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Portfolio Capital Flows: Hot or Cold?

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A distinction is often made between short-term and long-term capital flows: the former are deemed unstable hot money and the latter are deemed stable cold money. Using time-series analysis of balance of payments data for five industrial and five developing countries, we find that in most cases the labels "short-term" and "long-term" do not provide any information about the time-series properties of the flow. In particular, long-term flows are often as volatile as short-term flows, and the time it takes for an unexpected shock to a flow to die out is similar across flows. Long-term flows are also at least as unpredictable as short-term flows, and knowledge of the type of flow does not improve the ability to forecast the aggregate capital account.

Several developing countries have received large capital inflows in recent years, reversing a trend of outflows for most of the 1980s (see Gooptu 1993). Much of this new capital inflow has been short-term portfolio investment, including bonds, equities, and short-term instruments such as certificates of deposit and commercial paper. This surge in short-term flows has raised the question of whether these flows will be sustained or instead be reversed in the near future.

Some observers argue that the recent flows are inherently unsustainable because they have short maturities. For example, on the basis of this argument, Reisen (1993:2) concludes that "the majority of flows [to Latin America] are hot rather than cool." Nunnenkamp (1993) employs a similar approach and points out that the composition of inflows varies considerably among developing countries. His conclusion is that hot money transactions have been relatively small in the Chilean case but significantly large in Brazil. And Turner (1991), in his review of capital flows for industrial countries, ranks short-term bank lending as most volatile and long-term bank flows as least volatile, followed by foreign direct investment (FDI) as the next-to-least volatile (Turner 1991, table 35, p. 95).

This article focuses on the implicit reasoning that reliable inferences can be drawn about the degree to which a flow tends to sustain itself at its current level,

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that is, the degree of persistence, solely on the basis of data categories given in balance of payments statistics. That is, the conventional view asserts that persistence can be inferred from labels. Here we ask whether, given direct statistical measures of persistence, labels can be drawn from persistence. In effect, our way of verifying this proposition is to turn it around and see if it also holds in the opposite direction. When only time-series statistics on persistence are used, can the label of the flow be identified? As we explain in section II, we are skeptical on theoretical grounds that such an inference is reliable; however, we think the issue is worth a systematic examination.

Section I provides the motivation for the analysis. Section II discusses the modeling of capital flows. Section III discusses what evidence is relevant. Section IV provides the classifications for the various capital flows and the data sources. Section V analyzes simple univariate statistics for the various individual flows and looks at the predictability of these flows to answer the question: hot or cold? Section VI investigates the interactions between the various flows. It also looks at the predictive power of the overall capital flows and the interactions between the various flows and the overall capital account. Section VII is a summary.

I. Motivation

The notion that inferences can be made about the characteristics of financial flows by just observing their labels is, of course, not new in economics. The flows-of-funds approach used by many central banks and others to analyze developments in the domestic economy embodies the implicit view that there is information in labels. This view has also long been an important part of the traditional analysis of international finance (see Nurske 1944 for a description of experiences in the 1920s). A distinction is often made between short-term and long-term capital flows: short-term capital movements are deemed speculative and reversible—hot money—and long-term capital flows—cold money—are based on fundamentals and are deemed reversible only when the fundamentals change.

The fact that capital control programs in many countries distinguish between short- and long-term flows already points to the importance attached to this distinction. Capital account transactions are often also subject to policy interventions that differ according to the type of flow. Withholding taxes are often levied on one kind but not another kind of capital flow. Subsidies often take the form of a government guarantee of private liabilities, favorable tax treatment on earnings (for example, on FDI), or access to special government facilities (for example, debt-equity swaps). Each of these distortions is designed to encourage or discourage a given type of capital transaction. In fact, the whole structure of balance of payments accounts reflects the implicit view that different types of capital flows have different economic implications.

However, it is easy to be skeptical about the information value of the balance of payments labels for any purpose, not just for assessing persistence.

Increasingly, multiple financial instruments are available to finance any project, and so if a tight link ever existed between the financing method and the underlying nature of the project, it is probably becoming increasingly loose. A Treasury bond with a thirty-year maturity can be sold on the secondary market, and short-term assets can be continuously rolled over. Many observers seem to base their notion that short-term flows are more volatile on the fact that short-term-maturity inflows need to be repaid more quickly than long-term flows. Although rapid repayment may lead to higher volatility of gross short-term flows, it need not make net flows more volatile. Short-term flows that are rolled over are equivalent to long-term assets, and a disruption of gross FDI inflows, for example, can cause its net flow to be equivalent to a repayment of a short-term flow.

In addition, the explicit label given to a flow may not cover its implicit nature. Dooley (forthcoming) argues, for example, that, although the inflows to developing countries in the 1970s were private capital flows in name, the universal government guarantees of both lenders and borrowers considerably subdued the discipline of the market. The flows, which helped generate the debt crisis of 1982, should have been considered official capital flows.

The reasoning based on the label of the flow can nevertheless underpin substantive policy measures. Once a flow is identified as hot money, it is often seen to require some policy response. At various times countries (especially developing countries) have responded with exchange rate management, (sterilized) intervention, fiscal contraction, borrowing taxes, absolute foreign borrowing constraints, and reserve requirements (see, for example, Kiguel and Caprio 1993, Fischer and Reisen 1992, and Corbo and Hernandez 1993 for reviews of developing countries' responses to recent capital inflows). Many of these responses have differed depending on the "label" of the flow, thus presuming that labels are meaningful.

II. Modeling Capital Flows

Research on international capital flows has differed on whether it is more accurate to treat the flows as exogenous (with respect to the country in question) or endogenous. In this study, although we do not think it vital to take a stand on this issue, we do clarify how the interpretation of our findings depends on this issue.

If capital flows are exogenous from the point of view of the domestic economy, perhaps because they are driven by changes in international financial variables and market perceptions of the country, then the policymaker's concern about the volatility of capital flows can make good sense. Depending on the exchange rate policy being pursued by the country, volatile capital flows can translate into exchange rate volatility (in the case of a flexible exchange rate) or into variations in official reserves (in the case of a fixed or pegged exchange rate). Either consequence can be undesirable because it leads to

temporary signals to shift resources between traded and nontraded sectors or because it requires monetary adjustments. If flows are exogenous, it would clearly be useful to know whether the data support the conventional view that certain kinds of flows are inherently more volatile and that certain flows can be predicted better.

If capital flows are endogenous, however, an analysis of the behavior of capital flows in isolation makes little sense. Here, everything depends on the nature of the shock that gives rise to changes in the current account. The behavior over time of the flows would reflect the behavior over time of the underlying shocks. In the unlikely event that different flows have different ultimate causes and that the causes have different time-series properties, the flows themselves would have different time-series properties. But this seems to be a remote possibility. If capital flows are predominantly endogenous, there is no deep reason to expect any particularly tight relationship between types of flows and time-series properties.

It may be argued that rather than taking an agnostic approach to the causality question, it would be better to present a model and try to identify the important causes, and then to use that framework to assess the question of persistence of financial flows. It has proven difficult, however, to develop such a structural model empirically with underlying sources of shocks. Capital flows in general, and perhaps even more so portfolio flows to developing countries, have been difficult to explain. Recent studies by Calvo, Leiderman, and Reinhart (1993); Chuhan, Claessens, and Mamingi (1993); and Fernandez-Arias (1994) find low explanatory power, and the authors have difficulty identifying which factors exactly determine capital flows. One finding common to these three papers is that external factors, particularly the lower interest rates in the United States in the early 1990s, may have been important in motivating capital flows to developing countries.

III. What Evidence Is Relevant?

The view that labels convey information about persistence underlies laws about capital controls and is implicit in some academic research, but it is not expressed in a way that makes it obvious how to evaluate it empirically. Broadly speaking, to evaluate claims that certain kinds of flows are more volatile, we look at coefficients of variation; to evaluate claims about persistence, we look at measures of (positive) serial dependence and half-lives from impulse responses; and to evaluate claims about predictability, we look at time-series measures of forecasting performance. This evidence provides part of what we want; we also look at additional evidence on total capital flows and on how the flows interact with each other. Questions about the volatility of certain types of capital flows are (presumably) motivated by concerns about the volatility of the total capital account, not just about the volatility of one particular capital flow. Policymakers after all wish to assess the likelihood of sudden and destabilizing changes in the total capital account, not just in its components.

To frame this point in a more concrete setting, suppose that a policymaker observes a rise in FDI during the latest quarter. Does this mean anything for the level of total capital flows? At an extreme, the FDI inflow can be merely a shift from, for example, long-term (bank) inflows to FDI inflows. In this case there would be an exact offset because the two flows would be perfectly negatively correlated, and the rise in FDI would carry no information about the level of total capital inflows and its volatility.

An actual example of this phenomenon of substitution between various capital flows was the rapid growth of holdings of deposits in offshore banks by U.S. residents in the 1970s. These deposits were attracted by higher yields offshore that were made possible by the absence of deposit interest rate ceilings, reserve requirements, charges for deposit insurance, and other factors. The capital outflow in the U.S. balance of payments was matched at first by interbank loans from the branches to the U.S. head office. When these inflows were discouraged, other forms of capital inflows took their place. Such inflows and outflows were offsetting and had little to do with an analysis of the U.S. balance of payments position. A similar effect occurred in the context of the Voluntary Restraint Program that the United States launched in February 1965, and the effect was particularly strong with respect to FDI (see, for example, Brimmer 1966 and Dooley 1981 and 1990).

More generally, if a flow is a close substitute for other flows, it can be quite volatile, but this need not necessarily be a cause for concern, because other flows may be offsetting its volatility. Correspondingly, attributing volatility to a particular flow can be misleading in the presence of substitution or complementarity. The possibility of systematic interactions between components of the capital account needs thus to be addressed before making inferences from the parts to the whole.

We examine these questions by first looking at correlations among the various flows. Then we ask a question that we think is central to assessing whether data on the components of capital flows can provide an early warning for future levels of capital flows: to what extent does the knowledge of the composition of the capital account improve the ability to forecast future levels of the capital account?

This article analyzes data on components of capital flows in five industrial and five developing countries. It investigates whether volatility and persistence match up with categories of capital flows as expected and whether the data reveal systematic relationships among the flows, as well as the extent to which the available categorization of data provides useful information for forecasting total capital inflows. Because the article relies completely on time-series analysis, data requirements are limited.

IV. Data

For our analysis, we classified balance of payments flow data according to the type of instrument within the country studied. We distinguished between

four categories of flows: FDI, portfolio equity, long-term (official and private), and short-term. The focus of the analysis was on net flows, because our concern was net financing. A list of the categories of data used is in table A-1. (Note that we took the labels as they are given in IMF, various years, and did not make any data corrections.) From the same source, we used data on quarterly changes in claims and liabilities to investigate the short-run time-series behavior of various flows. All flows are in millions of U.S. dollars deflated by the U.S. producer price index to convert them into real (1987) dollars.

A second distinction we made is by transactor, that is, foreign direct investors (FDI plus other long-term flows), banks, government, and the private sector. The results of using this distinction are provided in Claessens, Dooley, and Warner (1993).[1]

In addition, countries could be concerned with the occurrence of rare but large, sudden movements in capital flows, such as those that occurred in 1982 in many developing countries with the start of the debt crisis and in 1992–93 in some industrial countries with the breakdown of the European Exchange Rate Mechanism. This concern, and the possible lumpiness of quarterly data, would suggest that annual data should also be analyzed. Given the rare occurrence of such crises and the limited annual data, however, analysis of time series is of little use. Instead, case studies are more appropriate for investigating such events.

We selected five industrial countries (France, Germany, Japan, the United Kingdom, and the United States) and five developing countries (Argentina, Brazil, Indonesia, the Republic of Korea, and Mexico). The five industrial countries are the largest economies in the world, and flows to and from these countries represent the majority of capital flows between industrial countries. The five developing countries are among the developing countries that have received the largest share of private capital flows in recent years, and they represent very different country circumstances and institutional backgrounds. Such a choice has given us a broad selection of country circumstances on which to make some generalizations.

1. A third classification we could have made would have been by source (type of creditor). For developing countries, the source can be determined by using the World Bank Debtor Reporting System (DRS). One source distinction could, for example, be between official (bilateral and multilateral) and commercial sources (further distinguished, if desired, by destination, public, publicly guaranteed, and privately nonguaranteed). Adding the IMF balance of payments flows (short-term, FDI, and equity) to the breakdown of the DRS gives a more complete picture of the sources of external financing. But using DRS data (in addition to IMF data), instead of IMF data exclusively, has three drawbacks: (1) DRS data are reported annually, not quarterly; (2) the DRS does not cover industrial countries; and (3) DRS and IMF data can differ (greatly) for a given developing country (because of different data sources, conceptual problems, and capital flows not recorded in IMF data, such as capital flight). Nevertheless, the advantages of being able to distinguish long-term flows by source would likely be considerable, given the different objectives of official and commercial creditors.

V. Hot or Cold?

Table 1 provides means, standard deviations, and coefficients of variation (CVs) for various kinds of flows, broken down by type.[2] To provide an indication of the relative magnitude of these flows compared with the total capital account, the third column of table 1 presents the average for the flows as shares of total financing. Long-term flows are the most important for all countries except the United States and Japan, where, respectively, short-term flows and portfolio equity flows are more important. There does not appear to be a systematic pattern in the volatility (as measured by the CV) of various types of flows across countries. Long-term flows have the highest CV for four countries; FDI for four countries; and portfolio equity flows for two countries. Perhaps surprising to those claiming that short-term flows are hot is the fact that short-term flows have the lowest CV in seven countries. Note also that the volatility of the total capital account is often less than that of a component.

High relative volatility is one of the notions that has been associated with hot money. A related notion is that a hot-money inflow is likely to disappear or reverse itself in the near future, whereas a cold-money inflow is more likely to persist. Degree of persistence and level of volatility are two complementary measures: hot flows are associated with low persistence and high volatility. Figure 1 provides data on net capital flows in Japan (in millions of 1987 dollars, positive figures denoting inflows), by type of flow. These data provide the best corroboration we have found for conventional ideas about the persistence of various kinds of flows. Figure 1 shows that the FDI and portfolio equity flows display much less volatility over short periods than do the short-term flows and that the long-term flows are somewhere in between.

One efficient way to summarize the idea of persistence that is apparent in figure 1 is to calculate autocorrelations for each type of capital inflow. A persistent series will be positively autocorrelated, whereas a transitory series will have a low or negative autocorrelation. In general, the classic case of a cold-money flow would be a flow that is highly positively autocorrelated, whereas a hot-money flow would exhibit zero or even negative autocorrelations. Referring back to figure 1, we would expect the FDI flows for Japan to have large positive autocorrelations and the short-term flows to exhibit far lower or even negative autocorrelations.

The autocorrelations for Japan in figure 2 conform to these expectations, given the time-series plots. Note that FDI and portfolio equity have high positive autocorrelations. In contrast, the short-term flows exhibit negative autocorrelations, and the signs change from quarter to quarter. The long-term flows are only positively correlated at short horizons.

The main finding for the other countries is that, if anything, the conventional pattern exhibited by the Japanese data is the exception rather than the rule. In

2. The detailed results for the categorization of flows by transactor are available in Claessens, Dooley, and Warner (1993).

Table 1. *Basic Statistics on Capital Flows, by Country*

Country, period, and type of flow	*Mean (millions of 1987 dollars)*	*Standard deviation (millions of 1987 dollars)*	*Average share in total financing (percent)*	*Coefficient of variation (CV) (percent)*
Argentina, 1976:1–1992:1				
Foreign direct investment	21	237	1.8	1,123
Portfolio equity	94	444	−2.5	473
Long-term	−896	1,829	100.0	204
Short-term	747	1,158	0.7	155
Short- and long-term	−149	1,549	100.7	1,040
Total	−34.05	1,456.47	100.0	4,278
Brazil, 1975:1–1991:4				
Foreign direct investment	−55	309	−1.0	562
Portfolio equity	−6	99	0.3	1,611
Long-term	−1,056	4,961	78.0	470
Short-term	3,000	3,080	22.7	103
Short- and long-term	1,944	3,052	100.7	157
Total	1,883	3,043	100.0	162
France, 1978:1–1992:3				
Foreign direct investment	—	—	—	—
Portfolio equity	—	—	—	—
Long-term	−534	5,569	88.1	1,043
Short-term	−1,170	2,704	11.9	231
Short- and long-term	−1,196	5,020	100.0	420
Total	—	—	—	—
Germany, 1979:1–1992:1				
Foreign direct investment	−376	755	2.1	201
Portfolio equity	2,140	3,169	−7.9	148
Long-term	−2,761	9,642	70.0	349
Short-term	−5,866	4,067	35.9	69
Short- and long-term	−8,627	9,853	105.8	114
Total	−6,864	9,752	100.0	142
Indonesia, 1976:1–1992:1				
Foreign direct investment	3	100	0.7	3,719
Portfolio equity	15	68	1.3	454
Long-term	−560	1,438	70.7	257
Short-term	1,062	342	27.3	32
Short- and long-term	501	1,496	98.0	298
Total	519	1,519	100.0	293
Japan, 1979:1–1992:1				
Foreign direct investment	−1,261	1,234	5.9	98
Portfolio equity	−8,451	10,282	66.0	122
Long-term	−125	11,280	21.9	9,007
Short-term	−959	4,506	6.1	470
Short- and long-term	355	10,941	28.1	3,081
Total	−10,854	13,407	100.0	124
Korea, 1976:1–1992:1				
Foreign direct investment	−1	159	2.8	23,366
Portfolio equity	63	189	2.7	300
Long-term	−757	2,271	92.4	300
Short-term	669	745	2.0	111
Short- and long-term	−88	2,187	94.5	2,490
Total	−25	2,304	100.0	9,036
Mexico, 1975:1–1992:1				
Foreign direct investment	79	224	−1.3	283
Portfolio equity	−2	873	−2.7	53,811
Long-term	−358	3,783	92.0	1,057
Short-term	1,348	1,186	11.9	88
Short- and long-term	990	3,599	103.9	363
Total	1,068	3,340	100.0	313

Country, period, and type of flow	*Mean (millions of 1987 dollars)*	*Standard deviation (millions of 1987 dollars)*	*Average share in total financing (percent)*	*Coefficient of variation (CV) (percent)*
United Kingdom, 1973:1–1992:1				
Foreign direct investment	−2,041	2,302	2.8	113
Portfolio equity	413	969	−4.6	235
Long-term	1,075	8,927	102.2	830
Short-term	−378	1,612	−0.4	426
Short- and long-term	697	8,688	101.8	1,247
Total	−931	8,014	100.0	860
United States, 1973:1–1992:1				
Foreign direct investment	−478	5,308	13.0	1,110
Portfolio equity	−2,046	3,045	0.4	149
Long-term	3,635	11,169	40.7	307
Short-term	5,897	11,929	45.9	202
Short- and long-term	9,532	16,886	86.7	177
Total	7,007	20,118	100.0	287

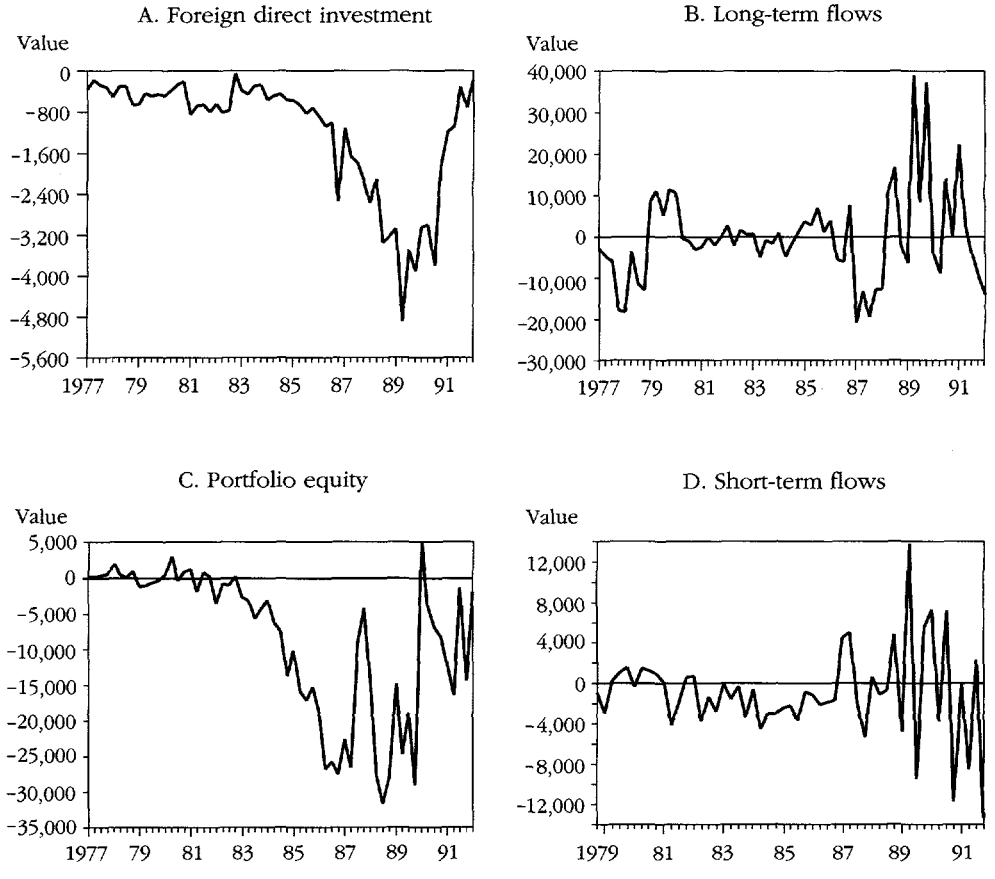
— Not available.
Note: The statistics are based on quarterly data deflated by the U.S. producer price index.
Source: IMF (various years) and authors' calculations.

many other countries the conventional pattern simply breaks down. Figures 3 and 4 show this for Germany and Mexico. For Germany, for example, FDI appears at least as volatile as short-term flows, and long-term flows appear the most stable for Germany. And for Mexico, when broken down by transactor, flows to the banking system appear more stable than flows to the government (as well as to the private sector). The autocorrelations for Germany (figure 5) confirm that FDI flows are the least stable and long-term flows the most stable. For Mexico (figure 6), the government and private sector flows have indeed the lowest (for some lags even negative) autocorrelations.

Another way to summarize the evidence on persistence for all countries is to compute half-lives from impulse response functions. To do this, we estimated a univariate fourth-order autoregressive or AR(4) model for a given flow and then examined how a given shock to the error term in the estimated equation propagated itself through time.[3] If a time series is highly positively autocorrelated, it will take a long time for a shock to die out; if the autocorrelations are low, the shock should vanish quickly. The half-life in this context is simply the number of quarters it takes for the shock to lose half or more of its initial value. The results are reported in table 2.

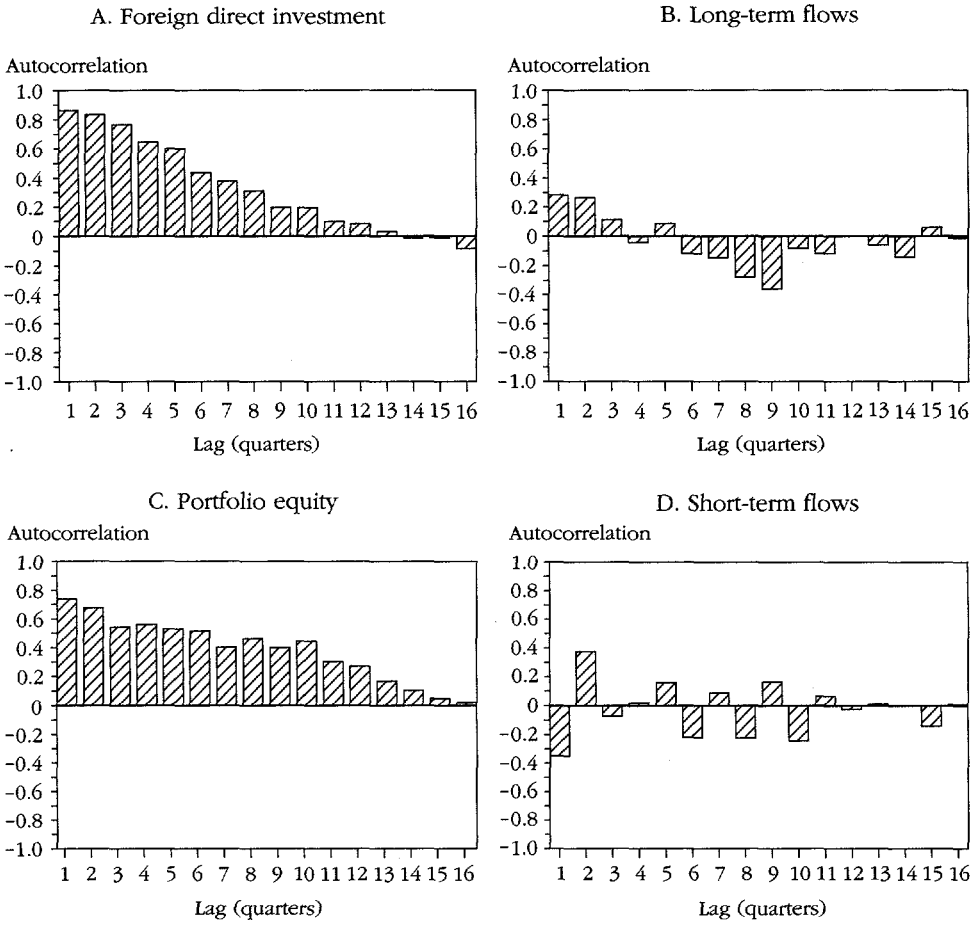
3. We chose an AR(4) model because we used quarterly flows and we wanted to account for possible seasonal effects. We used four lags because we thought it was important to at least exceed one year in the lag length and because experiments with longer lags did not alter the results importantly.

Figure 1. *Net Capital Flows by Type, Japan, 1977–91*
(millions of 1987 dollars)



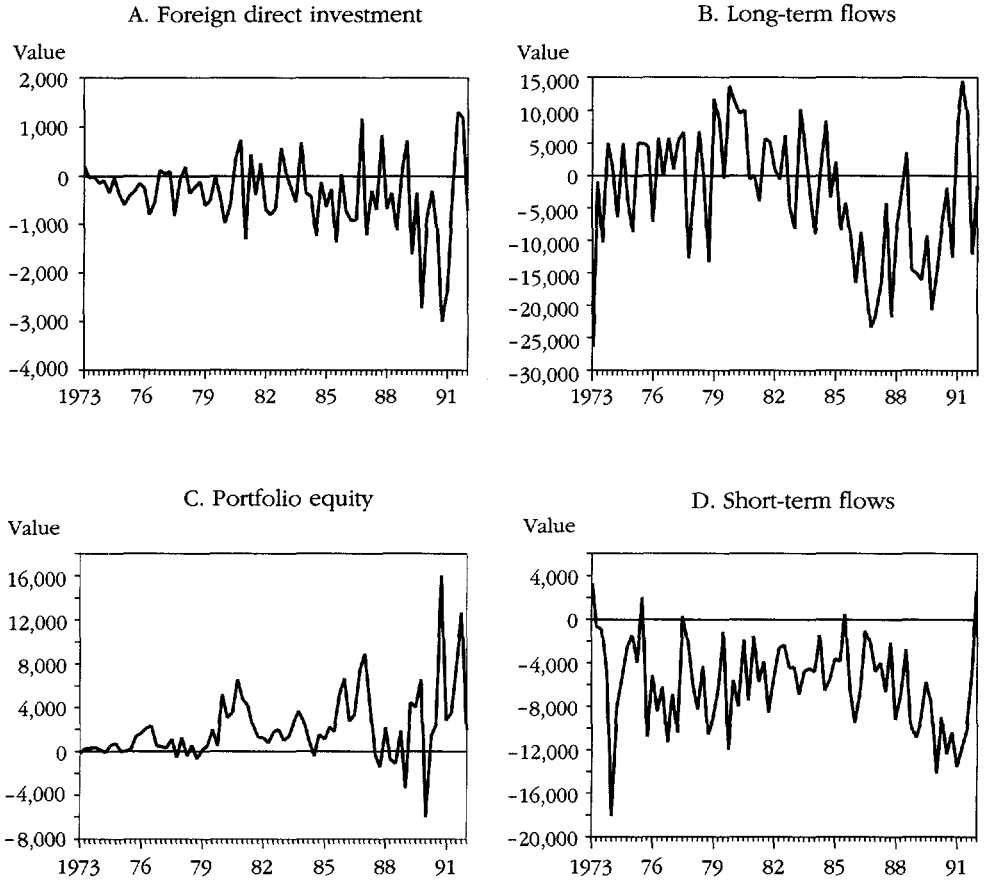
Note: Positive values denote inflows.
Source: IMF (various years) and authors' calculations.

Figure 2. *Autocorrelations of Net Capital Flows by Type, Japan*



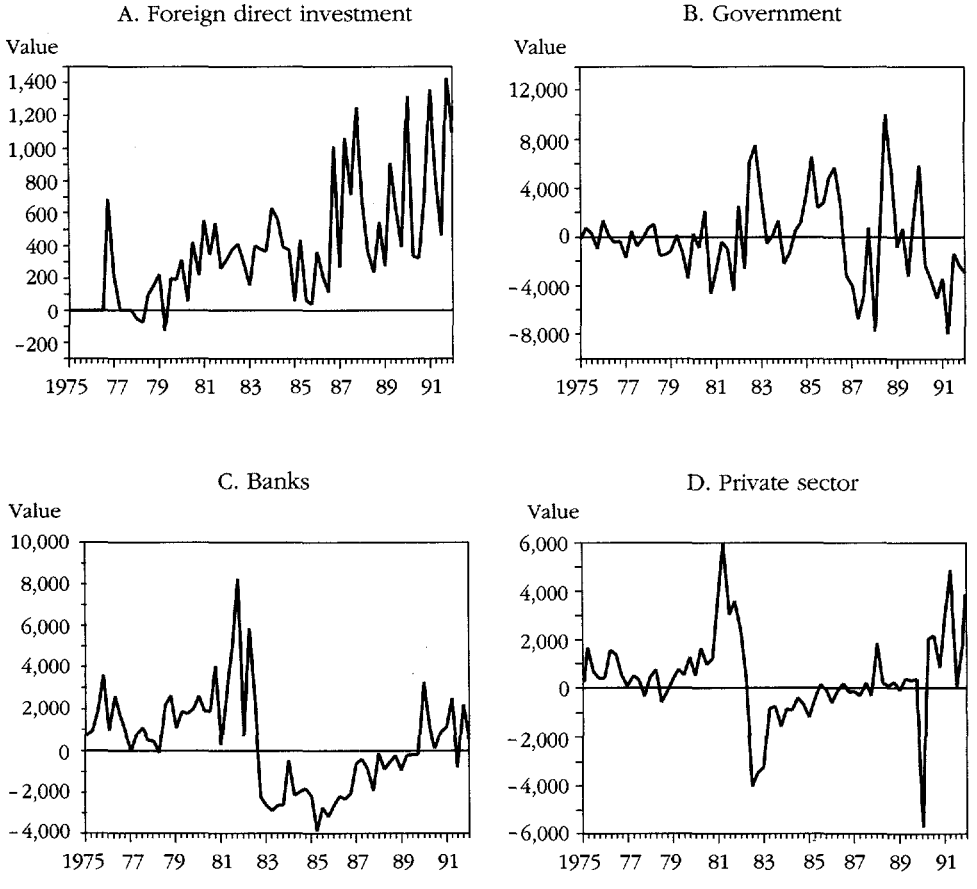
Source: Authors' calculations.

Figure 3. *Net Capital Flows by Type, Germany, 1973–91*
(millions of 1987 dollars)



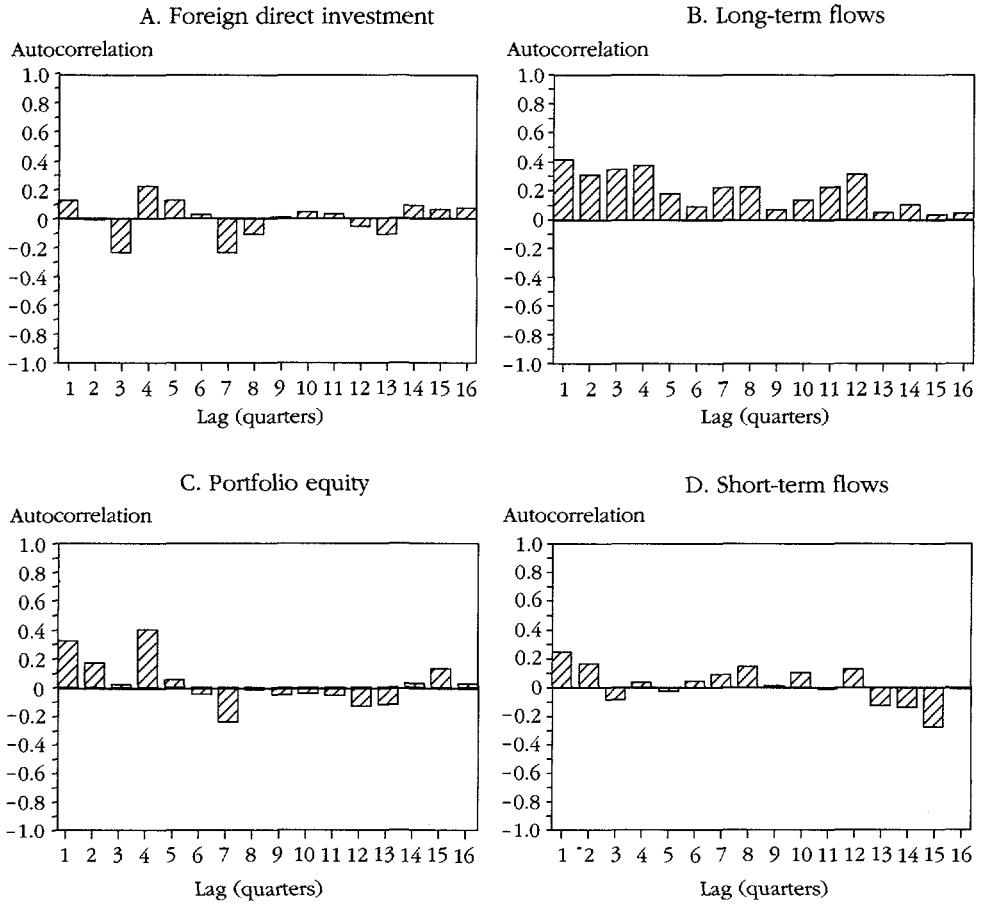
Note: Positive values denote inflows.
Source: IMF (various years) and authors' calculations.

Figure 4. *Net Capital Flows by Transactor, Mexico, 1975–91*
(millions of 1987 dollars)



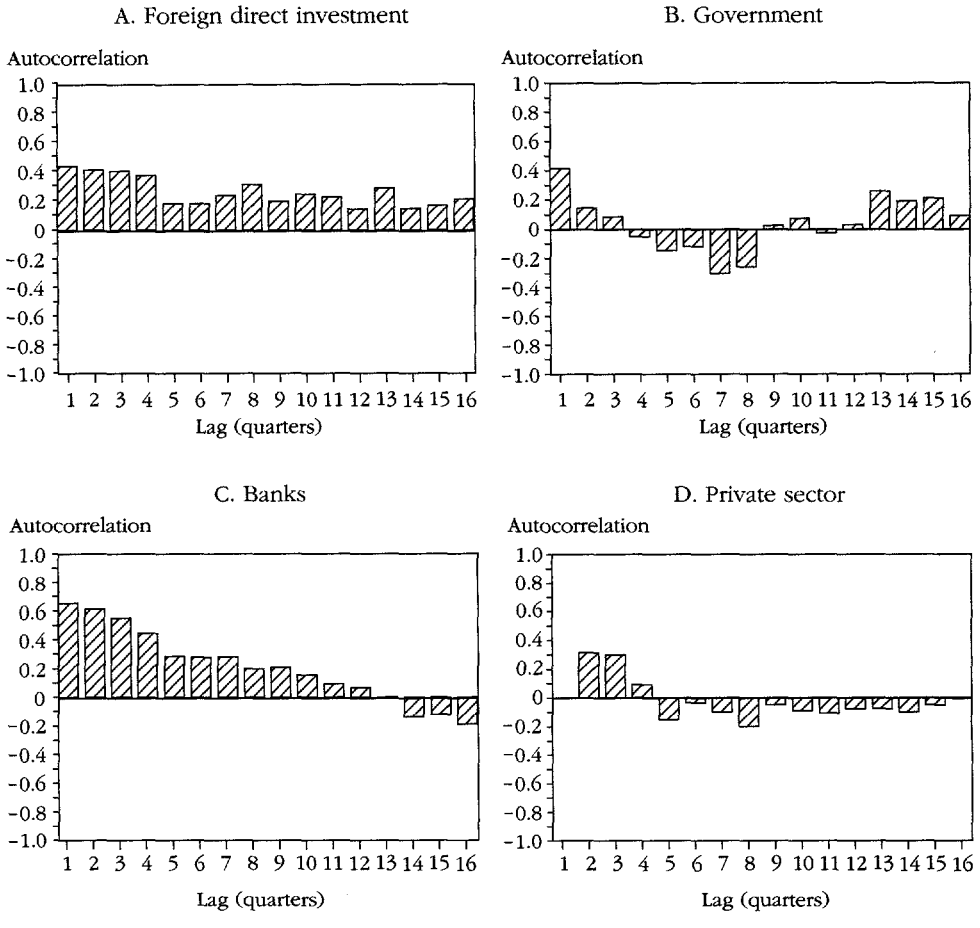
Note: Positive values denote inflows.
Source: IMF (various years) and authors' calculations.

Figure 5. *Autocorrelations of Net Capital Flows by Type, Germany*



Source: Authors' calculations.

Figure 6. *Autocorrelations of Net Capital Flows by Transactor, Mexico*



Source: Authors' calculations.

Table 2 provides little support for those who wish to infer persistence from labels. With the exception of Japan, most of the half-lives are 1: that is, more than 50 percent of the shock has dissipated before even one quarter has elapsed. This is true for the breakdown of flows by type as well as by transactor (not reported). It basically reflects the fact that the lag coefficients in the estimated autoregressive equations are small. In addition, there is little evidence, apart from the case of Japan, that the allegedly persistent flows—such as FDI and long-term flows—exhibit more memory than the other flows.

So far, we have examined the question of whether persistence—as measured by autocorrelations and half-lives—matches up with the categories, and we have found that often there is not a close correspondence. A different but related question is whether the flows are forecastable solely on the basis of their own past and whether the forecasts match up with the categories in the expected way. The key point here is that a flow can be predictable without necessarily being significantly positively autocorrelated or having a high half-life. As long as a flow follows some pattern, not necessarily that of positive serial correlation, it can be predictable. It is possible that instead of making statements about half-lives or autocorrelations, conventional wisdom may simply be saying that long-term flows are more predictable than short-term flows.

The test we employ on predictability is a simple measure of the goodness of predictive power: the residual mean square error (RMSE). We estimated again, starting from 1982, a univariate AR(4) model for all flows and then performed out-of-sample forecasts for the next four quarters on the level of the flows. Using the new data, we updated the AR(4) model each year and performed another out-of-sample forecast—for the next year—repeating this procedure for each year. We then standardized the out-of-sample forecasting RMSE with

Table 2. *Half-Lives from Impulse Response Functions*
(in quarters)

Country	*Foreign direct investment*	*Portfolio equity*	*Long-term flows*	*Short-term flows*
Argentina	—	1	—	1
Brazil	1	3	1[a]	3
France	—	1	—	1
Germany	1[a]	1	1[a]	1
Indonesia	—	1[a]	1[a]	1[a]
Japan	9[a]	1	3	1
Korea, Rep. of	1[b]	1[a]	2[a]	1[a]
Mexico	1[b]	1	—	2
United Kingdom	2[a]	1	1[a]	1
United States	1	1	1	1

— Not available.
Note: The half-lives measure the number of quarters it takes before the impulse response is half or less of the initial shock. For countries with incomplete data, we analyzed liabilities or claims separately.
a. Based on data from liabilities side only.
b. Based on data from claims side only.
Source: Authors' calculations.

Table 3. *Relative Ability to Predict Individual Categories of Flows*
(ratios of residual mean square errors)

Country	*Foreign direct investment*	*Portfolio equity*	*Long-term flows*	*Short-term flows*
Argentina	—	—	1.11	1.00
Brazil	0.97	1.24	1.02	1.00
France	—	—	1.35	1.00
Germany	1.40	1.31	1.13	1.00
Indonesia	—	1.03	0.77	1.00
Japan	0.76	0.89	1.06	1.00
Korea, Rep. of	0.91	0.95	0.91	1.00
Mexico	1.16	1.23	1.15	1.00
United Kingdom	1.18	1.17	1.05	1.00
United States	0.86	0.98	0.83	1.00

— Not available.

Note: We first estimated AR(4) univariate forecasting equations for each of the four categories. Then we computed all possible four-step-ahead dynamic forecast errors from these equations and calculated residual mean square errors (RMSEs). These were then divided by the standard deviation of the time series to obtain a unit-free measure of forecasting performance. These normalized RMSEs were then divided by the normalized RMSE for the last category, short-term flows, to compare forecasting performance across categories. These ratios are reported above. A value over 1.0 indicates that the category exhibits poorer forecasts than the forecasts for short-term flows. Quarterly data were used for the forecast period from the first quarter of 1982 to the fourth quarter of 1991, except for France (from the first quarter of 1985 to the fourth quarter of 1991) and Brazil (from the first quarter of 1982 to the third quarter of 1988).

Source: Authors' calculations.

the standard deviation of the respective flow to get a measure of the relative ability to forecast the various flows. Finally, we compared the ability to forecast the various flows with the ability to forecast short-term flows. Short-term flows are commonly assumed to be the most volatile and least predictable type of flow, and we would thus expect the other flows to be more predictable than short-term flows.

The evidence on this issue (table 3) is that, compared with the benchmark (short-term flows), other flows cannot systematically be predicted more accurately. For about half of the countries, our forecasts for the other flows were actually worse than the forecast for short-term flows. The two countries for which we were able to predict all other flows better were the United States and the Republic of Korea. Altogether, only about half of the other flows were more predictable than short-term flows. Compared with the autocorrelations and half-lives, the evidence on relative predictability using the time-series model showed that a low score on the first two measures generally translates into high unpredictability.

VI. How Do the Flows Interact?

The evidence so far provides some basis for skepticism about gauging volatility and persistence by using only the labels given to the flows. As explained

Table 4. *Marginal Sources of Financing the Current Account*
(slope coefficients)

Country	*Foreign direct investment*	*Portfolio equity*	*Long-term flows*	*Short-term flows*
Argentina	−0.03	−0.08	1.06**	0.06
Brazil	−0.00	0.01	1.27**	−0.27
France	—	—	0.98**	0.02
Germany	−0.02*	0.02	0.83**	0.17**
Indonesia	0.01	0.01	0.99**	−0.01
Japan	−0.03**	0.17	0.86**	0.00
Korea, Rep. of	−0.02	0.00	1.28**	−0.26**
Mexico	−0.00	−0.10**	1.07**	0.03
United Kingdom	0.03	−0.02*	0.99**	0.00
United States	0.11**	−0.01	0.42**	0.49**

— Not available.
* Significant between the 5 and 10 percent level.
** Significant at the 5 percent level or better.
Note: Slope coefficients for the regressions of the quarter-to-quarter change in the level of a particular flow on the quarter-to-quarter change in the level of the total capital account.
Source: Authors' calculations.

before, there may be some offsets between various flows. It would thus clearly help to know whether there are systematic correlations in the data along these lines. We started by calculating the simple correlation matrixes between the various categories of flows for all countries (not reported). The correlations showed some degree of substitution (that is, negative correlations) between most flows for almost all countries. For some countries, the substitution was very pronounced, with high negative correlation between short- and long-term flows.

We next performed an analysis on the marginal source of financing the current account.[4] We ran regressions of the changes in the various types of flows on the change in the total capital account. Slope coefficients provide a measure of the degree to which a particular flow "finances" at the margin the country's overall financing requirements or surplus (under the assumption that the current account movements drive capital flows). Table 4 provides the slope coefficients. Long-term flows appear to be the most sensitive: for all countries except one the slope coefficient for long-term flows is the highest. The lack of consistent ranking among the other flows across countries suggests that short-term flows do not differ on this measure from, for example, FDI.

Our results differ from those of Turner (1991) and Fry (1993). Two facts may account for this: we used quarterly as opposed to annual data; and we

4. As mentioned before, this approach does not allow us to distinguish between the endogenous and exogenous natures of the various types of capital flows. Doing so would require a structural model that covered, among other things, shifts in investment opportunities. Nevertheless, our approach gives an indication of the empirical relation between the total capital account and its components.

took the total capital account as the right-hand variable, whereas the other two studies excluded the balance of official monetary movements (that is, official reserve movements) from the total capital account. The classification by transactor (not reported) showed that, except for the United States, flows to and from the government sector have been the most accommodative. Although it may not be surprising that the government sector is the most accommodative, it does raise the question of whether the government is the source of volatility in capital flows or whether it is accommodating to the volatility of other flows.

The results so far suggest there is sufficient substitution between and interactions among the various flows to make an analysis of the time series of a single flow possibly misleading.[5] This possibility can best be further addressed by investigating how well we can forecast the total capital account using past information. Table 5 presents the ratio (ratio 1) of the RMSE of the forecast of the total capital account using a time-series predictor, AR(4) regression, to the RMSE of a naive predictor (one with no change in the capital account). As can be observed, we can generally improve on the naive forecasts (by up to 34 percent), and this indicates that there is some information in the past time series for the aggregate capital account.

Does knowledge of the breakdown category of flows convey any information about total capital flows? To analyze this, we forecasted the total capital account by using past information on the total capital account as well as information on the contemporaneous shares of the individual flows. We reasoned that if the total capital account is independent of a particular flow, then adding the contemporaneous share of the flow should not affect our forecasting ability. Conversely, if a flow helps determine the total capital account, then adding the contemporaneous share should help the forecast.

Ratio 2 in table 5 presents this horse race in relation to the AR(4) time-series predictor. Using the shares as additional information did not greatly improve our forecasting ability. At most, it improved our ability to forecast net flows by 10 percent (Japan), and in most cases the gain is less than 3 percent. This result provides evidence that, in general, movements in the overall capital account are little influenced by the type of capital flow. Because there is much substitution going on between the various flows, analyzing individual flows may not be very meaningful. It is thus better to focus attention on the determinants of the overall capital account; for example, the impact of the aggregate external shocks the economy is exposed to and the overall (macro-) economic policies the government pursues.

5. This analysis ignores any impact of the various flows on domestic savings or investment in this or future periods.

Table 5. *Relative Ability to Predict Overall Flows*
(ratio)

Country	*Ratio 1*	*Ratio 2*
Argentina	0.85	0.99
Brazil	0.77	1.00
France	—	—
Germany	0.94	1.00
Indonesia	0.67	0.97
Japan	0.84	0.90
Korea, Rep. of	0.96	1.00
Mexico	0.66	0.95
United Kingdom	0.92	0.92
United States	0.87	0.99

— Not available.

Note: Ratio 1 is RMSE(f2)/RMSE(f1), where RMSE(f1) is the residual mean square error (RMSE) of a naive predictor (no change in the capital account) and RMSE(f2) is the RMSE of the forecast of the total capital account using a time-series predictor, AR(4) regression, without share variables. Ratio 2 is RMSE(f3)/RMSE(f1), where RMSE(f3) is the RMSE of the forecast of the total capital account using a time-series predictor, AR(4) regression, with all the contemporaneous share variables plus their two lags. The RMSEs are based on four-step-ahead forecast errors. Flows include claims and liabilities.

Source: Authors' calculations.

VII. Summary

Using time-series analysis of data for five industrial and five developing countries, we find that in most cases the labels "short-term" and "long-term" in relation to capital flows do not provide any information about the time-series properties of the flows. Put differently, if only time-series statistics are available, it is not likely that the label of the flow can be identified. In particular, long-term flows are often as volatile as short-term flows, and the time it takes for an unexpected shock to a flow to die out is similar across flows. And, arguably the most relevant measure from a policymaker's point of view, short-term flows are at least as predictable as long-term flows. There is also little evidence that information about the composition of flows is useful in forecasting the overall level of flows, and this suggests that the overall capital account is independent of the type of flow.

The implication is that the emphasis on analyzing specific flows, especially short-term portfolio flows, is overdone. We find virtually no time-series property that can be regarded as an inherent property of any particular kind of flow. An attempt to reduce capital account volatility by administratively limiting short-term inflows is unlikely to be effective because there is little evidence that these flows really are more volatile than other flows. The evidence here is consistent with the view that capital flows are fungible, highly substitutable, and endogenous with respect to external shocks and internal policies.

Table A-1. *Data Classifications*

Item	*Line numbers*
Flow	
1. Change in direct investment claims	45, 46
Change in direct investment liabilities	49, 50
2. Change in bond claims	53, 56
Change in bond liabilities	54, 55, 57, 58
3. Change in equities claims	59
Change in equities liabilities	60, 61
4. Change in bank loan claims	69–71, 77–79
Change in bank loan liabilities	72–76, 80–83
5. Change in bank deposit claims	89
Change in bank deposit liabilities	90–92
6. Change in other short-term claims	48, 93, 94
Change in other short-term liabilities	52, 95–97
7. Change in other long-term claims	47
Change in other long-term liabilities	51
8. Change in long-term official claims (non reserve)	62–64
Change in long-term official liabilities (non reserve)	65–68
9. Change in short-term official claims	84, 85
Change in short-term official liabilities	86–88
10. Change in official reserves	98–111
11. Errors and omissions	112
Classification	
Foreign direct investment	1
Long-term flows	2, 4, 7, 8, 10
Short-term flows	5, 6, 9
Portfolio equity	3

Note: Flow items and line numbers refer to those in IMF (various years); line numbers for the items under Classification refer to the numbered items under Flow.

Source: IMF (various years) and authors' classifications.

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