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John Y. Campbell, Harvard University

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ARE DAILY CROSS-BORDER EQUITY FLOWS PUSHED OR PULLED?

John M. Griffin, Federico Nardari, and René M. Stulz*

Abstract—We investigate the conditions under which an intertemporal equilibrium model based on investors' portfolio decisions can explain the dynamics of high-frequency equity flows. Our model shows that, when there are barriers to international investment and when the expectations of foreign investors are more extrapolative than those of domestic investors (either due to foreigners being less informed or for behavioral reasons), unexpectedly high worldwide or local stock returns lead to net equity inflows in small countries. We investigate these predictions using daily data on net equity flows for nine emerging-market countries. Equity flows are positively related to host-country stock returns as well as market performance abroad at daily frequencies. Though these effects are remarkably robust at the daily frequency, they dissipate quickly.

I. Introduction

WITHIN the neoclassical paradigm, capital flows to where its marginal product is higher. As a result, the allocation of capital is more efficient and welfare is higher if capital can flow freely across borders. The emerging market crises of the 1990s persuaded many to challenge that view. Since 1997, economists, policymakers, and journalists have talked about shocks being propagated across countries with little regard for fundamentals through the actions of an "electronic herd" (Friedman, 1999, p. 142) of investors. This led Bhagwati (1998) to state that "Capital flows are characterized, as the economic historian Charles Kindleberger of the Massachusetts Institute of Technology has famously noted, by panics and manias." If markets work this way, it is not surprising that Stiglitz (1998), calling for greater regulation of capital flows, argues that ". . . developing countries are more vulnerable to vacillations in international flows than ever before."

In this paper, we investigate the determinants of daily cross-border equity flows for a sample of countries. Our paper builds upon existing empirical observations about holdings of foreign equity by domestic investors.[1] First, the home-bias evidence shows that domestic investors hold less foreign equity than if they held the world market portfolio. Second, there is some evidence that domestic investors buy foreign stocks following unexpectedly high returns on these stocks, a behavior often characterized as trend-chasing or momentum investing. We build a simple intertemporal model of equity flows and show under which conditions the model yields predictions consistent with these empirical facts. We find that a model consistent with these facts also predicts a relation between flows and nonhost-country stock returns that has not been examined empirically in the published literature.

Our main theoretical results are that (1) a model with perfect financial markets and investors who know the true distribution of returns cannot explain the existing evidence on flows, (2) the expectations of nonresident investors regarding the expected returns of a market have to be more extrapolative than the expectations of resident investors in

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* University of Texas at Austin; Arizona State University; and Ohio State University and NBER, respectively.

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[1] See Karolyi and Stulz (2003) for a review of this literature.

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order to explain the evidence that unexpectedly high stock returns in a country, say Thailand, attract equity flows toward that country, and (3) in a model where there is a home bias and extrapolative expectations, net equity flows toward small countries such as Thailand increase with unexpectedly high worldwide stock returns.

To examine the implications of our simple model, we use a unique data set of aggregate equity flows in nine emerging markets.[2] When testing the prediction of our model that flows into a country increase with the performance of other markets, we find that lagged returns in bigger markets such as the United States are helpful to understand flows into smaller countries such as Thailand. Adding lagged returns of other markets in a vector autoregression (VAR) of flows and returns improves the R^2 of the flow equation by roughly 25% on average. Though local market returns have an economically significant effect on flows, our impulse response analysis shows that flows are generally more responsive to past U.S. market performance than to local returns. These daily results persist even after controlling for contemporaneous effects, pooled analysis, alternative methods of scaling flows, exchange rate effects, regional flows, currency of denomination, structural breaks, and asymmetries. However, these effects dissipate rapidly, and at the weekly frequency we find very limited evidence of foreigners chasing past local and international returns.

Some papers have explored the relation between equity flows toward foreign countries and U.S. returns using monthly and quarterly data. The evidence is mixed, possibly because of a lack of power or because analyses using such data may be misspecified over longer periods of time that encompass economic regime changes. Bohn and Tesar (1996) investigate the contemporaneous effect of U.S. returns and host-country returns on monthly equity flows from the United States. Using a portfolio demand equation for individuals, they predict a portfolio-rebalancing effect and a return-chasing effect. With the rebalancing effect, investors sell equities from countries that are the best performers in their portfolio, for they have become overweighted in these securities. They predict that the portfolio-rebalancing effect implies that a high U.S. return is accompanied by flows toward foreign countries. However, most of the correlations between contemporaneous flows and the U.S. return in excess of the host-country return are insignificant in their data set, and no correlation is significantly positive.

Brennan and Cao (1997) present a model in which foreign investors are less informed than host-country investors about host-country stocks. Because of their information disadvantage, foreign investors learn more from public news. Good news announcements lead them to buy stocks from host-country investors. They argue that stock purchases by foreign investors in the host country could be associated with high returns in the country of origin of the foreign investors due to wealth effects. Since their investors have exponential utility functions, they cannot model such wealth effects, but they allow for them in their regressions. Using quarterly data, they find that equity purchases from U.S. investors of foreign-market securities are contemporaneously related to foreign-market performance but not related to U.S. equity returns.

Froot, O'Connell, and Seasholes (2001) use daily flow data to examine whether foreign capital precedes, moves with, or follows short-term local-market return performance. They find that flows increase following unexpectedly high returns in the host market and that they forecast returns. They interpret their evidence to be consistent with the view that foreign (say, American) investors are better informed about local (say, Thai) stocks than are local (Thai) investors. Because their data cover only custodian clients from State Street, further research is needed to understand whether their results describe the behavior of foreign investors in general.

A related literature has focused on the relation between capital flows and U.S. interest rates and industrial production. Calvo, Leiderman, and Reinhart (1993), Chuhan, Classens, and Mamingi (1998), and Fernandez-Arias (1996) all examine data from 1988 to 1992, a period during which a number of countries liberalized their capital flows, and find some evidence that low interest rates in the United States lead to higher outflows from the United States. When Bekaert, Harvey, and Lumsdaine (2002) take into account regime changes brought about by capital flow liberalizations, they fail to find a statistically significant relation between interest rates and flows. Edison and Warnock (2003) also take account of liberalization dates in a sample from 1989 through 1999 and find that an increase in U.S. interest rates reduces monthly net flows to some emerging countries.

This paper proceeds as follows. In section II, we present our model of how stock returns affect equity flows and the testable hypotheses we derive from the model. In section III, we describe the composition of the foreign flow data and examine their basic features. Section IV examines the extent of foreign-investor positive-feedback trading within a country and whether foreign investors' trading behavior foreshadows future price movements. The effect of regional returns on flows is examined in Section V and compared with that of local returns. Section VI examines the robustness of our results to the scaling of flows, exchange rate effects, foreign flows, currency of denomination, time periods, structural breaks, return asymmetries, and the use of weekly data. Section VII concludes.

[2] In a study developed independently, Richards (2004) relies on similar flow data from a subset of the countries considered here and for the period 1999–2001. He examines several of the relationships analyzed in the present paper.

II. A Simple Model of Equity Flows

We develop an intertemporal continuous-time model. Investors are infinite-lived. To make the model tractable, we assume that investors have logarithmic utility, so that investors are myopic, and that all investors are the same within a country. For simplicity, we consider a world with two countries, the domestic country D and the foreign country F. We assume that each country has one stock (the market portfolio of that country) and that the returns of the two stocks are uncorrelated. Let $\mu_D(t)$ and $\sigma_D(t)$ be, respectively, the instantaneous drift minus the risk-free rate and the instantaneous volatility of the diffusion process at date t followed by the instantaneous return of the domestic stock. We assume that trading is continuous, $\mu_D(t)$ and $\sigma_D(t)$ evolve randomly over time, the outstanding supply of shares of the domestic stock consists of N_D^S shares, and a share has price P_D. The subscript F denotes foreign values. Though portfolio choice models generally focus on portfolio shares, the available data on equity flows are in terms of net purchases and not portfolio shares. We therefore derive results for net purchases. Let $N_D^D(t)$ be the number of domestic shares and $N_F^D(t)$ the number of foreign shares demanded by domestic investors. The aggregate wealth of domestic investors is $W^D(t)$. We follow Brennan and Cao (1997) in ignoring currencies, so that foreign nominal quantities are in the same currency as domestic nominal quantities. The number of shares of stock in each country is kept fixed.

With internationally perfect capital markets where risk aversion does not differ across countries and where investors consume the same consumption basket, all investors hold the world market portfolio and changes in expected returns do not lead to equity flows, because all investors always hold assets in the same proportions, which vitiates the possibility of a rebalancing effect. Below we first introduce a market imperfection—barriers to international investment—so that there is a home bias. We then consider the additional effect of extrapolative expectations.

A. *The Effect of Barriers to International Investment*

To introduce barriers to international investment, we follow Stulz (1981) and assume that the return of domestic investors is lower than the return of foreign investors by a positive constant δ^D on a long position in the foreign stock. The barrier could represent any proportional costs to investing abroad that lowers the net expected return relative to a resident investor. To simplify the analysis, we consider only the case where the equilibrium outcome is such that no investors hold short positions. With these assumptions, the demand for foreign shares by domestic investors is

$$N_F^D = \frac{\mu_F - \delta^D}{\sigma_F^2} \frac{W^D}{P_F}. \tag{1}$$

Since nonresident investors have a lower expected return on local shares than resident investors, investors do not hold the world market portfolio and exhibit a home bias. The home bias implies that a positive return on foreign shares enriches foreign investors relatively more than it enriches domestic investors. Everything else equal, foreign investors would like to take some of the gain from the increase in value of their country's shares and invest it abroad. However, if domestic investors earn a dollar on foreign shares, they do not want to keep all of their gain abroad. Obviously, it is not possible for domestic and foreign investors to sell foreign shares at the same time, so that expected returns have to adjust.

To determine the impact of an increase in the price of foreign shares on flows, we therefore have to turn to an investigation of the equilibrium holdings of foreign shares by domestic investors. The equilibrium holdings of foreign shares by domestic investors and foreign investors are respectively

$$N_F^D = N_F^S \Omega + \frac{\delta^D}{\sigma_F^2} [\Omega - 1]\Omega \frac{W^W}{P_F}, \tag{2}$$

$$N_F^F = N_F^S[1 - \Omega] + \frac{\delta^D}{\sigma_F^2} \Omega[1 - \Omega] \frac{W^W}{P_F}, \tag{3}$$

where Ω is the ratio of domestic wealth to world wealth. Because $\Omega < 1$, domestic investors have a lower equilibrium allocation to foreign stocks in the presence of barriers to international investment than if δ^D were equal to 0, and foreign investors have a higher allocation. The derivative of the holdings of the foreign stock by domestic investors with respect to the price of the foreign stock (shown in Section 1 of the Appendix) cannot be signed unambiguously. However, an increase in the price of the foreign stock decreases the holdings of that stock by domestic investors for the symmetric case where both countries have initially the same supplies of shares, share prices, wealth, and barriers to international investment. Following the increase in the price of the foreign stock, the weight of the foreign stock must increase in the portfolios of investors in equilibrium. This can happen only if the expected return on that stock increases. However, in the symmetric case, an increase in the expected return of the stock has a greater impact on the holdings of the foreign stock by foreign investors, because their wealth has increased more than the wealth of domestic investors.

It is useful to examine the properties of equations (2) and (3) numerically. We explore extensively a numerical example where the volatility of the return of the foreign stock is 30%. The base case is $P_F = P_D = 1$, $W^D = W^F = 10$, $N_F^S = N_D^S = 10$, $\delta^D = 3\%$. In this base case, domestic investors hold 3.33 shares of foreign stock and foreign investors hold 6.67 shares. If the price of the foreign stock doubles, domestic holdings of the foreign stock fall from

3.33 to 3.20. If we double δ^D, the holdings of the foreign stock fall by roughly half, and the number of foreign shares held by domestic investors falls from 1.67 to 1.51 if the price of the foreign stock doubles. Though the domestic holdings of the foreign stock generally fall when the price of the foreign stock increases, this is not the case when the domestic country is small.

B. The Effect of Extrapolative Expectations

Suppose now that an unexpectedly high return on foreign stocks leads domestic, but not foreign, investors to expect a higher return on these stocks. This can be justified for one of two reasons. First, if investors do not know the true expected returns but are trying to estimate them with past data, then past returns are useful in forming expectations. As long as resident investors are better informed than nonresident investors, our assumption could be derived from the optimizing behavior of investors.[3] It could also be the result of stronger extrapolative expectations for a country's stock returns of nonresident investors than of resident investors, on account of behavioral considerations.[4] We do not model the formation of expectations. Let μ_F^D be the domestic investors' expected return for the foreign stock. This expected return now depends positively on the past foreign stock return. The foreign investors' expected return for the foreign stock is assumed to not depend directly on past returns. For domestic stocks, the foreign investors' expected return depends on past domestic stock returns, but the domestic investors' expected return does not.

The Impact of Foreign Stock Price Changes: With μ_F^D positively related to past returns, the foreign stock becomes more attractive to domestic investors if it has performed well, which leads them to increase their holdings of that stock. However, when the foreign stock performs well, foreign investors become overweighted in that stock and want to sell some of their holdings to buy the domestic stock. As shown in Section 2 of the Appendix, as long as μ_F^D increases enough following positive returns, the equilibrium holdings of the foreign stock by domestic investors increase so that positive returns on the foreign stock lead them to buy that stock.

We can use our numerical example to investigate the impact of an increase in the price of the foreign stock when domestic investors expect a higher return on the foreign stock following an unexpectedly high return on that stock. Using the symmetric case and setting the extrapolation component of μ_F^D/σ_F^2, which we denote by Δ_F^D, equal to $k \times \Delta P_F/P_F$ with $k = 0.1$, the equilibrium holdings of the foreign stock by domestic investors increase from 3.33 shares to 3.58 shares with a doubling of the price of the foreign stock. Hence, in this case, foreign investors decrease their holdings of foreign shares from 6.67 to 6.42 shares. With weaker extrapolative expectations, however, it becomes possible for the holdings of the foreign stock by domestic investors to fall when the foreign stock earns an unexpectedly high return.

The Impact of Domestic Stock Price Changes: Consider now the impact of an unexpectedly high increase in the domestic stock price on net flows to the foreign country. The foreign residents investing in the domestic country expect to earn $\delta^F - \Delta_F^D$ less than domestic investors on domestic stocks. In this case, the demand for the domestic asset by foreign investors is

$$N_D^F = N_D^S[1 - \Omega] - \left(\frac{\delta^D - \Delta_F^D}{\sigma_F^2}\right)\Omega[1 - \Omega]\frac{W^W}{P_D}. \qquad (4)$$

We set the extrapolative component of the domestic stock expected return for foreign investors to $0.1 \times \Delta P_D/P_D$. Starting from the base case, high past returns on the domestic stock increase the demand for the domestic stock for foreign investors, because they increase the expected return on that stock for these investors; however, the effect is dampened by the rebalancing effect for these investors, which induces them to sell some of their holdings of the domestic stock. The rebalancing effect for domestic investors leads them to buy the foreign stock. When the domestic country is large enough compared to the foreign country and expectations are sufficiently extrapolative, domestic investors increase their holdings of the foreign stock following high returns on the domestic stock.

C. Summary of Model Implications

Our model shows that equity flows depend on stock returns both in the host market and outside the host market. If nonresident investors in a market have extrapolative expectations for the expected return of that market, equilibrium holdings of foreign stocks by nonresident investors relate as follows to past returns:

Result 1. Unexpectedly high returns on foreign stocks are accompanied by net equity flows into the foreign country as long as expectations are sufficiently extrapolative and the wealth of the domestic country is large relative to the wealth of the foreign country.

Result 2. Unexpectedly high returns on domestic stocks are accompanied by net equity flows into the foreign country as long as expectations are sufficiently extrapolative and

[3] Though not formulated in an international context, the model of Williams (1977) leads to such a result directly. Evidence that foreign investors are less informed than domestic investors at the individual stock level is provided by Choe, Kho, and Stulz (2004) and Dvorak (2004), whereas Seasholes (2000) argues that foreign investors actually have more information prior to earnings announcements. Froot and Ramadorai (2002) and Pavabutr and Yan (2003) provide evidence supportive of foreign investors possessing information about future market returns.

[4] For instance, Hong and Stein (1999) have a group of investors who estimate expected returns by estimating a univariate regression on a short time series of returns. These investors have extrapolative expectations.

TABLE 1.—SUMMARY STATISTICS OF NET CAPITAL FLOWS AND MARKET RETURN BY COUNTRY

Country	Start Date		Mean	Median	Std. Dev.	*lag 1*	*lag 2*	*lag 3*	*lag 4*	*lag 5*	Corr.
					EastAsia						
Indonesia	Jan. 2, 1996	Flow	0.008	0.003	0.030	0.33*	0.24*	0.18*	0.12*	0.13*	0.375*
		Ret.	−0.021	−0.051	2.361	0.13*	0.01*	−0.02*	−0.07*	0.01*	
Korea	Jan. 4, 1996	Flow	0.013	0.006	0.055	0.49*	0.32*	0.29*	0.24*	0.25*	0.270*
		Ret.	0.000	−0.068	2.739	0.08*	−0.03*	−0.05*	−0.04*	−0.06*	
Philippines	Jun. 1, 1999	Flow	−0.003	−0.004	0.022	0.42*	0.22*	0.15*	0.12*	0.13*	0.325*
		Ret.	−0.081	−0.040	1.533	0.11*	−0.05*	−0.07*	0.03	−0.01	
Taiwan	Apr. 1, 1997	Flow	0.007	0.006	0.027	0.47*	0.34*	0.23*	0.21*	0.18*	0.282*
		Ret.	−0.006	−0.066	2.031	0.01	0.05	0.03	−0.13*	0.02*	
Thailand	Dec. 1, 1997	Flow	0.002	−0.004	0.041	0.48*	0.34*	0.28*	0.27*	0.27*	0.441*
		Ret.	−0.007	−0.240	2.686	0.10*	0.05*	−0.01*	−0.04*	−0.01*	
					South Asia						
India	Dec. 31, 1998	Flow	0.007	0.006	0.024	0.23*	0.20*	0.18*	0.12*	0.13*	0.218*
		Ret.	0.050	0.142	1.886	−0.01	0.08	0.00	0.02	−0.03	
Sri Lanka	Aug. 17, 1998	Flow	−0.007	−0.003	0.024	0.17*	0.17*	0.16*	0.09*	0.10*	0.070
		Ret.	−0.013	0.000	1.107	0.27*	0.10*	0.12*	0.02*	0.09*	
					Other						
Slovenia	Mar. 2, 1998	Flow	0.000	0.000	0.010	0.58*	0.47*	0.46*	0.38*	0.40*	−0.096*
		Ret.	0.031	−0.001	0.825	0.25*	0.14*	−0.04*	−0.04*	−0.05*	
S. Africa	Jan. 2, 1996	Flow	0.015	0.012	0.024	0.24*	0.20*	0.22*	0.16*	0.19*	−0.086*
		Ret.	0.052	0.089	1.394	0.13*	0.08*	0.00*	−0.02*	−0.01*	

This table reports descriptive statistics for daily net capital flows and market return in each country. Net flows are defined as (buy value) − (sell value) by foreign investors, scaled by previous-day market capitalization. To control for abnormal capital inflows, observations above the 99th percentile of the daily net flow distribution are set equal to the 99th percentile point. Returns and scaled net flows are expressed in local currency and in percentage terms. Returns are continuously compounded returns on the country stock market index. For each country the table shows the starting date of the sample, the mean, median, and standard deviation of net flows and returns, the contemporaneous correlation between net flows and returns, and the first five autocorrelation estimates for each series. The end date for all countries is February 23, 2001 except for Slovenia, which has an ending date of January 31, 2001.

*Significant at the 5% level.

the wealth of the domestic country is large relative to the wealth of the foreign country.

The model of this section is admittedly very simple. It is also incomplete in the sense that we do not derive how expectations are formed, yet extrapolative expectations are critical to make sense of the empirical evidence. The impact of a high return on the foreign stock on the asset allocation of domestic investors could be short-lived. With rational extrapolative expectations, there will be cases where investors ex post gave too much weight to yesterday's high return and reduce their allocation to the foreign stock following a sequence of "normal" returns. Our model does not allow us to work out the dynamics of flow over longer periods of time. Further work is required to extend the model to account for flow persistence. This model is consistent with the home bias noted at the beginning of the paper. The attributes of our model that make it consistent with existing evidence also lead to a new empirical prediction (Result 2) that we can test. In addition, though some evidence for Result 1 has been provided in the literature, we test Result 1 with short-term aggregate flow data.

III. Data Description

In testing predictions such as Results 1 and 2 above, it is particularly useful to use high-frequency data. Daily data allow for a better examination of lead–lag dynamics between flows and returns that, with lower-frequency data (namely, monthly or quarterly), would likely appear as contemporaneous relationships. To construct a data set of daily equity flows, we contacted approximately 60 stock exchanges and 12 regulatory agencies with Web sites on the Internet.[5] In all, we obtained data on foreign flows from nine markets, and these markets include the East Asian markets that have been the focus in the controversies surrounding the potentially destabilizing influence of flows.[6]

Our final sample consists of data from five countries in East Asia (Indonesia, Korea, the Philippines, Taiwan, and Thailand), two in South Asia (India and Sri Lanka), one in eastern Europe (Slovenia), and one in Africa (South Africa). Since these data are recorded by the exchange, they have the advantage of including all the recorded trades of foreign investors on the stock exchange. (They do not, however, include derivatives transactions that may be functionally equivalent to stock transactions.) As shown in Table 1, the data begin in January 1996 for Korea, Indonesia, and South Africa, 1997 for Taiwan and Thailand, 1998 for India, Sri Lanka, and Slovenia, and 1999 for the Philippines. The ending date for daily analysis is February 23, 2001 for all

[5] Some of the Web sites we used for finding stock exchanges and regulating agencies are www.gsionline.com/exchange.htm, www.world-exchanges.com, and www.iosco.org.

[6] Private data vendors were helpful in obtaining data from two other countries. We were not able to obtain flow data for two countries for which studies using daily data have been published: Sweden and Finland.

countries except Slovenia, which ends on January 31, 2001. The flows we consider contain trading by both foreign institutions and foreign individual investors. A legitimate issue is whether we should report results for Slovenia, South Africa, and Sri Lanka. Slovenia and Sri Lanka each represent less than 0.01% of the world market capitalization in 1997. South Africa represents a substantially larger market, but it is a country that suffered substantial capital flight, which our model ignores. Capital flight in South Africa has been occurring rapidly since the removal of apartheid laws and the relaxation of exchange rate controls in 1997, and laws introduced in 1997 allow South Africans to legally invest some capital offshore. With our flow data, as with other sources, there are no guarantees that domestic investors do not use offshore accounts to invest in their country, so that we would mistake them for foreign investors. We report results for all countries for the sake of completeness, but pay special attention to the East Asian countries.

The capital flow measure we use is the value of all equity purchases by foreigners minus all equity sales by foreigners, scaled by the previous day's market capitalization [$f_t = 100(f_{\text{buy},t} - f_{\text{sell},t})/mktcap_{t-1}$]. We use net flows relative to market capitalization because this measure tells us how important the net demand is relative to the total supply of available shares.[7] To control for capital inflows due to abnormal reasons as suggested by Edison and Warnock (2003), we set observations above the 99th percentile of the daily net flow distribution equal to the 99th percentile point.[8] Data for market indices and exchange rates are collected from Datastream.[9] We primarily focus on local-currency returns so that exchange rate effects will not confound our inferences, but subsequently we examine separately the role of exchange rates as well as the implications of using dollar returns.

We report the mean, median, and standard deviation of foreign net flows in Table 1. The standard deviation of net flows varies across countries, from 0.01% for Slovenia to 5.5 times as much (0.055%) for Korea. This means that in all markets most daily foreign net activity is generally less than 0.1% of market capitalization. Flows generally have much greater autocorrelations than returns. The autocorrelation in flows declines slowly and is generally still significant out to lag 5, indicating substantial persistence in the foreign investment activity.

Table 1 documents some substantial contemporaneous correlations between flows and returns within each country. All of the Asian countries have substantial positive correlations between flows and returns (ranging between 0.07 and 0.44). The negative correlations in Slovenia and South Africa are inconsistent with what has been observed elsewhere (for example, Froot, O'Connell, and Seasholes, 2001) and more consistent with the daily contrarian behavior observed for domestic individual investors at the firm level (Choe, Kho, and Stulz, 1999; Griffin, Harris, and Topaloglu, 2003; Grinblatt and Keloharju, 2000) and market level (Griffin, Harris, and Topaloglu, 2004).

IV. Flows and Own-Country Returns

This section examines the within-country joint dynamics of local market returns and net equity flows. Our model generally predicts that in the presence of extrapolative expectations, high stock returns in the local market increase the demand for local stocks from nonresident investors and hence lead to net flows. Though our model does not include price pressure effects, such effects could lead to a contemporaneous correlation between net flows and returns. The existence of such effects would mean that high capital flows today lead to high flows and returns tomorrow through the effect of net flows on prices. The end result is that foreign trading activity could be predictive of future returns even when foreigners are informationally disadvantaged. To examine these implications, we ask two main questions of the flow data. Is there any reliable evidence of foreign investors chasing local market returns? Do foreign investment flows predict future price movements, and, if so, is this predictability more consistent with information or with price pressure explanations? To investigate these issues within each country, we use a vector autoregression (VAR) framework.[10]

Table 2 displays the VAR regression results for both flows and returns. The examination of the flow regressions in panel A shows several interesting findings. First, flows are strongly related to their past values. For example, a 1-standard-deviation positive movement in yesterday's foreign flows in Indonesia leads to a 0.208 standard deviation increase in today's flows. The effect of past flows decreases quickly at lag 2 (coefficients ranging from 0.015 to 0.139 across countries) but persists even out to lag 5 in most of the countries. Some of the flow persistence might be due to large quantities of foreign capital moving slowly in the market to minimize price impact.

The second interesting finding, which is consistent with our model, is that foreign flows are highly affected by the previous day's return. For instance, a 1-standard-deviation increase in yesterday's Indonesian market return leads to a

[7] Without scaling, it is problematic to compare flows across countries or even across time within a country. Though Froot, O'Connell, and Seasholes (2001), Bekaert, Harvey, and Lumsdaine (2002), and Griffin, Harris, and Topaloglu (2003) scale flows as we do, a number of papers, including that of Edison and Warnock (2003), do not scale flows. In Section V A we examine an alternative way of scaling flows.

[8] We also reexamine our main results by using flows including these tail-end observations, and obtain similar findings.

[9] In Sri Lanka and Slovenia, data on market capitalization and returns are supplied by the exchange.

[10] For most countries the Hannan–Quinn information criterion (HQC) selects the optimal lag length at four or five lags. We choose to model the system with five lags in each variable for all countries, as this choice makes the analysis homogeneous across countries. The fairly large sample size at our disposal allows us to be less concerned about the losses of degrees of freedom induced by more highly parameterized models. We also reexamine all our VAR results with systems only containing two lags [as selected for several countries by the Schwarz criterion (SIC)] and find that our results are, essentially, unchanged.

0.16-standard-deviation increase in today's foreign inflows. Foreign flows in all five East Asian countries are highly responsive to past returns, with coefficients ranging between 0.160 for Indonesia and 0.287 for Thailand. However, this effect dies out quickly, the effect of lag-2 returns being small and actually negative in six of the nine countries. Foreigners buy following high previous-day stock returns, but respond little or actually are net sellers several days later.

Moving to the return equation of the VAR, panel B of Table 2 examines the relationship between current market returns and past foreign trading activity as well as lagged returns. Foreign flows are significant predictors of returns at lag 1 for Korea, Taiwan, Thailand, and India, indicating that foreign investors are buying before market index increases. Relative to the explained variation in flows, the variation in returns that is explained by past returns and flows is small. The adjusted R^2's in the return equations are less than 0.04 in all the East Asian countries. Comparatively, the adjusted R^2's in the flow equations for East Asian countries range up to approximately 0.40. Nevertheless, we wish to further understand the cause of this relationship between foreign activity and next-day stock returns. Froot and Ramadorai (2002) find similar evidence of predictability and conclude that U.S. investors in closed-end country funds do have information about future fundamentals of foreign stock funds. Flows forecasting returns could arise from price pressure or information. If price pressure is driving the predictability, there should be a contemporaneous positive correlation between flows and returns that would subsume the lead–lag dynamics between the flows and the returns. If foreign investors are better informed at time $t - 1$ about returns at time t than domestic investors, flows should still predict returns if we include contemporaneous flows in the return equation.

The tests for this specification in panel C of Table 2 show that contemporaneous flows are positive and highly significant in India and all five East Asian countries. However, lagged flows in these countries are positive and significant in two countries only, and negative and significant in two other countries. Thus, these results seem to suggest that the importance of foreign flows (in the VAR without contemporaneous flows) is mainly due to past flows signaling future foreign investment that leads to contemporaneous price movements. Although admittedly limited, this evidence does not support the view that foreigners have better information than locals about future local-market movements.

V. Flows and Nonhost-Country Returns

As discussed in Section II, our model predicts a positive relationship between net flows and nonhost-country (or regional) equity returns when nonhost countries are substantially richer than the host country. In this section we investigate the relationship between regional equity returns and foreign investment flows.

A. Cross-Country VAR Models

To investigate the importance of regional indices in explaining flow dynamics, we estimate a structural VAR system where net foreign flows and country index returns depend on their lagged values as well as those of the Pacific, European, North American, and emerging-market indices. If the predictions of our model hold up, we would expect the relationship between flows and regional returns to be positive and larger for those indices with larger market cap, especially the North American and, then, the European index. In this structural VAR, the regional index returns are assumed to be exogenous variables. To make the presentation of our results more space-effective, even though we estimate the system with five lags for each variable (exogenous and endogenous), only two lags are reported in the tables, and the additional lags are discussed when relevant. Table 3 displays the results for the flow regressions.

The coefficients on regional indices are consistent with the prediction of our model that flows are positively related to market returns in large markets. The most noticeable effect is related to the previous-day North American return. North American returns exhibit a positive and significant relationship with subsequent foreign inflows in Indonesia, Korea, Taiwan, Thailand, and India. The economic magnitude of this effect is substantial: a one-unit (one-standard-deviation) shock to the North American return index is followed the next day by an increase of between 0.095 and 0.247 units in foreign flows in these five countries. Looking back further in time shows that lagged two-period North American returns are sometimes negatively related to current foreign flows, although only significantly so in Korea. However, in Korea lagged three-period returns from North America are positive and significant, and lagged four- and five-period coefficients are smaller but positive. The Pacific-market index exhibits a positive although not statistically significant relationship to flows, and the lagged emerging-market index is significantly related to foreign flows in Taiwan only. Consistent with the European index being second (behind the U.S.) in market capitalization, the previous-day European index is positively and significantly related to equity flows in two countries, Korea and Thailand. We also assess the joint significance of the lag-1 to -5 returns and similarly find that own-country lagged returns are important in six markets, North American lagged returns are important in four markets, and European returns are important in two markets.

B. Economic Importance and Dynamic Analysis

To estimate the variation in flows that can be explained by the different (local versus regional) equity indices, we first estimate the basic system with flows as a function of past flows only. We add local index returns (as in Table 2), gauge the incremental increases in adjusted R^2's, and then add both local and regional index returns. We find that the

TABLE 2.—VECTOR AUTOREGRESSION OF RETURNS AND STANDARDIZED NET FLOW BY COUNTRY

	East Asia					South Asia		Others	
	Indonesia	Korea	Philippines	Taiwan	Thailand	India	Sri Lanka	Slovenia	South Africa
Panel A: Flow Equations									
Intercept	0.006	0.004	0.008	0.004	−0.004	0.013	−0.001	0.018	0.008
(*p*-val)	(0.81)	(0.88)	(0.85)	(0.88)	(0.88)	(0.75)	(0.98)	(0.53)	(0.77)
Net flows *Lag 1*	0.208	0.391	0.354	0.342	0.307	0.152	0.126	0.370	0.154
(*p*-val)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Lag 2	0.115	0.042	0.015	0.117	0.054	0.139	0.114	0.053	0.138
(*p*-val)	(0.00)	(0.18)	(0.79)	(0.00)	(0.18)	(0.00)	(0.01)	(0.18)	(0.00)
Lag 3	0.049	0.088	0.094	0.027	0.130	0.108	0.118	0.182	0.080
(*p*-val)	(0.11)	(0.00)	(0.09)	(0.45)	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)
Lag 4	0.047	0.052	−0.005	0.098	0.144	0.079	0.020	−0.028	0.100
(*p*-val)	(0.13)	(0.09)	(0.93)	(0.01)	(0.00)	(0.08)	(0.62)	(0.48)	(0.00)
Lag 5	0.085	0.102	0.060	0.047	0.100	0.055	0.078	0.149	0.083
(*p*-val)	(0.00)	(0.00)	(0.24)	(0.15)	(0.01)	(0.22)	(0.06)	(0.00)	(0.00)
Returns *Lag 1*	0.160	0.237	0.178	0.204	0.287	0.059	0.028	−0.108	−0.034
(*p*-val)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.18)	(0.51)	(0.00)	(0.21)
Lag 2	0.031	−0.079	−0.002	0.010	−0.038	−0.075	0.019	−0.045	−0.006
(*p*-val)	(0.28)	(0.00)	(0.97)	(0.75)	(0.26)	(0.09)	(0.66)	(0.14)	(0.84)
Lag 3	−0.002	0.010	0.005	−0.027	−0.063	−0.052	0.040	0.031	0.035
(*p*-val)	(0.95)	(0.68)	(0.92)	(0.36)	(0.06)	(0.24)	(0.35)	(0.31)	(0.19)
Lag 4	−0.032	−0.037	−0.004	−0.038	−0.119	−0.060	0.033	−0.060	0.051
(*p*-val)	(0.25)	(0.14)	(0.94)	(0.19)	(0.00)	(0.17)	(0.44)	(0.04)	(0.06)
Lag 5	−0.034	−0.041	−0.014	−0.016	−0.087	−0.013	−0.010	−0.018	−0.009
(*p*-val)	(0.23)	(0.10)	(0.77)	(0.59)	(0.01)	(0.76)	(0.80)	(0.53)	(0.74)
Adj. R^2	0.162	0.346	0.219	0.307	0.391	0.093	0.068	0.399	0.117
Granger 1	0.000	0.000	0.011	0.000	0.000	0.147	0.613	0.000	0.198
Panel B: Return Equations									
Intercept	−0.022	−0.001	−0.079	−0.011	−0.009	0.048	−0.001	0.024	0.042
(*p*-val)	(0.43)	(0.96)	(0.10)	(0.74)	(0.79)	(0.27)	(0.99)	(0.50)	(0.13)
Net flows *Lag 1*	0.004	0.107	−0.020	0.196	0.157	0.167	−0.063	−0.132	0.017
(*p*-val)	(0.91)	(0.00)	(0.73)	(0.00)	(0.00)	(0.00)	(0.12)	(0.01)	(0.57)
Lag 2	0.054	0.100	−0.096	0.012	0.013	0.018	−0.027	0.080	−0.006
(*p*-val)	(0.11)	(0.01)	(0.12)	(0.77)	(0.81)	(0.70)	(0.50)	(0.11)	(0.83)
Lag 3	0.006	−0.017	0.034	−0.125	−0.005	0.056	−0.031	0.071	0.007
(*p*-val)	(0.85)	(0.66)	(0.59)	(0.00)	(0.93)	(0.24)	(0.45)	(0.15)	(0.81)
Lag 4	−0.014	−0.039	0.089	0.058	0.054	0.021	0.082	−0.069	−0.028
(*p*-val)	(0.67)	(0.30)	(0.15)	(0.17)	(0.30)	(0.66)	(0.05)	(0.16)	(0.35)
Lag 5	0.004	0.002	0.086	−0.009	−0.051	−0.037	0.010	−0.048	0.005
(*p*-val)	(0.90)	(0.96)	(0.13)	(0.82)	(0.26)	(0.42)	(0.81)	(0.29)	(0.86)
Returns *Lag 1*	0.139	0.069	0.126	−0.031	0.051	−0.020	0.268	0.208	0.136
(*p*-val)	(0.00)	(0.02)	(0.02)	(0.36)	(0.20)	(0.66)	(0.00)	(0.00)	(0.00)
Lag 2	−0.022	−0.135	−0.027	0.005	−0.043	0.000	0.019	0.114	0.061
(*p*-val)	(0.49)	(0.00)	(0.61)	(0.89)	(0.31)	(1.00)	(0.66)	(0.00)	(0.03)
Lag 3	−0.049	−0.076	−0.039	0.007	−0.057	−0.014	0.075	−0.065	−0.012
(*p*-val)	(0.11)	(0.01)	(0.46)	(0.85)	(0.17)	(0.76)	(0.08)	(0.09)	(0.68)
Lag 4	−0.033	−0.043	0.029	−0.085	−0.043	0.005	−0.035	−0.037	−0.046
(*p*-val)	(0.28)	(0.16)	(0.58)	(0.01)	(0.30)	(0.90)	(0.41)	(0.33)	(0.10)
Lag 5	−0.016	−0.072	−0.080	−0.001	0.006	−0.016	0.090	−0.038	−0.002
(*p*-val)	(0.59)	(0.02)	(0.12)	(0.97)	(0.88)	(0.71)	(0.03)	(0.31)	(0.96)
Adj. R^2	0.018	0.039	0.026	0.036	0.021	0.018	0.085	0.078	0.019
Granger 2	0.667	0.000	0.073	0.000	0.012	0.002	0.227	0.007	0.943
Panel C: Return Equations with Contemporaneous Flows Included									
Intercept	−0.024	−0.002	−0.082	−0.012	−0.007	0.046	0.000	0.024	0.042
(*p*-val)	(0.35)	(0.93)	(0.07)	(0.70)	(0.83)	(0.29)	(0.99)	(0.50)	(0.13)
Net flows *Lag 0*	0.402	0.303	0.389	0.313	0.567	0.192	0.072	−0.006	−0.085
(*p*-val)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.07)	(0.90)	(0.00)
Lag 1	−0.080	−0.011	−0.158	0.089	−0.018	0.138	−0.072	−0.130	0.030

TABLE 2.—(*CONTINUED*)

	East Asia					South Asia		Others	
	Indonesia	Korea	Philippines	Taiwan	Thailand	India	Sri Lanka	Slovenia	South Africa
(*p*-val)	(0.01)	(0.75)	(0.01)	(0.03)	(0.71)	(0.00)	(0.08)	(0.01)	(0.31)
Lag 2	0.007	0.087	−0.102	−0.024	−0.018	−0.008	−0.036	0.080	0.005
(*p*-val)	(0.81)	(0.02)	(0.08)	(0.55)	(0.69)	(0.86)	(0.39)	(0.11)	(0.86)
Lag 3	−0.013	−0.043	−0.003	−0.133	−0.078	0.035	−0.040	0.072	0.014
(*p*-val)	(0.67)	(0.24)	(0.96)	(0.00)	(0.09)	(0.45)	(0.33)	(0.15)	(0.64)
Lag 4	−0.033	−0.055	0.091	0.027	−0.028	0.005	0.081	−0.069	−0.020
(*p*-val)	(0.29)	(0.13)	(0.12)	(0.50)	(0.55)	(0.91)	(0.05)	(0.16)	(0.51)
Lag 5	−0.030	−0.029	0.063	−0.023	−0.107	−0.048	0.004	−0.048	0.012
(*p*-val)	(0.31)	(0.37)	(0.24)	(0.53)	(0.01)	(0.30)	(0.92)	(0.31)	(0.68)
Returns *Lag 1*	0.075	−0.003	0.056	−0.095	−0.111	−0.031	0.266	0.208	0.133
(*p*-val)	(0.01)	(0.93)	(0.25)	(0.00)	(0.00)	(0.48)	(0.00)	(0.00)	(0.00)
Lag 2	−0.034	−0.111	−0.026	0.002	−0.021	0.014	0.017	0.114	0.061
(*p*-val)	(0.24)	(0.00)	(0.59)	(0.96)	(0.58)	(0.75)	(0.68)	(0.00)	(0.03)
Lag 3	−0.048	−0.079	−0.041	0.015	−0.022	−0.004	0.072	−0.065	−0.009
(*p*-val)	(0.09)	(0.01)	(0.41)	(0.65)	(0.57)	(0.93)	(0.09)	(0.09)	(0.76)
Lag 4	−0.020	−0.032	0.030	−0.073	0.024	0.017	−0.037	−0.037	−0.042
(*p*-val)	(0.49)	(0.28)	(0.54)	(0.03)	(0.52)	(0.70)	(0.38)	(0.33)	(0.14)
Lag 5	−0.003	−0.059	−0.074	0.004	0.056	−0.014	0.091	−0.038	−0.002
(*p*-val)	(0.92)	(0.04)	(0.12)	(0.91)	(0.14)	(0.75)	(0.03)	(0.31)	(0.93)
Adj. R^2	0.153	0.098	0.143	0.102	0.216	0.050	0.089	0.077	0.024
Granger 2	0.032	0.044	0.001	0.005	0.002	0.054	0.148	0.015	0.837

This table presents results from the bivariate vector autoregression (VAR) specified below with five lags for each endogenous variable. $r_{i,t}$ is the daily percentage continuously compounded returns on the country stock market index, $f_{i,t}$ is the daily net capital flow (buy value − sell value) originated by foreign investors scaled by the previous-day market capitalization, the α's are constant intercept terms, $b(L)$ denotes a polynomial in the lag operator L, and $\varepsilon^r_{i,t}$ and $\varepsilon^f_{i,t}$ are zero-mean disturbance terms that are assumed to be intertemporally uncorrelated. The scaled net flow is also expressed in percentage terms. Returns, flows, and market capitalizations are all expressed in local currency. The VAR is estimated separately for each country by OLS. Panels A and B report coefficient estimates, their p-values, and adjusted R^2 for the flow and return equations, respectively, from a standard VAR with no contemporaneous variables in either equation. Panel C reports the return equation results for a structural VAR with contemporaneous flows in the return equation. For each country the p-values of two Granger causality tests are reported. Granger 1: Returns do not Granger-cause flows. Granger 2: Flows do not Granger-cause returns. The VAR equations are as follows:

$$\begin{bmatrix} r_{i,t} \\ f_{i,t} \end{bmatrix} = \begin{bmatrix} \alpha_{i,r} \\ \alpha_{i,f} \end{bmatrix} + \begin{bmatrix} b_{11}(L) & b_{12}(L) \\ b_{21}(L) & b_{22}(L) \end{bmatrix} \begin{bmatrix} r_{i,t-1} \\ f_{i,t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon^r_{i,t} \\ \varepsilon^f_{i,t} \end{bmatrix}.$$

average adjusted R^2's for East Asian markets with only lagged flows is 0.242, but the explanatory power increases by 16.8% to 0.285 with the inclusion of lagged local index returns, and increases an additional 12.7% to 0.320 with the inclusion of both local and regional index returns. For the other countries the increases in adjusted R^2's are much smaller. Regional index returns appear, thus, to be economically important in determining the variation in foreign flows in East Asian countries.

One potential explanation for the positive relation between North American returns and foreign flows to Asian countries is that positive returns in North America incorporate global news that spills over into higher Asian equity returns. Since flows and local market returns are contemporaneously correlated, the positive relationship between flows and lagged North American index returns could simply be an artifact of the correlation between North American returns and the next-day East Asian equity returns. To examine this possibility, we assess the overall dynamics by looking at impulse response functions for flows from a recursive (or orthogonalized) VAR where flows are ordered before returns.[11] This structure implies that flows are allowed to contemporaneously affect returns but returns are not allowed to contemporaneously affect flows. Impulse response graphs are shown in Figure 1. The shocks to North American returns lead to larger increases to capital flows than those from local returns in seven of the nine countries (exceptions are the Philippines and Sri Lanka). North American market returns lead to economically and statistically significant increases in flows in Indonesia, Korea, Taiwan, and Thailand, respectively. In Korea, Taiwan, and Thailand, a 1-standard-deviation increase in the North American market returns leads to an economically large response of a more than 0.50-standard-deviation increase in net flows.

As another (perhaps more stringent) method to control for contemporaneous effects, in Table 4 we estimate a structural VAR where contemporaneous returns are included in the flow equation. This approach of examining coefficients is somewhat limited as compared to the impulse response graphs, in that the dynamic nature of the VAR is not fully captured. Nevertheless, we find that lagged local returns are positive and significant in Indonesia, Korea, the Philippines, Taiwan, and Thailand, and negative and significant in Slovenia. Whereas contemporaneous effects weaken the significance of the North American return somewhat, North American returns still significantly affect flows in Korea, Taiwan, and Thailand.

C. *Pooled Analysis and Joint Significance Tests*

Our analysis thus far has been conducted on a country-by-country basis. We now investigate the dynamics of interest by jointly utilizing data from all countries. At the

[11] A generalized impulse response function where residuals in the VAR equations are allowed to be contemporaneously correlated shows a much larger effect of returns on flows, mainly arising from the strong contemporaneous correlation between shocks to flows and shocks to returns.

TABLE 3.—VAR: FLOWS WITH REGIONAL INDEX RETURNS

	East Asia					South Asia		Others	
	Indonesia	Korea	Philippines	Taiwan	Thailand	India	Sri Lanka	Slovenia	South Africa
Intercept	−0.004	−0.007	0.009	−0.004	−0.015	0.008	−0.004	0.023	0.010
(*p*-val)	(0.87)	(0.77)	(0.83)	(0.87)	(0.59)	(0.84)	(0.92)	(0.42)	(0.72)
Net flows *Lag 1*	0.212	0.384	0.354	0.301	0.318	0.134	0.125	0.370	0.155
(*p*-val)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Lag 2	0.115	0.028	0.013	0.150	0.057	0.132	0.110	0.057	0.140
(*p*-val)	(0.00)	(0.36)	(0.81)	(0.00)	(0.17)	(0.00)	(0.01)	(0.15)	(0.00)
Returns *Lag 1*	0.148	0.206	0.164	0.168	0.270	0.047	0.028	−0.104	−0.047
(*p*-val)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.31)	(0.51)	(0.00)	(0.20)
Lag 2	0.035	−0.097	−0.006	0.016	−0.036	−0.066	0.019	−0.052	−0.002
(*p*-val)	(0.27)	(0.00)	(0.90)	(0.57)	(0.33)	(0.16)	(0.67)	(0.10)	(0.96)
Pacific *Lag 1*	0.009	0.039	−0.040	0.009	−0.013	0.079	0.027	−0.009	0.004
(*p*-val)	(0.78)	(0.15)	(0.47)	(0.79)	(0.70)	(0.12)	(0.60)	(0.81)	(0.92)
Lag 2	0.022	0.048	−0.064	0.005	−0.021	0.024	0.017	0.033	0.044
(*p*-val)	(0.49)	(0.08)	(0.25)	(0.87)	(0.53)	(0.63)	(0.74)	(0.35)	(0.19)
Europe *Lag 1*	0.029	0.073	0.067	0.059	0.122	0.005	−0.023	−0.039	0.001
(*p*-val)	(0.40)	(0.01)	(0.26)	(0.09)	(0.00)	(0.92)	(0.67)	(0.31)	(0.99)
Lag 2	0.014	−0.028	0.070	−0.045	−0.011	−0.026	−0.010	−0.053	−0.024
(*p*-val)	(0.68)	(0.35)	(0.27)	(0.21)	(0.76)	(0.65)	(0.86)	(0.18)	(0.54)
North America									
Lag 1	0.095	0.148	0.033	0.247	0.123	0.095	0.020	0.031	−0.062
(*p*-val)	(0.00)	(0.00)	(0.51)	(0.00)	(0.00)	(0.05)	(0.67)	(0.34)	(0.04)
Lag 2	−0.024	−0.076	−0.045	0.034	−0.052	0.028	−0.077	0.009	0.035
(*p*-val)	(0.48)	(0.01)	(0.46)	(0.33)	(0.14)	(0.62)	(0.16)	(0.82)	(0.32)
All emerging									
Lag 1	0.014	0.045	0.061	0.092	−0.013	−0.020	0.071	0.038	0.029
(*p*-val)	(0.69)	(0.12)	(0.26)	(0.01)	(0.73)	(0.71)	(0.17)	(0.31)	(0.41)
Lag 2	−0.022	0.013	0.048	0.027	0.005	−0.021	−0.017	0.027	−0.016
(*p*-val)	(0.54)	(0.66)	(0.38)	(0.42)	(0.90)	(0.70)	(0.75)	(0.48)	(0.66)
Adj. R^2	0.170	0.391	0.216	0.394	0.427	0.100	0.050	0.399	0.119

This table presents estimation results from a bivariate VAR of flows and returns. Scaled net flows are expressed in percentage terms. Daily returns on regional market indices, which are considered to be exogenously determined, are included in the VAR. Five lags are used for all endogenous variables as well as exogenous variables, but only the first two are reported. All variables are expressed in local currency, and the system is estimated separately for each country as seemingly unrelated regressions (SURs).

general level, the first choice the researcher has to make is between pooled and heterogeneous specifications, the former being characterized by assuming homogeneous parameters (some or all) across cross-sectional units. Within each class, in turn, several alternative estimation and inference approaches are available.[12]

We restrict the overall covariance matrix to be block-diagonal.[13] Thus, heterogeneity across countries is allowed for through fixed effects as well as through cross-sectional heteroskedasticity. Within each country, residuals are allowed to be contemporaneously correlated, whereas they are assumed to be uncorrelated across countries.

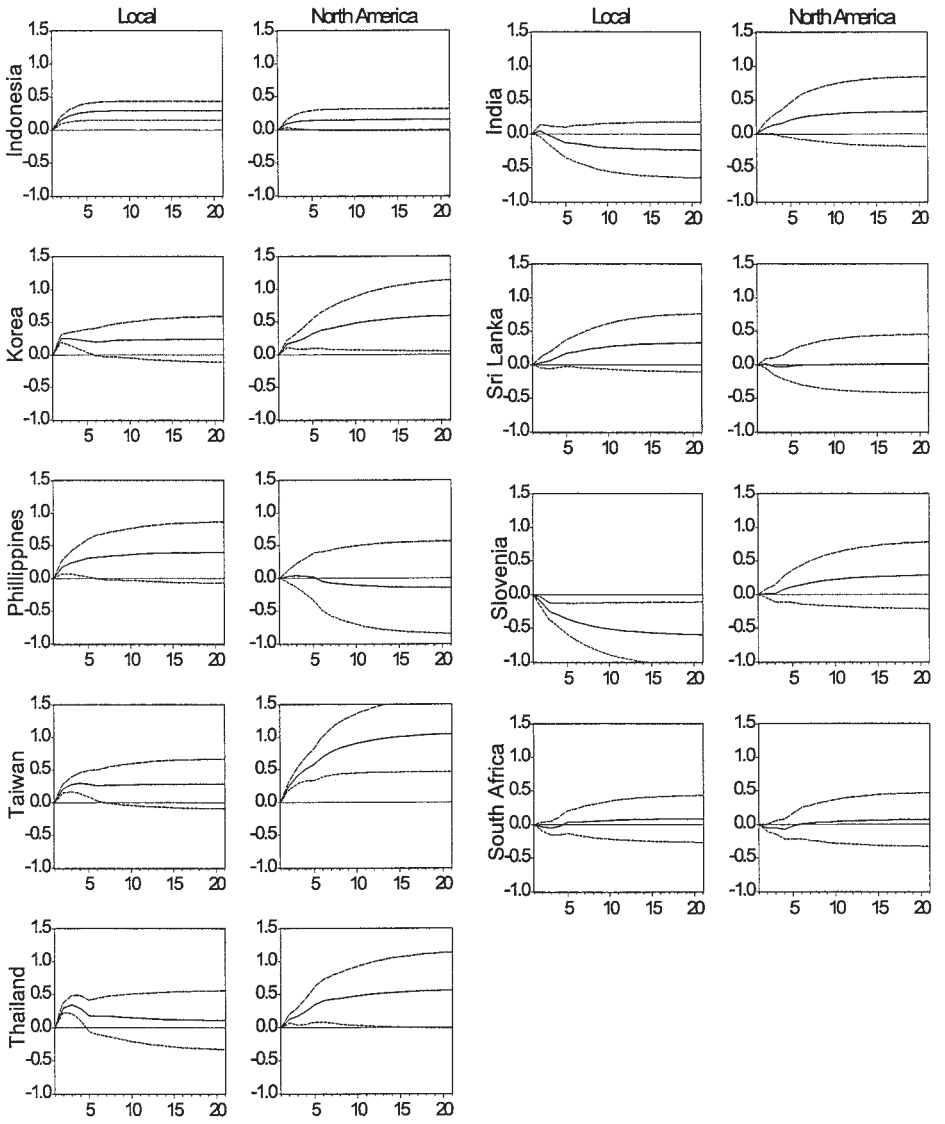
Since in our applications the time series dimension is much larger than in typical panel studies and the number of cross-sectional units is quite limited, we can circumvent many of the estimation problems ordinarily encountered in the analysis of dynamic panels [see, among many others, Pesaran and Smith (1995) and Holtz-Eakin, Newey, and Rosen (1988)]. We estimate the autoregressive coefficients and error covariance matrix through a feasible generalized least squares (FGLS) pooled procedure where the parameters are first estimated by OLS country by country and, in a second stage, the OLS residuals are used to estimate the residuals covariance matrix, which then is used to construct the FGLS estimates.

Using the estimated autoregressive coefficients and variance–covariance matrix of the residuals, we can then compute the orthogonalized impulse response function (IRF) for each country and, finally, the pooled orthogonalized IRF as the averaged response across countries. As we

[12] Theoretical considerations seem to offer little guidance for the choices, whereas the evidence from applied studies is unsettling at best. Pesaran and Smith (1995), Baltagi and Griffin (1997, 2000), and Hoogstrate, Palm, and Pfann (2000), among others, discuss the pros and cons of alternative approaches.

[13] We restrict the autoregressive coefficients and the lag length to be the same across countries for both endogenous and exogenous variables. The lag length is selected by the Hannan–Quinn Information Criterion (HQC) to be 5 for daily data and 2 for weekly data. Checks with the shorter lag length selected by the Schwarz criterion or the longer lag length suggested by the Akaike criterion indicate that the results are not sensitive to the chosen number of lags.

FIGURE 1.—RESPONSES OF FLOWS TO LOCAL AND NORTH AMERICAN RETURN SHOCKS: DAILY DATA



This figure shows impulse response functions describing the response of scaled net flows to a 1-standard-deviation shock in local market returns and in North America index returns. Responses are expressed in standard-deviation units. The time scale on the horizontal axis is in days. Results are based on the vector autoregression (VAR) specified in Table 3. The VAR is estimated separately for each country, with five lags for each endogenous variable and for each exogenous variable. All returns are expressed in local currency. Shocks are orthogonalized through a Cholesky factorization in order to allow for contemporaneous correlations across equations. For each impulse response functions we also report the 95% confidence intervals (dashed lines), which are computed by Monte Carlo simulation.

do for the country-by-country analysis, we choose a Cholesky ordering with flows before returns so that returns do not affect flows contemporaneously. We examine sample periods starting in January 1996 as well as September 1998 and find similar results across periods. The pooled IRFs show that shocks to both local and North American returns lead to positive and significant increases in net flows. The accumulated effects of return shocks remain significant out to 30 lags for both variables, although most, if not all, appear to be due to the first few lags, indicating a very quick reaction of foreign investors to unexpected local and U.S. returns. Our model predicts that when the foreign market is sufficiently large relative to the domestic market, equity flows are positively related to foreign returns and to the size of the foreign market. Consistent with these predictions, we find that equity flows into Asian countries are positive and significantly related to North American market returns and, to a lesser extent, to European returns.

VI. Robustness of the Main Results

In this section, we report results taking into account alternative methods of scaling flows, exchange rate changes, other-country flows, dollar returns, regime shifts, crises, and weekly returns and flows.

A. Scaling Flows by Volume

In all of our previous analysis flows are scaled by the previous day's market value. An alternative method to scale

TABLE 4.—VAR: FLOWS WITH CONTEMPORANEOUS LOCAL, LAGGED LOCAL, AND REGIONAL INDEX RETURNS

	East Asia					South Asia		Others	
	Indonesia	Korea	Philippines	Taiwan	Thailand	India	Sri Lanka	Slovenia	South Africa
Intercept	0.010	−0.004	0.038	−0.002	−0.007	0.002	−0.003	0.023	0.011
(*p*-val)	(0.67)	(0.87)	(0.36)	(0.94)	(0.77)	(0.97)	(0.94)	(0.42)	(0.69)
Net flows *Lag 1*	0.207	0.368	0.345	0.274	0.263	0.107	0.130	0.369	0.155
(*p*-val)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)
Lag 2	0.100	0.011	0.038	0.149	0.053	0.131	0.112	0.058	0.140
(*p*-val)	(0.00)	(0.71)	(0.48)	(0.00)	(0.15)	(0.00)	(0.01)	(0.15)	(0.00)
Returns *Lag 0*	0.339	0.158	0.331	0.151	0.330	0.164	0.085	−0.007	−0.052
(*p*-val)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.05)	(0.82)	(0.08)
Lag 1	0.112	0.200	0.148	0.175	0.269	0.046	0.007	−0.103	−0.038
(*p*-val)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.31)	(0.88)	(0.00)	(0.30)
Lag 2	0.043	−0.079	0.019	0.017	−0.012	−0.060	0.016	−0.051	0.001
(*p*-val)	(0.15)	(0.00)	(0.69)	(0.55)	(0.73)	(0.19)	(0.71)	(0.11)	(0.97)
Pacific *Lag 1*	0.014	0.037	−0.030	−0.002	0.006	0.077	0.029	−0.008	−0.004
(*p*-val)	(0.63)	(0.17)	(0.56)	(0.96)	(0.84)	(0.13)	(0.56)	(0.81)	(0.91)
Lag 2	0.019	0.047	−0.089	0.004	−0.015	0.027	0.018	0.033	0.043
(*p*-val)	(0.53)	(0.08)	(0.09)	(0.90)	(0.64)	(0.59)	(0.73)	(0.35)	(0.20)
Europe *Lag 1*	−0.009	0.054	0.023	0.050	0.097	−0.003	−0.020	−0.039	−0.006
(*p*-val)	(0.78)	(0.07)	(0.69)	(0.15)	(0.00)	(0.95)	(0.71)	(0.31)	(0.88)
Lag 2	−0.007	−0.033	0.089	−0.028	−0.028	−0.028	−0.016	−0.052	−0.024
(*p*-val)	(0.83)	(0.27)	(0.13)	(0.43)	(0.40)	(0.61)	(0.78)	(0.19)	(0.53)
North America *Lag 1*	0.035	0.115	−0.038	0.217	0.057	0.073	0.013	0.032	−0.039
(*p*-val)	(0.21)	(0.00)	(0.44)	(0.00)	(0.05)	(0.12)	(0.79)	(0.33)	(0.24)
Lag 2	0.010	−0.061	−0.077	0.038	−0.059	0.027	−0.082	0.008	0.035
(*p*-val)	(0.76)	(0.04)	(0.18)	(0.27)	(0.07)	(0.62)	(0.13)	(0.83)	(0.32)
All emerging *Lag 1*	−0.003	0.045	0.063	0.081	−0.021	−0.012	0.063	0.038	0.030
(*p*-val)	(0.92)	(0.12)	(0.21)	(0.01)	(0.55)	(0.82)	(0.23)	(0.31)	(0.39)
Lag 2	−0.003	0.021	0.059	0.024	0.004	−0.031	−0.018	0.027	−0.015
(*p*-val)	(0.93)	(0.46)	(0.25)	(0.47)	(0.91)	(0.56)	(0.73)	(0.47)	(0.67)
Adj. R^2	0.275	0.413	0.311	0.414	0.524	0.124	0.055	0.398	0.120
	P-values for joint significance test (Lags 1–5)								
Own return	0.000	0.000	0.038	0.000	0.000	0.318	0.663	0.000	0.270
Pacific	0.777	0.010	0.881	0.738	0.598	0.204	0.833	0.456	0.460
Europe	0.755	0.054	0.311	0.077	0.006	0.779	1.000	0.198	0.532
N. America	0.001	0.000	0.704	0.000	0.000	0.382	0.849	0.286	0.121
All emerging	0.231	0.321	0.758	0.054	0.325	0.568	0.859	0.567	0.364

This table presents estimation results from the structural bivariate VAR below. $r_{i,t}$ denotes the daily percentage continuously compounded market return for country i, and $f_{i,t}$ denotes the daily net flow (buy value − sell value) originated by foreign investors, scaled by previous-day market capitalization, for country i. The α's are constant intercept terms, $b(L)$ denotes a polynomial in the lag operator L, and $\varepsilon^r_{i,t}$ and $\varepsilon^f_{i,t}$ are zero-mean disturbance terms that are assumed to be intertemporally uncorrelated. Scaled net flows are expressed in percentage terms. x_t is a vector of daily returns on regional-market indices, which are considered to be exogenously determined. Five lags are used for all endogenous variables as well as exogenous variables, but only the first two are reported. All variables are expressed in local currency, and the system is estimated separately for each country as seemingly unrelated regressions (SURs). The structural VAR contains contemporaneous local-market returns in the flow equation. Wald tests of joint significance of lags 1 through 5 for each regressor are also reported. The equation for the VAR with the contemporaneous local market return included is as follows:

$$\begin{bmatrix} r_{i,t} \\ f_{i,t} \end{bmatrix} = \begin{bmatrix} \alpha_{i,r} \\ \alpha_{i,f} \end{bmatrix} + \begin{bmatrix} b_{11}(L) & b_{12}(L) \\ b_{21}(L) & b_{22}(L) \end{bmatrix} \begin{bmatrix} r_{i,t-1} \\ f_{i,t-1} \end{bmatrix} + \begin{bmatrix} 0 \\ b_c r_{i,t} \end{bmatrix} + A_i(L)x_{t-1} + \begin{bmatrix} \varepsilon^r_{i,t} \\ \varepsilon^f_{i,t} \end{bmatrix}.$$

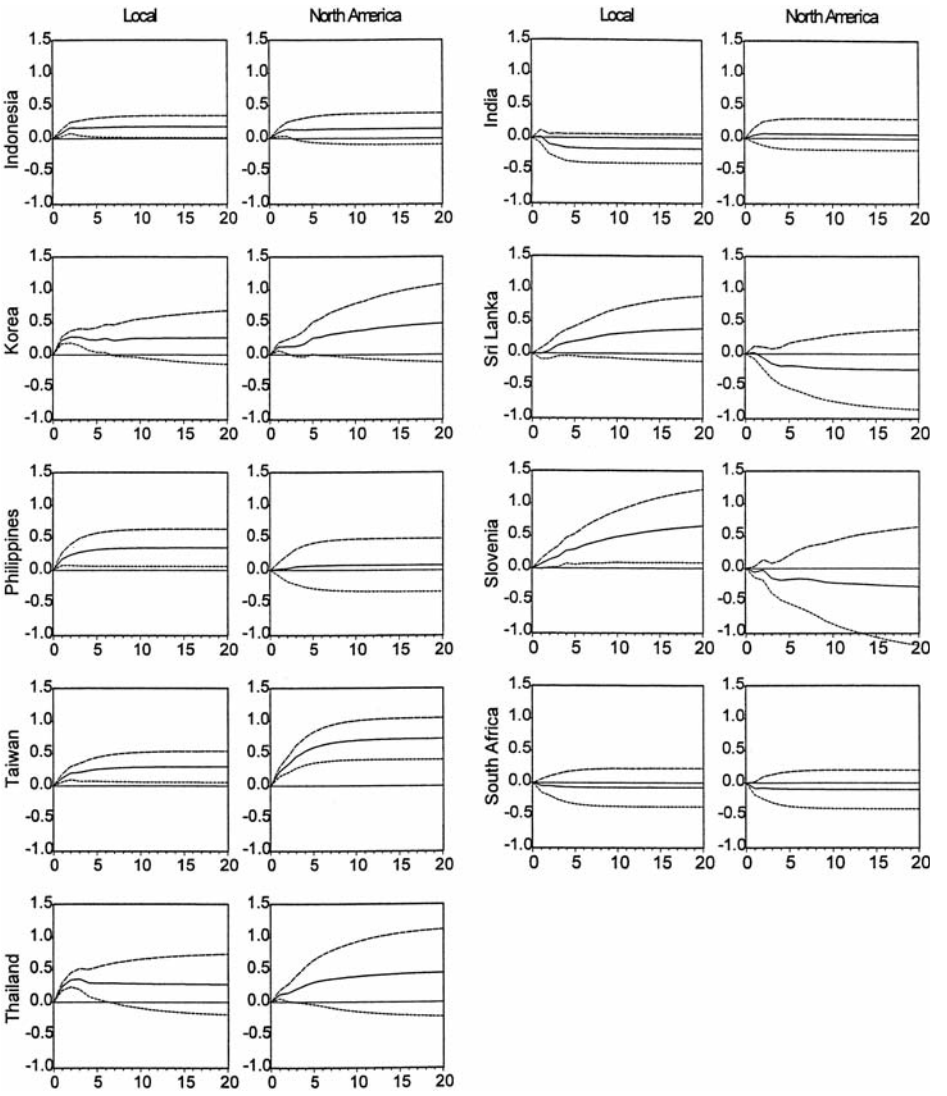
capital flows is relative to the total trading activity. We scale the buy–sell share value of foreigners by the daily value of shares traded[14] and reexamine our main findings with impulse response graphs analogous to those shown previously in Figure 1. The results in Figure 2 show that daily foreign flows scaled by the value of shares traded are significantly related to past local returns at some horizon in Indonesia, Korea, the Philippines, Taiwan, Thailand, and Slovenia. Foreign capital follows U.S. returns in Indonesia, Korea, Taiwan, and Thailand. The alternative method of calculating flow relative to trading activity and not market capitalization leads to similar findings.

[14] This measure is similar to scaling by trading volume, except that, to be consistent with the buy–sell value of shares in the numerator, the daily value of shares traded must be in the denominator.

B. Exchange Rates

To the extent that exchange rate changes are contemporaneously correlated with equity market increases, a positive relationship between nonhost-country returns and equity flows could simply be proxying for an exchange rate effect. In regressions not reported here, we add foreign exchange

FIGURE 2.—RESPONSES OF FLOWS SCALED BY TRADING VALUE TO LOCAL AND NORTH AMERICAN RETURN SHOCKS: DAILY DATA



This figure shows impulse response functions describing the response of scaled net flows to a 1-standard-deviation shock in local-market returns and in North America index returns. Responses are expressed in standard-deviation units. The time scale on the horizontal axis is in days. Results are based on a vector autoregression (VAR) like the one specified in Table 3, but where net flows are scaled by total trading value and not market capitalization. The VAR is estimated separately for each country with five lags for each endogenous variable and for each exogenous variable. All returns are expressed in local currency. Shocks are orthogonalized through a Cholesky factorization in order to allow for contemporaneous correlations across equations. For each impulse response function we also report the 95% confidence intervals (dashed lines), which are computed by Monte Carlo simulation.

rate changes as exogenous variables in our structural VAR (similar to Table 4). The exchange rate coefficients are positive in eight of the nine countries, indicating that a depreciation of the local currency leads to more foreign equity inflows. However, the relationship is statistically significant only in Indonesia and the Philippines. As with returns, the two-period lags of the exchange rate generally have coefficients closer to 0, indicating that investors react quickly to changes in the exchange rate. More importantly, coefficient estimates are generally quite close to the specification excluding exchange rates.

C. *Foreign Flows*

Flows are correlated across countries, particularly within East Asia. One would expect that cross-country flow correlations are due to common information shocks across countries. One could also argue that these cross-country flow relations are primarily driven by nonfundamental contagion. In a world where nonfundamental contagion is important, one might expect flow herding behavior to be the only major determinant of flow activity, and this would drive out the other inferences observed in our model.

To assess the importance of foreign herding behavior across markets, we estimate structural VARs similar to those previously examined in Table 4 with cross-country flows as an additional exogenous variable. Because of the strong regional component in flows, we examine East Asian flows for the four countries with the longest coverage: Indonesia, Korea, Taiwan, and Thailand. We construct a foreign flow index as a simple equally weighted average of the flows in

the three other East Asian countries. We find that foreign flows are an important determinant of Korean flows and the magnitude of this effect is economically large.[15] Interestingly, the inclusion of the foreign flow index does sharpen some of the inferences obtained from other variables in the system. European equity returns have positive coefficients in Korea and Thailand, and the emerging market index is now significantly positive in both Korea and Thailand but significantly negative in Taiwan. The coefficients on the North American returns are highly significant in three of the four countries and have a p-value of 0.07 in Indonesia.

D. Currency of Denomination

All of the previously discussed findings are obtained with local-currency-denominated returns and thus are taken from the perspective of an investor who is completely hedged against exchange rate movements. An alternative method of conducting (and checking the robustness of) the inferences is to take the perspective of an investor who is unhedged against foreign currency movements and uses a common currency such as the U.S. dollar. To this end, we compute dollar returns on local and regional indices.[16] In unreported results, structural VAR models estimated with dollar returns confirm that positive daily equity returns in other parts of the world, particularly the United States, lead to an increase in foreign investments into Asian markets.

E. Subperiod Analysis

An important question is whether our inferences change through time. Most of our stronger inferences come from Asian countries, where we have a time series extending through the Asian crisis. We first examine the importance of possible structural breaks using both the univariate and multivariate tests of Bai, Lumsdaine, and Stock (1998), which have been implemented in flow analysis by Bekaert, Harvey, and Lumsdaine (2002). At the 10% level only three of the nine countries have significant structural break dates.[17] We run pre- and postbreak regressions in Thailand, Taiwan, and South Africa and find that own-country returns and the North American returns for Thailand and Taiwan are still significant both before and after the break date.

Even though the tests indicate no structural break for most markets, one may think that the Asian or Russian crises altered fundamental flow relations. We first estimate VAR regressions for the three countries with the longest coverage, Indonesia, Korea, and Taiwan, during the precrisis period (prior to July 2, 1997), during the crisis (July 2, 1997 to December 31, 1997), and after the crisis (January 2, 1998 to February 23, 2001). Our findings of Asian capital flows following large local and North American market moves are not driven by the Asian or Russian crisis periods.

F. Return Asymmetries

Another interesting issue is whether net flows are affected differently by up and down market movements. In particular, if foreign investors are more sensitive to negative news, local negative returns may be followed by capital outflows to a greater extent than a positive return of the same absolute value would affect foreign inflows. Similarly, stock price declines in North American markets may have a stronger influence than North American stock price increases on capital flows in Asia. Our model gives no predictions regarding flow asymmetry, and it is not clear whether positive or negative returns should have more effect on flows.

We investigate this issue by estimating VAR regressions of flows on local and U.S. market returns with dummy variables for flow asymmetries. Unreported results show that net flows react differently to positive and negative lagged own returns only in Slovenia and South Africa, and the asymmetries are of opposite sign. As for lagged U.S. returns, there is no evidence that positive shocks affect subsequent flows differently than negative shocks, with the exception of Slovenia.

G. Weekly Inferences

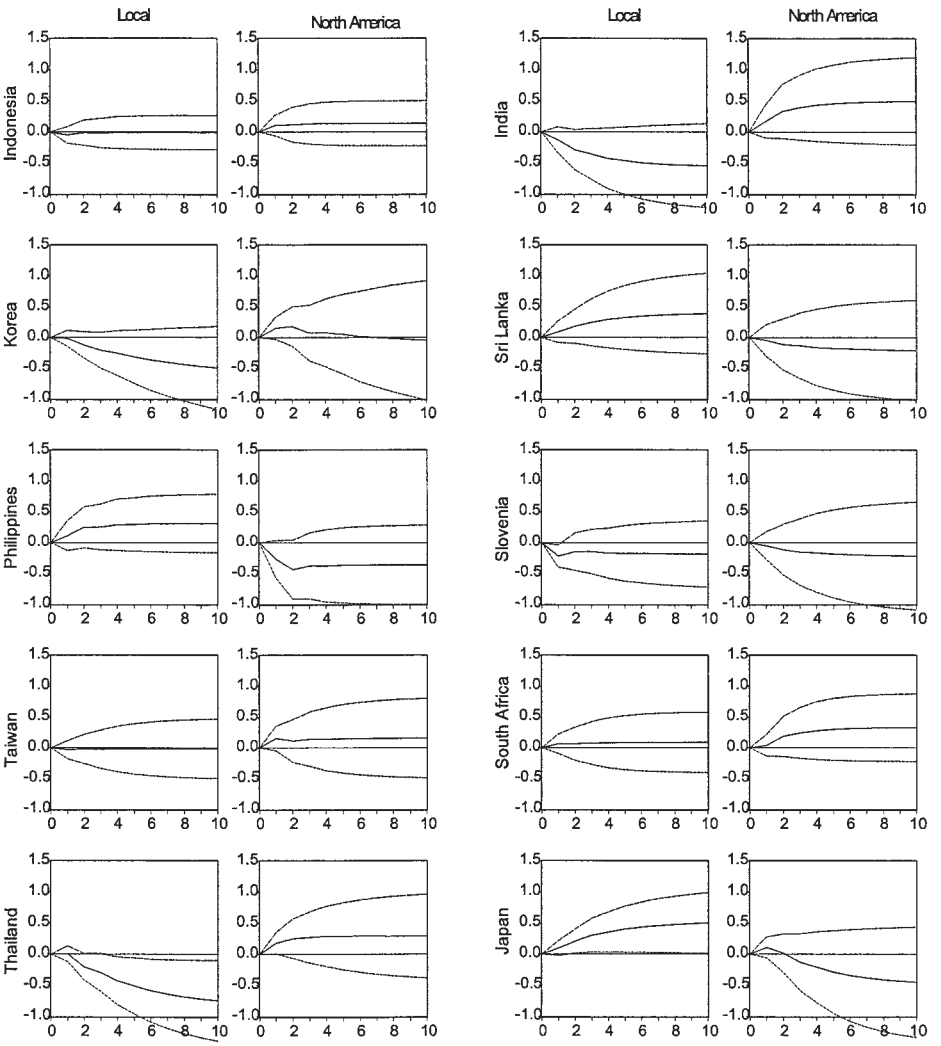
The daily data are important for examining the timing of capital movements, but it is also interesting to observe how capital flows are affected by past returns over longer horizons. We cumulate our daily returns and flows to the weekly frequency and then examine our basic VAR specification for the flow equation with regional returns. Figure 3 presents results similar to those shown at the daily frequency in Figure 1. Because of the availability of weekly flow data in Japan (beginning in January 1996), we are able to add Japan to the analysis. Shocks to lagged returns lead to larger flows only in Japan. There is weak evidence that U.S. returns lead to higher foreign flows in Japan and Thailand. Flows are highly persistent, and Pacific and European returns have little effect on them. In unreported results, we examine pooled impulse response functions similar to those discussed in Section IV C, and find that North American returns have a positive and significant effect on flows at lag 1. Weekly flows are not significantly related to past local returns in any interval. One possible explanation for why

[15] This result is consistent with the evidence of a regional common factor in flows presented in Froot, O'Connell, and Seasholes (2001). In unreported results, we decomposed the average flow measure into three separate foreign flows (one for each other country) and find that it is flows from Thailand that are leading the Korean flows.

[16] Net flows are scaled by market capitalization and hence invariant to the currency of denomination.

[17] Given the short time period, the few detected structural breaks could be driven by low power, especially in that data prior to the Asian crisis are limited. Multivariate break dates are June 18, 1998 for Thailand, October 8, 1998 for Taiwan, and February 4, 1997 for South Africa. The univariate tests yield dates that are the same for South Africa and within 4 to 6 days for Thailand and Taiwan. We also conducted Bai and Perron's (1998) univariate test and find similar break dates.

FIGURE 3.—RESPONSES OF FLOWS TO LOCAL AND NORTH AMERICAN RETURN SHOCKS: WEEKLY DATA



This figure shows impulse response functions describing the response of scaled net flows to a 1-standard-deviation shock in local market returns and in North America index returns. Responses are expressed in standard deviation units. The time scale on the horizontal axis is expressed in weeks. Results are based on a vector autoregression (VAR) like the one specified in Table 3, but estimated on weekly data. The VAR is estimated separately for each country with two lags for each endogenous variable and for each exogenous variable. All returns are expressed in local currency. Shocks are orthogonalized through a Cholesky factorization in order to allow for contemporaneous correlations across equations. For each impulse response function we also report the 95% confidence intervals (dashed lines), which are computed by Monte Carlo simulation.

weekly flows do not seem to follow returns consistent with the extrapolative expectations in our model is that foreign investors believe that past local returns forecast future expected returns but only over short (daily) horizons.

VII. Conclusion

We present a simple model of equilibrium equity flows with barriers to international investment and with foreign investors who find past stock prices more informative about future domestic returns than do domestic investors. The model predicts that equity flows toward a country increase with the return of that country's stock market. Further, when a country is small, the model predicts that equity flows toward the country increase with stock returns in bigger markets. Using daily flow data from nine markets, we find support for both of these predictions.

We find that foreign investors invest more following high returns in a market and that they react quickly, often within a few calendar days. There is only weak evidence of foreigners having information about future market moves after controlling for the contemporaneous daily flow–return relation. Using a bivariate structural VAR where flows are allowed to depend on returns to regional indices as well as past flows and local returns, we find that equity flows increase following unexpectedly positive regional equity returns. North American returns are particularly important in determining equity flows toward Asia. These findings are robust at the daily frequency when taking into account alternative methods of scaling flows, exchange rate effects, cross-country flow dynamics, the Asian and Russian crises, and potential asymmetric effects of positive and negative returns. Pooled tests indicate that lagged local and North

American returns are both highly significant predictors of capital flows at the daily frequency but not at weekly frequencies.

Our results open important avenues for further research. First, further research should investigate why the results obtained using daily data do not carry over to the weekly frequency. It would be worthwhile to examine the implications of our model for flows and returns over longer periods of time. Second, though some money managers have their decisions affected by the returns on the most recent days, many other money managers base their decisions on returns for longer periods as well as on fundamental information. It could well be that past returns affect trading behavior differently for various investor groups. Third, the model of Brennan and Cao (1997) could be generalized so that domestic investors learn from domestic returns about foreign stocks. Our empirical work does not make it possible to exclude this explanation for the relation between flows and nonhost-country returns. Fourth, the trading practices of money managers could explain the persistence of flows and might even offer an explanation for why daily results differ from weekly.

The result that inflows into small countries are positively related to U.S. stock market returns has important implications for our understanding of equity flows. Some have argued that capital flows cannot be explained by innovations about fundamentals and must be due to some contagious activity. However, both our model and our empirical results indicate that, to understand daily capital flows into a country, it is not enough to focus on fundamentals of the host country or even markets with similar fundamentals. Capital can be pushed toward a country as well as pulled toward it, but our evidence shows that these effects are surprisingly short-lived.

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APPENDIX

1. Impact of an Increase in P_F on N_F^D When There Are Barriers to International Investment

Take the derivative of N_F^D with respect to P^F in equation (2):

$$\frac{dN_F^D}{dP_F} = N_F^S \frac{\partial \Omega}{\partial P_F} + \frac{\delta^D}{\sigma_F^2}[2\Omega - 1]\frac{\partial \Omega}{\partial P_F}\frac{W^W}{P_F} + \frac{\delta^D}{\sigma_F^2}[\Omega - 1]\Omega \frac{\partial (W^W/P_F)}{\partial P_F}. \quad \text{(A-1)}$$

The first term is always negative. The second term is negative if Ω is greater than 0.5. The third term is always positive. When the domestic country is small enough and the ratio δ^D/σ_F^2 is large, the second term is positive and more than offsets the first one, so that the derivative is positive. In the symmetric case, the derivative is negative provided that δ^D/σ_F^2 is not greater than 1.

2. Proof that N_F^D Increases as P_F Increases if the Expected Return for Domestic Investors Increases Sufficiently Strongly with P_F

Let $\Delta_F^D = \Delta_F^D(P_F)$ and $Q = \delta^D - \Delta_F^D$. With our assumptions, Q falls as P_F increases. The derivative of N_F^D with respect to P_F is then

$$\frac{dN_F^D}{dP_F} = N_F^S \frac{\partial (W^D/W^W)}{\partial P_F} + \frac{\partial Q/\partial P_F}{\sigma_F^2}\left[\frac{W^D}{W^W} - 1\right]\frac{W^D}{P_F} + \frac{Q}{\sigma_F^2}\frac{\partial (W^D/W^W)}{\partial P_F} + \frac{Q}{\sigma_F^2}\left[\frac{W^D}{W^W} - 1\right]\frac{\partial (W^D/W^W)}{\partial P_F}. \quad \text{(B-1)}$$

In this expression, the second and fourth terms are positive and the other terms are negative. Hence, as long as the second and fourth terms are large enough, it is possible for a positive return on the foreign stock to lead domestic investors to purchase foreign shares. The second positive term is the term that distinguishes this expression from the expression of Section 1 of this Appendix. If this term is large enough, it makes the derivative positive in the symmetric case.