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**Duration and Recidivism in IMF Programs:
Evidence from the period 1973-1992**

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Abstract

Quarterly evidence on participation in IMF programs for the period 1973-1992 is examined statistically using the techniques of hazard analysis. Two hypotheses are proposed and tested. First, the hypothesis that cumulative participation in IMF programs in the period leading up to a new spell is significantly related to the length of the new spell is rejected in the data. Second, the hypothesis that the length of time between spells is reduced significantly with an increase in cumulative participation in IMF programs cannot be rejected. These results are derived while controlling for country-specific unobserved heterogeneity, external shocks, and pre-existing policy distortions.

These results suggest that the lengths of spells of IMF participation are determined by external shocks and by initial conditions on reserve stocks and real exchange rate settings, but not by the effects (good or bad) of prior IMF programs. By contrast, the length of time between spells of participation depends upon external shocks and upon prior participation, but not on the initial stock of foreign exchange reserves or the initial real exchange rate.

JEL Codes: E63, F34, F41, O19

The IMF Articles of Agreement created the IMF purchase/repurchase facility to provide temporary balance-of-payments support to member countries. The framers of the Articles of Agreement were determined that this support be temporary. To ensure this, they required countries participating in this facility to agree to conditions limiting the country's macroeconomic policies. IMF staff were to design these conditions to ensure that the participating country exited quickly from its balance-of-payments difficulties. I will refer to this combination of purchase/repurchase facility and associated conditions on macroeconomic policy as an IMF program.

The number of IMF programs undertaken by developing countries was small in the early decades of IMF operation, but programs proliferated in the 1970s with the twin oil crises. The number of IMF programs with developing countries has been growing ever since. Controversy about the effectiveness of IMF programs in the developing-country context surfaced in the 1970s as well. Williamson (1982) surveys the early controversy, while Spraos (1986) summarizes the early case against the IMF's work in these programs as "ineffectual, misguided, mistargeted". Further controversy emerged in the early 1990s around the IMF programs for Russia and other former members of the Soviet Union.¹ Most recently, the debate over the role of IMF programs in precipitating the Asian Crisis of 1998 was quite contentious; many observers attributed the collapse of these economies in part to the effect of conditions associated with IMF programs.²

The criticisms of IMF activity have been summarized most recently in the 2000 Report of the International Financial Institution Advisory Commission (also known as the Meltzer

¹ Arbatov (1992) is a good example of this criticism.

² Martin Feldstein and Jeffrey Sachs were two economists critical of the IMF programs in Asia -- see Feldstein (1998), Sachs (1997) and Sachs (1998) for examples. Rosett (1999) provides a good summary of these criticisms.

Commission, or IFIAC).³ The Commission chronicled twelve serious criticisms of current IMF activity that it claimed had encouraged prolonged use of IMF funds by member countries.⁴ Its majority then proposed a sweeping reform in IMF operating procedures that will do away with facilities of duration greater than 240 days and with the “conditionality” component of IMF programs.⁵

The debate over the effect of IMF programs can be separated into two empirical questions.

- What is the impact on a country’s current economic performance of participating in an IMF program?

- Is there a lasting effect on a country’s economic performance of participating in an IMF program?

The first question has been addressed extensively in the economics literature; ul Haque and Khan (1998) provides a summary of the statistical techniques used and results obtained in that work up to that time. While the results are not unanimous, there is a strong consistency in results indicating that participation in IMF programs will lower the current economic growth rate on average, will improve measures of external balance (current account, stock of foreign-exchange

³ The Commission majority report is available in its entirety from the US Congress website <http://www.house.gov/jec/imf/ifiac.htm>. The legally mandated Response by the US Treasury to the Commission report is critical of the core recommendations, and can be found at <http://www.ustreas.gov/press/releases/docs/response.pdf>. Allan Meltzer’s response to the Response is available at <http://www.gsia.cmu.edu/afs/andrew/gsia/meltzer>.

⁴ These criticisms were not documented in the report. The text states (p. 25) that “Members of the Commission do not necessarily endorse or subscribe to all of these criticisms. They are listed to summarize the context in which reform must occur ...”

⁵ IFIAC, pp. 30-31.

reserves), and will lower current investment on average.⁶

The second question has received less attention. Conway (1994) introduces a rudimentary dynamic into the cross-sectional estimating structure, and finds its inclusion quite important in understanding the impact on economic performance. More recently, however, the emphasis in research has been on a variant of the second question. If IMF programs have lasting effects, then the pattern of participation observed should be one of limited-term participation followed by extended periods of non-participation. This is the dynamic envisioned in the IMF Articles of Agreement.⁷

In fact, the tendency among developing countries in recent years has been toward more prolonged periods of participation and shorter periods of non-participation. The second question can then be re-interpreted as “Does prior participation in an IMF program lead to a greater propensity to participation in the current period?” Among recent papers, Bird and Rowlands (2000), Bird, Hussain and Joyce (2000) and Joyce (2001) have searched empirically for the determinants of a country’s propensity to extend its use of IMF resources over many programs.

In this paper, I examine two features of IMF program participation that I label “duration” and “recidivism”. The duration of IMF participation by a single country should be predictable based upon a combination of policy choices and external shocks. If IMF-program participation has the

⁶ The Meltzer Commission drew a different conclusion. “Numerous studies of the effects of IMF lending have failed to find any significant link between IMF involvement and increases in wealth or income.” (p. 27) Three sources are cited, of which one is ul Haque and Khan (1998).

⁷ Article I, section v, states that the IMF purpose is: “To give confidence to members by making the general resources of the Fund temporarily available to them under adequate safeguards, thus providing them with opportunity to correct maladjustments in their balance of payments without resorting to measures destructive of national or international prosperity.”

effect of improving economic performance, then it should have an independent effect in shortening the duration of IMF participation. Recidivism in IMF participation refers to the necessity of a participating country to return to an IMF program after having completed a previous program. If IMF programs are effective, then the degree of recidivism evident in formerly participating countries should be reduced.

The analysis of this paper includes three innovations over much of the existing literature on this second question. First, the data used are observed quarterly to focus upon the dynamics of participation in IMF programs. While this limits the range of data available for the countries in the sample, it provides a richer picture of the underlying dynamic. Second, the duration analysis is paired with the discussion of recidivism. Others (e.g., Joyce (2001)) have addressed the propensity to participate in IMF programs, but none has examined the complementary question: what determines the duration of the periods of non-participation? If these periods are shortened significantly by prior participation in IMF programs, then there is evidence of recidivism in IMF programs. Third, the statistical analysis is based upon a correction for unobserved heterogeneity. Country-specific differences in behavior are quite significant, and should not be misattributed to the effects of prior participation in IMF programs.

The results of these exercises are quite simply stated. There is no evidence that prior participation in IMF programs either extends or shortens the duration of participation in the current program. However, there is evidence of a large and significant negative effect of prior participation on the country's propensity to enter a new program. Those countries with prior participation are less likely, *ceteris paribus*, to enter a new program in any period.

IMF programs.

In the period from the beginning of 1973 to the end of 1992, the IMF offered five types of program agreements.⁸ The “first tranche” agreement was a decision by the borrowing country to draw down its hard-currency position at the IMF. The “stand-by” was an agreement by the IMF to allow the member country to draw down a percentage of its quota, also in hard currency. Repayment (or, more properly, repurchase) under these stand-by agreements occurred usually over a single year, although exceptions were made in some circumstance. The “extended fund facility”, or EFF, was an agreement to allow members to draw down some percentage of their quota, but with repayment scheduled over a longer (often 3-year) period. These agreements were first extended in September 1974. The “structural adjustment facility” (SAF) and “extended structural adjustment facility” (ESAF) were introduced in 1986. The SAF had a similar repayment period to the EFF, but was extended to members whose balance of payments difficulties were viewed to be more systemic, or structural, in origin. The ESAF was designed to provide longer repayment periods than the SAF for countries with especially difficult structural adjustments to complete.

For the 89 countries considered here, their quarterly experience with participation in IMF programs in the period 1973:1 to 1992:4 can be characterized as in Table 1. The salient feature of the data is the relative infrequency of participation in IMF programs. Two-thirds of the quarterly observations in the sample were characterized by non-participation, while only in the remaining one-

⁸ In some cases, countries were able to negotiate a hybrid of more than one of these types. There were other facilities offered by the International Monetary Fund as well that provided financing without the notion of conditionality associated with the programs cited. These other facilities included the Compensatory Financing Facility, the Buffer Stock Financing Facility and the Oil Facility, and participation in these is not considered here. The Supplementary Financing Facility, established in 1979, provided added resources (from borrowed funds rather than subscriptions) to participating countries; this facility was only available in tandem with one of the five programs noted in the text.

third was program participation observed. Unscheduled termination of existing agreements (termed “program failure” above) occurred in only 1.1 percent of the sample, with such failure leading to adoption of a new program in the same quarter in 70 percent of those cases and to no new program in the remainder.

Participation in some type of IMF agreement was characteristic of 34.1 percent of the quarterly observations. By far the most common of these was the stand-by arrangement (17.6 percent of the total sample), with EFF, first tranche, SAF and ESAF programs observed less frequently. Hybrid programs (for example, a stand-by/SAF combination) were observed in 1.7 percent of the total sample.

Participation in IMF programs is not randomly distributed; rather, participation in the preceding quarter is a strong predictor of participation in the present quarter. The transition matrix based upon the observations summarized above is given in Table 2.

Persistence in non-participation is not surprising, for IMF programs are set up to be used in external-payments crisis situations. The data indicate that in 95 percent of the cases, a country not participating in an IMF program continues its non-participation in the next period. Those adopting an IMF program after not participating the previous period were 5 percent of the sample. As Table 3 indicates, the move to participate in IMF programs was variable by year. It began below the average, but rose throughout the period. The largest shares were observed in 1982 and 1991.⁹

Table 2 also indicates substantial persistence in participation in IMF programs. Some degree of this is not surprising, given the quarterly nature of the data at hand. Given that the typical stand-

⁹ This is in fact consistent with the low average of 5 percent in the transition matrix. The shares in Table 3 are contingent upon there being a preceding observation of non-participation. Countries already participating in IMF programs were thus excluded from the sample.

by arrangement has one-year duration, and that EFF and ESAF programs are multi-year in nature, there should be a degree of persistence. The data indicate that in over 90 percent of the cases, participation in the preceding quarter led to participation in the present quarter; this percentage is in excess of what would be predicted based upon the normal length of programs.

The 89 developing countries in the sample can be differentiated by the degree of participation they enjoy with the IMF. Figure 1 illustrates a differentiation by the percent of the 1973:1 - 1992:4 time period the countries spent participating in IMF programs. Ten of the countries did not undertake an IMF program during the sample period. The modal range for participation was the 41-50 percent period, with 14 countries in that category. Four countries spent more than 70 percent of the period in IMF programs.

Programs vs. spells.

IMF programs are contracts between the IMF and the member country. As such, the duration of each program is specified as a term of the contract. In practice, however, member countries and the IMF have repeatedly reached agreements over this period to have one IMF program begin just as the previous one has ended, or to terminate one IMF program and replace it with another immediately. Under these circumstances, the duration of the program is not of interest – more important is the set of uninterrupted agreements between the IMF and the member country. This set, following the labor literature, is called a “spell”. Consider the example of Kenya during the period 1974-1992. As Table 4 indicates, Kenya and the IMF agreed upon 10 different programs over this 19-year period. Of the ten programs, five were terminated prior to the contractual expiration date and one other was extended by mutual agreement beyond its expiration date. In each case, the terminated program was replaced immediately (i.e., the next day) by a new IMF program.

Kenya's experience with the IMF can be grouped in four spells: July 1975 through July 1978, November 1978 through September 1984, February 1985 through February 1986, and February 1988 through December 1992.¹⁰ Kenya was thus participating in one or another IMF program for 79 percent of the period under consideration.

While Kenya's participation in IMF programs can be classified as above-average for the period, its experience is not atypical. It raises two questions for consideration by the researcher:

- Why does the IMF rely upon periodic recontracting to provide financial support to member countries over an extended spell of participation?
- What determinants can be identified for the length and frequency of spells of participation in IMF programs?

The first question is the focus of companion research, while in this paper I focus upon the second question.

For any developing country, there are two states that can be observed in period t : either the country is participating in an IMF program, or it is not. These same two states can be observed in period $t+1$. The state transition matrix can be summarized in two probabilities: the probability $\theta_x(c,t)$ that a country in an IMF spell in period t will end the spell in $t+1$, and the probability $\theta_n(c,t)$ that a country not in an IMF program in period t will begin a spell in period $t+1$. Table 2 provides average transition probabilities of $\theta_x = .087$ and $\theta_n = .049$, but these ignore the time-dependent nature of this transition probability.

A more precise estimation of these transition probabilities can be derived through explicit

¹⁰ There is a two-month break in IMF participation after the fifth program (i.e., from January to March 1983). The data used in this econometric study are measured on a quarterly basis, so that break does not qualify in this study as the end of a spell.

modeling of the hazard functions $\theta_x(c,t)$ and $\theta_n(c,t)$.

$$\ln(\theta_i(c,t)) = \mu_i(c) + \alpha_i(t) + X_i(c,t)\beta_i + \delta_i CI(c,t) + \varepsilon_i(c,t) \quad (1)$$

for $i=x,n$ for all c,t

The $\theta_i(c,t)$ are then the hazard functions either for the end of an IMF spell ($\theta_{xi}(c,t)$) or for the end of a spell of non-participation in IMF programs ($\theta_{ni}(c,t)$).¹¹ The first hazard function ($\theta_x(c,t)$) conveys information about the length of IMF spells, while the second hazard function ($\theta_n(c,t)$) conveys information about the frequency of IMF spells by examining the determinants of the length of non-participation periods in the sample countries.

There are five sets of determinants specified for the hazard functions. The residual $\varepsilon_i(c,t)$ is drawn from a zero-mean bivariate distribution of random errors. The $\alpha_i(t)$ is a baseline hazard represents the average trend in this probability over time in the sample. There is unobservable heterogeneity ($\mu_i(c)$) in the probability of exiting (or entering) a spell; this is country-specific and time-independent. The vector product $X_i(c,t)\beta_i$ is the summation of effects due to time- and country-varying exogenous determinants of the probability. The coefficients β_i are invariant over time and across countries for each of the entry or exit hazard rates. The product $\delta_i CI(c,t)$ is the effect of prior participation in IMF programs on the hazard function. $CI(c,t)$ measures the percent of the three years prior to the beginning of the current spell spent in IMF programs, while δ_i is the average effect of a one-percent increase in participation on the hazard rate.

¹¹ If the probability distribution function for country c to exit its IMF spell period t is $f(c,t)$ and the probability of the spell continuing up until t is $S(c,t)$ – also called the survivor function – then $\theta_x(c,t) = f(c,t)/S(c,t)$. Lancaster (1990) has a useful development of these probability concepts.

The conclusions of this paper rely upon hypothesis tests of the values of the coefficients in the vectors β_i and δ_i . The baseline hazard $\alpha_i(t)$ and unobservable heterogeneity $\mu_i(c)$ must be controlled for in estimation, but are not of other interest. For that reason, I employ the proportional-hazard estimation technique of Cox (1972) with stratification to eliminate the $\mu_i(c)$ and the $\alpha_i(t)$.¹²

Duration: the length of spells.

There are four alternative hypotheses associated with the length of an IMF spell.

- The length is reduced (i.e., the probability of exiting rises) as the cumulative effect of terms of trade changes over the period of the spell ($ctot(c,t)$) increases.
- The length is reduced with an increase in the reserve/import ratio ($rir(c,t)$) observed at the beginning of the spell.
- The length is reduced with the depreciation of the real effective exchange rate ($rxr(c,t)$) observed at the beginning of the spell.
- The length is reduced as the percent of the 3-year period prior to beginning the spell that was spent in IMF programs ($cix(c,t)$) increases.

The first hypothesis is related to the external environment. When the terms of trade turn in favor of the country while it is in the IMF spell, the country has less need to borrow. The cumulative terms-of-trade index is measured as the cumulative effect of terms of trade changes during the

¹² The correction for unobserved heterogeneity is quite important in the results obtained. Table A1 reports the differences in estimation under the hypotheses (simple) that unobserved heterogeneity is not significant and (UH) that unobserved heterogeneity is significant for one of the specifications used in the paper. The likelihood ratio test for significance rejects the simple specification in favor of the UH specification. The estimates of δ_i and β_i are significantly different under the two hypotheses as well.

current IMF spell. The probability that the country will exit the spell at any point in time is expected to increase as this measure increases. The next two are hypotheses about policy fundamentals: as the $rir(c,t)$ or the $rxr(c,t)$ rise, $\theta_x(c,t)$ should be higher at any moment within the spell. These variables are measured in the period prior to the beginning of each spell in order to remove any simultaneity bias from the contemporaneous decisions on reserves, nominal exchange rate and participation. The fourth is a hypothesis about the persistent positive effects of IMF programs: as $cix(c,t)$ rises, $\theta_x(c,t)$ should rise as well. The initial twelve observations of the sample were excised to allow for consistent construction of the $cix(c,t)$ indicator. Left-censored participation spells were excluded as well. The estimation results are reported in Table 5.

The panel data include 182 spells of IMF program participation drawn from 72 countries. The $ctot(c,t)$ variable is available for 177 of those spells, and column (1) of Table 5 reports the lack of success of $cix(c,t)$ and $ctot(c,t)$ in predicting duration when taken as sole predictors. The estimates are separately insignificantly different from zero, and the likelihood ratio test reported at the bottom of the column indicates that the pair of variables taken together also contributes insignificantly to an explanation of duration.

The initial reserve-import ratio $rir(c,t)$ and real effective exchange rate $rxr(c,t)$ were hypothesized to affect the decision to exit an IMF spell, and the results of columns (2), (3) and (4) cannot reject this hypothesis. Once these variables are controlled for, as well, the cumulative terms of trade variable has a significant impact in the hypothesized direction. As these results are quite similar across specifications, consider the estimates of column (4). Cumulative participation in IMF programs has an insignificant effect on the probability of exiting the current spell. Positive cumulative shocks to the terms of trade contribute significantly and positively to the probability of

exiting the current spell. A larger initial reserves-import ratio and a depreciated initial real exchange rate also contribute positively and significantly to the probability of exiting. The hazard ratios for these variables (not reported in the table) indicate that a 10 percent increase in $\text{rir}(c,t)$ will be associated with a 37 percent rise in the probability of exiting, while a one-standard deviation depreciation in $\text{rxr}(c,t)$ will be associated with an 85 percent rise in the probability of exiting. A one-standard-deviation rise in $\text{ctot}(c,t)$ will be associated with a 10 percent rise in the probability of exiting.

The results are in fact quite robust across specifications. There is an insignificant contribution $\text{cix}(c,t)$ to the probability of exiting the current spell, while the hypothesized effects of $\text{rir}(c,t)$, $\text{rxr}(c,t)$ and $\text{ctot}(c,t)$ are both observed and significant.

Recidivism: the frequency of IMF spells.

The periods observed between IMF spells also convey information about the economic effects of IMF programs. There are four alternative hypotheses associated with the frequency of IMF spells.

- The frequency of spells is reduced (i.e., the probability of entering an IMF spell is reduced) as the cumulative effect of terms of trade changes over the period between spells $\text{ctot}(c,t)$ increases.

- The frequency of spells is reduced (i.e., the probability of entering an IMF spell is reduced) as the level of the reserve-import ratio $\text{rir}(c,t)$ observed at the beginning of the non-participation period is increased.

- The frequency of spells is reduced as the real effective exchange rate $\text{rxr}(c,t)$ observed at the beginning of the non-participation period depreciates.

- The frequency of spells is reduced as the percent of the 3-year period prior to beginning the non-participation period $cin(c,t)$ spent in IMF programs is increased.

The initial twelve observations of the sample were excised to allow for consistent construction of the $cin(c,t)$ indicator. Left-censored non-participation spells were excluded as well. The estimation results are reported in Table 6.

There were 143 periods of non-participation drawn from 62 countries in the panel data set.¹³ In column (1) of Table 6 the joint effect of prior participation and cumulative terms of trade changes on recidivism is estimated. An increase in previous participation is strongly and negatively associated with the propensity to enter a new IMF program at any point in time. The cumulative impact of terms of trade changes during the period of non-participation is also significant: as $ctot(c,t)$ rises, the country is significantly less likely to enter a new IMF program. The likelihood-ratio test result indicates the joint significance of these two variables in predicting the pattern of recidivism.

The results of columns (2) through (4) illustrate that the other two hypothesized determinants of entry into IMF programs are not significantly related to the propensity to begin a new IMF program. The initial reserve-import ratio and the real exchange rate index do not improve the prediction of the propensity to enter, either introduced singly or together. The effects of prior IMF participation and of cumulative terms of trade effects are robust to the inclusion of these variables.

¹³ Spells of participation outnumber spells of non-participation because the spells observed at the beginning and end of the sample are excluded to avoid censoring bias. More non-participation spells are excluded, especially at the beginning of the sample: most countries were not participating in IMF programs at the beginning of 1973.

Conclusions.

In this paper, I've tested two hypotheses: First, the duration of IMF spells is unaffected by prior participation in IMF spells once other country-specific and systematic factors have been controlled for. I cannot reject this hypothesis in a number of alternative specifications of the propensity to exit. (Table 5) Second, the length of time between IMF spells is unaffected by prior participation once other country-specific and systematic factors have been controlled for. I reject this hypothesis in all specifications of a model that controls for external shocks and initial conditions on policy variables. (Table 6) Both tests are performed over quarterly data for the period 1973-1992.

These statistical results shed light upon the current debate over prolonged use of IMF programs by developing countries. The available evidence suggests that prior participation is largely irrelevant to the duration of IMF spells. There is a great deal of systematic variation in the duration of IMF spells, and it has been captured in this paper by a model including terms of trade shocks, initial reserve-import ratio, initial real exchange rate, and country-specific heterogeneity. Prior participation has an insignificant and small independent effect once those are accounted for. However, the empirical record indicates that prior participation contributes strongly and significantly to lengthening the periods between IMF spells. This result is robust to the specification chosen. While IMF program participation does not on average shorten the duration of a future IMF spell, it does push the average starting time for that next spell off into the future: recidivism is reduced.

Do IMF programs have lasting effects on economic performance? I have not answered that question directly. There could be other systemic reasons for this reduction in recidivism, including an IMF bias against repeat programs (as opposed to a bias against the length of spells) or a

cumulative country-level aversion to participation that is independent of economic performance. While these must be investigated, it is also important to note that the results found here are consistent with IMF programs having lasting effects on economic performance. In future research I plan to address this issue directly.

It is also important to recognize that behavior in the decades between 1972 and 1992 may not be representative of current behavior. There is a new class of participants, made up of countries formerly in the Soviet Union, and these may respond differently to IMF programs. There are new institutional details (e.g. the Poverty Reduction Strategic Plan) that virtually assure a longer duration of IMF spells for the least developed countries. It will be useful to extend this analysis to the present.

The analysis of this paper sheds no light on the question of whether the IMF should be involved in lengthy spells of IMF programs. As the Meltzer Commission states, “Whatever the wisdom of these programs, their longevity is a clear sign that the IMF has departed from the principle of providing member states exclusively short-term balance-of-payments assistance as envisaged by its founders.” (IFIAC, p. 20) The evidence here addresses a narrower question: does cumulative participation have a positive effect in lengthening the average period between IMF programs? The answer drawn from the data is yes.

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Table 1: **Participation in IMF programs during sample period**

Status of member relative to IMF	Number of observations	Percentage of total
No program participation in quarter:	4695	65.9
Program failure, no new program in quarter:		21
Program failure, adoption of a new program:	53	0.8
Participation in first tranche	252	3.5
Participation in stand-by arrangement	1251	17.6
Participation in EFF	342	4.8
Participation in SAF	186	2.6
Participation in ESAF	200	2.8
Participation in hybrid programs	121	1.7

Total observations: 7120.

Table 2: **Transition in IMF Programs**

		period t+1	
		Participation (percent, count)	Non-participation (percent, count)
period t	Participation	91.3 2180	8.7 208
	Non-participation	4.9 227	95.1 4416

Total observations: 7031. (One observation lost for each country.)

**Table 3: Share of countries participating in an IMF program
after not participating the preceding quarter**

1973	3.0	1983	7.1
1974	2.0	1984	5.0
1975	3.7	1985	4.4
1976	2.8	1986	7.2
1977	4.8	1987	4.9
1978	3.3	1988	3.8
1979	7.4	1989	5.3
1980	5.5	1990	4.6
1981	5.4	1991	10.8
1982	7.5	1992	4.8

Table 4: Programs and Spells in Kenya, 1974-1992

Program	Arrangement Date	Expiration (or Cancellation) Date	Percent disbursed	Spell
EFF	7/7/75	7/6/78	11	1
Stand-by	11/13/78	8/19/79 *	100	2
Stand-by	8/20/79	10/14/80 *	0	2
Stand-by	10/15/80	1/7/82 *	37	2
Stand-by	1/8/82	1/7/83	60	2
Stand-by	3/21/83	9/20/84	100	2
Stand-by	2/8/85	2/7/86	100	3
Stand-by	2/1/88	5/15/89 *	74	4
SAF	2/1/88	5/15/89 *	28	4
ESAF	5/15/89	3/31/93 **	83	4

Source: International Monetary Fund, Annual Report, various issues.

* - Program cancelled before expiration date.

** - Program extended beyond contractual expiration date.

Table 5: Proportional-hazard Estimation Results for $\theta_x(c,t)$

	(1)		(2)		(3)		(4)	
	Estimate	χ^2	Estimate	χ^2	Estimate	χ^2	Estimate	χ^2
cix(c,t)	-0.04	1.63	0.01	0.12	0.01	0.06	-0.01	0.04
ctot(c,t)	0.004	0.08	0.05	6.42 **	0.10	10.47 **	0.10	8.43 **
rir(c,t)			1.22	13.19 **			1.56	10.61 **
rxr(c,t)					-0.90	1.10	-1.90	3.72 *
Spells	177		144		104		104	
C: Number of countries with spells	69		59		50		50	
LR χ^2 test	1.69		21.89 **		14.11 **		23.86 **	
-2 Ln L	523.41		370.86		225.91		216.17	
-2 ln L (no covariates)	525.10		392.75		240.03		240.03	

also included in each proportional-hazards model: C country-specific fixed-effect terms.

* - indicates significance at 90 percent level of confidence.

** - indicates significance at 95 percent level of confidence.

Table 6: Proportional-hazard Estimation Results for $\theta_n(c,t)$

	(1)		(2)		(3)		(4)	
	Estimate	χ^2	Estimate	χ^2	Estimate	χ^2	Estimate	χ^2
cin(c,t)	-2.35	14.92 **	-2.90	12.62 **	-3.81	10.98 **	-3.87	10.87 **
ctot(c,t)	-0.07	9.24 **	-0.08	8.84 **	-0.07	3.76 *	-0.07	3.31 *
rir(c,t)			-0.30	1.86			0.08	0.07
rxr(c,t)					-1.42	1.74	-1.38	1.68
N: number of spells	137		108		94		94	
C: Number of countries with spells	61		52		50		50	
LR χ^2 test	22.17 **				21.66 **		21.73 **	
-2 Ln L	411.96				220.54		220.47	
-2 ln L (no covariates)	434.13				242.20		242.20	

Also included in each proportional-hazards model: C country-specific fixed-effect terms

* - indicates significance at 90 percent level of confidence.

** - indicates significance at 95 percent level of confidence.

Data:

Program data: from IMF Annual Report, various years.

cix(c,t), cin(c,t): created from program data.

ctot(c,t): cumulative terms of trade index. The terms of trade index from the World Economic Outlook is used to construct this variable. It is available only in annual form, but quarterly values were interpolated for each country from the annual data. Interpolation uses a cubic spline such that both the curve and its first and second derivatives are continuous.

rxr(c,t): real effective exchange rate, from IMF sources.

rir(c,t): reserves/import ratio, from IMF sources.

ctot(c,t) and **rxr(c,t)** are converted for cross-country comparability through creation of “normalized” versions of the two variables. The mean and standard deviation by country is calculated. The mean is subtracted from the index, and the difference is divided by the standard deviation. For **ctot(c,t)**, these normalized variables are summed for the periods while the country is in (or is not in) an IMF program to create the cumulative index.

Appendix: controlling for unobserved heterogeneity.

The duration analysis of this paper yields estimation results that are highly dependent upon the simultaneous estimation of the coefficients and the correction for unobserved heterogeneity. The reason is evident in the following chart. The series pictured in the chart are the average duration of spells of participation (duration to exit) and non-participation (duration to re-entry) in the data. As is evident, the average duration varies widely from country to country within each type of spell. If this variation is not acknowledged in estimation, the unobserved heterogeneity can lead to biases in estimation coefficients. In Table A1 on the next page, I report the results of duration analysis for the same samples: one set includes the control for unobserved heterogeneity (UH), while the other does not. Note the large differences in results.

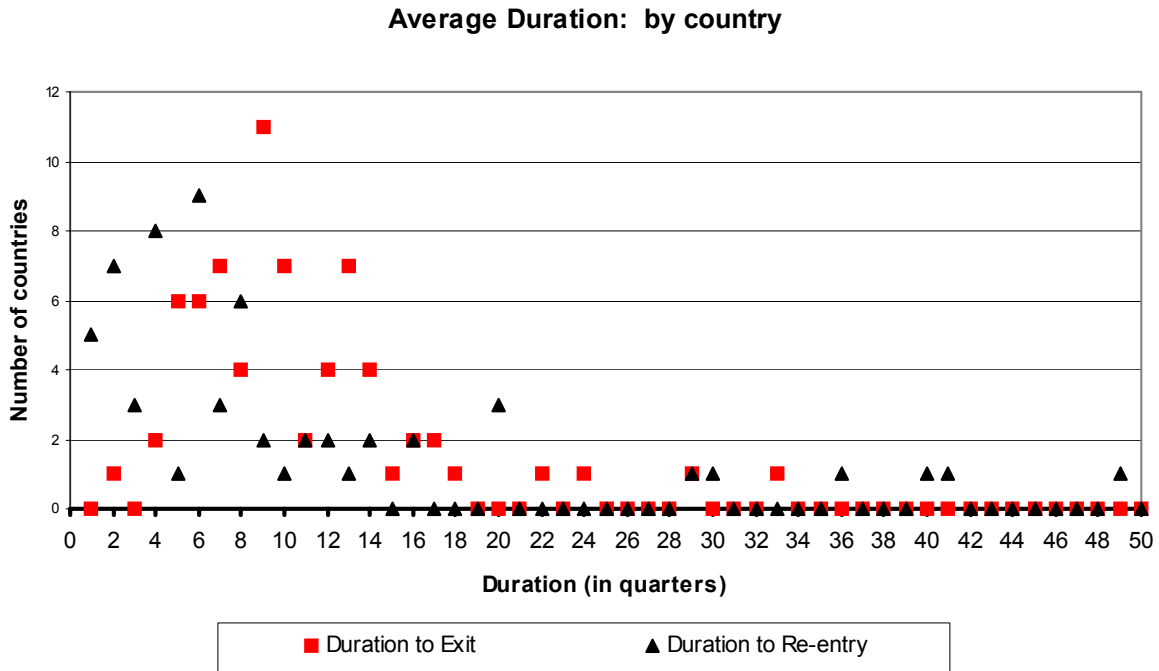


Table A1: The Importance of Controlling for Unobserved Heterogeneity

	$\theta_x(c,t)$: simple		$\theta_x(c,t)$: UH		$\theta_n(c,t)$: simple		$\theta_n(c,t)$: UH	
	Estimate	χ^2	Estimate	χ^2	Estimate	χ^2	Estimate	χ^2
cin(c,t)	0.00	0.00	-0.01	0.06	0.78	3.81 *	-3.87	10.87 **
ctot(c,t)	-0.01	0.31	0.10	8.43 **	-0.01	1.20	-0.07	3.31 *
rir(c,t)	0.05	0.07	1.56	10.61 **	0.19	2.41	0.08	0.07
rxr(c,t)	-0.05	0.01	-1.90	3.72 *	-0.92	3.87 **	-1.38	1.68
N: number of spells	104		104		94		94	
C: Number of countries with spells	50		50		50		50	
LR χ^2 test	0.36		23.86 **		13.80 **		21.73 **	
-2 Ln L	931.47		216.17		938.93		220.47	
-2 ln L (no covariates)	931.84		240.03		952.73		242.20	

Included in the proportional-hazards models labeled UH: C country-specific fixed-effect terms

* - indicates significance at 90 percent level of confidence, ** - indicates significance at 95 percent level of confidence.

Likelihood ratio χ^2 test for inclusion of 50 country-specific fixed-effect terms: 691.81 and 710.53 for θ_x and θ_n , respectively. Critical value at 95 percent level of confidence is 67.51.

