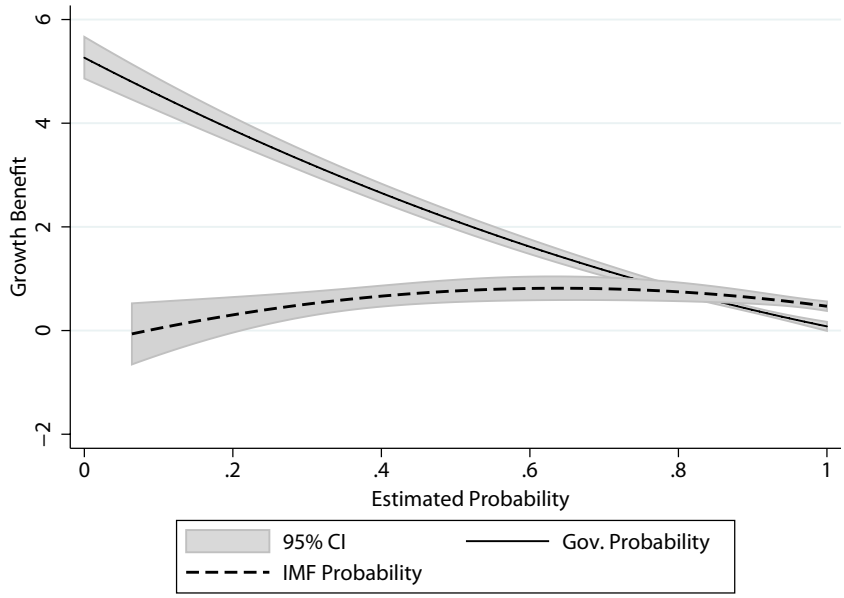

Figure 4: Quadratic Fit of Estimated Growth Benefit versus Government's and IMF's Probabilities

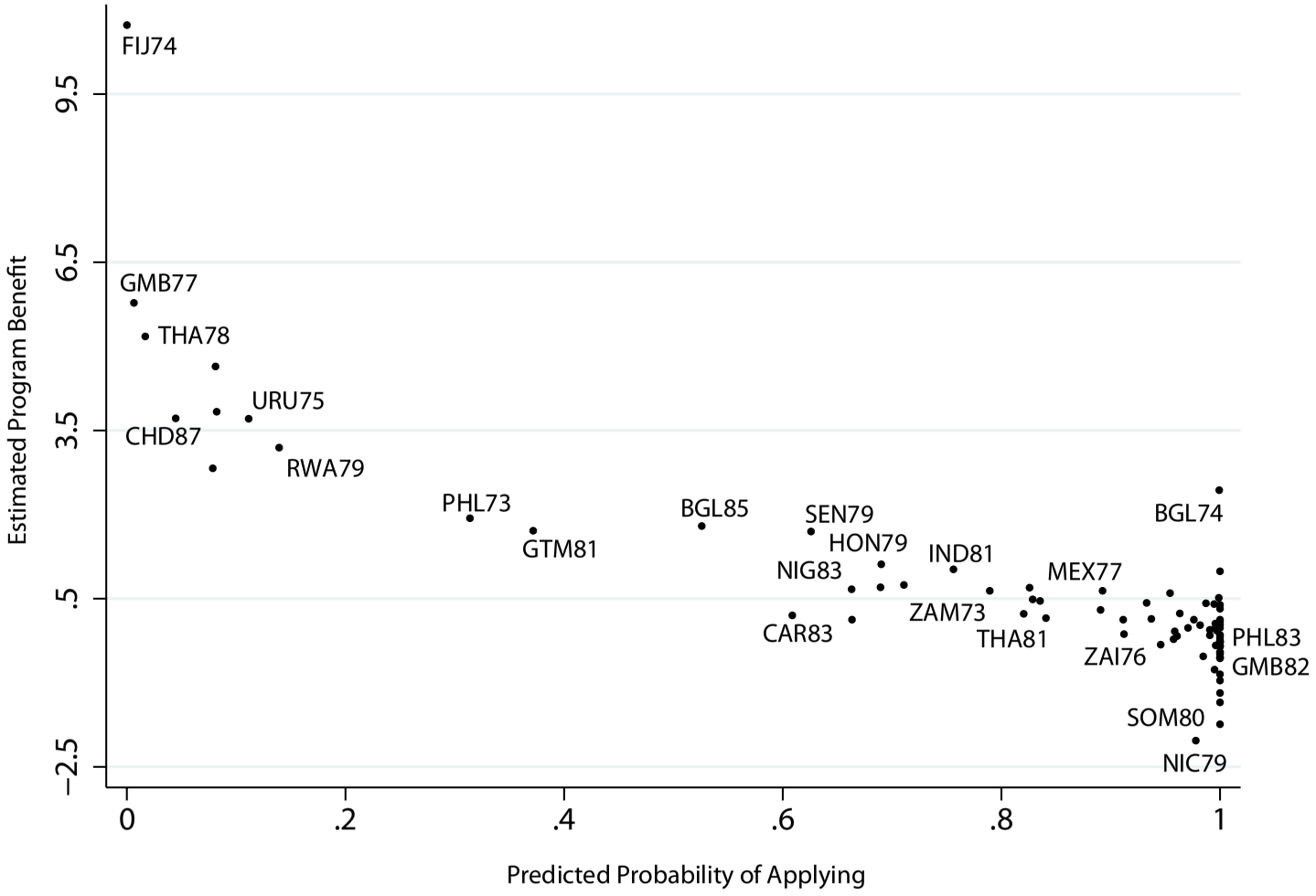

Figure 5: Predicted Probability of Applying and Estimated Growth Benefit (Program Initiation Years)

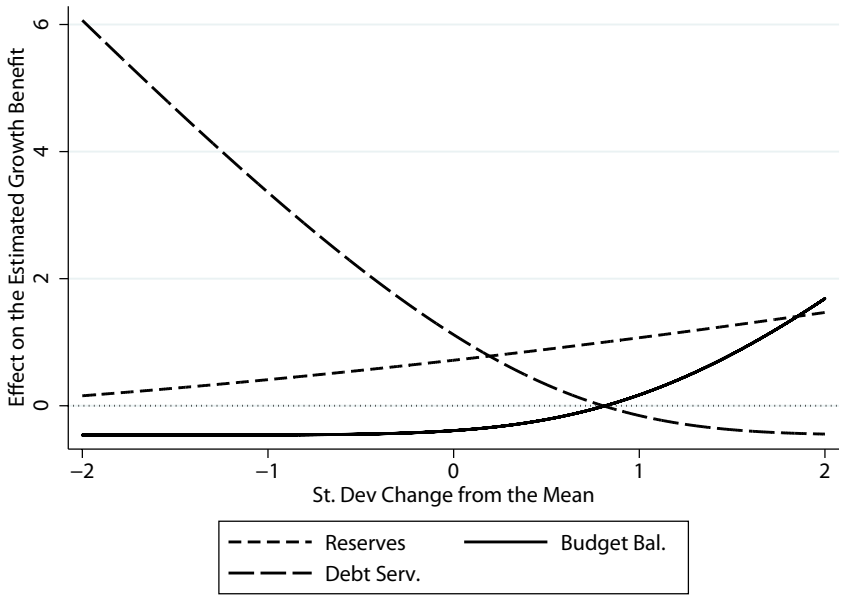

Figure 6: The Effect of Reserves, Debt Service and Budget Balance on the Estimated Growth Benefit of a Program Country

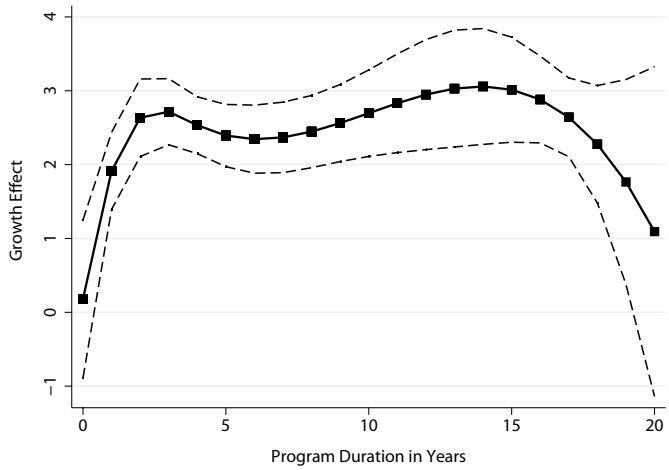

Figure 7: The estimated Effect of Program Duration on Growth Rates (From Model 3 in Table 2)

	Government				
	Bivariate Probit		**Strategic Probit**		
	Model S1		**Model S2**	**Model S3**	
Variable	Enter	Remain	Pooled	Enter	Remain
Reserves	-.833	-4.464	2.183	-1.945	-.918
	(.125)	(.007)	(.396)	(.076)	(.023)
Budget Bal.	-.952	1.145	-11.294	-3.179	.106
	(.011)	(.014)	(.004)	(.000)	(.383)
Debt Serv.	1.377	2.363	12.284	6.048	.364
	(.004)	(.125)	(.008)	(.000)	(.085)
Investment	-6.059	17.485	-6.048	-2.086	.114
	(.001)	(.019)	(.013)	(.003)	(.424)
Years Under	.358	-1.140	.049	-.540	.092
	(.083)	(.112)	(.976)	(.428)	(.623)
Num. Under	.444	-.708	1.064	.396	-.099
	(.014)	(.176)	(.337)	(.280)	(.483)
Lagged Elec.	.869	-1.025	14.804	5.630	-.098
	(.007)	(.181)	(.009)	(.000)	(.644)
Under	-	-	4.019	-	-
			(.563)		
Constant	-2.271	6.537	1.337	1.176	4.229
	(.000)	(.013)	(.860)	(.635)	(.000)
	IMF				
	Bivariate Probit		**Strategic Probit**		
	(MLE)		**MLE**	**PMLE**	
Variable	Enter	Remain	Pooled	Enter	Remain
BOP*Size	-.914	-.296	-1.710	-12.444	2.808
	(.014)	(.067)	(.012)	(.000)	(.024)
Num. Under	-.728	.200	-.157	-.268	1.453
	(.027)	(.023)	(.211)	(.007)	(.015)
Under*Num.Und.	-	-	.374	-	-
			(.026)		
Regime	.430	.387	.388	.368	-.120
	(.114)	(.041)	(.037)	(.096)	(.822)
Under	-	-	5.064	-	-
			(.001)		
Constant	2.145	.117	-.505	.471	.925
	(.150)	(.747)	(.349)	(.436)	(.689)
N of Observ.	1024		1024	1024	
Log-likelihood	-353.93		-344.65	-303.70	
% Predicted	86%		87%	88%	

a. p-values for each coefficient are reported in parentheses.

Table 1: Selection into IMF Programs

		Selection Corrected			
	Model 1	**Model 2**		**Model 3**	
Variable	Pooled	Under	Not Under	Under	Not Under
Under	-.065	-	-	-	-
	(.808)				
Lagged Growth	-	-	-	.063	.002
				(.002)	(.952)
Cap. Stock Gr.	.454	.478	.441	.477	.442
	(.000)	(.000)	(.000)	(.000)	(.000)
Labor Force Gr.	.434	.484	.378	.489	.373
	(.000)	(.000)	(.013)	(.000)	(.017)
λ_{GOV}	-	.683	-1.331	.465	-1.038
		(.042)	(.000)	(.100)	(.140)
λ_{IMF}	-	-.686	-.374	1.217	.007
		(.078)	(.522)	(.087)	(.993)
Constant	-.018	-.308	-.048	-2.629	.431
	(.951)	(.367)	(.919)	(.002)	(.724)
N. of Observ.	1024	465	559	465	559

a. p-values for each coefficient are reported in parentheses.

Table 2: The Effect of IMF Programs on Growth

	Est. Benefit		
Actual Gr.	Neg.	Pos.	Total
Neg.	51	96	147
Pos.	20	298	318
Total	71	394	465

Table 3: Estimated Growth Benefit and Actual Growth Rates for Countries Under a Program

Country Country	ACLP Code	Year	Pr_G(Apply)	Pr_{IMF}(Sign)	Est. Growth Benefit	Actual Growth
Somalia	38	1980	1	.260	-1.735	-18.49
Jordan	86	1989	1	.280	-1.352	-11.04
Congo	12	1986	1	.191	-1.184	-2.98
Benin	3	1989	1	.312	-.852	-4.87
Sudan	40	1979	.999	.495	-.957	-8.98
Trinidad and Tobago	64	1989	.999	.284	-.562	-2.02
Gambia	17	1982	.999	.331	-.339	1.44
Philippines	94	1983	.996	.650	.055	.070
Congo	12	1987	.995	.999	-.604	-2.32
Ghana	18	1979	.995	.291	-.769	-5.86
Gabon	16	1987	.988	.999	-1.060	-12.19
Sudan	40	1973	.985	.953	-.675	-7.19
Nicaragua	62	1979	.977	.425	-2.028	-27.72
Niger	32	1984	.976	1	-.739	-11.58
Mauritania	28	1987	.960	.999	-.657	-1.03
Guyana	72	1982	.917	.999	-1.08	-21.50
Guyana	72	1978	.899	.999	-.716	-16.17
Guyana	72	1977	.899	.962	-.659	-14.38
Uganda	45	1984	.798	.999	-1.799	-45.47
Uruguay	76	1980	.558	.995	2.013	6.37
Bangladesh	78	1985	.525	.312	1.800	8.95
Guatemala	57	1981	.371	.149	1.714	1.27
Philippines	94	1973	.313	.138	1.938	7.60
Rwanda	34	1979	.139	.257	3.194	6.41
Uruguay	76	1975	.111	.628	3.707	4.29
Peru	74	1977	.082	.810	3.833	.68
Lesotho	23	1988	.080	.544	4.640	14.23
El Salvador	55	1980	.078	.267	2.821	-8.07
Chad	10	1987	.044	.369	3.720	-2.43
Thailand	99	1978	.016	.458	5.174	8.63
Gambia	17	1977	.006	.541	5.777	5.56
Fiji	130	1974	.001	.379	10.730	5.99

Table 4: Probability of Applying and Estimated Growth Benefit

	Actual Outcome		
Pred. Outcome	No Program	Program	Total
No Program	486	56	542
Program	73	409	482
Total	559	465	1024

Table 5: Predicted vs. Actual Program Cases