February 7, 1997

International Portfolio Investment Flows

Michael J. Brennan*, H. Henry Cao†

*Irwin and Goldyne Hearsh Professor of Banking and Finance, University of California, Los Angeles, and Professor of Finance, London Business School.

†Haas School of Business, University of California, Berkeley. We are grateful to the Center for International Business Education and Research of the University of California, Los Angeles for financial support. Previous versions of this paper were presented at the meetings of AFFI, Geneva 1996, the Northern Finance Association, Quebec City 1996, and the CEPR Summer Workshop, Gerzensee, 1996. The paper has been improved as a result of comments from the referee and the Editor, Rene Stulz.

Abstract

This paper develops a model of international equity portfolio investment flows based on differences in informational endowments between foreign and domestic investors. It is shown that when domestic investors possess a cumulative information advantage over foreign investors about their domestic market, investors tend to purchase foreign assets in periods when the return on foreign assets is high and to sell when the return is low. The implications of the model are tested using data on U.S. equity portfolio flows.

Despite the apparent advantages of the international diversification of equity portfolios, demonstrated by Grubel (1968), Levy and Sarnat(1970) and Solnik (1974), and despite the general relaxation of controls on foreign portfolio investments by developed countries that took place in the early 1980's, French and Poterba(1991), Cooper and Kaplanis (1994) and Tesar and Werner (1995) show that there continues to exist a strong domestic bias in national equity portfolios. Explanations that have been offered for this bias include both barriers to capital flows created by higher costs of transacting in foreign securities, withholding taxes, and political risk, as well as other factors such as the failure of purchasing power parity (PPP), information asymmetries, and regulation.

Equilibrium models of international asset pricing that explain the domestic bias in terms of tax and transaction cost barriers to international capital flows have been developed by Black(1974) and Stulz (1981). However, higher transaction costs on foreign transactions could be expected to lead to lower turnover rates on the overseas components of portfolios than on the domestic components, yet Tesar and Werner (1995) find just the opposite: portfolio turnover rates are higher on foreign than on domestic portfolios. Similarly, while withholding taxes on foreign investment income can be expected to cause a home bias in the composition of investment portfolios to the extent that these taxes cannot be offset against domestic taxes, Cooper and Kaplanis (1994) and French and Poterba (1991) find that the expected return differentials that are required to explain the observed degree of home bias exceed what can reasonably be attributed to the effects of differential taxation of foreign investments. Finally, Frankel (1991) has shown that for most developed countries political risks, as reflected in the differentials between Euro and domestic interest rates, are too small to account for significant biases in the composition of portfolios.

Adler and Dumas (1983), and Uppal (1993), show that deviations from PPP that lead investors in different countries to choose portfolios to hedge different inflation could also cre-

ate a home bias in investment portfolios.However, Cooper and Kaplanis (1994) demonstrate that the magnitude of PPP deviations, combined with plausible estimates of the deadweight costs of foreign investing, are sufficient to explain observed portfolio allocations only if investors have very low levels of risk aversion. While residual regulations on foreign portfolio investments remain even in developed countries,[1]they also seem insufficient to account for the magnitude of the domestic bias found in these countries.

In the more recent models of Low (1992), Gehrig (1993), and Kang and Stulz (1994), asymmetric information between domestic and foreign investors leads to a home bias. Kang and Stulz present empirical evidence that foreign investment in Japanese equities is concentrated in the largest firms, which is consistent with foreign investors having relatively less information about small firms than local investors, while Carlos and Lewis (1995) demonstrate that informational considerations were of first order importance in explaining British investment in Canadian railroads in the 19th Century; Chuhan (1992) reports that market participants list limited information on emerging markets as one of the major impediments to investing in those markets.

In this paper we develop and test the implications of the information asymmetry hypothesis for *flows* of portfolio investment between countries.Thus our analysis complements the previous papers that have explored the static implications of information asymmetry for the composition of equity portfolios. International portfolio flows have received little theoretical analysis,[2]although these flows have grown enormously following the liberalization of capital markets in the early 1980's, and the recent fashion for emerging capital markets.

The model we develop abstracts from barriers to investment, currency and political risk, deviations from purchasing power parity, and interest rate differentials, in order to focus on the implications of informational differences between foreigners and domestic residents. The model is a dynamic generalization of the noisy rational expectations model of Hellwig (1980),

extended by Admati (1985) to a multi-asset setting. The basic assumption underlying the model is similar to that of Low (1992), Gehrig (1993) and Kang and Stulz (1994) in that domestic investors are assumed to be better informed about the payoffs on the domestic market than are foreign investors.

Some would argue with this assumption of geographic information asymmetry since communication between countries is now close to instantaneous. Nevertheless, we believe that such an assumption may have considerable descriptive appeal. First, Coval and Moskowitz (1996) find that even portfolios of United States (U.S.) domestic mutual funds are geographically biased towards the home of the fund; and problems of distance are dwarfed by problems of language and communication, so that while information about the domestic economy may be acquired virtually costlessly by regular reading of the local press and normal business activities, information about foreign economies requires considerably more effort to acquire - subscriptions to foreign newspapers, translations etc.[3]Our formal model requires only an information asymmetry for the *average* (individual) investor in different countries - there is little doubt that such asymmetry exists between most pairs of countries. Nevertheless, it is probably true that a major part of international portfolio investment is carried out by financial institutions, pension funds, etc. and for these investors it might seem that the case for information asymmetry is much weaker. However, while it is true that institutions will often have individuals assigned to monitoring various foreign countries, we believe that it is rare for these informed individuals to have sole responsibility for country allocation.[4]Consistent with the asymmetric information hypothesis, Shukla and Inwegen (1995) report that foreign managed mutual funds in the U.S. are outperformed by domestic funds and that at least part of this performance shortfall is attributable to inferior market timing by the foreign funds. Shiller *et al.* (1996) provide striking evidence that expectations about market returns differ very significantly between countries. Using survey data from a large number of Japanese financial institutions and U.S. institutional investors, they report that: "The

Japanese were uniformly more optimistic in their short run expectations for the Japanese market than were the Americans. At a horizon of one year, there was usually a spread on the order of *20 percentage points*[5]between the Japanese and U.S. forecasts for the Japanese market." While this is not direct evidence of differences in information precisions, it does suggest that geographic location or country of origin may have some bearing on information acquisition about different country returns.[6]

The assumption of information asymmetry is shown to imply a home-bias in portfolio holdings relative to a model with homogeneous information, and a higher turnover rate on foreign than on domestic portfolios, and to place testable restrictions on the relation between international flows of portfolio investment and returns on foreign and domestic assets. In order to focus attention on the role of information asymmetry, exchange risk and interest rate differentials are ignored, and the analysis is conducted in a model with many trading periods but only a single terminal consumption period.[7]

The major empirical implications of the model are that purchases of foreign equities will be a linear function of returns on the domestic and foreign equity markets; and that the coefficient of the return on the foreign market index will be positive, provided that foreign investors are less well-informed about the payoffs on stock than are local investors,[8]and provided that the information advantage of locals is the result of a gradual process of superior information acquisition rather than of periodic large information leakages to locals. The sign of the coefficient of the return on the domestic market index is indeterminate.

The intuition for the result is as follows. Foreign and domestic investors have positions in a national stock market based on their past private information signals, past public signals, and the information about the private signals received by others that they are able to glean from the price in a noisy rational expectations equilibrium. Given these portfolio positions, a public signal leads investors to revise their priors. The assumption of normal

distributions implies that the effect of the public signal on the precision of investors' priors is independent of the signal realization. However, investors do revise the means of their predictive distributions in a way that depends on the signal realization. Most importantly, the less well-informed (i.e. foreign) investors revise the means of their distributions by more than do better-informed (i.e. local) investors. This implies, for example, that if the public signal conveys good news about the payoff on the domestic market portfolio, foreign investors increase their assessment of the expected payoff faster than do better informed domestic investors; as a result, the price rises to clear the market, and the less well informed foreign investors purchase more of the domestic market portfolio from the better informed domestic investors; the reverse occurs if the news is bad and the price falls. The net effect is that foreign purchases of the market portfolio tend to be positively correlated with the return on the portfolio. The situation is only slightly complicated by news about the payoff on the other market, and indeed if the signal errors in the two markets are independent, then purchases of foreign securities depend only on the return on the foreign market index, and not on the return on the domestic index.

It is important for our theory that the information advantage of domestic investors accrue gradually over time, because the trend following behavior of foreign investors is dependent on their relative information disadvantage *at the start* of the trading period. In fact, if foreign investors enter the period with no information disadvantage, but receive a less precise signal than domestic investors during the trading period, then foreign investors could act as contrarians. The intuition here is that if domestic investors receive a more precise signal than do foreigners then they will revise their priors by more than do foreigners, and this will cause them to be net buyers (and foreigners net sellers) when the average private signal is good so that the price rises. We derive our empirical model by assuming that the information advantage of domestic investors accrues gradually over time from their closer observation of the domestic economy since we believe that it is unlikely that domestic investors would, as

a group, be privy to significant information events in any one period that were unknown to foreigners.

We test the association between foreign purchases of equities and the domestic index return by examining U.S. purchases of equities in four developed countries and sixteen emerging markets. We also examine the association between purchases of U.S. equities from the four developed countries and the return on the U.S. market index. We find that U.S. purchases of equities in foreign developed markets tend to be positively associated with the concurrent return in that market; this is consistent with U.S. investors being less well informed about those markets than local investors. However, it is also consistent with exogenous shifts in U.S. investors' demand for foreign securities, that are unrelated to new information, having a price impact on the foreign market, so we are not able to distinguish these hypotheses. There is no association between purchases of U.S. equities by residents of the four developed countries and the concurrent return on the U.S. market index, so there is no indication that investors in these countries are less well informed than U.S. residents about the returns on U.S. equities. It is perhaps to be expected that information asymmetries will be most pronounced in the emerging markets, and for these markets we do tend to find that U.S. purchases are positively associated with the concurrent return on the local market index. While this could be attributable to exogenous shifts in U.S. demands affecting foreign stock prices, we also find some evidence that U.S. purchases are positively related to the *previous* quarter's return; this is not explicable in terms of market impact, but is consistent with the asymmetric information story if this is extended to allow for lagged decision-making by U.S. investors. Finally there is no evidence of wealth effects that would cause purchases of foreign securities to be positively associated with the return on the domestic market index.

The paper is organized as follows. Section I presents a general model of a noisy dynamic rational expectations equilibrium with many assets. In Section II this is interpreted within an

international context to yield testable predictions about the relation between equity portfolio flows and national stock market returns. Section III describes the data that are used in the empirical tests. The empirical results for developed and emerging markets are described in Sections IV, V, and VI.

I A General Model

We first consider a dynamic generalization of the multi-asset noisy rational expectations model of Admati (1985). The payoffs on the M risky assets are realized at time 1, and are represented by a $M \times 1$ normally distributed random vector $\tilde{U}$ with mean $\bar{U}$ and precision matrix H. Without loss of generality, the riskless interest rate is taken as zero. Each investor $i, i \in [0,1]$, is endowed at time 0 with quantities of the risky assets represented by the vector X^i; investors are characterized by exponential utility functions defined over time 1 consumption with common coefficient of absolute risk aversion $1/r$. The vector of aggregate per capita supply of the risky assets, $\tilde{X}_0$, is normally and independently distributed with mean $\bar{X}_0$ and precision matrix Φ_0. Unlike Admati who considers only a single trading session, we allow trading to take place in T trading sessions which are held at times $\tau_t = t/T, t = 0, \cdots, T-1$. The asset payoffs are realized and consumption takes place at time 1 after the last trading session: there is no intermediate consumption in the model.

Immediately prior to trading session t, each investor i obtains an $M \times 1$ vector of *private* signals about the asset payoffs, $\tilde{Z}_t^i$, where

$$\tilde{Z}_t^i = \tilde{U} + \tilde{\epsilon}_t^i,$$

$\tilde{\epsilon}_t^i$ is distributed normally and independently of $\tilde{U}$, has mean zero, and is independent of $\tilde{\epsilon}_j^k$, if $k \neq i$ or $j \neq t$. The precision matrix of the private signals received by investor i immediately before session t is denoted by S_t^i. In addition to the private signals, a vector of *public* signals

is released immediately before each trading session $t = 0, \cdots, T-1$. The public signals are represented by the $M \times 1$ vector $\tilde{Y}_t$, where

$$\tilde{Y}_t = \tilde{U} + \tilde{\eta}_t.$$

$\tilde{\eta}_t$ is normally distributed with mean zero and precision matrix N_t. We assume that $N_0^{-1} = N_T^{-1} = O$ where O is a zero matrix, to reflect the assumption that there is no public information at time 0 and that all risky asset returns are realized at session T. For notational simplicity, we define $\tilde{Y}_0 = 0$. New liquidity traders are assumed to enter the market in each trading session $t = 1, .., T-1$ after the initial session; the incremental net supply of these traders is represented by the normally distributed random vectors, $\tilde{X}_t$, which have means, $\bar{X}_t$, and precision matrices, Φ_t. For simplicity we shall impose $\bar{X}_t = 0$, for $t > 0$. In order to retain the less than fully revealing nature of the rational expectations equilibrium described in the theorem below we assume that the total volume of trading is not observable by traders.[9]

The elements of the precision matrices, S_t^i, are assumed to be uniformly bounded, and S_t, the population average of the precision matrix at trading session t, is given by

$$S_t \equiv \int_0^1 S_t^i di.$$

We follow the convention used by Admati (1985) in defining the integral of random variables in the continuum economy with multiple risky assets. If $(\tilde{V}^i)_{i \in [0,1]}$ is a process of independent random variables with zero mean and bounded variance, and $(\tilde{W}^i)_{i \in [0,1]}$ is almost surely integrable, then $\int_0^1 (\tilde{V}^i + \tilde{W}^i) di = \int_0^1 \tilde{W}^i di$. For example, this convention implies that $\int_0^1 \tilde{Z}^i = \tilde{U}$, a.s., and $\int_0^1 S_t^i \tilde{Z}^i = S_t \tilde{U}$, a.s.

Let $\tilde{P}_t$ denote the vector of equilibrium risky asset prices, $\tilde{D}_t^i$ the vector of risky asset demands for investor i in market session t, $\tilde{F}_t$ the public information set including the prices

at trading session t, and $\tilde{F}_t^i$ the information set of investor i at trading session t. Then the following theorem describes the risky asset prices and investor asset demands at each market session in a noisy rational expectations equilibrium:[10]

Theorem *There exists a partially revealing rational expectations equilibrium in the T trading session economy in which*

(i) the vectors of risky asset prices, $\tilde{P}_t$, and individual asset demands, $\tilde{D}_t^i$, are given by:

$$\tilde{P}_t = K_t^{-1}[(K_t - \sum_{j=0}^{t} S_j)\tilde{\mu}_t + \sum_{j=0}^{t}\{S_j\tilde{U} - \tilde{X}_j/r\}], \tag{1}$$

$$\tilde{D}_t^i = rK_t^i[\tilde{\mu}_t^i - \tilde{P}_t] = r[\sum_{j=0}^{t}\{S_j^i\tilde{Z}_j^i - S_j\tilde{U} + \tilde{X}_j/r - (S_j^i - S_j)\tilde{P}_t\}], \tag{2}$$

where

$$\tilde{\mu}_t^i \equiv E(\tilde{U}|\tilde{F}_t^i) = (K_t^i)^{-1}(H\bar{U} + \sum_{j=0}^{t}[N_j\tilde{Y}_j + S_j^i\tilde{Z}_j^i + r^2S_j\Phi_jS_j\tilde{Q}_j]),$$

$$\tilde{\mu}_t \equiv E(\tilde{U}|\tilde{F}_t) = (K_t - \sum_{j=0}^{t} S_j)^{-1}(H\bar{U} + \sum_{j=0}^{t}[N_j\tilde{Y}_j + r^2S_j\Phi_jS_j\tilde{Q}_j]),$$

$$\tilde{Q}_j = \tilde{U} - r^{-1}S_j^{-1}(\tilde{X}_j - \bar{X}_j),$$

$$K_t^i \equiv \mathrm{Var}^{-1}(\tilde{U}|\tilde{F}_t^i) = H + \sum_{j=0}^{t}[S_j^i + N_j + r^2S_j\Phi_jS_j],$$

$$K_t \equiv \int_0^1 K_t^i di = H + \sum_{j=0}^{t}[N_j + S_j + r^2S_j\Phi_jS_j].$$

(ii) The optimal trading strategy of the individual investor i is given by

$$\nabla\tilde{D}_t^i \equiv \tilde{D}_t^i - \tilde{D}_{t-1}^i = r[S_t^i(\tilde{Z}_t^i - \tilde{P}_t) - S_t(\tilde{U} - \tilde{P}_t) + \tilde{X}_t/r - \sum_{j=0}^{t-1}(S_j^i - S_j)\nabla\tilde{P}_t], \tag{3}$$

where $\nabla\tilde{P}_t \equiv \tilde{P}_t - \tilde{P}_{t-1}$.

Equation (3) shows that the trading strategy of investor i in period t depends on (i) the difference between his vector of private signals in period t and the vector of prices, $\tilde{P}_t$, weighted by his private signal precision matrix, S_t^i; (ii) the difference between the vector of

the average private signal, $\tilde{U}$, and the vector of prices, $\tilde{P}_t$, weighted by the average private signal precision matrix, S_t; (iii) the vector of supply shocks due to new liquidity traders in session $\tilde{X}_t$; and (iv) the vector of price changes, $\nabla\tilde{P}_t$, weighted by the difference between the investor's private signal precision matrix and the market average precision matrix, $S_j^i - S_j$, accumulated for all sessions up to session $t-1$.

Since the econometrician observes neither the supply shock, nor the private signals, it is convenient to consider the expected trade of investor i conditional on the vector of price changes at time t, $\nabla\tilde{P}_t$; the conditional expected trade vector may be written as:

$$E[\nabla\tilde{D}_t^i|\nabla\tilde{P}_t] = r[\omega_t^i\Gamma_t\nabla\tilde{P}_t + E[\tilde{X}_t/r|\nabla\tilde{P}_t] - \Omega_t^i\nabla\tilde{P}_t], \tag{4}$$

where

$$\omega_t^i = S_t^i - S_t,$$

$$\Omega_t^i = \sum_{j=0}^{t}\omega_j^i = K_t^i - K_t,$$

$$\begin{aligned}
\Gamma_t &= \mathrm{Cov}[\tilde{U} - \tilde{P}_{t-1}, \nabla\tilde{P}_t]\mathrm{Var}^{-1}[\nabla\tilde{P}_t] \\
&= \{[I + K_{t-1}^{-1}(\sum_{j=0}^{t-1} S_j + r^{-2}\Phi_j^{-1})][K_{t-1}^{-1} - K_t^{-1}]\} \times \\
&\quad \{[K_{t-1}^{-1} - K_t^{-1}][I + (\sum_{j=0}^{t-1} S_j + r^{-2}\Phi_j^{-1})(K_{t-1}^{-1} - K_t^{-1})] + K_t^{-1}[S_t + r^{-2}\Phi_t^{-1}]K_t^{-1}\}^{-1}.
\end{aligned}$$

ω_t^i represents the marginal informational (dis)advantage of investor i arising from private signals received at time t, while Ω_t^i represents the cumulative informational (dis)advantage of the investor arising from all the private signals received up to time t. Note first that if the marginal information advantage is zero ($\omega_t^i = 0$) and there is no liquidity shock in trading session t, then each investor's conditionally expected trade will depend only on the final term in expression (4), which is the negative of a matrix representing the investor's cumulative information advantage times $\nabla\tilde{P}_t$, the vector of price changes in session t. On the other

hand, if there is no cumulative private information advantage (i.e. $\Omega_t^i = 0$), then, apart from the supply shock, $\tilde{X}_t$, the investor's conditionally expected trade is equal to a matrix representing the investor's information advantage in the current period times the vector, $\Gamma_t \nabla \tilde{P}_t$. Thus the cumulative information advantage from all the private signals, and the marginal information advantage from the current private signal affect the investor's expected trades in quite different ways. Indeed, the following simple results can be obtained in a single security setting: $\Gamma_t > 0$ so that the trades of an investor with no cumulative information advantage ($\Omega_t^i = 0$), but with a positive marginal information advantage ($\omega_t^i > 0$), will be *positively* correlated with the current price change; the trades of an investor with a positive cumulative information advantage ($\Omega_t^i > 0$), but with no marginal information advantage ($\omega_t^i = 0$), will be *negatively* correlated with the price change in the current period.

Thus the relation between the trades of well- and poorly-informed investors and price changes is critically related to the extent to which the information (dis)advantage arises from a marginal private information advantage in the current period, or from an accumulation of superior private information signals in the past. To derive testable implications from the model it will be necessary to make an assumption about the relative magnitudes of the cumulative and marginal information advantages of domestic investors - this is discussed below.

II International Portfolio Investment

To develop the implications of the model for international portfolio investment, we consider a setting in which there are M countries indexed m. The market portfolio of each country is treated as a single risky asset, currency risk is ignored, and we assume that investors in all countries have access to the same riskless asset whose return is zero.

Let μ^m denote the measure of domestic investors in country m. Then, from equation (4), the vector of conditional expected trades by investors in country m is given by:

$$E[\nabla \tilde{D}_t^m | \nabla \tilde{P}_t] = r \int_{i \in m} [\omega_t^i \Gamma_t \nabla \tilde{P}_t + E[\tilde{X}_t / r | \nabla \tilde{P}_t] - \mathbf{\Omega}_t^i \nabla \tilde{P}_t] di. \tag{5}$$

We further assume that the contribution of noise traders in country m to the aggregate supply shock, $\tilde{X}_t$, is $\mu^m \tilde{X}_t$. Then, adding the trades of noise traders to those of the (rational) investors, and dropping the time subscript, the expectation of the vector of aggregate security purchases by all individuals in country m (including noise traders), $\tilde{\Pi}^m$, conditional on the vector of price changes, $\nabla \tilde{P}$, is

$$E[\tilde{\Pi}^m | \nabla \tilde{P}] = \Theta^m \nabla \tilde{P}, \tag{6}$$

where

$$\Theta^m \equiv r[\omega^m \Gamma - \mathbf{\Omega}^m],$$
$$\omega^m \equiv \int_{i \in m} \omega^i di,$$
$$\Omega^m \equiv \int_{i \in m} \Omega^i di.$$

Equation (6) implies that portfolio flows can be written as a linear function of price changes in the M market portfolios plus an orthogonal error term. If there are no differences in information precisions across countries, then $\omega^m = \Omega^m = 0$ and portfolio flows will be independent of market returns. If there are differences in information endowments, the conditional expectations of portfolio flows will be linearly dependent on the vector of price changes.[11]

The aggregate trade of investors in country m in their domestic asset is given by the mth element of the vector $\tilde{\Pi}^m$:

$$\tilde{\Pi}_m^m = \sum_{j=1}^{M} \Theta_{mj}^m \nabla \tilde{P}_j + \tilde{\nu}_m^m. \tag{7}$$

where $\tilde{\nu}_m^m$ is an orthogonal, mean zero, error term. Similarly, the aggregate trade of investors in country m in the *foreign asset*, k, is

$$\tilde{\Pi}_k^m = \sum_{j=1}^{M} \Theta_{kj}^m \nabla \tilde{P}_j + \tilde{\nu}_k^m, \tag{8}$$

where $\tilde{\nu}_k^m$ is an orthogonal, mean zero, error term. Ω^m represents the cumulative information (dis)advantage of the average investor in country m over an average global investor, while ω^m represents the marginal information (dis)advantage of the average investor in country m over an average global investor arising from the precisions of the private information received in the current period. We shall assume that, on average, domestic investors have better information about domestic assets than do foreign investors, and have less information about foreign assets than average foreign investors. In addition, we shall assume that the marginal information (dis)advantage is small relative to the cumulative information (dis)advantage. This is expressed formally in the following assumption:

Assumption A: Domestic Cumulative Information Advantage

$$\Omega_{mm}^m > 0,\ \Omega_{jj}^m < 0,\ |\omega_{mm}^m| << |\Omega_{mm}^m|,\ |\omega_{jj}^m| << |\Omega_{jj}^m|,\ j \neq m,$$

which implies that:

$$\Theta_{mm}^m < 0,\ \Theta_{jj}^m > 0, j \neq m.$$

Combining Assumption A with equations (7) and (8) yields the following restrictions on the regression of portfolio flows on price changes:

Proposition *Under Asumption A (domestic cumulative information advantage) (i) when the domestic investors' trade in a given foreign market, k, is regressed on the returns of domestic and all foreign markets, the regression coefficient on the market return of country k is positive; (ii) when the domestic investor's trade in the domestic market is regressed on the returns on domestic and foreign markets, the regression coefficient on the domestic market return is negative.*

Part (i) of the Proposition implies that under the conditions of Assumption A foreign investors will tend to behave as trend-followers in a given market, buying in periods when the index rises and selling when the index falls; this will be the focus of the empirical tests that are reported below. Part (ii) of the Proposition is a consequence of market clearing; if foreign investors buy when the domestic index appreciates, then domestic investors must sell.

If we impose additional symmetry on the informational endowments, then expressions (7) and (8) can be greatly simplified. Thus, assume that there is no asymmetry in the off-diagonal elements of the precision matrices S_t^m across m:

Assumption B: Symmetric Information Endowments

$$S_{tkl}^m = S_{tkl}, \forall m; k \neq l.$$

This assumption will be satisfied, for example, if domestic investors have private information only about the domestic asset and not about foreign assets.

Assumption B implies

$$\Theta_{tkl}^m = 0, k \neq l.$$

Under Assumptions A and B, expressions (7) and (8) for the domestic and foreign investments of individuals in country m can be rewritten as:

$$\tilde{\Pi}_m^m = \Theta_{mm}^m \nabla \tilde{P}_m + \tilde{\nu}_m^m, \tag{9}$$

$$\tilde{\Pi}_k^m = \Theta_{kk}^m \nabla \tilde{P}_k + \nu_k^m, \forall k \neq m; \tag{10}$$

where $\Theta_{mm}^m < 0,\ \Theta_{jj}^m > 0, j \neq m$. This may be stated more formally as:

Corollary *Under Assumption B(symmetric information endowments) the trade of an investor in the domestic market depends only on the domestic market return, and the trade in*

a foreign market depends only on the foreign market return. Under Assumption A (domestic cumulative information advantage) the domestic market trade is negatively associated with the domestic market return, while the foreign market trade is positively associated with the foreign market return.

The Corollary implies that under the posited conditions there will be more diversification in a global bull market and more home country bias in a global bear market.

To investigate the tendency towards a *home bias* in investor portfolios under Assumptions A and B, consider the vector of average holdings of investors of country m in the various market portfolios at time t: this is given from (2) by

$$E[\tilde{D}_t^m] = \bar{X}_t + \Omega_t^m K_t^{-1} \bar{X}_t,$$

where $\bar{X}_t = E[\sum_{j=0}^{t} \tilde{X}_j]$. Let $V_t \equiv K_t^{-1}$ denote the average investor's conditional covariance matrix of asset payoffs at trading session t. Then since Ω_t^m is a diagonal matrix under symmetric information endowments, the expected holding of an average investor in country m of the domestic market portfolio m is:

$$E[D_{tm}^m] = \bar{X}_{tm} + \Omega_{tmm}^m \sum_{j=1}^{M} V_{tmj} \bar{X}_j,$$

and the expected holding of an average investor in country m of the foreign market portfolio k is:

$$E[D_{tk}^m] = \bar{X}_{tk} + \Omega_{tkk}^m \sum_{j=1}^{M} V_{tkj} \bar{X}_j, \quad \text{for } k \neq m.$$

Remark 1: The necessary and sufficient condition for the expected holdings of the domestic market portfolio of country m by domestic (foreign) investors to exceed (fall short of) the expected average endowment, under Assumptions A and B is that

$$\sum_{j=1}^{M} V_{tmj} \bar{X}_{tj} > 0. \tag{11}$$

Condition (11) is just the requirement that the conditional covariance of the payoff on country m's portfolio with the expected world market portfolio be positive, and the result follows because under Assumption A (domestic cumulative information advantage):

$$\Omega^m_{tmm} > 0, \Omega^m_{tkk} < 0, \forall, k \neq m.$$

Remark 1 implies that, on average, domestic investors hold more than their share of the domestic market portfolio and less than their share of each foreign market portfolio. It also predicts that, for a given level of information asymmetry as represented by the cumulative information advantage Ω^m_{tmm}, the home bias will be greater for countries whose payoffs have a high covariance with the payoff on the expected world market portfolio. Intuitively, when the covariance is large, the benefits of international diversification are small and the home bias created by the informational asymmetry becomes large.[12]The empirical implications of Remark 1 could be tested by running a regression of the degree of home bias for each national market on the covariance of the market return with the return on the world market portfolio.

To understand the effects of information asymmetry on *turnover rates* in foreign and domestic portfolios, define the portfolio turnover rate as the expected trade divided by the expected holding in period t,

$$TO^i_{tj} \equiv |\frac{E\nabla\tilde{D}^i_{tj}}{E\tilde{D}^i_{(t-1)j}}|, \tag{12}$$

where TO^i_{tj} is the turnover rate of investor i in asset j at period t, $\tilde{D}^i_{tj}$ is the holding of asset j by investor i in session t, and $\nabla\tilde{D}^i_{tj} \equiv \tilde{D}^i_{tj} - \tilde{D}^i_{(t-1)j}$ is his trade in session t.

Remark 2: Under the same conditions as those in Remark 1, when $M = 2$ the domestic investors' turnover rate in the domestic market is smaller than that of the foreign investor in the same market.

Proof: See Appendix.

Remark 2 is consistent with the finding of Tesar and Werner (1995) that turnover rates are higher on foreign than on domestic portfolios. The intuition underlying the result is that the less informed foreign investor will tend to take a smaller position in the foreign market than the domestic investor; then, since the domestic investor's trades are of equal and opposite sign to those of the foreign investor, they constitute a smaller fraction of the domestic investor's portfolio.

We now turn to some empirical tests of the major new empirical prediction of the asymmetric information model, that under Assumptions A and B purchases of a country's equity by foreigners will be positively related to the current return on the national market index.

III Data

The data on portfolio flows are taken from the U.S. Treasury Bulletin which reports quarterly data on transactions in equities (and bonds) between U.S. residents and residents of a large number of other countries. We examine equity flows between the U.S. and four developed countries, Canada, Germany, Japan, and the U.K., for the period 1982.2 to 1994.4.[13]For these countries we examine both purchases of foreign equities by U.S. residents and purchases of U.S. equities by foreign residents. We also examine net purchases by U.S. residents of equities in 16 emerging markets over the period 1989.1 to 1994.4. The shorter sample period for the emerging markets was selected because it is only in recent years that foreign investment restrictions have been lifted in these markets. We do not examine purchases of U.S. equities by residents of these countries. To take account of the dramatic growth in cross-border equity flows, we normalize each quarter's net flow by the average of the absolute values of the flows over each of the previous four quarters; it is these normalized flows that we attempt

to explain in our regressions. For the U.S. and four developed countries, market returns are taken as capital gains computed from the Goldman Sachs-Financial Times-Actuaries dollar denominated price indices. For the emerging markets the quarterly returns are calculated from the International Finance Corporation (IFC) total return series in U.S. dollars.[14]

IV Portfolio Flows between Developed Countries

A U.S. Portfolio Investment in Developed Markets

We estimate three models of the relation between portfolio flows and equity returns. *Model I*, which corresponds to equation (8), treats portfolio flows as a linear function of returns on all the markets considered plus an orthogonal error term. Under Assumption A (domestic cumulative information advantage), we expect the coefficient of the return on the market to which the capital flows are directed, the *host market return*, to be positive, as stated in the *Proposition*. *Model II*, which corresponds to equation (10), treats portfolio flows as a linear function of the return on the host market alone, plus an orthogonal error term; this corresponds to the restriction of symmetric information endowments described by Assumption B. If, in addition, there is a domestic cumulative information advantage as described by Assumption A, then, as stated in the *Corollary*, we expect the coefficient of the host market return to be positive. *Model III* is an intermediate model that allows portfolio flows to depend not only on the host market return, but also on the *source market return*, which is defined as the return on the equity market in the country which is the origin of the portfolio flows. *Model III* is intended to allow for wealth effects which are not formally included in our model because of the assumption of constant absolute risk aversion. We conjecture that if wealth effects are important, then a positive return on the source market, which will tend to increase the wealth of residents of the source country relative to residents of the host

country, will be associated with an increased flow from the source to the host country.

Table I reports the results of seemingly unrelated regressions in which the dependent variables are the (normalized) quarterly purchases of foreign equities in each of the four developed markets by U.S. residents, and the independent variables are the returns on the U.S. and foreign market indices measured in USD. The top panel shows the results for *Model I*. The model explains only 2 per cent of the flows to Canada, but 15 to 21 per cent for the other three countries. Consistent with Assumption A, the coefficients on the host market returns are positive for Canada, Germany and Japan, and significant for the latter two countries. However, the coefficient for the host market return is negative and significant in the case of the U.K.; this suggests either that Americans are better informed than are U.K. residents about the U.K. market, or that the U.K. residents' informational advantage is relatively short-lived, so that the marginal effect exceeds the cumulative effect.

The second panel shows the results for *Model II* in which the only independent variable is the host market return. Now the coefficient of the host market return is positive in every case, and statistically significant except in the case of the U.K. A likelihood ratio test of the restrictions of *Model II* implied by symmetric information endowments, that the coefficients of the non-host market returns are zero, yields a χ^2 statistic of 24.43 with 16 degrees of freedom, and an associated p-value of 0.08. Thus, we are unable to reject the restrictions implied by symmetric information endowments. Under this assumption, the parameter estimates are consistent with American residents being at an informational disadvantage in Canada, Germany, and Japan, but not in the U.K. It is possible that the major U.S. banking presence in London is what distinguishes the results for the U.K. from those for the other countries.

The third panel of Table I shows the results for *Model III* in which the source market return is included along with the host market return to allow for possible wealth effects. The

results are somewhat mixed. On the one hand, the coefficient of the host market returns remains positive for Canada, Germany, and Japan, and remains insignificant for the U.K. On the other hand the coefficient of the source market return (i.e. U.S. market return) is positive and significant for Japan and the U.K., which is consistent with wealth effects being important. However, they are also consistent with informational effects. A positive sign on the source market return implies under Assumption A (cumulative domestic information advantage) that $\Omega^m_{mk} < 0$; this would be the case for example if the off diagonal elements of the correlation matrix of signal errors were the same and positive across countries while residents of each country received a more precise signal of the domestic market return than foreigners. A likelihood ratio test of the restrictions that the coefficients of the host country returns are jointly zero yields a χ^2 statistic of 9.04 with 4 degrees of freedom, and an associated p-value of 0.06, so that we marginally fail to reject the null of no wealth effects.

While the results for Canada, Germany and Japan are consistent with the hypothesis that foreign investors are less well informed, as we have suggested, a possible concern is that exogenous shifts in the U.S. demand for foreign equities, that are not caused by new information, will give rise to an increase in U.S. purchases of foreign equities, and that the price impact of these purchases will create a spurious association between the return on the foreign index and U.S. portfolio flows. This is a problem that we cannot entirely rule out, though the lack of a positive coefficient for the U.K. suggests that the price impact of U.S. transactions is unlikely to be the whole story. The data reported by Tesar and Werner (1995) imply, for example, that U.S. holdings of Canadian equities amounted to 10.4 per cent of the total Canadian equity market in 1990, while Kang and Stulz (1994) estimate that *total* foreign ownership of Japanese equities has fluctuated in the range of 4 to 11 per cent in our sample period. It is not clear whether the changes that have taken place in these portfolio positions would have created a large enough price impact to affect our results. It is worth noting also in this context that Tesar and Werner (1995) report that the turnover of foreign

equities held by U.S. residents is some two and one half times the rate of turnover of domestic equities; this alone suggests that the transactions costs, which include price impact in the foreign markets, cannot be very significant.

When we replace the foreign return in the regression by the lagged foreign return the coefficients become insignificant, though all except Japan are positive. When a single coefficient on the lagged foreign return is estimated across all four countries it is positive, but only significant at the 54 per cent level. It is difficult to interpret these results, since the lack of a significant lagged effect of returns on portfolio flows is consistent with the contemporaneous effect being the spurious result of price impact caused by shifts in U.S. demands for foreign securities that are not related to new information; but it is also consistent with the predictions of the model which imply that the association between returns and flows will be contemporaneous. A test for Granger causality between foreign returns and U.S. portfolio flows using two lags yielded ambiguous results. On the one hand we could reject the null that German returns are not (Granger) caused by U.S. purchases; on the other hand we could reject the null that U.S. flows to Japan are not (Granger) caused by Japanese returns. The other results are not significant. While the finding for Japan is consistent with a lagged version of the asymmetric information hypothesis, the finding for Germany does not imply that price impact is important, since we are aware of no theory that predicts a *lagged* price impact, and it is difficult to conceive of the mechanism for such an effect.

B Portfolio Investment in the U.S. from Developed Countries

Table II reports the results of estimating the three models using foreign purchases of U.S. equities as the dependent variable. The *Model I* estimates reported in the top panel provide no support for the Proposition: the coefficients of the U.S. market return are uniformly negative and insignificant, which implies that residents of these countries are not at an

informational disadvantage relative to U.S. residents about the U.S. market.

The *Model II* estimates in the second panel tell a similar story, except that now it appears that U.K. residents are at an informational disadvantage in the U.S. market, which is consistent with the evidence of Shukla and Inwegen (1995) that U.K. fund managers exhibit inferior market timing ability in the U.S. market. Moreover, a likelihood ratio test of the restrictions implied by Assumption B(symmetric information endowments) and reflected in *Model II* yield a χ^2 statistic of 29.07 with 16 degrees of freedom, and an associated p-value of 0.02, so that the restrictions are rejected. The *Model III* estimates are shown in the third panel of the table. Introducing the source country returns has little effect on the coefficients of the host country (U.S.) returns, although the coefficients of all four source market returns are positive, and two are statistically significant. A joint test of the significance of the source market returns yields a χ^2 statistic that is significant only at the 27 per cent level.

In summary, our analysis of equity portfolio flows between the U.S. and these four developed markets has revealed no evidence that foreign investors are less well-informed about the U.S. market than U.S. investors, although there is evidence that is consistent with differences in informational endowments. On the other hand, the results are consistent with U.S. investors being less well-informed about the foreign markets (except the U.K.) than the locals in those markets. However, our conclusions are tempered by recognition of the possible confounding effect of exogenous shifts in the U.S. demand for foreign equities that are not associated with new information.

V U.S. Portfolio Investment in Emerging Markets

Models II and *III* are estimated for U.S. portfolio flows to 16 emerging markets for the period 1989.1 to 1994.4. The shorter sample period and larger number of countries make it necessary

to split the country sample into two subsamples of eight countries in order to perform the seemingly unrelated regression procedure. The split was made on an alphabetical basis, and the results are reported in Tables III and IV. There were insufficient data to permit estimation of *Model I*. Table III reports the results of the *Model II* regressions. Of the 16 countries, the coefficient of the host market return is positive, as the Proposition predicts, in 14, and t-ratios in excess of 2 are estimated for 5 countries. The only significant negative host market return coefficient is that for Chile.

Model III regression estimates are reported in Table IV. The coefficients on the host (i.e. foreign) market return are not affected significantly by the introduction of the source (i.e. U.S.) market return. There is no evidence that the capital flows are driven by wealth effects not encompassed by our model, since the coefficient of the source market return is nowhere significant and is negative in 12 out of 16 cases. Moreover, χ^2 statistics yielded by the likelihood ratio test of the restrictions imposed by *Model II* relative to *Model III* are 5.88 and 6.78 for Groups A and B respectively, with associated p-values of 0.66 and 0.56.[15]

There is no reason to expect that our model of capital flows will be appropriate for markets where portfolio investment is regulated. Therefore Table V arranges the markets according to the estimated t-statistic on the local market return in the regressions reported in Table III, and presents summary information about the openness of the various markets to foreign portfolio investment. Since regulations differ across markets and have been changed at different times, it is not possible to present a single measure of market openness. For each country, where available, the table gives the fraction of trading accounted for by U.S. transactions in 1990, the degree of market integration as estimated by Bekaert and Harvey (1995), and the average premium on the country closed-end fund listed in the U.S. The countries in the first column are those that conform best to the asymmetric information model, and it is notable that these tend to be the most open and least restricted markets

with the highest levels of foreign participation. On the other hand, the two countries with negative coefficients, Chile and Taiwan, restrict foreign investment to closed end funds which are not likely to vary their equity participation much, and to authorized financial institutions.

The possibility that the results are distorted by exogenous shifts in U.S. investor demands for foreign securities is probably more serious in the case of emerging markets, since the size of the markets is much less than that of the developed markets. Tesar and Werner (1993) report that U.S. transactions as a proportion of all transactions in 1990 ranged from a low of 0.1 per cent in India to a high of 29 per cent in Colombia: for the complete figures see Table V. When the host market return was replaced by its lagged value and the coefficient was constrained to the same across all countries within each group, the coefficient was positive for both groups and the t-statistic was 2.90 for Group A but only 0.17 for Group B. Granger causality tests with two lags between portfolio flows and local market returns reject the null hypothesis that portfolio flows are not Granger caused by local market returns for Argentina, Indonesia, and Turkey at better than the 5 per cent level; in no case are we able to reject the null that local market returns are not caused by portfolio flows. Thus, on the whole there is fairly strong evidence of *lagged* trend following by American investors in emerging markets. This might occur if Americans were both less informed and were slow in making investment decisions. Combined with the evidence for the coefficient of the contemporaneous market return, there is fairly strong evidence that equity capital flows from the U.S. to emerging markets are consistent with a model in which U.S. investors behave as rational individuals who are less well informed about local market conditions in emerging markets than are the local investors.

VI Currency Effects

To this point we have followed our formal model and ignored the role of currency risk by measuring all of the returns in U.S. dollars. Nevertheless, it is of interest to consider the effect of changes in exchange rates on portfolio flows since the dollar return contains an exchange rate component. We investigate this issue within the context of *Model III* in which the independent variables are the host and source market returns. To test whether U.S. portfolio flows are influenced by exchange rate changes in addition to the host and source market returns measured in USD we add to the *Model III* regressions the change in the host country exchange rate against the USD.[16]Likelihood ratio tests of the null hypothesis that the coefficient of the host country exchange rates are zero yield p-values of 0.33 for U.S. investment in the four developed markets, and 0.63 and 0.006 for investment in the two subsamples of emerging markets; significance in the second subsample is mainly attributable to Malaya and Pakistan where the investment flows are positively associated with a decline in the value of the local currency. Thus there is little evidence that U.S. flows are associated with exchange rate changes except insofar as these are impounded in the USD returns.

The results are considerably different for investment by residents of the developed countries in the U.S. A likelihood ratio test of the null hypothesis that these flows do not depend on exchange rate changes in addition to the U.S. market return measured in USD's is rejected at a p-level of 0.00. Therefore Panel A of Table VI reports the results of regressions in which the exchange rate change is subtracted from the U.S. and source market returns in USD to yield a return in the source country currency. Using source country currency returns does not change the signs of any of the coefficients from those reported in Table II. A likelihood ratio test of the null that flows do not depend on exchange rate changes in addition to source country currency returns rejects at the 0.03 level. Therefore Panel B reports regressions that include the return on the source country currency as an additional

independent variable - the currency variable is significant only for Japan, and the sign of the coefficient implies that the Japanese increase their foreign investment in quarters in which the yen appreciates. There continues to be no evidence that residents of these countries are at an informational disadvantage in the U.S. market. Finally, we tested whether our results were affected by including lagged values of the investment flows as an independent variable. We find no association between current and lagged U.S. flows to either developed or emerging markets, and while we do find lag effects for investment in the U.S. from the developed countries, inclusion of the lag variable does not affect our qualitative conclusion that there is no evidence that residents of these countries are at an informational disadvantage in the U.S. equity market.

VII Conclusion

In this paper we have developed a model of international equity portfolio flows that relies on informational differences between foreign and domestic investors. The model predicts that if foreign and domestic investors are differentially informed, then portfolio flows between two countries will be a linear function of the contemporaneous returns on all national market indices; and if domestic investors have a cumulative information advantage over foreign investors about domestic securities, the coefficient of the host market return will be positive. If we impose additional symmetry on the informational endowments, we obtain the stronger result that the portfolio flow will depend only on the host market return.

We find empirically that portfolio flows are associated with returns on national market indices as the asymmetric information hypothesis implies. We also find that while U.S. purchases of equities in developed foreign markets tend to be positively associated with the foreign market return, foreign purchases of U.S. equities show no such relation to the

U.S. market return. This is consistent with U.S. investors being less well informed about foreign markets than locals, but with foreigners being as well informed about U.S. markets as U.S. residents. An alternative interpretation that we cannot rule out is that the association between U.S. portfolio flows and foreign market returns is due to price impact associated with exogenous shifts in the U.S. demand for foreign securities that is not information related. However, we note that the high turnover rates of U.S. portfolios of foreign equities suggest that price impact effects are not large.

When we examine U.S. portfolio investment in emerging markets we find strong evidence that U.S. purchases are positively associated with local market returns in many countries. There is even evidence that this effect persists when we substitute the lagged local market return for the contemporaneous return. This is consistent with U.S. residents being at an informational disadvantage relative to locals in these markets, and trading on new information with a lag. For neither developed nor emerging markets do we find significant evidence that portfolio flows are affected by host country returns as might be expected if flows were caused by relative wealth shifts between residents of different countries. Our model is able to explain only a small proportion of the variance of international equity portfolio flows. Since these flows are now large and variable, further effort to understand their determinants is called for.

Appendix

Proof of Theorem: We provide the proof for a two trading session economy. The equilibrium in the last trading session is equivalent to the Admati (1985) single trading session model and the proof is neglected. We focus on the proof of the equilibrium in the first trading session. It is straightforward to prove that the price function stated in the theorem

clears the market; then we need only to show that the demand of the investors in the first period is optimal, given the public information and each investor's private signal.

Let $\tilde{a}$ denote the price change at trading session 1; $\tilde{b}_t^i$ denote the expected long run excess return for investor i at trading session t; and $\tilde{w}_t^i$ denote the wealth of investor i at trading session t; i.e.,

$$\tilde{a} \equiv \tilde{P}_1 - P_0,\ \tilde{b}_t^i \equiv \tilde{\mu}_t^i - \tilde{P}_t, \tilde{w}_1^i = \tilde{w}_0^i + (\tilde{D}_0^i)'\tilde{a}.$$

In the last trading session, since there is only one trading session left, investor i's trading strategy is characterized by Admati (1985):

$$\tilde{D}_1^i = rK_1^i[\tilde{\mu}_1^i - \tilde{P}_1] = rK_1^i\tilde{b}_1^i. \tag{A-1}$$

Given the equilibrium trading strategy in the second trading session, investor i's expected utility conditional on his information at the second trading session is:

$$E[U^i|F_1^i] = E[U^i|F_0^i, \tilde{a}, \tilde{b}_1^i] = -\exp\{-\frac{\tilde{w}_1^i}{r} - \frac{(\tilde{b}_1^i)'K_1^i\tilde{b}_1^i}{2}\}, \tag{A-2}$$

The first term in the exponential comes from the investor's wealth, and the second term represents the gains in expected utility from returns in the second period. Note that the effect of public and private signals on investor i's expected utility is manifested through the variable $\tilde{b}_1^i$. Since all the random variables are multi-normally distributed, the conditional mean $\tilde{\mu}_1^i \equiv \tilde{b}_1^i + \tilde{P}_0$ is the sufficient statistic for all information in calculating expectations at session 1.

To determine the optimal strategy of investor i, we need to calculate his expected utility given any strategy D_0^i at time 0, i.e., $E[U^i|F_0^i]$. This can be determined in two steps: $E[U^i|F_0^i] = E[E[U^i|F_0^i, \tilde{a}]|F_0^i] = E[E[E[U^i|F_0^i, \tilde{a}, \tilde{b}_1^i]|F_0^i, \tilde{a}]|F_0^i]$.

We can rewrite $\tilde{a}$ as:

$$\tilde{a} = A(\tilde{u} - P_0 + \tilde{\delta})$$

where $A = K_1^{-1}(K_1 - K_0), \tilde{\delta} = (K_1 - K_0)^{-1}[N_1\eta_1 - (rS_1\Phi_1 + r^{-1})\tilde{X}_1]$.

Define:

$$\Lambda^i \equiv \mathrm{Var}^{-1}[\tilde{u}|\tilde{a}, F_0^i]$$

$$\tilde{\mu}_{\tilde{b}_1^i} \equiv E[\tilde{b}_1^i|F_0^i, \tilde{a}] = B^i\tilde{a} + C^i\tilde{b}_0^i,$$

$$\mu_{\tilde{a}}^i \equiv E[\tilde{a}|F_0^i] = A\tilde{b}_0^i,$$

$$B^i \equiv [I - C^i]A^{-1} - I,$$

$$C^i \equiv (\Lambda^i)^{-1}K_0^i,$$

$$\Gamma^i \equiv \mathrm{Var}^{-1}[\tilde{b}_1^i|F_0^i, \tilde{a}] = [\mathrm{Var}[\tilde{u}|\tilde{a}, F_0^i] - \mathrm{Var}[\tilde{u}|\tilde{a}, \tilde{b}_1^i, F_0^i]]^{-1} = [(\Lambda^i)^{-1} - (K_1^i)^{-1}]^{-1},$$

$$\Psi \equiv \mathrm{Var}^{-1}[\tilde{a}|F_0^i] = (A')^{-1}[(K_0^i)^{-1} + (\Lambda^i - K_0^i)^{-1}]^{-1}A^{-1} = (B^i + I)'K_0^iA^{-1}.$$

We can now calculate the expected utility conditional on $\tilde{a}$; dropping irrelevant terms, this is given by:

$$\begin{aligned}
E[U^i|F_0^i, \tilde{a}] &\propto \int_{R^M} \exp[-\frac{(D_0^i)'\tilde{a}}{r} - \frac{(\tilde{b}_1^i)'K_1^i\tilde{b}_1^i}{2} - \frac{(\tilde{b}_1^i - \tilde{\mu}_{\tilde{b}_1^i})'\Gamma^i(\tilde{b}_1^i - \tilde{\mu}_{\tilde{b}_1^i})}{2}d\tilde{b}_1^i \\
&\propto -\exp[-(D_0^i)'\tilde{a}/r - \tilde{\mu}_{\tilde{b}_1^i}'\Gamma^i\tilde{\mu}_{\tilde{b}_1^i}/2 + \tilde{\mu}_{\tilde{b}_1^i}'\Gamma^i(K_1^i + \Gamma^i)^{-1}\Gamma^i\tilde{\mu}_{\tilde{b}_1^i}/2] \\
&= -\exp[-(D_0^i)'\tilde{a}/r - \tilde{\mu}_{\tilde{b}_1^i}'((K_1^i)^{-1} + (\Gamma^i)^{-1})^{-1}\tilde{\mu}_{\tilde{b}_1^i}/2] \\
&= -\exp[-(D_0^i)'\tilde{a}/r - \tilde{\mu}_{\tilde{b}_1^i}'\Lambda^i\tilde{\mu}_{\tilde{b}_1^i}/2] \\
&= -\exp[-\frac{(D_0^i)'\tilde{a}}{r} - \frac{(B^i\tilde{a} + C^i\tilde{b}_0^i)'\Lambda^i(B^i\tilde{a} + C^i\tilde{b}_0^i)}{2}]. \qquad \text{(A-3)}
\end{aligned}$$

Taking the expectation with respect to $\tilde{a}$ we get,

$$\begin{aligned}
E[U^i|F_0^i] &\propto -\int_{R^M} \exp[-\frac{(D_0^i)'\tilde{a}}{r} - \frac{(B^i\tilde{a} + C^i\tilde{b}_0^i)'\Lambda^i(B^i\tilde{a} + C^i\tilde{b}_0^i) - (\tilde{a} - \mu_{\tilde{a}}^i)'\Psi^i(\tilde{a} - \mu_{\tilde{a}}^i)}{2}]d\tilde{a} \\
&\propto -\exp[(F^i)'G^iF^i/2 - (\tilde{b}_0^i)'H^i\tilde{b}_0^i/2], \qquad \text{(A-4)}
\end{aligned}$$

where

$$F^i = D_0^i/r + (B^i)'\Lambda^i C^i \tilde{b}_0^i - \Psi^i \mu_{\tilde{a}}^i, \tag{A-5}$$

$$G^i = [(B^i)'\Lambda^i B^i + \Psi^i]^{-1}, \tag{A-6}$$

$$H^i = (C^i)'\Lambda^i C^i + A'\Psi A = (C^i)'K_0^i + [(B^i + I)A]'K_0^i = [C^i + I - C^i]'K_0^i = K_0^i. \tag{A-7}$$

Since Λ^i, Ψ^i are positive definite, G^i is positive definite. The first order condition simplifies to:

$$F^i = 0. \tag{A-8}$$

This implies that the optimal demand for the first trading session is

$$\tilde{D}_0^i = r[\Psi^i \mu_{\tilde{a}}^i - (B^i)'\Lambda^i C^i \tilde{b}_0^i] = r[(B^i + I)' - (B^i)']K_0^i \tilde{b}_0^i = rK_0^i[\tilde{\mu}_0^i - \tilde{P}_0]. \tag{A-9}$$

The optimal demand in expression (21) has the same form as (13) except for the time subscript. Thus the optimal demand at session t is unaffected by the existence of future trading sessions. Substituting equations (19) and (20) back into equation (16), we have

$$E[U^i|F_0^i] \propto -\exp[-\frac{w_0^i}{r} - (\tilde{b}_0^i)'K_0^i \tilde{b}_0^i/2]. \tag{A-10}$$

Expression (22) has the same form as expression (14) except for the time subscript which shows that we can easily extend the proof to the general case of T trading sessions..

Proof of Remark 2: In equation (12) the numerator is the same for a domestic and foreign investor but the denominator is higher for the domestic investor. This implies that the domestic investor has the lower turnover rate under the same conditions as Remark 1.

Footnotes

1. Developed countries continue to impose regulations on foreign investments by pension funds and insurance companies: for example Germany limits foreign investments to 5% of the value of the portfolio of insurance companies and pension funds; New York State raised the ceiling on foreign investments of insurance companies from 3 per cent to 6 per cent of asset in 1990; Japan has a 30 per cent limitation for insurance companies and pension funds; Canada had a foreign investment limit of 10 per cent until 1991. Source: Goldstein and Folkerts-Landau (1994).

2. Miller and von Neumann Whitman (1970, 1972) combine a portfolio balance model with stock adjustment to explain aggregate U.S. foreign portfolio investment. Other empirical studies include Tesar and Werner (1994, 1995) and Chuhan *et al.* (1993) who report that the first principal component of several U.S. interest rates and industrial production has some explanatory power for monthly flows of equity capital from the U.S. to Latin America and Asia; Bohn and Tesar (1996) report, consistent with the theory and empirical findings in this paper, that monthly U.S. portfolio flows are positively related to the contemporaneous returns in the host market for most large equity markets.

3. The difficulty that foreigners have in obtaining information in some markets is recognized by Price (1994) who remarks of Argentina that "foreigners have been cautioned to use influential intermediaries if they hope to succeed...in a market that releases all too little essential investment information..".

4. The dangers of assigning too much local responsibility to an individual simply because he is better informed are well illustrated by the Barings debacle and the more recent Morgan-Grenfell incident in which the manager of an overseas fund greatly exceeded

prudent (as well as legal) norms in his allocations to individual companies.

5. Emphasis added.

6. The Wall Street Journal frequently carries stories highlighting foreigners' views of U.S. stocks: Typical headlines include "Cautious foreigners shun U.S. stocks", WSJ December 4, 1995, "A rare view from abroad: bullish on U.S.", WSJ August 19, 1996.

7. The single period nature of our model allows us to derive closed form expressions for prices and trades. Noisy rational expectations models with more than one consumption period such as Wang (1993) require numerical solution.

8. The idea that foreigners will be net sellers of equities in bad times is commonly held. For example "As stock prices in 'emerging markets' stagger on the bad news from Mexico...Mutual fund managers are rushing for the exits." *Wall Street Journal*, January 13, 1995.

9. See Blume *et al.*(1994) for a model in which trading volume is informative.

10. The proof is given in the Appendix.

11. While this result was derived by treating the market portfolio in each country as a single asset, similar results can be obtained when each country has multiple assets if appropriate restrictions are placed on the information endowments.

12. While previous authors have noted that domestic bias can be rationalized by informational considerations, the importance of the covariance with the world market portfolio has not previously been noted.

13. We are grateful to Linda Tesar and Ingrid Werner for making these data available to us. Tesar and Werner (1995) point out that these countries accounted for 84% of the total value of world equities in 1990.

14. We are grateful to Philippe Jorion and Richard Roll for making the return series available to us. For the tests reported in Section VI we also use returns measured in terms of the local currency.

15. Caution should be exercised in interpreting the likelihood ratio statistic in view of the small number of observations.

16. The exchange rates for developed countries were taken from *International Financial Statistics*; for the emerging markets they were inferred from the difference between market returns measured in USD and in the local currency as reported by IFC.

References

Adler, M., and B. Dumas, 1983, International portfolio choice and corporation finance: a synthesis, *Journal of Finance* 38, 925-984.

Admati, A. (1985), A noisy rational expectations equilibrium for multi-asset securities markets, *Econometrica* 53, 629-657.

Bekaert, G., 1995, Market integration and investment barriers in emerging equity markets, *The World Bank Economic Review* 9, 75-107.

Bekaert, G., and C.R. Harvey, 1995 Time-varying world market integration, *Journal of Finance* 50, 403-444.

Bekaert, G., and M.S. Urias, 1995, Diversification, integration and emerging market closed-end funds, NBER Working paper No. 4990.

Black, F., 1974, International capital market equilibrium with investment barriers, *Journal of Financial Economics*, 337-352.

Blume, L., D. Easley and M. O'Hara, 1994, Market statistics and technical analysis: the role of volume, *Journal of Finance* 49, 153-182.

Bohn, H., and L.L. Tesar, U.S. equity investment in foreign markets: portfolio rebalancing or trend chasing, 1996, *American Economic Review* 86, 77-81.

Brennan, M.J., and A. Subrahmanyam, 1995, The determinants of average trade size, Working paper No. 7-95, University of California, Los Angeles.

Carlos, A.M., and F. D. Lewis, 1995, Foreign financing of Canadian railroads, M.D. Bordo and R. Sylla Eds., *Anglo- American Financial Systems*(Irwin, New York, New York).

Chuhan, P., 1992, Sources of portfolio investment in emerging markets, Working paper, World Bank, International Economics Department, Washington, D.C.

Chuhan, P., Claessens, S., and N. Mamingi, 1993, Equity and bond flows to Latin America, Working Paper No. 1160, World Bank, Washington, D.C.

Cooper, I.A., and E. Kaplanis, 1994, Home bias in equity portfolios, inflation hedging, and international capital market equilibrium, *Review of Financial Studies* 7, 45-60.

Coval, J., and T. Moskowitz, 1996, Home bias at home: local equity preference in domestic portfolios, unpublished manuscript, University of California, Los Angeles.

de Caires, B. (Editor), 1988, *The GT Guide to World Equity Markets* (Euromoney, London).

Frankel, J.A., 1991, Quantifying international capital mobility in the 1980's, in B. Douglas Bernheim and John B. Shoven, Eds.,*National Savings and Economic Performance*, , University of Chicago Press, Chicago.

French, K.R., and J..M. Poterba, 1991, Investor diversification and international equity markets, *American Economic Review*, Papers and Proceedings 81, 222-226.

Gehrig, T. P., 1993, An information based explanation of the domestic bias in international equity investment, *The Scandinavian Journal of Economics* 21, 7-109.

Goldstein, M., and D. Folkerts-Landau, 1994, *International Capital Markets: Developments, Prospects, and Policy Issues* (International Monetary Fund, Washington D.C.).

Grubel, H., 1968, Internationally diversified portfolios, *American Economic Review* 58, 1299-1314.

Hellwig, M. F., (1980), On the aggregation of information in competitive markets, *Journal of Economic Theory* 22, 477-498.

Kang, J-K., and R.M. Stulz, 1994, Why is there a home bias ? An analysis of foreign portfolio equity ownership in Japan, unpublished manuscript, Ohio State University.

Levy, H., and M. Sarnat, 1970, International diversification of investment portfolios, *American Economic Review* 50, 668-675.

Low, A., 1992, Essays on asymmetric information in international finance, Ph.D. dissertation, University of California, Los Angeles.

Miller, N.C., and M. von Neuman Whitman, 1970, A mean-variance analysis of United States long-term portfolio foreign investment, *Quarterly Journal of Economics* 84, 175-196.

Miller, N.C., and M. von Neumann Whitman, 1972, Alternative theories and tests of U.S. short-term foreign investment, *Journal of Finance* 28, 1131-1150.

Park, K.K.H., and A.W. van Agtmael, 1993, *The World's Emerging Stock Markets* (Probus, Chicago, Illinois).

Price, M.M., 1994, *Emerging Stock Markets: A Complete Investment Guide to New Markets around the World*(McGraw-Hill, New York, New York).

Shiller, R.J., F. Kon-Ya, and Y. Tsutsui, 1996, Why did the Nikkei crash? Expanding the scope of expectations data collection, *Review of Economics and Statistics* 78, 156-164.

Shukla, R., and G. van Inwegen, 1995, Do locals perform better than foreigners ?, *Journal of Economics and Business* 47, 241-254.

Solnik, B., Why not diversify internationally rather than domestically? *Financial Ana-*

lysts' Journal 30, 48-54.

Stulz, R., 1981, On the effects of barriers to international investment, *Journal of Finance* 36, 923-934.

Tesar, L.L., and I. Werner, 1993, U.S. equity investment in emerging markets, Research paper 1278, Stanford University.

Tesar, L.L., and I. Werner, 1994, International equity transactions and U.S. portfolio choice, in J.A. Frankel, Ed. *The Internationalization of Equity Markets* (University of Chicago Press, Chicago).

Tesar, L.L., and I. Werner, 1995, Home bias and high turnover. *Journal of International Money & Finance* 14, 467-492.

Uppal, R., 1993, A general equilibrium model of international portfolio choice, *Journal of Finance* 48, 529-554.

Wang, J., 1993, A model of intertemporal asset prices under asymmetric information, *Review of Economic Studies* 60, 249-282.

Table I
U.S. Purchases of Equities in Developed Foreign Markets

Seemingly unrelated regressions of normalized quarterly US purchases of foreign equities in four developed markets on US and foreign equity returns measured in US dollars for the period 1982.2 to 1994.4. Normalized purchases are net purchases in quarter *t* expressed as a proportion of the average absolute level of net purchases over the previous four quarters. Returns are quarterly capital gains computed from Goldman-Sachs FTA dollar-denominated price indices. D-W: Durbin-Watson statistic. Nobs: Number of observations. LL: value of the log likelihood for the system. (t-ratios in parentheses).Coefficients in bold are positive under the domestic cumulative information advantage hypothesis of Assumption A.

	Constant	R_{US}	R_{CAN}	R_{GER}	R_{JAP}	R_{UK}	R^2 D-W	LL Nobs
Model I:								-418.11
Canada	0.58 (1.99)	-3.02 (0.52)	**5.09** **(1.11)**	2.91 (1.10)	1.11 (0.53)	2.54 (0.68)	0.02 1.61	51
Germany	0.60 (2.16)	6.61 (1.18)	-6.91 (1.57)	**8.37** **(3.28)**	-0.48 (0.24)	-3.21 (0.90)	0.15 1.57	51
Japan	0.29 (0.68)	15.87 (1.85)	5.14 (0.76)	0.66 (0.17)	**7.68** **(2.50)**	-13.47 (2.47)	0.21 1.86	51
U.K.	0.99 (3.25)	10.77 (1.75)	4.59 (0.95)	0.19 (0.07)	4.16 (1.89)	**-8.55** **(2.19)**	0.17 2.33	51
Model II:								-430.39
Canada	0.69 (2.57)		**7.19** **(2.51)**				0.05 1.56	51
Germany	0.60 (2.20)			**6.83** **(3.00)**			0.15 1.48	51
Japan	0.61 (1.41)				**4.79** **(2.08)**		0.09 1.61	51
U.K.	1.30 (4.02)					**1.53** **(0.59)**	0.01 1.99	51
Model III:								-425.86
Canada	0.71 (2.49)	-0.76 (0.14)	**7.29** **(1.65)**				0.03 1.56	51
Germany	0.64 (2.25)	-1.78 (0.49)		**7.26** **(3.00)**			0.13 1.47	51
Japan	0.27 (0.61)	13.84 (2.48)			**3.23** **(1.36)**		0.16 1.76	51
U.K.	1.02 (3.30)	13.06 (2.99)				**-2.08** **(0.71)**	0.13 2.32	51

Table II

Purchases of U.S. Equities by Residents of Developed Foreign Countries

Seemingly unrelated regressions of normalized foreign purchases of US equities by residents of four developed countries on US and foreign equity returns measured in US dollars for the period 1982.2 to 1994.4. Normalized purchases are net purchases in quarter *t* expressed as a proportion of the average absolute level of net purchases over the previous four quarters. Returns are quarterly capital gains computed from Goldman-Sachs FTA dollar-denominated price indices. D-W: Durbin-Watson statistic. Nobs: Number of observations. LL: value of the log likelihood for the system. (t-ratios in parentheses).Coefficients in bold are positive under the domestic cumulative information advantage hypothesis of Assumption A.

	Constant	R_{US}	R_{CAN}	R_{GER}	R_{JAP}	R_{UK}	R^2 D-W	LL Nobs
Model I:								-391.03
Canada	0.62 (2.22)	**-5.32** **(0.94)**	7.55 (1.70)	-4.49 (1.75)	2.98 (1.48)	-2.62 (0.73)	0.06 1.06	51
Germany	0.22 (0.74)	**-7.45** **(1.24)**	5.22 (1.10)	3.37 (1.23)	4.00 (1.86)	-1.48 (0.39)	0.02 1.48	51
Japan	0.23 (0.77)	**-3.08** **(0.50)**	3.27 (0.68)	2.89 (1.04)	3.75 (1.71)	-1.74 (0.45)	0.00 1.92	51
U.K.	-0.09 (0.43)	**-0.59** **(0.14)**	4.93 (1.49)	4.59 (2.39)	0.53 (0.35)	1.99 (0.74)	0.21 1.40	51
Model II:								-402.00
Canada	0.52 (1.80)	**-0.76** **(0.21)**					0.00 1.17	51
Germany	0.36 (1.18)	**0.74** **(0.20)**					-0.02 1.31	51
Japan	0.37 (1.20)	**2.73** **(0.73)**					-0.01 1.71	51
U.K.	0.01 (0.04)	**8.13** **(3.02)**					0.13 1.29	51
Model III:								-399.44
Canada	0.59 (2.08)	**-8.80** **(1.73)**	8.95 (2.16)				0.02 0.98	
Germany	0.31 (1.03)	**-0.23** **(0.06)**		1.85 (0.69)			-0.02 1.32	
Japan	0.23 (0.77)	**-0.67** **(0.17)**			4.79 (2.56)		0.03 1.96	
U.K.	-0.03 (0.14)	**4.94** **(1.53)**				4.24 (1.70)	0.16 1.30	

Group A	Const-ant	R_{ARG}	R_{BRA}	R_{CHI}	R_{COL}	R_{GRE}	R_{INDI}	R_{INDO}	R_{KOR}	R^2 D-W	LL Nobs
Model II											-306.05
Argentina	-2.18 (0.93)	**5.44** **(3.07)**								0.00 2.05	24
Brazil	1.76 (2.51)		**1.58** **(1.66)**							-0.04 1.88	24
Chile	2.41 (5.04)			**-6.66** **(3.44)**						-0.00 2.27	24
Columbia	1.14 (1.43)				**1.14** **(0.80)**					-0.04 1.80	24
Greece	1.21 (2.95)					**1.53** **(2.21)**				-0.10 1.81	24
India	1.61 (2.24)						**4.18** **(1.79)**			0.08 1.85	24
Indonesia	3.80 (2.17)							**35.11** **(4.18)**		0.26 1.10	24
Korea	1.06 (2.60)								**3.54** **(1.44)**	-0.02 1.41	24

Group B	Const-ant	R_{MAL}	R_{MEX}	R_{PAK}	R_{PHIL}	R_{PORT}	R_{TAIW}	R_{THAI}	R_{TURK}	R^2 D-W	LL Nobs
Model II											-268.38
Malaysia	1.11 (2.59)	**2.82** **(0.95)**								-0.00 1.89	24
Mexico	1.11 (2.14)		**6.05** **(2.49)**							0.18 1.61	24
Pakistan	1.23 (1.78)			**0.79** **(0.29)**						-0.04 1.21	24
Philippines	1.81 (4.75)				**1.81** **(4.75)**					0.00 2.34	24
Portugal	1.95 (3.29)					**7.17** **(1.84)**				0.09 (2.18)	24
Taiwan	0.49 (1.27)						**-0.62** **(0.49)**			-.03 1.80	24
Thailand	0.58 (1.59)							**2.58** **(1.63)**		0.07 1.85	24
Turkey	4.89 (0.62)								**22.8** **(1.10)**	0.01 (2.25)	24

Table III
U.S. Purchases of Equities in Emerging Markets

Seemingly unrelated regressions of normalized quarterly US purchases of foreign equities in sixteen emerging markets on host market returns measured in US dollars for the period 1982.2 to 1994.4. Normalized purchases are net purchases in quarter *t* expressed as a proportion of the average absolute level of net purchases over the previous four quarters. Returns for the non-US markets are the IFC dollar-denominated total return series. D-W: Durbin-Watson statistic. Nobs: Number of observations. LL: value of the log likelihood for the system. (t-ratios in parentheses).Coefficients in bold are positive under the domestic cumulative information advantage hypothesis of Assumption A.

Group A	Const-ant	R_{US}	R_{ARG}	R_{BRA}	R_{CHI}	R_{COL}	R_{GRE}	R_{INDI}	R_{INDO}	R_{KOR}	R^2 D-W	LL Nobs
Model III												-303.11
Argentina	-2.24 (0.89)	-4.75 (-.13)	**6.34 (3.41)**								-0.07 2.08	24
Brazil	1.87 (2.50)	-5.64 (0.46)		**1.74 (1.83)**							-0.09 1.84	24
Chile	2.46 (4.97)	-3.19 (0.42)			**-6.46 (3.45)**						0.05 2.21	24
Columbia	1.14 (1.43)	1.21 (2.95)				**2.35 (1.14)**					-0.06 1.96	24
Greece	1.31 (3.02)	-4.94 (0.70)					**1.58 (2.28)**				-0.13 1.67	24
India	1.38 (1.70)	8.11 (0.60)						**5.10 (1.94)**			0.06 1.81	24
Indonesia	4.24 (2.41)	-37.26 (1.26)							**35.84 (4.47)**		0.27 1.07	24
Korea	1.16 (2.64)	-4.60 (0.62)								**4.38 (1.75)**	-0.06 1.40	24

Group B	Const-ant	R_{US}	R_{MAL}	R_{MEX}	R_{PAK}	R_{PHIL}	R_{PORT}	R_{TAIW}	R_{THAI}	R_{TURK}	R^2 D-W	LL Nobs
Model III												-271.88
Malaysia	1.21 (2.74)	-7.65 (0.99)	**4.18 (1.28)**								-0.00 2.11	24
Mexico	1.27 (2.46)	-13.25 (1.46)		**7.70 (2.94)**							0.22 (1.95)	24
Pakistan	1.46 (1.99)	-10.88 (0.94)			**1.07 (0.39)**						-0.05 1.22	24
Philippines	1.66 (4.36)	11.21 (1.55)				**-1.41 (0.82)**					0.02 2.12	24
Portugal	2.01 (3.12)	-3.33 (0.30)					**7.60 (1.79)**				0.05 2.20	24
Taiwan	0.35 (0.86)	7.51 (1.07)						**-1.14 (0.84)**			-0.03 1.82	24
Thailand	0.69 (1.91)	-9.99 (1.50)							**3.89 (2.19)**		0.12 1.73	24
Turkey	5.85 (0.70)	-47.99 (0.35)								**24.11 (1.13)**	-0.03 2.26	

Table IV
The Influence of U.S. Market Returns on
U.S. Purchases of Equities in Emerging Markets

Seemingly unrelated regressions of normalized quarterly US purchases of foreign equities in sixteen emerging markets on US and host market returns measured in US dollars for the period 1982.2 to 1994.4. Normalized purchases are net purchases in quarter t expressed as a proportion of the average absolute level of net purchases over the previous four quarters. Returns for the non-US markets are the IFC dollar-denominated total return series. D-W: Durbin-Watson statistic. Nobs: Number of observations. LL: value of the log likelihood for the system. (t-ratios in parentheses).Coefficients in bold are positive under the domestic cumulative information advantage hypothesis of Assumption A.

Table V
A Comparison of Model Results with Evidence of Capital Flow Restrictions for Emerging Markets

Emerging markets classified by t-ratio of coefficient of host market return in regression of normalized US equity purchases on host market returns. Numbers in brackets are the proportion of total trading volume accounted for by US transactions in 1990 (Tesar and Werner (1993)). Numbers in square braces are the degree of market integration estimated by Bekaert and Harvey (1995). Numbers in curly braces are the average U.S. closed-end country fund premium over the period January 1986 to August 1993 as reported by Bekaert and Urias (1995). Notes on the countries are based on Park and van Agtmael (1993), Price (1994), and de Caires (1988).

t-stat. > 2.0	2.0 > t-stat. > 0	0 > t-stat
Argentina (3.6%)[0.26]{12.8%} No restrictions for foreign capital since November 1989. Foreign investors began entering the market in 1991.	**Brazil** (3.5%) [n.a.]{-11.1%} Until 1991 only Brazil Fund and similar closed end funds; since then foreign institutional investors allowed.	**Chile** (n.a.) [0.26]{-5.5%} Only authorized Foreign Capital Investment Funds; limitations on repatriation of capital; 2.63% foreign ownership in 1990.
Greece (1.3%) [0.86]{n.a.} No restrictions for foreign capital. It is estimated that foreign investors account for 25% of the activity.	**Columbia** (29.0%) [0.14]{n.a.} 10% limit on foreign ownership of individual companies lifted 1991, and requirement that investment funds remain in the country for one year abolished. Institutional investors only.	**Taiwan** (0.05%) [0.90]{26.9%} Only closed end funds allowed to invest prior to 1990; since then authorized institutions allowed to invest up to $100m each. Total foreign investment quota of $5 billion.
Indonesia (1.3%) [n.a.] {1.71%} Open to foreigners since 1989; 49% limit on foreign holdings of most companies.	**India** (0.02%) [0.10]{-3.6%} In 1992 market opened to foreign institutional investors who must be approved by Securities Board.	
Mexico (12.5%)[0.04]{-17.1%} May 1989 rule allowed foreigners to hold unrestricted positions in 73% of companies. Foreign holdings 18.3% of total capitalization at end-1991.	**Korea** (0.26%) [0.99] {54.8%} Foreign investment limited to closed-end funds prior to Janaury 1992; foreign holdings 2.1% of total capitalization in 1989, 'less than 4%' in 1992.	
Philippines (7.07%)[n.a.]{1.7%} Foreigners may purchase special 'B' shares	**Malaysia** (5.1%) [0.79]{-2.2%} 30% limit on foreign holdings of individual companies. At the end of 1990 foreigners held 27.4% of equity.	
	Pakistan (n.a.) [n.a.]{n.a.} Most barriers removed 1991; prior to that foreigners required special permission to invest.	
	Portugal (5.1%) [n.a.] {-5.3%} Foreigners hold 60% of free float of shares.	
	Thailand (2.0%) [1.00]{-8.0%} Foreign ownership limited to 49% for individual companies; Foreign transactions accounted for 10.0% of volume in 1987.	
	Turkey (1.6%) [n.a.]{-14.6%} Non-resident investment funds permitted since 1988.	

Table VI
The Influence of Exchange Rates on
U.S. Purchases of Equities in Developed Foreign Markets

Seemingly unrelated regressions of normalized foreign purchases of US equities by residents of four developed countries on US equity returns measured in source country currency (R^*_{US}), the return on the source country market in local currency (R^*_{Source}), and the change in the USD value of the source country currency (R_X)for the period 1982.2 to 1994.4. Normalized purchases are net purchases in quarter *t* expressed as a proportion of the average absolute level of the net purchases over the past four quarters. US and foreign equity returns are quarterly capital gains computed from the Goldman-Sachs dollar-denominated price indices less the proportional change in the value of the source country currency measured in USD. D-W: Durbin-Watson statistic. Nobs: Number of observations. LL: value of the log likelihood for the system. (t-ratios in parentheses).Coefficients in bold are positive under the domestic cumulative information advantage hypothesis of Assumption A.

	Constant	R^*_{US}	R^*_{Source}	R_X	R^2 **D-W**	**LL Nobs**
Panel A:						-294.32
Canada	0.58	**-8.13**	8.59		0.02	51
	(2.01)	**(1.73)**	(1.96)		0.99	
Germany	0.34	**-0.41**	1.67		-0.02	
	(1.21)	**(0.14)**	(0.59)		1.32	51
Japan	0.36	**-4.25**	4.31		0.01	
	(1.28)	**(1.66)**	(1.96)		1.94	51
U.K.	-0.04	**0.14**	8.82		0.24	
	(0.19)	**(0.06)**	(3.31)		(1.18)	51
***Panel B*:**						-289.02
Canada	0.66	**-3.62**	0.53	25.11	0.04	51
	(2.37)	**(0.68)**	(0.1)	(1.94)	(1.13)	
Germany	0.35	**-0.84**	2.20	-0.70	-0.04	
	(1.12)	**(0.20)**	(0.78)	(0.12)	(1.33)	51
Japan	0.04	**3.69**	1.06	17.11	0.05	
	(0.13)	**(0.88)**	(0.45)	(2.70)	1.78	51
U.K.	-0.04	**0.13**	8.97	0.07	0.22	
	(0.21)	**(0.04)**	(3.01)	(0.01)	1.19	51