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## ABSTRACT

### Global Private Information in International Equity Markets\*

This paper studies international equity markets when some investors have private information that is valuable for trading in many countries simultaneously. We use a dynamic model of equity trading to show that 'global' private information helps understand US investors' trading behaviour and performance. In particular, the model predicts global return chasing – positive comovement of US investors' net purchases with returns in many countries – which we show to be present in the data. Return chasing in our model can be due to superior performance of US investors, not inferior knowledge or naive trend-following. We also show that trades due to private information are strongly correlated across countries: a common 'global' factor accounts for about half their variation.

JEL Classification: F36, G12, G14 and G15

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# 1 Introduction

It has been widely documented that US investors' net purchases in a foreign equity market comove positively with returns there. For example, US investors tend to be net buyers of equity in a foreign country when stock prices there are rising, thus "chasing returns". A common explanation of return chasing is based on the assumption that US investors lack the private information of local investors in foreign markets. In the presence of local private information, less informed US investors react more strongly to public signals than better informed local investors, even if all investors have rational expectations. If public signals are sufficiently important drivers of returns, this mechanism generates both return chasing and underperformance of US investors in foreign markets.

While the private information view of international equity markets helps understand return chasing and also equity home bias, it has been challenged by recent empirical findings on investor performance. If local private information was important, domestic investors should make higher trading profits than foreign investors. However, the evidence on the performance of foreign and local investors is mixed, with several studies suggesting that foreign investors outperform their domestic counterparts.<sup>1</sup> In light of models with local private information, it is puzzling why foreigners should sometimes have country-specific private information that is not available to local investors.

This paper proposes to broaden the private information view of international equity markets by considering "global" private information that is relevant for trading in many foreign countries simultaneously. As a concrete example, consider market research about the technology sector. Insights about the future of this sector in the United States, a country that dominates growth in the sector, are likely to be important for the valuation of tech-stocks in Europe as well. Experience gained in the US market may thus give sophisticated US investors an advantage in recognizing global trends in technology and lead them to outperform domestic investors in Europe. More generally, the presence of global factors in international equity returns is a robust stylized fact and in many empirical studies global factors are captured by US-specific variables (e.g., Campbell and Hamao (1992) and Harvey (1991)). This suggests that US investors' local private information could be valuable in foreign markets as well.

The presence of global private information reconciles the private information view with the mixed evidence on investor performance and also helps understand new evidence we present on the cross-country correlation of returns and flows. To show this, we first set out a theoretical

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<sup>1</sup>For evidence that domestic investors perform better, see Shukla and van Inwegen (1995), Hau (2001), Choe, Kho and Stulz (2001) or Timmermann and Blake (2005). Studies that suggest foreign investor perform better include Grinblatt and Keloharju (2000), Karolyi (2002), Hamao and Mei (2001), Seasholes (2000), Bailey, Mao, and Sirodom (2004), and Froot and Ramadorai (2001).

model of international equity trading and derive its implications for returns and equity flows. Stock returns in our model are driven by both local and global factors. While local investors in every country receive signals about local factors, US investors are special in that they also receive signals about global factors. A key implication of this information structure is that return chasing can reflect *superior* performance of US investors. Indeed, it may arise because local investors abroad underreact to movements in global factors, about which they know less than US investors.

Analysis of the model leads to three predictions. First, if global information is important, we should observe “global return chasing:” US investors’ net purchases in any given country should comove positively not only with returns in that country, but also with returns in other countries. We document this new fact in a monthly dataset of US investors’ equity purchases in eight developed countries. Second, the model suggests that it is natural to find mixed evidence on the performance of foreign investors relative to local investors. Indeed, while local shocks which are reflected in local private signals favor local investors, global shocks are reflected in global private signals and hence favor US – that is, foreign – investors. Empirical studies may thus uncover under- or overperformance of foreigners depending on the particular time period and country studied.

The third prediction is that global private information induces positive correlation in US investors’ trades across countries. To assess it, we construct empirical measures of US investors’ trades due to private information. If most private information were local, then the correlation of such trades across countries should be low. For example, private information generated by market research about France that leads sophisticated US investors to purchase French equities should not help forecast returns in Germany, and therefore should not entail purchases of German equities. In contrast, the more private information is global, the higher the cross-country correlation of trades due to private information. We find that a *global factor* accounts for approximately half of the variation in trades due to private information across the eight countries we study. At the same time, private information accounts for about two thirds of the overall variation in trades. Global private information thus plays an important role in international equity markets; it explains one third of US investors’ trades abroad.

Relative to the literature, the paper makes two contributions. The first is to solve a model of trading with both local and global private information. Our assumptions about local private information are similar to those in the seminal paper of Brennan and Cao (1997): domestic investors have an initial information advantage that induces home bias. However, a key difference is the more general signal structure: we model a global factor in fundamentals as well as global signals, both of which induce a global factor in trades due to private information. We present closed form solutions for equilibrium trades and prices. Our solution permits us to explicitly

state conditions under which return chasing obtains. Moreover we can trace out how public and private signals are transmitted to investors via public and private signals and then become observable in equity flows and returns.

The model highlights that the relationship between trades, returns and information is quite different when information is global rather than local. With local private information, there is a natural tension between the presence of private information and observed return chasing. Indeed, the arrival of local private signals induces negative correlation between US investors' purchases and returns. This is because a private signal that brings good news and is partly reflected in a price increase, also leads local informed investors to buy from US investors. The later underreact relative to a symmetric information benchmark and sell. In a model with local private information, return chasing can only come from local public signals, which must be important enough to outweigh the opposing effect from local private signals.

In contrast, both public and private global signals contribute to global return chasing. The arrival of a good global private signal is partly reflected in price increases in many countries, and also leads US investors who receive the signal to buy in those countries, while local investors underreact and sell. The arrival of a good public signal has two effects. On the one hand, it reduces US investors' information advantage with respect to the global factors. One might thus expect local investors in the other countries to overreact to the signal and become net buyers. On the other hand, the signal reduces local investors' information advantage about payoffs. Our analysis shows that in a world where local private information is strong enough that home bias holds, as in the data, the second effect is always stronger, and both types of signals induce US investors to buy when prices rise.

Our second contribution is an empirical analysis of links between US investors' trades in a cross-section of countries. The existing empirical literature on foreign investors' trading behavior focuses on data sets from a specific country or short time period. In contrast, we use data on US investors' monthly purchases and sales of equities in the eight major foreign markets between 1977 and 2003. This allows for a comparison of trades across markets, which is required to identify global return chasing and trades due to global private information. In particular, we can examine the factor structure of private information. Previous analyses of international expected return variation try to separate the influence of global and local risk factors. Here, we are interested in describing the extent to which measured private information also displays significant global components. To the best of our knowledge, this paper is the first to document global return chasing and global private information in international markets.<sup>2</sup>

The paper proceeds as follows. In Section 2 we develop our model of international equity

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<sup>2</sup> The domestic asset pricing literature has illustrated the potential role for common factors in private information to explain time series properties of returns (e.g. Subrahmanyam (1991) and Chan (1993)).

flows with global private information. In Section 3 we present our data and results on global return chasing. In Section 4 we introduce the empirical models of the expected components of international equity flows and returns and show that there is significant common variation in US private information trades. In Section 5, we document that our measures of private information can be used to forecast returns. Section 6 concludes. The appendix contains proofs to the propositions in the main text and details on the empirical estimable models.

## 2 The Model

In this section we describe a general model of equity trading under asymmetric information that accommodates global factors. We allow for both local and global risk factors. In addition, public and private information can also be either local or global in nature.

### 2.1 Setup

#### *Assets*

Asset trade takes place over  $T$  periods,  $t = 1, \dots, T$ . Investors in the global equity market have access to  $n$  regional stock indices as well as a riskless asset that pays a zero interest rate. The  $j$ th stock index is a claim to a terminal payoff  $U_j$  that is received at date  $T$ . In what follows, we refer to the terminal payoff as a “dividend,” although it can also be interpreted as the initial price in a future round of trading. The dividend has mean  $\mu_u > 0$  and depends on a local factor  $U_j^l$ , as well as a global factor  $U^g$  that is the same for all regions.

The vector of all dividends is written as

$$U = \mu_u \iota + U^l + U^g \iota,$$

where  $U^l$  is an  $(n \times 1)$ -vector of local factors and  $\iota$  is an  $(n \times 1)$ -vector of ones. We assume that all factors are normally distributed and have mean zero. Local factors are uncorrelated across regions and have identical variance  $1/\pi_l$ . The global factor is uncorrelated with the local factors and has variance  $1/\pi_g$ . It follows that the covariance matrix of dividends is  $\Sigma = \pi_l^{-1}I + \pi_g^{-1}\iota\iota'$ , where  $I$  is an identity matrix of size  $n$ .

#### *Investors*

Each region  $j$  is populated by informed investors and liquidity traders. The total mass of traders, informed plus uninformed, is the same in each region, namely  $1/n$ . Informed investors have preferences over terminal wealth represented by  $U(W_T) = -\exp(-\frac{1}{r}W_T)$ ; their coefficient of absolute risk aversion is thus  $1/r$ . They start out in period 0 with an initial vector of asset positions  $A_0^j$ . A liquidity trader in region  $j$  sells an exogenous amount of the regional index  $j$  at every date. We assume that the vector  $x_t$  of liquidity trades at date  $t$  is normally distributed



with mean  $\mu_x t > 0$  and covariance matrix  $\pi_x I$ . It is also helpful to define the vector of cumulative liquidity trades  $X_t = \sum_{\tau=1}^t x_\tau$ .

*Public Information*

All investors observe local and global public signals. The local signals are informative only about dividends in region  $j$ , while the global signals provide information relevant to all regions. We assume

$$\begin{aligned} y_t^j &= U_j + v_t^j; \quad j = 1, \dots, n, \\ y_t^g &= \frac{1}{n} \sum_{j=1}^n U_j + v_t^g, \end{aligned}$$

where the shocks  $v_t^j$  are normally distributed and mutually as well as serially uncorrelated, with  $\text{var}(\varepsilon_t^j) = 1/q_l$ ,  $j = 1, \dots, n$  and  $\text{var}(\varepsilon_t^g) = 1/q_g$ . The cumulative errors in the public signals are denoted  $V_t^j = \sum_{\tau=1}^t v_\tau^j$ .

*Local Private Information*

The informed investors of region  $j$  all share the same information. At date 0, they start out with background information about the dividend in their home-region. As trading progresses, they obtain further local signals about their home region dividend. The local signal received by informed investors in region  $j$  at date  $t$  is

$$z_t^j = U_j + \varepsilon_t^j; \quad j = 1, \dots, n,$$

where the shocks  $\varepsilon_t^j$  are normally distributed and mutually as well as serially uncorrelated, with  $\text{var}(\varepsilon_t^j) = 1/p_l$ .

Following common practice in Bayesian statistics, we encode background information in investors' prior beliefs at date 0. In particular, the prior is set equal to the posterior that obtains if investors have already seen  $t_0$  local signals. The precision matrix of the prior (the inverse of the covariance matrix) is therefore

$$K_0^j = \pi_l I - \frac{\pi_l^2}{n\pi_l + \pi_g} \iota \iota' + t_0 p_l J^j,$$

where  $J^j$  is a matrix that has a one in the  $j$ -th diagonal element, while all other elements are zero. The matrix  $K_0^j$  captures investors initial knowledge about the different asset markets. Without background information ( $t_0 = 0$ ), investors would have identical beliefs about the indices in all countries. The background information that investor  $j$  has about his own country increases knowledge about the domestic index only, which is reflected in a higher precision.

### *The United States*

A fraction  $\alpha$  of the  $n$  regions form the United States. US investors are special in our model because they receive global signals, to be described below. The other regions can be interpreted either as individual countries with homogenous populations, or as subregions of a country. Following Coval and Moskowitz (1999), a number of papers have documented regional home bias within countries; this literature suggests that superior local information is responsible for this phenomenon. Alternatively, one may think about the “regional stock indices” as individual stocks, where each individual stock has a clientele of investors who have better information than the public at large.

### *Global Private Information*

Every US investor receives a global signal  $z_t^g$  that is informative about the sum of the dividends:

$$z_t^g = \frac{1}{n} \sum_{j=1}^n U_j + \varepsilon_t^g, \quad (1)$$

where the noise  $\varepsilon_t^g$  is again normally distributed and uncorrelated with all other shocks, with  $\text{var}(\varepsilon_t^g) = 1/p_g$ . As the local factors  $U_j^l$  are uncorrelated,  $z_t^g$  is effectively a signal about the global factor in dividends  $U^g$ . Having only one group of investors receiving the signal on the global factor means that the off-diagonal terms in the precision matrix of the private signals of that investor differ from those of the remaining investors. Information endowments are thus not symmetric.

### *Equilibrium*

A rational expectations equilibrium is a sequence of random variables for prices  $\{P_t\}$  and individual asset demand vectors  $\{A_t^j\}$  such that (i) at every date  $t$ , informed investors’ asset demands maximize utility given equilibrium prices and information, and (ii) the  $n$  stock markets clear, that is,

$$\frac{1}{n} \sum_{j=1}^{n+1} A_t^j = x_t, \quad t = 0, 1, \dots, T - 1. \quad (2)$$

### *Interpreting Global Private Information*

Our interpretation of global private information received by US investors is that it originates in information about US economic variables. For example, US investors could have superior knowledge about US business cycle variation. Lumsdaine and Prasad (2003) estimate a common component in industrial production growth rates in seventeen OECD countries. The average weight of US industrial production in this common component is 38.92 percent, well above the weights for all of the other countries. This common component is shown to drive industrial production in all of the countries. Similarly, Kwark (1999) finds that shocks to US output are

important in explaining shocks to foreign country output and Glick and Rogoff (1995), analyzing productivity shocks in the manufacturing industries of seven major industrial countries, find that gross country investment responds to a global productivity shock. Superior knowledge of US industrial production or aggregate output would then be of benefit in many countries.

US investors could also have a superior ability to interpret US monetary or productivity shocks which would help in forecasting growth in foreign economies. Kim (2001) estimates several different identified vector autoregression models of the effects of US monetary policy shocks on the current account and foreign country growth. He finds that expansionary shocks to US monetary policy increase imports in the short run. It also causes higher growth in the non-US developed countries with much of the effect coming from a reduced real world interest rate.

Sophisticated investors may also gain an information advantage by monitoring the customer order flows of other investors. For example, the proprietary trading desks of large financial institutions will be able to observe order flows in many markets. In addition, sophisticated US investors may also have private knowledge about links between US firms and firms in particular foreign countries. This may arise from customer or supplier relationships or proposed merger or acquisition activity. Gehrig (1998) discusses the information externalities that are present in large financial centers such as New York.

## 2.2 Model solution

We need to track investors' information as it evolves over time. As for the initial period, we identify knowledge with the inverse of an investor's posterior covariance matrix of dividends based on his own signals,  $K_t^j$ . In our setup, knowledge accumulates linearly:

$$\begin{aligned} K_t^j &= K_0^j + t \left( q_l I + \frac{1}{n} q_g \mu \mu' \right) + t p_l J^j; & \text{if } j \text{ is not a US investor.} \\ K_t^j &= K_0^j + t \left( q_l I + \frac{1}{n} q_g \mu \mu' \right) + t p_l J^j + \frac{1}{n} t p_g \mu \mu', & \text{if } j \text{ is a US investor} \end{aligned}$$

All investors learn by observing the public signal. Apart from that, non-US investors learn only about home country dividends, so that the arrival of private signals changes their knowledge matrix only in one position. For US investors, the arrival of global private information changes the knowledge in all positions.

We also define *average* knowledge  $K_t$  as the population weighted average of the individual knowledge matrices. Average knowledge does not describe the information set of any particular investor. Nevertheless, it will be useful for characterizing equilibria below. The evolution of its

local and global components are conveniently summarized by two sequences of numbers:

$$\begin{aligned}
K_t & : = \frac{1}{n} \sum_{j=1}^n K_t^j = k_t^l I + \frac{1}{n} k_t^g \iota \iota', \\
k_t^l & = k_0^l + \Delta k_t^l = k_0^l + p_l (t_0 + t) / n + q_l t + r^2 \pi_x p_l^2 / n^2 t, \\
k_t^g & = k_0^g + \Delta k_t^g = k_0^g + \alpha p_g t + q_g t + r^2 \pi_x \alpha p_g (\alpha p_g + 2p_l / n) t.
\end{aligned} \tag{3}$$

The first sequence  $\{k_t^l\}$  represents the accumulation of knowledge about the local factors through local signals. The number  $k_0^l = \pi_l$  captures the initial knowledge of foreign investors, and  $\Delta k_t^l$  captures the increase in knowledge through local signals, including the background information of local investors. The direct contribution of local private signals to average knowledge is  $p_l (t_0 + t) / n$ , because the signals are only received in one of the  $n$  regions, namely the home region. Moreover, local private signals contribute to average knowledge indirectly, as they are partly revealed by the price. The indirect contribution – the last component of  $k_t^l$  – is larger the smaller is the variance of the liquidity trades ( $\pi_x$  larger). The second sequence  $k_t^g$  represents knowledge about the global factor. Here initial knowledge is  $k_0^g := -\frac{\pi_l^2}{n\pi_l + \pi_g}$ , while the change in knowledge  $\Delta k_t^g$  derives from global signals.<sup>3</sup> We also denote the sum by  $k_t := k_t^l + k_t^g$ .

#### *Asset Demands and Equilibrium Prices and Quantities*

With exponential utility and no discounting, the asset demands of informed investor  $i$  can be written in terms of current prices as well as their (subjective) posterior mean dividend  $E_t^i[U]$  and the (inverse of) the posterior variance of dividends  $var_t^i(U) = K_t^{i-1}$ :

$$A_t^i = r K_t^i (E_t^i[U] - P_t). \tag{4}$$

The subjective conditional moments are calculated by Bayesian updating, taking into account all relevant information. This includes in particular any information contained in market prices. The price thus enters the portfolio demand (4) in two ways: directly as part of the return  $U - P_t$ , and indirectly as part of the conditioning information.

Equilibrium prices and equity holdings of informed investors in region  $i$ , are then given by:

$$P_t = K_t^{-1} \int K_t^i E_t^i[U] di - r^{-1} K_t^{-1} x_t, \tag{5}$$

$$A_t^i = x_t + r K_t^i \left( E_t^i[U] - K_t^{-1} \int K_t^i E_t^i[U] di \right) + (K_t^i K_t^{-1} - I) x_t. \tag{6}$$

The equilibrium price depends on fundamentals and information through the *knowledge-weighted average expectation*, the first term in (5). This term captures how the investor population learns about the dividend. The second term is a risk premium: if informed investors are to hold the

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<sup>3</sup>That  $k_0^g < 0$  reflects the fact that dividends across countries are positively correlated.

supply  $x_t$ , they require a price discount that increases with the risk aversion coefficient  $r^{-1}$  and decreases with average knowledge (the inverse of risk conditional on the average information set).

Equation (6) aggregates the equilibrium equity holdings of liquidity traders  $x_t$  and the holdings of informed investors, which in turn consist of two terms. The first depends on investors' expectations about fundamentals, or, more specifically, to *disagreement about fundamentals*: it is zero with symmetric information, that is, when  $E_t^i[U]$  is independent of  $i$  and  $K^i = K$ . More generally, investor  $i$  takes a long position in an asset if his own subjective expectation of the dividend is higher than the knowledge-weighted average of others' expectations. The second term depends on liquidity shocks: it reflects the fact that in equilibrium informed investors must offset the sales of liquidity investors.

Since the demand of the liquidity traders is simply  $-x_t$ , the equilibrium holdings of the informed investors consist of the disagreement term in (6) plus a component due to liquidity,  $(K_t^i K_t^{-1} - I)x_t$ . Here the expression  $K_t^i K_t^{-1} - I$  may be thought of as investor  $i$ 's information advantage. If informed investors disagree, then better informed investors take larger positions and hence absorb more of the supply fluctuations. If informed investors agree and  $K^i = K$ , then the supply by domestic liquidity traders is absorbed by domestic informed investors.

We now characterize equilibrium prices and holdings in terms of the shocks to fundamentals, errors in public signals and liquidity trades. The proof is relegated to Appendix A. There, we first establish a more general result that allows for arbitrary linear dependence of signals on dividends, as well as an arbitrary sequence of signal precisions.<sup>4</sup> The following proposition builds on that general result, exploiting the symmetry assumptions on information imposed above to work out explicitly the contributions of different shocks in terms of the primitives of the model.

**Proposition 1** *The stock price at date  $t$  in a region  $j$  outside the US is*

$$P_{t,j} = \mu_u + \frac{1}{k_t^l} \left\{ \Delta k_t^l (U_j^l - \bar{U}^l) + q_l (V_{t,j}^l - \bar{V}_t^l) - r^{-1} (1 + r^2 \pi_x p_l / n) (X_{t,j} - \bar{X}_t) \right\} \\ + \frac{1}{k_t} \left\{ \Delta k_t (U^g + \bar{U}^l) + \frac{1}{n} q_g V_t^g + q_l \bar{V}_t^l - r^{-1} (1 + r^2 \pi_x (\alpha p_g + p_l / n)) \bar{X}_t \right\}, \quad (7)$$

where  $\bar{U}^l$ ,  $\bar{V}_t^l$  and  $\bar{X}_t$  are cross sectional averages of the local factors, the cumulative local public signals and the liquidity trades, respectively.

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<sup>4</sup>The proposition in the appendix is more general than that of Brennan and Cao (1997), who require that signals are dividends plus noise, thus ruling out global signals such as (1).

(ii) The equilibrium per capita position of US investor  $i$  in stock  $j$  at date  $t$  is

$$\begin{aligned}
A_{t,j}^i &= x_{t,j} + r \frac{1}{k_t^l} p_l (t + t_0) \left\{ -\pi_l (U_j^l - \bar{U}^l) + q_l (V_{t,j}^l - \bar{V}_t^l) + (1 + r^2 \pi_x p_l / n) (X_{t,j} - \bar{X}_t) \right\} \\
&\quad + r \frac{1}{n k_t} ((1 - \alpha) p_g t - p_l (t + t_0)) \\
&\quad \times \left\{ \frac{\pi_l \pi_g}{\pi_g + n \pi_l} (U^g + \bar{U}^l) + \frac{1}{n} q_g V_t^g + q_l \bar{V}_t^l + r^{-1} (1 + r^2 \pi_x (\alpha p_g + p_l / n)) \bar{X}_t \right\}. \quad (8)
\end{aligned}$$

**Proof.** See Appendix A. ■

### Price Formation

In every trading round, the evolution of prices depends on the “true” payoff factors  $U$ , the (cumulative) errors in public signals  $V$ , and the liquidity trades  $X$ . All of these shocks affect investors’ beliefs, and hence the learning terms in (5). Indeed, the payoff factors – although unobservable – are partly revealed by public signals, as well as by prices which also reflect private signals. The errors in private signals do not matter since they cancel out across investors by the law of large numbers. However, the errors in public signals are aggregate shocks that do affect prices. Finally, the liquidity trades matter directly, but also affect beliefs since they make price signals noisy.

Since all factors have mean zero, the mean price of stock  $j$  is seen to be

$$E[P_{t,j}] = \mu_u - (1 + r^2 \pi_x (\alpha p_g + p_l / n)) \mu_x / r k_t.$$

The mean price is thus the mean dividend less a risk premium that is inversely related to  $k_t = k_t^l + k_t^g$ , the parameter that captures the accumulation of *average* public and private knowledge. The more knowledgeable the average investor is, the less he has to be compensated for risk and the higher is the price.

The price of stock  $j$  is higher than its mean if asset  $j$  is perceived to be attractive relative to other assets. The first line of (7) shows that this can happen either for fundamental reasons, or because of aggregate errors. On the one hand, when the local factor  $U^l$  is higher than the average local factor  $\bar{U}^l$ , both public and private signals suggest to investors that asset  $j$  is valuable, and the price is bid up. Since signals are imperfect, the price will not fully reflect the unobservable payoff; instead, there is a sequence of positive price changes as average knowledge accumulates ( $\Delta k_t^l / k_t^l$  is increasing over time). On the other hand, errors in public signals  $V_{t,j}^l$  also induce investors to trade asset  $j$ . This effect becomes less important over time as an increase in knowledge  $k_t$  reduces the weight on the error.

The price of stock  $j$  is also affected by global shocks. The second line of (7) shows that the price is high if either the global factor is high, or if there is a high realization of the global public signal. Because  $\Delta k_t / k_t$  is increasing over time, a high realization of the global factor

gives rise to “global momentum:” all prices tend to move up together in positively correlated steps. The mechanism is analogous to the case of local shocks: the price moves further away from the mean and closer to the dividend realization, as more signals arrive and beliefs move away from the prior.

The averages of the local factor and errors have similar effects on price as their global counterpart. This is natural since a simultaneous high realization of all local factors, say, has the same effect on signals as an increase in the global factor. However, the mean  $\bar{U}$  has variance  $1/\pi_l n^2$ . With a large number of countries, its volatility is thus an order of magnitude smaller than that of the global factor, which has variance  $1/\pi_g$ . In what follows, we mostly ignore terms involving  $\bar{U}^l$  in the analysis. Finally, the risk premium of stock  $j$  is larger than the average premium if the liquidity trades in stock  $j$  are high relative to the average liquidity trade. Intuitively, investors require a price discount if they have to incur a higher than average exposure to the local factor  $U_j^l$  in equilibrium. The risk premium decreases over time as average knowledge about the local factor increases.

#### *US Investors’ Positions and Home Bias*

US investors’ equilibrium holdings depend on the same factors as do prices. In the absence of any signals, and hence any disagreement, all investors simply absorb a proportional amount of the random stock supply  $x_{t,j}$ . On average, every investor would then hold  $\mu_x$  units of every stock; there would be no equity home bias. More generally, the unconditional mean demand – per capita – for stock  $j$  is given by

$$E [A_{t,j}^i] = \mu_x + \frac{1}{nk_t} ((1 - \alpha) p_g t - p_l (t + t_0)) (1 + r^2 \pi_x (\alpha p_g + p_l/n)) \mu_x. \quad (9)$$

Home bias emerges in equilibrium if the second term is negative, that is, if

$$p_l (t + t_0) > (1 - \alpha) p_g t. \quad (10)$$

If this condition holds, US investors’ per capita average holdings of foreign stock  $j$  are below the per capita mean amount of stock outstanding  $\mu_x$ . The condition says that local investors’ knowledge, measured by the total precision of all local signals that have arrived up to date  $t$ , is larger than the combined knowledge derived by all US investors from global signals. Naturally, there must be enough local private information to generate home bias.

Consider next how US positions vary with the different shocks. The first line of (8) shows the impact of local factors. The higher is the local factor  $U_j^l$  relative to the cross-sectional mean, the *less* of the equity from region  $j$  is held by US investors. This is because local factors are better understood by local investors who buy up local stocks when the local factor promises high payoffs. In contrast, positive errors  $V_{t,j}^l$  in local public signals increase investment by US investors who “overreact” to such errors, mistaking them for good news about the local factor.

The second and third line of (8) show the effect of global factors on holdings. We focus on the case when there is home bias. US investors' position in foreign countries at any point in time is then smaller when the realization of the global factor  $U^g$  is large. Intuitively, a realization of the global factor affects dividend and is therefore not only reflected in global signals, but also in local signals around the world. Since the sum of these signals is more precise than the global signals – this is precisely the condition for home bias above – US home bias is more pronounced when a global boom occurs. At the same time, US investors' access to global private information does reduce home bias over time, as discussed next.

### *Global Shocks and Return Chasing*

The main fact we are interested in is return chasing, or positive comovement of local returns in a market with US investors' net purchases in that market. In the context of our model, returns from one trading period to the next are simply changes in the price, while changes in US investors' market share in region  $j$  correspond to changes in the position  $A_{t,j}^i$ . It is helpful to think of an econometrician who observes a large number of trades and price changes generated by the model, possibly based on different realizations of the fundamentals  $U$ . Formulas (7) and (8) tell us to what extent various shocks induce positive comovement of local returns and US net purchases in the eyes of the econometrician.

Consider first the effect of the global factor  $U^g$  on changes in prices and US positions. We have seen above that the coefficient on  $U^g$  in (7) is increasing over time: as investors learn, the price function places more and more weight on the true realization of the global factor. It follows that a shock to  $U^g$  induces return chasing if and only if the coefficient on  $U^g$  in (8) also increases with time. Indeed, suppose this is true and that the realization of  $U^g$  is, say, high. US investors' positions then gradually increase over time, an increase that must be achieved by a sequence of stock purchases in foreign markets. At the same time, prices (in all countries) also increase as they move closer to reflecting the true high dividend component  $U^g$ . Similarly, when  $U^g$  is low, US investors' positions in all foreign countries decrease as prices there also decrease toward lower dividend realizations. In sum, either case, the econometrician will tend to measure a component in trades

In sum, if the coefficient on  $U^g$  in (8) is increasing in time, the time series of returns and US net purchases will contain a component, proportional to  $U^g$  that makes returns and US net purchases in many countries move together. If this component is important enough relative to other shocks, an econometrician will observe global return chasing if and only if

$$(1 - \alpha)p_g > p_l - \frac{p_l t_0}{k_0} \left( q_l + q_g + r^2 \pi_x (p_g + p_l/n)^2 \right) \quad (11)$$

Intuitively, this condition says that US investors become more informed about the global factor over time, relative to local investors. As US investors learn more about the true realization



of the global factor, their position reflects that realization more closely; i.e., the weight on  $U^g$  increases.

Several features of the information structure matter for return chasing. First, US investors become relatively more informed over time if their global private signals are sufficiently precise (i.e., other things equal, (11) holds as long as  $p_g$  is large enough). Second, US investors tend to learn more if they know relatively little to begin with, that is, if the initial advantage of local investors is large (high  $t_0$ ). This is because there are always public signals that gradually reveal any information that makes up local investors' initial advantage. Even if there is no exogenous public signal ( $q_l = q_g = 0$ ), prices partially reveal the content of local private signals, especially if there is not much noise from liquidity trades ( $\pi_x$  large). Whenever there is some initial information advantage of local investors ( $t_0 > 0$ ), US investors thus become relatively more informed about the global factor over time as long as the available public signals, including prices, are sufficiently precise.

It remains to show that conditions (10) and (11) are mutually compatible, so that the model jointly predicts home bias and return chasing by US investors. The following proposition says that both facts emerge in equilibrium as long as local investors' initial information advantage – measured by the number of initial local signals  $t_0$  – is sufficiently large.

**Proposition 2** *For any set of signal precisions, there is a threshold for local investors' initial information advantage, captured by the number of initial signals  $t_0$ , such that if  $t_0$  is above the threshold then (i) US investors' portfolios are on average biased against foreign stocks, and (ii) there is a common factor in US investors' international equity trades that induces global return chasing.*

**Proof.** See Appendix A. ■

We draw two main lessons from this analysis that will be relevant as we go to the data in Section 3 below. First, if global information, either private or public, is important, there should be global return chasing: positive correlation of US net purchases in one country with returns in another country. This fact is documented in Section 3. Second, if global private information is important, then trades based on private information should be correlated across target countries. This is examined in Sections 4 and 5.

Another lesson from the above discussion is that return chasing may reflect superior performance of US investors, since it may be driven by global private information. Indeed, a high realization of the global factors induces a period in which prices increase as US investors buy. Moreover, subsequent global returns will also be high as the price reveals more and more of the true global factor. To an observer, it will thus look as if US investors bought at precisely the

right time, on average. This result shows that studies in the literature that document superior performance by foreigners are not incompatible with an asymmetric information explanation of home bias and return chasing.

*US Investors' Trades with Local Information*

The explicit formulas for prices and positions in Proposition 1 also clarify the contribution of local shocks to return chasing. Suppose for instance that the local factor  $U_j^l$  is higher than the cross-sectional mean  $\bar{U}^l$ . The local shock induces return chasing if first component of the price (7) is then increasing over time. Return chasing in country  $j$  thus obtains when the corresponding component of US investors' positions also increase over time, so that the sequence of positive price changes is accompanied by a sequence of US purchases. The coefficient on  $U_j^l$  in (8), is increasing over time if and only if

$$\pi_l < t_0 (r^2 \pi_x p_l^2 / n^2 + q_l).$$

Local fundamental shocks in country  $j$  thus induce return chasing in that country only if (i) there is some initial information advantage of local investors ( $t_0 > 0$ ) and (ii) local shocks become *public* to a sufficient extent (the bracketed term on the right hand side is large enough). The intuition is analogous to the discussion of global return chasing above: a shock to  $U_j^l$  leads US investors to chase returns in country  $j$  if the arrival of more local signals over time makes US investors more informed about the local factor. The latter will tend to be true if there are more precise public signals (high  $q_l$ ), if a lot of the information contained in local private signals is revealed by prices, and also if local investors' initial information advantage is larger (which makes the reaction to any signal stronger).

It follows that, if information is local, there is a natural tension between information asymmetry and return chasing: the latter occurs only if local *public* information is sufficiently important. If instead local private information is important and not revealed by prices, for example, if there are no public signals and liquidity trades are very volatile (small  $\pi_x$ ), then local investors' information advantage grows over time and the local factor does not contribute to return chasing. Interestingly, this tension does not arise when information is global: both private and public global signals serve to make US investors relatively more informed about the global factor.<sup>5</sup> In particular, the presence of public signals is not needed for the global factor to induce global return chasing.

The presence of public signals contributes to return chasing in a second way. Since the coefficients on the cumulative errors  $V_{t,j}^l$  in both (7) and (8) are positive, the arrival of such an error also makes local returns and US net purchases move together. For example, a positive

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<sup>5</sup>For public signals, this follows because the coefficients on the cumulative errors in both (7) and (8) are positive.

error misleads all investors to believe that dividends are high, thus driving up the stock price. At the same time, the initially less informed US investors put more weight on the signal. They are therefore misled more and purchase stocks from local investors. This mechanism, emphasized by Brennan and Cao (1997), implies that return chasing can reflect underperformance of US investors. Indeed, after a positive error has occurred, subsequent returns will be low on average, because the true dividend is not related to the error and the price must thus come down from its temporarily inflated value. From the point of view of an observer, US investors have thus purchased local stocks at exactly the wrong time, on average.

### 3 US International Equity Flows

#### 3.1 Data

Data on gross purchases, gross sales and net purchases of foreign equities by US residents is obtained from the Treasury International Capital (TIC) reporting system of the US Treasury.<sup>6</sup> The TIC data has one important advantage for our study. The data contain the equity flows across a large cross section of countries with long, coincident time spans. This is typically not available in other data sets and is necessary in order to measure common components in unexpected flows and their effects on asset prices. There are two main weaknesses with the TIC data. First, the Treasury does not collect data on transactions in equity derivative securities, which have grown in importance in recent years. To the best of our knowledge, this criticism applies to all datasets used in this literature. Second, the Treasury collects data by geographic center and not by the security's country of origin. This means that the data may be unrepresentative to countries like the UK and Switzerland that host large international financial centers. The typical example of this problem is an European company that issues securities in the Euro-equity market, selling them through banks in London to US investors. This transaction is recorded as a sale of UK equity (Warnock and Cleaver (2002)).

In this paper, we examine transactions by US investors in the equity markets of eight large, developed countries – Germany, Japan, UK, France, Canada, Netherlands, Switzerland and Italy – which account for approximately 68 percent of the market value of non-US markets at the end of our sample period. We restrict the analysis to a group of relatively homogeneous, developed countries to correctly measure the public and private components of US net purchases; flows in and out of the equity markets in these countries are likely to be driven by stable economic relationships. In contrast, the on-going process of liberalization of equity markets in developing countries leads to capital flows that are mostly driven by changing risk-sharing op-

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<sup>6</sup>There are a number of related studies that use the same data set (Tesar and Werner (1993, 1995), Bohn and Tesar (1996a,b) and Brennan and Cao (1997)). See Froot et al. (2001) and Levich (1994) for a description of limitations/advantages of US Treasury data.

opportunities or declining transactions costs (e.g. Stulz (1999) and Bekaert and Harvey (2003)). Distinguishing these effects from the asymmetric information effect in flows is difficult. Moreover, empirical models of portfolio flows into emerging markets suffer from non-stationarity due to structural breaks from changing foreign ownership restrictions that make them difficult to estimate. This is perhaps one of the reasons why researchers have focused on aggregate/regional data for these countries (e.g. Froot et al. (2001), and Bekaert et al. (2002)).

Table 1a details our data set which ranges from January, 1977 (the start of the monthly TIC data) to May, 2003. We normalize the flows data by dividing by Datastream’s beginning-of-period index of foreign market capitalization. The table reveals three properties of US international equity flows: (i) gross flows are much larger than net flows, with numbers for the UK likely overstated because London is an international financial center; (ii) gross flows have higher volatilities, but lower coefficients of variation, than net flows; and, (iii) flows display considerable serial correlation, with net flows reversing after one year – though they all appear stationary. Persistence of US equity flows is consistent with persistence of order flow of individual stocks (Hasbrouck (1991)) and persistence of mutual fund flows (Warther (1995)).

Table 1b presents the summary statistics of data on excess returns. We use the end-of-month equity return index from Datastream translated into US dollars, and subtract from it the US risk-free interest rate. Table 1b shows that the volatility of excess returns is much larger than that of equity flows. This has implications below when we try to model the expected portions of flows and returns. The indexes are based on the firms with the largest equity values in each country. Because there is evidence that US investors tilt their portfolios towards the largest companies in each market, we assume, as is usual in the literature, that the returns on these indexes track closely the returns actually obtained by US investors in foreign markets.

### 3.2 Local vs. Global Return Chasing

Table 2 presents the correlations of excess returns with US investors’ net purchases of foreign equities. The main diagonal of the table illustrates the well known fact of *local return chasing* by US investors: in each country, US net purchases of equities correlates positively with excess returns. With the exception of the UK and Switzerland, these correlations are statistically significant at the 5 percent significance level.

The correlation estimates outside the main diagonal provide evidence in favor of the new phenomenon of *global return chasing* predicted by our model. With global return chasing, excess returns in any country correlate positively with US net purchases of equities in *any* foreign country. For example, when excess returns in Germany are high and US net purchases of German stocks are up due to local return chasing (correlation of 0.2473), US net purchases of Japanese stocks are also generally up due to global return chasing (correlation of 0.1863).

In Table 2, only 8 out of 64 correlations are negative and none of these negative correlations is statistically significant.

Recall how global return chasing arises in our model. After a positive shock to a global factor, prices rise in all countries at the same time that US investors increase their positions in all countries. While this may appear to be an irrational response, it is indeed optimal for US investors because they are better informed about the global factor than any other investor in the world. Following the lead of the model, in the rest of the paper we study the phenomenon of global return chasing as it relates to US investors' global private information. We first extract a measure of comovement in unexpected US net purchases of foreign stocks and call it the global private information of US investors. We show that global private information is a non-trivial component of US trading. Second, we show that foreign stock market returns also respond positively to shocks to global private information. The combination of the two facts implies that global private information is an important driver of global return chasing.

## 4 Measuring Trades Based on Private Information

In this section, we estimate empirical models of international equity flows and present measures of private information. If private information is to be valuable, equilibrium prices must not be fully revealing. In our model this is true due to the presence of noise traders, but prices are also non-revealing if there is private information about nontraded labor income or the number of market participants. With non-revealing prices, investors' trades contain private information that we can measure.

To obtain a measure of *trades based on private information* we need to provide an empirical framework that accounts for trades due to public information. With high frequency microstructure data, as in Hasbrouck (1991), this is easily achieved by regressing trades on lagged trades and lagged prices, because at this frequency the public news can be assumed to impact trades only indirectly via the price. The residual of this regression is a measure of private information.<sup>7</sup> With our data sampled with a monthly frequency, we generalize Hasbrouck's approach by allowing the public information contained in variables other than prices to also drive flows directly. We discuss the nature of these public information variables next.

### 4.1 Expected international equity flows

To measure expected equity flows we use four different comprehensive sets of public information variables. In the first public information set (A), we use an autoregressive model to capture the expected portion of the flows. This is motivated by two reasons. First, our model suggests

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<sup>7</sup>Indeed it is a noisy measure of private information as it contains also transient liquidity shocks.

that the diffusion over time of private information generates persistence in flows (from changes in the terms  $k_t^l$  and  $k_t^g$ ).<sup>8</sup> Second, as noted in Table 1a, US flows are persistent.

In the second and third information sets (B and C), we choose public information variables that have been shown to predict the cross section of international equity returns. These account for trades driven by myopic demand changes or hedging demand changes which are correlated with the variables that drive expected returns. It is common to separate these variables into two groups, global and local, where the use of local variables is justified by the existence of incomplete international risk sharing (e.g. Harvey (1991) and Ferson and Harvey (1993,1994)).<sup>9</sup> From this literature we select the US short-term interest rate, the US credit spread, the dividend yield on the global stock market, the slope of the US term structure and the US equity return to act as “global” variables.<sup>10</sup> The global variables, along with lagged flow variables are used as our second data set (B). Table 1b provides the summary statistics of the global instruments, which resemble those in many other papers.

The inclusion of the US stock market return, the US short-term interest rate and slope of the term structure, and the US credit spread is important for two additional reasons. First, they reflect public information about the US that might lead US investors to trade abroad. Second, the inclusion of these variables accounts for trading that is motivated by changes in US stockholders’ wealth (as captured by the returns on the stock, government and corporate bond markets). We include these variables for completeness, but are aware that Bohn and Tesar (1996b) have shown that portfolio rebalancing is not an important determinant of US investors’ net trades abroad.

The information set (C) adds “local” variables for each foreign country to information set (B). These local variables are: the country’s stock return (to capture any local return chasing activities by investors); the country’s dividend yield and interest rate differential to the US; and the change in the spot exchange rate of the country’s currency against the US dollar.

To construct our fourth information set (D), we rely on the literature that examines the links between trading activity and market volatility. This literature shows a positive contem-

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<sup>8</sup>See Albuquerque et al. (2006) for an alternative theoretical justification.

<sup>9</sup>Bohn and Tesar (1996a,b) also separate their instruments into local and global groups and find that net purchases are related to the cross section of expected equity returns using a similar list of instruments. Our approach differs from theirs by using the variables directly in modeling gross purchases and sales, which turn out to be much more predictable than net purchases.

<sup>10</sup>Most of the data are from Datastream. We use the 30-day Eurocurrency rate on the last business day of each month as the risk-free interest rate for each country. We use the Datastream equity return index and dividend yield on the index available at the end of each month. The dividend yield series is deseasonalized in the usual manner (we take the average dividend over the last 12 months and divide by the current price). The exchange rate is reported daily by Datastream in UK pounds and we translate the end-of-month values into US dollar equivalents. The US credit spread is the difference between the AAA and BBB bond yields available at the US Federal Reserve web site. The term structure slope is the long bond yield from the OECD database less the 30 day Eurodollar interest rate.

poraneous correlation between conditional volatility and trading volume (e.g. Lamoureux and Lastrapes (1990), Gallant et al. (1992)). As our international equity flows represent the trading activity of a specific group of investors, it may be that they are correlated with conditional volatility and that instruments which forecast time-varying second moments can also forecast the flows. We thus use a very simple autoregressive conditional heteroskedasticity (ARCH) type representation to capture these potential effects. We form a small vector autoregression (VAR of order 1) composed of the US excess equity return, the foreign country excess equity return and the change in the spot exchange rate between the two countries. The squared estimated residuals from this VAR act as instruments to forecast future flows. Again we include lagged flows in information set (D) to capture any additional missing variation.

The long list of variables we consider is also designed to avoid the concern that our measure of private information based trading is picking up *idiosyncratic* shocks that are orthogonal to private information about future asset returns. Possible examples include hedging demand trades triggered by news about individual human capital or trades due to individual liquidity shocks. On the one hand, the impact of such shocks on our measure of private information is mitigated by the averaging of individual trades; in any given month, some investors will typically receive positive liquidity shocks, while others receive negative shocks. To the extent that these idiosyncratic trades survive aggregation, it should be possible to explain them through changes in observable aggregate public information variables. We do this via the long list of variables discussed above.

On the other hand, liquidity shocks may be correlated across investors and be hard to explain with public information variables, e.g., aggregate noise trades. These trades will naturally contaminate our measure of trades due to private information and will bias our results toward not finding anything. We demonstrate below that this measurement error is not serious: *(i)* we find that our measure of trades based on private information is correlated across countries, while it is not clear why noise trades should be correlated across countries; *(ii)* Section 5 shows that the global factor extracted from our measure of private information helps predict future returns. The later finding is inconsistent with an i.i.d. sequence of noise trades that only exert temporary “price pressure.”

A final criticism of our approach is that the model of expected equity flows does not impose enough structure to separate private information from portfolio inventory shocks or other microstructure type shocks (e.g. smoothing of the price process by the specialist, stale quotes, etc.) However, these microstructure effects are important at very short horizons of one day or less whereas our data is monthly.

## 4.2 Private information based trades

Define the econometrician's information set:

$$\tilde{\Omega}_t = \{Z_t, (Z_{t-h}, NF_{t-h}^{US})_{h \geq 1}\}.$$

$\tilde{\Omega}_t$  describes the information used by the econometrician to predict net flows in month  $t$ . The vector  $Z_t$  contains public information variables as described above, which we separate from lagged US net-flows  $NF_{t-h}^{US}$  (information set A). All time  $t$  variables are measured at the end of the month, *including* returns realized during the month, both in the target country and in the US market. This implies that *all* publicly relevant information is reflected in  $\tilde{\Omega}_t$ , at least through its effect on current stock prices. The measured residuals from a linear projection of the net flows  $NF_t^{US}$  on the information set  $\tilde{\Omega}_t$  are given by

$$\tilde{v}_t \equiv NF_t^{US} - E(NF_t^{US} | \tilde{\Omega}_t). \quad (12)$$

Given our discussion above on the motivations for trading and our long list of variables in the information set  $\tilde{\Omega}_t$ , it follows that the residuals  $\tilde{v}_t$  reflect *trades due to private information*.

Unfortunately, the residual  $\tilde{v}_t$  is likely to understate the average trade due to private information in a given month. This happens when private information that drives trades within the month is later incorporated into prices and hence in the information set  $\tilde{\Omega}_t$ . We thus label  $\tilde{v}_t$  our *conservative* measure of private information and view it as a lower bound on the contribution of private information to unexpected flows. For comparison, we also provide a measure that acts as an upper bound on the contribution of private information. This *broad* measure is constructed using beginning-of-period values of the public information variables. Let  $\Omega_t = (Z_{t-h}, NF_{t-h})_{h \geq 1}$ , so that no end-of-period variables are included. Using this information set the econometrician recovers the residuals

$$v_t \equiv NF_t^{US} - E(NF_t^{US} | \Omega_t). \quad (13)$$

The broad measure is likely to overstate the effects of private information if investors trade on unexpected public information released during the month. Nevertheless, it is reassuring that our main results below are quite similar for the two measures.

A potential concern with using residuals as a measure of private information is that we may be picking up the effect of public information that is observed by investors, but not by the econometrician, that is,  $\tilde{\Omega}_t$  or  $\Omega_t$  may not contain the full public information vector. This is indeed a concern with the broad measure; here the best we can do is include in  $\Omega_t$  as many good predictors of flows as we can. However, this concern does not apply to the conservative measure. By including returns over the month where the flow is measured in the information



set  $\tilde{\Omega}_t$ , we ensure that the conservative measure is *orthogonal* to any public information that is released during the month and is relevant for future returns. This is because any relevant public information is quickly incorporated into prices.<sup>11</sup>

### 4.3 Regression results

Summary statistics for OLS regressions of gross purchases and gross sales on the four different information sets are presented in Tables 3a and 3b, respectively. These regressions use beginning-of-month values of the variables (i.e., information set  $\Omega_t$ ). The regressions using end-of-month values (i.e., information set  $\tilde{\Omega}_t$ ) produce similar results and are available on request. A simple AR(6) specification (information set A) is able to capture a large part of the expected flow variation with  $\bar{R}^2$  measures (adjusted for degrees of freedom) ranging from 0.313 for France up to 0.948 for the UK for gross purchases by US residents. A similar range is recorded for gross sales by US residents.<sup>12</sup>

With information set B, regressions show high  $\bar{R}^2$  and joint significance of the global variables (excluding lagged flows). Thus, the global instruments that are typically used to explain the cross section of international equity returns also explain the cross section of international equity flows. It is clear, however, that most of the predictability comes from including the lagged values of the flows as the  $\bar{R}^2$  statistics increase only marginally by including the global variables.

We test for the predictability of the local instruments using information set C. There is a small increase in the  $\bar{R}^2$  statistics from adding the local variables to the regressions, except for those explaining gross purchases of Italian equities and gross sales of French and Italian equities. However, the local variables as a group are jointly significant at the 10 percent level for equity flows in and out of about half of the countries.

The fourth information set (D) uses lagged values of squared residuals to capture any time variation in flows related to time-varying volatility. The statistics show that while these instruments are significant in some of the regressions, they do not help to explain time-variation in expected flows much beyond that captured by the lagged flow itself.

Table 3c provides the  $\bar{R}^2$  and  $\chi^2$  statistics for the OLS regressions of the net equity flows on the four information sets. The striking fact is that net flows are much less predictable than either of the gross flows. This is even more striking as most of the existing literature has focussed on explaining the expected component of *net* portfolio equity flows. Using instrument set A, the  $\bar{R}^2$  statistics for the net flow regressions range from 0.015 for Italy to 0.310 for Japan. The

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<sup>11</sup> Andersen et al. (2003) show that news about a number of public information variables are incorporated into stock prices within a 5 minute period.

<sup>12</sup>Our tests are robust to the choice of lag length (results available on request).

global, local and heteroskedastic variables also do not appear to generate much predictability in the net flows regressions.

In summary, we find that (i) much of the predictability of flows derives from lagged flows, and (ii) gross flows are more predictable than net flows.

Our results also have interest for more general international asset pricing applications that use similar forecasting variables. One potential criticism of most asset pricing applications is that many of these variables have been chosen by an on-going implicit process of ‘data snooping’: i.e., choosing the variables based on ex-post statistical criteria of return predictability. To the extent that the flows data represent a new source of information, the (limited) predictability shown here may alleviate some of these concerns.

#### 4.4 Residuals as measures of private information

The regressions detailed in the previous section give us a way of estimating the expected portion of the gross and net portfolio equity flows. Following our derivations in section 4.2, the private information of US residents can be estimated by the unexpected portion of the net equity flows.<sup>13</sup> In this subsection, we discuss only the construction of our broad measure of private information, and note that the exact same steps apply for our conservative measure.

Recall from equation (13) that the vector of broad measures of private information is obtained from the unexpected net portfolio flows into the equity markets of the eight foreign countries and is denoted by  $v_t = (v_{1,t}, \dots, v_{8,t})$ . Our regression results allow two possible routes to estimating  $v_t$ . One is to use net purchases of equities by US investors in each foreign country as the dependent variable (Table 3c). The residual from that regression is  $v_t$  as desired. An alternative route is to estimate the regressions for gross sales and gross purchases separately and let

$$v_{n,t} = v_{n,t}^P - v_{n,t}^S, \quad (14)$$

where  $v_{n,t}^P$  and  $v_{n,t}^S$  are the residuals from the gross purchases and gross sales regressions (Tables 3a and 3b), respectively.

Although the gross flow regressions show substantially greater explanatory power than their net flow counterparts, it is uncertain as to whether the expected portion of the net flows are modelled better by using the difference between the expected gross flows or by using the net flows directly in a regression. To answer this, we construct an expected net flow variance ratio. The numerator is the variance of the expected net flow from the net flow regressions (Table 3c). The denominator is the variance of the implied expected net flow constructed using the

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<sup>13</sup>Kaufmann, Mehrez, and Schmukler (2005) proceed in a similar fashion to obtain a measure of private information. They use survey data on firm managers’ assessments of how the economy will perform. The advantage of using flow data is that investors actually “put their money where their mouth is.”

difference between the expected gross purchases and expected gross sales (Tables 3a,b). A ratio below 1.0 indicates that the approach using the gross flow regressions is to be preferred. We also test whether this difference is statistically significant. We regress net flows on both lagged gross purchases and sales and test if the coefficients on the two variables are equal (and opposite in sign). The resulting test statistic is  $\chi^2$  distributed with six degrees of freedom (using the sixth-order autoregressive model).

Table 4 presents the estimated variance ratios and the asymptotic marginal significance levels ( $P$ -values) of the test statistics. For all countries and information sets, the ratios are below 1.0, often by a substantial amount. It appears that this result is primarily driven by the different time-series properties of the gross purchases and sales which are obscured when one models net flows directly. This is shown in the first column of the table which compares the variances of the estimates using the AR models for the flows. Adding on other information variables to the basic AR specification raises the variance ratios in all cases. The  $P$ -values indicate that the differences between the coefficients on the lagged purchases and sales are statistically different at the 10 percent level in six of the eight countries examined for instrument sets A and C. In the following, therefore, we use the gross flow residuals to construct our measures of private information according to (14).

#### 4.5 Global factors in private information

Our model hypothesizes that US investors use global private information signals that help them forecast international returns and make investment decisions *across* international stock markets. Therefore, to measure global private information, we construct a linear combination of unexpected net flows

$$\Upsilon_t = \phi_t' v_t,$$

which explains a large fraction of the variance of  $v_t$ . We also define  $\tilde{\Upsilon}_t = \tilde{\phi}_t' \tilde{v}_t$  as the global factor in private information using the conservative measure. In either case, a global factor in private information is consistent with traders having private information about the global variables driving factor returns.

We perform a factor analysis on the residuals from the gross purchases and sales regressions separately ( $v_{n,t}^P$  and  $v_{n,t}^S$ ,  $n = 1, \dots, N$ ). The factor analysis is done by both the method of iterated principal factors and by maximum-likelihood estimation. The results presented below are very similar across the two methods.

Table 5 presents the results of the factor analysis on the residuals from the gross flow regressions using instrument set C, for the broad measure of private information. The results for the conservative measure are similar and available on request. The first factor captures 52.6 percent of the unanticipated purchases and 55.3 percent of the unanticipated sales. Adding in

the next two factors raises the total variation captured to over 85 percent of gross purchases and sales. Hence, global private information is an important determinant of US investors' total private information. Moreover, because estimated net flows explain an average of 35 percent of total variation in net flows (see Table 3c), global private information is also an important determinant of comovement in US investors' net flows, accounting for an average 32 percent of US investors' net flows (equal to  $0.50 \times (1 - 0.35)$  or, the product of the percent of variation in unexpected flows explained by the first component times the percent of total variation in net flows that is unexplained).

We perform likelihood-ratio tests for the number of factors using the results of the maximum-likelihood factor method. The tests reject the hypothesis that no factors are present in the residuals but give conflicting results about the precise number of factors. The gross purchases residuals reject a one-factor representation in favor of two factors with a  $P$ -value of 0.003 percent. However, a representation involving more than one factor model is rejected for the gross sales residuals. Tests reject more than two factors for both sets of residuals (not reported). Clearly then, the covariance matrices of the gross flow residuals show reduced rank structures associated with a common factor representation in total private information.<sup>14</sup>

To measure global private information in net flows, we use the factors estimated on the gross purchases and sales residuals,  $\Upsilon_t^P$  and  $\Upsilon_t^S$ , respectively. As the scale of the factors is arbitrary, we normalize each to have a standard deviation equal to the simple average standard deviation of its constituent residuals. We then obtain a measure of the global factor in net flows as

$$\Upsilon_t = \Upsilon_t^P - \Upsilon_t^S. \quad (15)$$

## 5 Private Information and Aggregate Equity Returns

In this section, we explore whether US investors' global private information helps investors allocate assets across broad stock market indices. We specify an estimable model of aggregate returns and confirm that our measures of global private information ( $\Upsilon_t$  and  $\tilde{\Upsilon}_t$ ) help predict aggregate returns. This demonstrates that global private information is an important determinant of global return chasing.

### 5.1 A model of international equity returns

As a benchmark, we adopt the latent-factor model of Hansen and Hodrick (1983) and Gibbons and Ferson (1985). In a  $K$ -factor model, the market price of risk of the  $k$ -th factor can be

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<sup>14</sup>Froot et al. (2001) showed in the earlier versions of their paper that there is an important regional factor in *expected* flows. We have removed the expected portion of the flows using the global and local instrument sets and our factor analysis is thus concerned with *unexpected* flows.

written as a linear combination of the set of  $L$  instruments  $Z_t = (Z_{1,t}, \dots, Z_{L,t})$  that are in the information set of the econometrician. Thus, the process for one-period returns conditional on the econometrician's information is described by:

$$R_t = \beta\alpha Z_{t-1} + \beta f_t + \varepsilon_t, \quad (16)$$

where  $f$  is a  $K \times 1$  vector of factor realizations with  $E[f_t|Z_{t-1}] = 0$ ,  $\beta = cov(R_t, f_t|Z_{t-1})$  is a constant  $N \times K$  matrix,  $\alpha$  is a  $K \times L$  matrix, and  $f$  and  $\varepsilon$  are uncorrelated. In this model, the linear combination  $\alpha Z_{t-1}$  represents the expected returns on the latent factors, while the  $\beta$  matrix is the loading of the assets on the factors. The latent-factor model of returns summarizes the public information relevant for forecasting returns in a parsimonious way. For example, under a one-factor model, the estimated combination  $\alpha Z_{t-1}$  is often interpreted as the return on the 'global' factor which is relevant for all stock markets if world equity markets are integrated (e.g. Campbell and Hamao (1992)).

Having properly identified trades due to global private information means that this estimated variable can be used to forecast returns. Let  $R_t^{t+H}$  be the cumulative equity return from the beginning of period  $t$  to the end of period  $t + H$ . For the broad measure  $\Upsilon_t$ , we use the fact that  $Z_{t-1}$  and  $\Upsilon_t$  are uncorrelated and require for each holding period  $H \geq 0$ ,

$$E \left[ R_t^{t+H} | Z_{t-1}, \Upsilon_t \right] = \beta_H \alpha_H Z_{t-1} + \gamma_H \Upsilon_t, \quad (17)$$

where the  $N \times 1$  vector  $\gamma_H$  measures the impact of unexpected net flows on the cross section of expected returns. The conservative measure  $\tilde{\Upsilon}_t$  is uncorrelated with  $R_t$ . As a result, the  $\tilde{\gamma}_H$  coefficients from a projection similar to (17) will not be significant for  $H = 0$  by construction. However, if private information does have long lived effects, then future months' returns will reflect the impact of private information released at time  $t$ . Therefore, our tests of the effects of the global factor in the conservative measures of private information follow the same form as (17) for holding periods  $H = 1$  to 3 with  $\tilde{\Upsilon}_t$  replacing  $\Upsilon_t$ .

## 5.2 Impact of global private information

The model is estimated by Generalized Method of Moments (GMM), separately for each holding period  $H$ . We relegate the details of the estimation as well as results for the coefficients  $\alpha$  and  $\beta$  to the Appendix; here we focus on the coefficients  $\gamma_H$  and  $\tilde{\gamma}_H$  that capture whether the global factor of private information contains information about future stock returns. The top panel of Table 6 presents the value of the chi-squared statistics associated with the Wald test of the null hypothesis that all of the  $\gamma_H$  coefficients in (17) are jointly equal to zero.<sup>15</sup> The low  $P$ -values

<sup>15</sup>Some authors (e.g. Harvey and Zhou (1993)) have noted potential problems with Wald tests in systems with instrumental variables and have advocated calculating the Gallant-Jorgensen (1979) (G-J) test statistic as well. We have calculated the G-J test statistics and found that all of the G-J statistics are larger in value than our reported Wald statistics. Both test statistics are  $\chi^2$  distributed with 8 degrees of freedom.

indicate that the global factor is jointly significant across all of the foreign countries and holding periods regardless of the instrument set used to construct the expected equity flows.

The bottom panel of the table shows the corresponding tests for the coefficients  $\tilde{\gamma}_H$  derived under the conservative measure of private information.<sup>16</sup> The test statistics tend to be lower as they are orthogonal to contemporaneous information. Nevertheless, the global factor is clearly significant for all instrument sets also under the conservative measure. To summarize, tests using both measures show that the unexpected component of US residents' net purchases of foreign securities leads to a long-run increase in stock prices. As these measures provide lower and upper bounds on the private information set of the US investors, we conclude that, on aggregate, US investors have significant private information about international equity markets.

### 5.3 Discussion

Mechanically, joint significance implies that there exists a linear combination of the coefficients  $\gamma_H$ , say  $w'\gamma_H$ , that is significantly different from zero. In the present context, the coefficients  $w$  have an economic interpretation: up to normalization, they define a vector of portfolio weights. Therefore, the return on the time-invariant portfolio strategy described by  $w$ ,  $w'R_t^{t+H}$ , is well predicted by the global factor. The ability to predict this portfolio return and comovement in US net flows is what makes the global factor an important determinant of global return chasing. Indeed, there exist dynamic trading strategies that use information contained in the global factor to time international markets. For example, suppose a riskless asset is available and consider a zero cost strategy that goes long in the portfolio  $w$  (and short in the riskless asset) whenever the expected return  $w'(\beta_H\alpha_H Z_{t-1} + \gamma_H Y_t) / \sum_i w_i$  is higher than the riskless rate and goes short in the portfolio  $w$  (and long in the riskless asset) otherwise. Such a trading strategy would use both public information and the global factor to generate positive excess returns on average.<sup>17</sup>

A potential alternative explanation of the results in this section is price pressure: unanticipated net inflows into a country's equity market cause prices to rise even if they are devoid of information content as the market absorbs the extra demand. However, there are two primary reasons why the price pressure explanation is unlikely using our monthly data. First, the net flows shown in Table 1 are a very small portion of the total market value and the unanticipated net flows will be an even smaller portion. The markets that we examine are all in developed countries where there should be adequate liquidity for absorbing such small amounts. Second,

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<sup>16</sup>Note that there is no conservative measure of private information using instrument set A as it contains only lagged values of the flow series.

<sup>17</sup>Our setup does not imply that all US investors should be following the same strategy. Indeed, the global factor is derived from average trades based on private information whereas the theoretical framework allows for the possibility that only informed investors receive signals about the global factor in real time.

if there were temporary price pressure impacts from unanticipated flows, then there should be immediate reversals. However, the effects remain positive as  $H$  increases.

## 6 Conclusion

This paper hypothesizes and documents the existence of global private information in the portfolio equity trades of US investors abroad. We build a model to show that global private information is consistent with one of the main features of international trading: US investors chase foreign returns by increasing their positions in months of high foreign returns. Provided that local investors have an accumulated initial information advantage, we show that in our model return chasing obtains together with home bias. Finally, because of its nature, global private information shows up in the trades of US investors across all foreign countries. We take this lead from the model to conduct our empirical analysis.

This paper obtains measures of US investors' trades based on private information by estimating empirical models of international gross equity flows. We document that modeling gross flows results in a better model of expected net flows than modeling net flows directly. We then show that residuals from our models provide bounds on the amount of trading based on private information.

To identify a global factor in private information, we test for a factor structure in our measures of trading based on private information. We find that the first factor, which we call the global factor, accounts for over half of the variation in total private information. We also show that this global factor has a significant impact on the cross section of international equity returns. Although the trades of US investors constitute a very small amount of the total market capitalization of the foreign country, the unexpected flows are able to predict returns.

Our results suggest that US investors play a special role in international markets. Rather than suffering from an absolute information disadvantage because of insufficient local information, they may enjoy *at times* an information advantage because of superior global information. This information advantage appears to be long lived and suggests trading strategies where (sophisticated) US investors outperform the average non-US investor participating in the foreign equity market. Further analysis of such strategies is an interesting issue for future research.

# Appendices

## A Proofs of Propositions

**Proof of Proposition 1.** To derive formulas for the price vector and equilibrium portfolios, it is helpful to write the problem first in more general notation, before exploiting the particular information structure assumed in the text. To capture background information, we think of our model as having effectively  $T + t_0$  trading periods, where local private information arrives for the first  $t_0$  periods, and all other shocks occur only at the actual trading dates  $1, \dots, T$ . In the general notation, we allow all precision matrices to depend on time. For example, we denote the precision matrix of the liquidity trades at date  $t$  by  $\Phi_t$ . When we specialize the information structure below, we will set  $\Phi_t$  to zero for the first  $t_0$  periods, and to the constant  $\pi_x I$  for the trading periods  $1, \dots, T$ .

The stacked vectors of public and private signals can be written as a linear function of the dividends and shocks:

$$\begin{aligned} y'_t &= (y_t^1, y_t^2, \dots, y_t^n, y_t^g) = U' C' + (v_t^1, v_t^2, \dots, v_t^n, v_t^g) = U' C' + v'_t, \\ z'_t &= (z_t^1, z_t^2, \dots, z_t^n, z_t^g) = U' C' + (\varepsilon_t^1, \varepsilon_t^2, \dots, \varepsilon_t^n, \varepsilon_t^g) = U' C' + \varepsilon'_t. \end{aligned}$$

A constant  $C$  matrix is sufficient to accommodate the assumptions in the text, where  $C' = (I \ n^{-1}l)$ , an  $n \times (n + 1)$  matrix. Every investor observes the public signals; let  $N_t$  denote their precision (that is, the inverse of the variance covariance matrix of  $v_t$ ). However, investor  $i$  observes only  $z_t^i$  and possibly  $z_t^g$  if he is located in the United States. This is equivalent to assuming that all investors observe the vector  $z_t$ , but perceive different precision matrices  $S_t^i$  for the shocks  $\varepsilon_t$ . For example, the precision of the global signal for a non-US investor is zero, captured by a zero as the last diagonal element of  $S_t^i$ . Finally, let  $S_t$  denote the average precision matrix of all private signals that arrive at date  $t$ .

In general notation, the individual and aggregate knowledge matrices are defined as

$$K_t = K_0 + \sum_{\tau=0}^t [C' N_\tau C + C' S_\tau C + r^2 C' S_\tau C \Phi_\tau C' S_\tau C],$$

and

$$K_t^i = K_0 + \sum_{\tau=0}^t [C' N_\tau C + C' S_\tau^i C + r^2 C' S_\tau C \Phi_\tau C' S_\tau C].$$

We conjecture the following solutions for per capita foreign holdings of US informed investors



and the equilibrium price:

$$\begin{aligned}
A_t^i &= r \sum_{\tau=0}^t C' (S_\tau^i - S_\tau) C K_t^{-1} \left\{ K_0 (U - \bar{U}) - \sum_{i=0}^t C' N_i v_i \right\} \\
&\quad + \left[ I + \sum_{\tau=0}^t C' (S_\tau^i - S_\tau) C K_t^{-1} \right] \sum_{i=0}^t x_t \\
&\quad + r^2 \sum_{\tau=0}^t C' (S_\tau^i - S_\tau) C K_t^{-1} \sum_{\tau=0}^t C' S_\tau C \Phi_\tau x_\tau \\
P_t &= K_t^{-1} \left[ K_0 \mu_u + \sum_{\tau=0}^t \left[ C' N_\tau Y_\tau + (r^2 C' S_\tau C \Phi_\tau + I) C' S_\tau C (U - r^{-1} (C' S_\tau C)^{-1} x_\tau) \right] \right] \\
&= K_t^{-1} \left[ K_0 \mu_u + (K_t - K_0) U + \sum_{\tau=0}^t [C' N_\tau v_\tau + r^{-1} (I + r^2 C' S_\tau C \Phi_\tau) x_\tau] \right] \tag{A.1}
\end{aligned}$$

The conjectured prices and asset holdings satisfy the  $n$  asset market clearing conditions (2). Moreover, if the conjectured quantities are the optimal choices given the conjectured prices, we have found an equilibrium. This last result can be shown by following the steps of the proof in Brennan and Cao (1997). Intuitively, under our assumptions, optimal trading behavior arises from a sequence of one-period trading problems where at every trading stage  $t$ , agents' asset trading is motivated by expectations about price changes at the end of the trading stage.

#### *Simplifying the information structure*

We now specialize to the information structure of our model. We describe the precision of the background information by individual and average precision matrices  $S_0^i$  and  $S_0$  that are constant across the first  $t_0$  periods; the precision of signals that arrive during the trading periods is described by per period precision matrices  $S^i$ ,  $S$ , and  $S_q$ . The matrix  $C$  mapping dividends into signals and the precision  $\Phi$  of the noise trades is the same for all periods.

An important term in the solution (A.1) is an individual investor's information advantage  $K_t^i K_t^{-1} - I$ . With the time dependence assume, it simplifies to

$$\begin{aligned}
K_t^i K_t^{-1} - I &= \sum_{\tau=0}^t C' (S_\tau^i - S_\tau) C \\
&= (t_0 C' (S_0^i - S_0) C + t C' (S^i - S) C). \tag{A.2}
\end{aligned}$$

The per capita holdings of US informed investors and price (A.1) can be rewritten as

$$\begin{aligned}
A_t^i &= r [K_t^i K_t^{-1} - I] \{ K_0 (U - \bar{U}) - C' S_q V_t \} \\
&\quad + [I + [K_t^i K_t^{-1} - I] (I + r^2 C' S C \Phi)] x_t, \\
P_t &= K_t^{-1} [K_0 \bar{U} + (K_t - K_0) U + C' S_q V_t + r^{-1} (I + r^2 \pi_x C' S C \Phi) x_t]. \tag{A.3}
\end{aligned}$$

Further simplification is possible by exploiting the symmetry of investors' information. Under the assumptions in the text, the matrices  $\Phi$ ,  $S_q$  and  $C$  are:

$$\Phi = \pi_x I; \quad S_q = \begin{pmatrix} q_l I & 0 \\ 0' & q_g \end{pmatrix}; \quad C = \begin{pmatrix} I \\ \frac{1}{n} l' \end{pmatrix}.$$

Moreover, the precision matrices for an individual investor  $i$  based in the US are:

$$S^i = \begin{pmatrix} p_l J^i & 0 \\ 0' & p_g \end{pmatrix}; \quad S_0^i = \begin{pmatrix} p_l J^i & 0 \\ 0' & 0 \end{pmatrix}.$$

If the individual investor is not based in the United States, the precision matrices are the same, except that  $p_g$  in the bottom right corner of  $S^i$  is replaced by zero.

Let  $\alpha$  denote the number of US investors and  $\alpha^*$  the number of investors who have information about every local factor. We now simplify various terms in (A.3) for the case where investor  $i$  is based in the United States. Consider first the matrices

$$\begin{aligned} C_0' S_0^i C_0 &= p_l J^i, \\ C_0' S_0 C_0 &= \alpha^* p_l I, \\ C' S^i C &= p_l J^i + \frac{1}{n} p_g u u', \\ CSC &= \alpha^* p_l I + \frac{1}{n} \alpha p_g u u'. \end{aligned}$$

Investors  $i$ 's holdings depend on the realized signals only through the term

$$\begin{aligned} &K_0 (U - \bar{U}) - C' S_q V_t \\ &= K_0 (U^l + U^g) - C' S_q V_t \\ &= \pi_l (U^l - \bar{U}^l) + \frac{\pi_l \pi_g}{\pi_g + n \pi_l} (U^g + \bar{U}^l) - q_l V_t^l - \frac{1}{n} q_g V^g, \end{aligned} \quad (\text{A.4})$$

where  $\bar{U}^l = n^{-1} \sum_{j=1}^{n+1} U_j^l$  is the cross sectional average of the dividends. The aggregate knowledge matrix is

$$\begin{aligned} K_t &= (\pi_l + \alpha^* p_l (t + t_0) + r^2 \pi_x \alpha^{*2} p_l^2 t + q_l t) I \\ &\quad + \frac{1}{n} \left[ -\frac{\pi_l^2 n}{\pi_l n + \pi_g} + \alpha p_g t + r^2 \pi_x \alpha p_g (\alpha p_g + 2\alpha^* p_l) t + q_g t \right] u u' \\ &: = k_t^l I + \frac{1}{n} k_t^g u u'. \end{aligned}$$

This defines the coefficients  $k_t^l$  and  $k_t^g$  used in the text. It is also helpful to introduce notation for their sum:

$$\begin{aligned} k_t : &= k_t^l + k_t^g = \frac{\pi_g \pi_l}{n \pi_l + \pi_g} + \alpha^* p_l (t + t_0) + \alpha p_g t \\ &\quad + r^2 \pi_x (\alpha^* p_l + \alpha p_g)^2 t + (q_l + q_g) t. \end{aligned}$$

We can then write the inverse of the aggregate knowledge matrix as

$$K_t^{-1} = \frac{1}{k_t^l} \left[ I - \frac{1}{n} \frac{k_t^g}{k_t} \iota \iota' \right].$$

Substituting into (A.2), the information advantage of a US investor  $i$  is represented by the matrix:

$$\begin{aligned} K_t^i K_t^{-1} - I &= \left[ K_t - \alpha^* p_l (t + t_0) I + \frac{1}{n} (1 - \alpha) p_g t \iota \iota' + p_l t J^i \right] K_t^{-1} - I \\ &= -\alpha^* p_l (t + t_0) K_t^{-1} + \frac{1}{n} (1 - \alpha) p_g t \iota \iota' K_t^{-1} + t p_l J^i K_t^{-1}. \end{aligned}$$

This expression describes the information advantage relevant for computing the full vector of US investors' optimal portfolio holdings, for both domestic and foreign assets. Since we are only interested in US positions in foreign assets, we can ignore the matrix  $J^i K_t^{-1}$  which has all zero elements in rows that correspond to foreign assets. We focus instead on the matrix:

$$\begin{aligned} \Pi_t &: = K_t^i K_t^{-1} - I - p_l t J^i K_t^{-1} \\ &= -\alpha^* p_l (t + t_0) K_t^{-1} + \frac{1}{n} (1 - \alpha) p_g t \iota \iota' K_t^{-1} \\ &= -\frac{\alpha^* p_l (t + t_0)}{k_t^l} I + \left\{ \frac{1}{n} \frac{(1 - \alpha) p_g t}{k_t^l} + \frac{1}{n} \frac{k_t^g}{k_t} \frac{\alpha^* p_l (t + t_0)}{k_t^l} - \frac{1}{n} \frac{(1 - \alpha) p_g t}{k_t^l} \frac{k_t^g}{k_t} \right\} \iota \iota' \\ &= -\frac{\alpha^* p_l (t + t_0)}{k_t^l} I + \left\{ \frac{1}{n} \frac{(1 - \alpha) p_g t}{k_t} + \frac{1}{n} \frac{k_t^g}{k_t} \frac{\alpha^* p_l (t + t_0)}{k_t^l} \right\} \iota \iota' \\ &= \beta_t I + \delta_t \iota \iota'. \end{aligned}$$

A row of  $\Pi_t$  that corresponds to a foreign assets accurately captures the information advantage of any US investor.

For an arbitrary vector  $x$ , we have

$$\begin{aligned} \Pi_t x &= \beta_t (x - \bar{x}) + (\beta_t + n \delta_t) \bar{x} \iota \\ &= -\frac{p_l (t + t_0)}{k_t^l} (x - \bar{x}) + \frac{\frac{1}{n} (1 - \alpha) p_g t - \alpha^* p_l (t + t_0)}{k_t} \bar{x} \iota, \\ K_t^{-1} x &= \frac{1}{k_t^l} (x - \bar{x}) + \frac{1}{k_t} \bar{x} \iota, \\ C' S C x &= \alpha^* p_l (x - \bar{x}) + (\alpha^* p_l + \alpha p_g) \bar{x}. \end{aligned}$$

#### *Solution for equilibrium prices and holdings*

Applying the above formulas to the specific  $x$  given by (A.4), a US investor's demand for

foreign asset  $j$  can be read from the corresponding rows of

$$\begin{aligned}
A_t^i &= r\Pi_t \left( K_0 (U^l + U^g \iota) - C' S N V_t \right) \\
&\quad + [I + [K_t^i K_t^{-1} - I] (I + r^2 \pi_x C' S C)] x_t \\
&= x_t \\
&\quad - \frac{p_l (t + t_0)}{k_t^l} \\
&\quad \times \left\{ \pi_l (U^l - \bar{U}^l) - q_l (V_t^l - \bar{V}_t^l) + r^{-1} (1 + r^2 \pi_x \alpha^* p_l) (X_t - \bar{X}_t) \right\} \\
&\quad + \frac{\frac{1}{n} (1 - \alpha) p_g t - \alpha^* p_l (t + t_0)}{k_t} \\
&\quad \times \left\{ \frac{\pi_l \pi_g}{\pi_g + n \pi_l} (U^g + \bar{U}^l) - \left( \frac{1}{n} q_g V^g + q_l \bar{V}_t^l \right) + r^{-1} (1 + r^2 \pi_x (\alpha^* p_l + \alpha p_g)) \bar{X}_t \right\} \iota,
\end{aligned}$$

while the stock price is

$$\begin{aligned}
P_t &= K_t^{-1} [K_0 \mu_u + (K_t - K_0) U + C' S_q V_t + r^{-1} (I + r^2 \pi_x C' S C) x_t] \\
&= U - K_t^{-1} K_0 (U^l + U^g \iota) + K_t^{-1} C' S_q V_t + r^{-1} K_t^{-1} (I + r^2 \pi_x C' S C) x_t \\
&= U \\
&\quad - \frac{1}{k_t^l} \left\{ \pi_l (U^l - \bar{U}^l) - q_l (V_t^l - \bar{V}_t^l) + r^{-1} (1 + r^2 \pi_x \alpha^* p_l) (X_t - \bar{X}_t) \right\} \\
&\quad - \frac{1}{k_t} \left\{ \frac{\pi_l \pi_g}{\pi_g + n \pi_l} (U^g + \bar{U}^l) - \left( \frac{1}{n} q_g V^g + q_l \bar{V}_t^l \right) + r^{-1} (1 + r^2 \pi_x (\alpha^* p_l + \alpha p_g)) \bar{X}_t \right\}.
\end{aligned}$$

The formulas in (7)-(8) obtain by assuming  $\alpha^* = 1/n$ . ■

**Proof of Proposition 2.** For part (i), the condition for home bias follows the argument in the text. We first take unconditional expectations of US per capita aggregate asset demand for foreign asset  $j$  (8). Net of mean per capita US noise trades, US average aggregate holdings are:

$$E [A_{t,j}^i - x_t] = \frac{1}{n k_t} [(1 - \alpha) p_g t - p_l (t + t_0)] (1 + r^2 \pi_x (\alpha^* p_l + \alpha p_g)) \mu_x.$$

Home bias means that US investors hold less than their cumulative average noise supply. This happens when the term in square brackets is negative:

$$(1 - \alpha) p_g < p_l (1 + t_0/t).$$

To guarantee that the condition holds for all trading periods we require that it holds for  $t = T$ :

$$(1 - \alpha) p_g < p_l (1 + t_0/T). \tag{A.5}$$

This condition is satisfied if  $t_0$  is large enough.

For part (ii) we show that the terms associated with  $U^g$  in the price and demand equations both increase with  $t$ . In the price function it is easy to see that  $\frac{\Delta k_t}{k_t}$  is increasing in  $t$ . In the demand function, the relevant term is

$$\frac{1}{k_t} ((1 - \alpha) p_g t - p_l (t + t_0)).$$

This term is increasing if and only if condition (11) in the text holds, or equivalently if

$$(1 - \alpha) p_g > p_l (1 - (t_0/k_0)) \left( q_l + q_g + r^2 \pi_x (p_g + p_l/n)^2 \right). \quad (\text{A.6})$$

This condition is also satisfied if  $t_0$  is large enough. The threshold in the statement of the proposition is defined as the smaller of the thresholds implied by (A.5) and (A.6). ■

## B Empirical Models

This appendix contains details of the empirical model of returns used in Section 5.

### *GMM Estimation of Equation 17*

Consider projecting the cross section of the returns onto the instrument set  $Z_{t-1}$  and the private information  $\Upsilon_t$ :

$$R_t^{t+H} = \Phi_H Z_{t-1} + \gamma_H \Upsilon_t + \varepsilon_{H,t}.$$

The model imposes a number of cross equation restrictions on the  $N \times L$  coefficient matrix  $\Phi_H$ . Under the model, the typical element of the matrix  $\Phi_H = \beta_H \alpha_H$  is  $\Phi_{H,n,l} = \sum_{k=1}^K \beta_{H,n,k} \alpha_{H,l,k}$ ,  $n = 1, \dots, N$  and  $l = 1, \dots, L$ . However, the model is not identified and we follow the standard practice and assume  $\beta_{H,1} = 1$  (for a one-factor model). Under these specifications,  $\Phi_H$  has a reduced rank structure with  $\text{rank}(\Phi_H) = K$ . These restrictions can be used as a test of the model using the GMM  $J$ -statistic which is distributed as  $\chi^2$  with  $(N - K)(L - K)$  degrees of freedom.<sup>18</sup>

Imposing the over-identifying restrictions of the latent-factor model results in more precise estimates of return variation due to the public and private information variables. This latter effect is important due to the noisiness of monthly return data.<sup>19</sup> Latent-variable models of

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<sup>18</sup>We use the Newey-West form of the asymptotic covariance matrix with the number of lags equal to  $H + 3$  to capture any autocorrelation in  $\varepsilon_{H,t}$ . Ferson and Foerster (1994) examine the small-sample properties of latent-variable models estimated by GMM. They find that an iterated GMM procedure results in coefficient estimates with small biases but that the standard errors are understated. They propose a correction factor which results in appropriate sized standard errors. We use the iterated GMM approach and apply their small-sample correction factor to our standard errors.

<sup>19</sup>Note that alternative models for the cross section of expected international equity returns (e.g. the international version of the three-factor model presented in Fama and French (1998)) would use realized returns on sub-portfolios (e.g. international book-to-market portfolios) as proxy variables for the factor returns. These proxies would contain return variation due to the release of private information revealed by the trades of US investors during the month, thus invalidating the tests using our broad measures of private information.

international stock returns have been used by Harvey (1991), Campbell and Hamao (1992), and Harvey, Solnik and Zhou (2002) among others. The results of these studies are mixed. Campbell and Hamao (1992) examine the integration of the US and Japanese equity markets and find that a single latent-variable model is rejected during the 1970s but not during the 1980s. Harvey (1991) finds that the data reject a single source of risk across all of the world’s equity markets, implying that the world market portfolio is not conditionally mean-variance efficient. However, the rejection is strongest for Japan; the model holds for the other countries examined in the paper. Harvey et al. (2002) find that a one to three latent-factor model is rejected by the cross section of 18 country index returns. However, when they examine the models’ pricing errors and variance ratios, they find that a two or three latent-variable model captures the cross section of country returns.<sup>20</sup>

### *Impact of public information*

To show that our global (public information) instrument set is able to capture time-varying expected returns, we follow the literature and present some initial OLS regressions of the excess stock returns on the global instruments without imposing any of the restrictions of the asset pricing model or including the effects of private information. Table 7 presents the  $\bar{R}^2$  measures (adjusted for degrees of freedom) as well as the  $\chi^2$  statistic of the test that the global variables are jointly insignificant. The low value of the  $\bar{R}^2$  statistics is typical in the equity return prediction literature. The  $\chi^2$  statistics do show however, that the global variables are significant at the 5 percent level for 4 of the 9 countries (Germany, Japan, Netherlands and Switzerland) and significant at the 10 percent level for the US. The instruments are not significant at standard levels for the UK, French, Canadian or Italian equity returns.

We also test whether the same local instruments that were used in the flow regressions also are able to capture expected return variation. When these variables are included there is only a small increase in the degree of linear predictability in some of the countries (Table 7). In addition, the  $\chi^2$  statistics show that the local variables are significant at the 10 percent level for the UK only ( $P$ -value of 0.088). Thus, it appears that the cross-section of international equity returns can be modelled by the global instrument set alone.<sup>21</sup>

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<sup>20</sup>One of the key assumptions in the latent variable model is that the betas are constant. This is not a strong assumption at the country level. Ferson and Harvey (1993) test an asset pricing model where the risk factors are global but the conditional betas depend on country-specific attributes. They find that although time variation in the betas is statistically significant it contributes little to the variation in expected returns. Ferson and Harvey (1994) examine whether country-specific fundamental attributes can be used to help motivate time-varying beta models. Again, the risk premia are global while the betas are functions of specific country attributes which they label “fundamental determinants”. They find some limited support for their model. However, the estimation approach used in both of these papers does not allow the cross-equation restrictions of a global asset pricing model to be imposed.

<sup>21</sup>This is a different picture than the one given for flows where local factors were shown to (marginally) increase the models’ explanatory power. If these local variables represent the effects of a local factor in flows then it may

We estimate the latent factor model (17) without any private information to examine how it captures expected return variation. Imposing the restrictions of the latent-variable model leads to precise estimates of the coefficients on the global information variables. Table 8a presents the estimated  $\alpha_H$  coefficients for holding periods ranging from the current month ( $H = 0$ ) to three months forward ( $H = 3$ ). The coefficients are statistically significant on most of the variables (except the intercept) at most forecast horizons. The coefficient on the short-term US interest rate is negative as has been shown in other studies. The coefficient of the credit spread is significant and negative at all forecast horizons. The global dividend yield is shown to have a positive and significant effect on international returns. The slope of the US term structure and the lagged US equity market return change signs and are significant at some forecast horizons, indicating that their effects on expected equity return variation depend on the holding period examined.

The estimated  $\beta_H$  coefficients are presented in Table 8b. Recall that the coefficient on the US equity returns is normalized to 1.00 for identification. The coefficients are precisely estimated for most of the foreign country returns. For the current month ( $H = 0$ ), the coefficients range from 1.0 for the US returns up to 3.4 for Swiss returns. All of the coefficients are significant at the 10 percent level indicating that the single global factor forecasts the cross section of international returns. As the holding period  $H$  lengthens, the Japanese coefficients decrease so that they are negative for a three month holding period. The poor showing for Japanese returns is in line with the results in many other papers (e.g. Campbell and Hamao (1992), Harvey (1991)) and suggest that the Japanese equity market is not integrated with world markets. In addition, the Canadian and Italian coefficients become insignificant. This may be indicating either that these equity returns respond differently to the global risk factor as the forecast horizon lengthens or that the model may be missing an additional risk factor. However, our results using the conservative measures of private information are robust to missing risk factors.

The model is able to capture return variation due to public information. To show this, we construct a variance-ratio statistic similar to the ones presented by Campbell and Hamao (1992) and Harvey (1991). The numerator is the variance of the fitted values from equation (17), denoted  $var(\hat{\beta}_H \hat{\alpha}_H Z_{t-1})$ , where  $\hat{\beta}_H$  and  $\hat{\alpha}_H$  are the GMM coefficients for holding period  $H$  given in Tables 8a and 8b, respectively. The denominator is the variance of the fitted values from an OLS regression of the excess return on the global instruments  $var(\hat{\delta} Z_{t-1})$ . The variance ratio thus shows how imposing the baseline model's over-identifying restrictions leads to a degradation of the data's ability to forecast expected returns.

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be that there is also a local factor in returns. However, the return regressions may not capture this factor as returns are much noisier than flows. This does not affect our tests below as the measures of private information constructed using instrument set C are orthogonal to these variables.

The results are presented in Table 8c. As can be seen, the latent-variable model does a good job at capturing expected return variation. The ratios range from 0.140 for Japanese returns up to 1.751 for Swiss returns during the current month ( $H = 0$ ). As the holding period lengthens, the impact of the model's restrictions increases for some countries and the ratios fall (e.g. Canadian and Swiss returns). Some of the other ratios increase (e.g. German and Dutch returns). In Table 8c, we also present the  $J$ -statistics that evaluate the over-identifying restrictions of the latent-variable model. The  $J$ -statistics show that the model is not rejected at any forecast horizon. Given the performance of the one-factor latent-variable model according to all of these metrics, we will use it as our model of public information in the subsequent tests.



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**Table 1a**  
**Summary Statistics of US Investors' International Portfolio Equity Flows**

The table shows summary statistics of US investors' gross purchases, gross sales, and net purchases of foreign equities from Germany, Japan, UK, France, Canada, Netherlands, Switzerland and Italy. All of the series are expressed in monthly per cent continuously compounded form. The series have been normalized by dividing by the market value of the foreign equity index at the start of the month, both expressed in US dollars. The sample period is January, 1977 to May, 2003. The three estimated autocorrelations of the series are for a one, six and twelve month lag, respectively.

	Mean (%)	Standard Deviation (%)	Autocorrelation		
			$\rho_1$	$\rho_6$	$\rho_{12}$
US Investors' Gross Purchases of Foreign Equities					
Germany	0.196	0.152	0.870	0.764	0.697
Japan	0.176	0.175	0.943	0.896	0.884
UK	0.865	0.703	0.963	0.941	0.934
France	0.266	0.121	0.474	0.330	0.107
Canada	0.632	0.373	0.834	0.671	0.538
Netherlands	0.249	0.147	0.683	0.521	0.395
Switzerland	0.393	0.193	0.616	0.350	0.300
Italy	0.150	0.160	0.611	0.508	0.427
US Investors' Gross Sales of Foreign Equities					
Germany	0.186	0.152	0.915	0.811	0.746
Japan	0.161	0.163	0.962	0.941	0.920
UK	0.825	0.702	0.967	0.946	0.937
France	0.224	0.094	0.473	0.311	0.223
Canada	0.584	0.361	0.850	0.767	0.642
Netherlands	0.239	0.149	0.744	0.674	0.603
Switzerland	0.352	0.168	0.499	0.311	0.166
Italy	0.136	0.153	0.580	0.459	0.358
US Investors' Net Purchases of Foreign Equities					
Germany	0.010	0.061	0.311	0.116	0.097
Japan	0.015	0.049	0.539	0.032	-0.098
UK	0.040	0.109	0.271	0.102	0.143
France	0.043	0.114	0.281	0.125	-0.009
Canada	0.047	0.163	0.404	0.067	-0.023
Netherlands	0.010	0.102	0.365	0.076	-0.045
Switzerland	0.042	0.156	0.277	-0.034	-0.023
Italy	0.014	0.142	0.146	0.056	-0.022

**Table 1b**  
**Summary Statistics of Excess Equity Returns and Global Instruments**

The table shows summary statistics of: (i) excess equity returns from the US, Germany, Japan, UK, France, Canada, Netherlands, Switzerland, and Italy; and (ii) the global instrument set: the US short-term interest rate ( $r_t^{US}$ ), the US credit spread ( $crsp_t^{US}$ ), the dividend yield on the global equity market ( $div_t^{all}$ ), the slope of the US term structure ( $sl_t^{US}$ ) and the excess returns on US stocks ( $rs_t^{US}$ ) (shown in the first line of the table). All of the series are expressed in monthly per cent continuously compounded form. The sample period is January, 1977 to May, 2003. The three estimated autocorrelations of the series are for a one, six and twelve month lag, respectively.

	Mean (%)	Standard Deviation (%)	Autocorrelation		
			$\rho_1$	$\rho_6$	$\rho_{12}$
Excess equity returns					
US	0.396	4.470	0.024	-0.001	0.013
Germany	0.170	5.888	-0.031	0.064	0.020
Japan	0.061	6.554	0.097	-0.002	0.052
UK	0.540	5.417	-0.040	-0.052	-0.083
France	0.531	6.628	0.030	0.014	-0.053
Canada	0.226	5.293	0.061	0.042	-0.105
Netherlands	0.501	4.926	-0.050	0.013	0.065
Switzerland	0.411	5.167	0.074	-0.029	0.003
Italy	0.400	7.439	0.067	0.093	0.063
Global instruments					
$r_t^{US}$	0.618	0.310	0.968	0.860	0.769
$crsp_t^{US}$	0.090	0.037	0.965	0.824	0.677
$div_t^{all}$	0.217	0.086	0.994	0.962	0.916
$sl_t^{US}$	0.067	0.154	0.925	0.684	0.496

**Table 2**  
**Local and Global Return Chasing:**  
**Correlations of US Investors' Net Purchases**  
**of Foreign Equities with Foreign Excess Stock Returns**

The table shows correlation coefficients of US investors' net purchases of foreign equities with foreign excess returns. The flows data are presented in Table 1a while the excess returns are given in Table 1b. Below each correlation estimate, the table displays the *p*-value of the null hypothesis that the correlation is zero. The bold figures represent significance at 10% or higher.

	<i>US investors' net purchases of foreign equities in</i>							
	Germany	Japan	UK	France	Canada	Netherlands	Switzerland	Italy
<i>Excess return in:</i>								
Germany	<b>0.2473</b> <b>0.0000</b>	<b>0.1863</b> <b>0.0016</b>	0.0476 0.4240	<b>0.1049</b> <b>0.0777</b>	0.0516 0.3867	0.0739 0.2145	-0.0321 0.5898	0.0549 0.3568
Japan	0.0485 0.4153	<b>0.3904</b> <b>0.0000</b>	-0.0335 0.5734	<b>0.1878</b> <b>0.0015</b>	0.0875 0.1412	-0.0535 0.3693	0.0475 0.4256	0.0169 0.7771
UK	0.0716 0.2290	<b>0.1707</b> <b>0.0039</b>	0.0744 0.2113	<b>0.1479</b> <b>0.0126</b>	<b>0.1206</b> <b>0.0423</b>	<b>0.1258</b> <b>0.0340</b>	-0.0274 0.6460	0.0792 0.1831
France	<b>0.1116</b> <b>0.0603</b>	<b>0.1330</b> <b>0.0250</b>	0.0273 0.6472	<b>0.1215</b> <b>0.0407</b>	<b>0.1871</b> <b>0.0015</b>	0.0110 0.8541	-0.0481 0.4194	0.0406 0.4961
Canada	0.0831 0.1623	<b>0.2015</b> <b>0.0006</b>	0.0746 0.2103	<b>0.1348</b> <b>0.0231</b>	<b>0.1384</b> <b>0.0196</b>	0.0858 0.1491	-0.0604 0.3106	0.0542 0.3628
Netherlands	<b>0.1554</b> <b>0.0087</b>	<b>0.2903</b> <b>0.0000</b>	0.0921 0.1216	<b>0.2042</b> <b>0.0005</b>	0.0735 0.2169	<b>0.1699</b> <b>0.0041</b>	-0.0294 0.6218	0.0813 0.1718
Switzerland	<b>0.1038</b> <b>0.0807</b>	<b>0.2087</b> <b>0.0004</b>	<b>0.1582</b> <b>0.0076</b>	<b>0.1255</b> <b>0.0346</b>	0.0585 0.3263	0.0776 0.1920	0.0503 0.3984	<b>0.1252</b> <b>0.0349</b>
Italy	<b>0.1410</b> <b>0.0174</b>	<b>0.1911</b> <b>0.0012</b>	0.0200 0.7373	0.0757 0.2035	<b>0.1239</b> <b>0.0370</b>	-0.0346 0.5618	-0.0216 0.7167	<b>0.1233</b> <b>0.0378</b>

**Table 3a**  
**Summary Statistics from OLS Regressions of US Investors' Gross Purchases**  
**of Foreign Equities on Different Information Sets**

The table presents summary statistics from OLS regressions of gross purchases of foreign equities by US investors on four information sets: (A) three lagged values of the gross purchases; (B) lagged purchases plus the global instruments; (C) lagged purchases plus global and local instruments; and (D) lagged purchases plus lagged squared residuals from a vector autoregression of the US excess stock return, the foreign country excess stock return and the change in the exchange rate. The global instruments are detailed in Table 1b. The local instruments (all lagged three periods) include: the foreign country's stock return; the foreign country's dividend yield; the difference in interest rates between the foreign country and the US; and the change in the spot exchange rate of the country's currency against the US dollar. The  $\bar{R}^2$  statistics are adjusted for degrees of freedom. The value of the chi-squared test statistic associated with the Wald test of the null hypothesis that the coefficients on the explanatory variables are jointly equal to zero is shown in the column ( $\chi^2$ ) along with its asymptotic marginal significance level ( $P$ -value). In some of the tests, the degrees of freedom are adjusted lower due to multicollinearity of the regressors.

	Instrument Set							
	(A) lagged flow		(B) lagged flow + global instruments		(C) lagged flow + global + local instruments		(D) lagged flow + squared residuals	
	$\bar{R}^2$	$\chi^2(6)$ for lagged flows $P$ -value	$\bar{R}^2$	$\chi^2(5)$ for global variables $P$ -value	$\bar{R}^2$	$\chi^2(4)$ for local variables $P$ -value	$\bar{R}^2$	$\chi^2(3)$ for squared residuals $P$ -value
Germany	0.783	1073.27 <0.001	0.788	15.31 0.009	0.789	8.62 0.071	0.786	34.99 <0.001
Japan	0.906	2698.26 <0.001	0.907	10.84 0.055	0.908	5.52 0.238	0.904	7.81 0.554
UK	0.948	6453.80 <0.001	0.948	6.86 0.231	0.948	7.31 0.120	0.951	49.61 <0.001
France	0.313	207.54 <0.001	0.336	21.56 <0.001	0.340	5.87 0.209	0.318	20.56 0.015
Canada	0.734	977.39 <0.001	0.739	15.53 0.008	0.741	7.98 0.092	0.732	18.37 0.031
Netherlands	0.563	492.31 <0.001	0.583	25.63 <0.001	0.597	16.83 0.002	0.555	9.02 0.435
Switzerland	0.448	234.31 <0.001	0.465	15.59 0.008	0.471	10.34 0.035	0.451	18.17 0.033
Italy	0.493	285.04 <0.001	0.504	15.12 0.010	0.500	3.33 0.504	0.483	6.555 0.683

**Table 3b**  
**Summary Statistics from OLS Regressions of US Investors' Gross Sales**  
**of Foreign Equities on Different Information Sets**

The table presents summary statistics from OLS regressions of gross sales of foreign equities by US investors on four information sets: (A) three lagged values of the gross sales; (B) lagged sales plus the global instruments; (C) lagged sales plus global and local instruments; and (D) lagged sales plus lagged squared residuals from a vector autoregression of the US excess stock return, the foreign country excess stock return and the change in the exchange rate. The global instruments are detailed in Table 1b while the local instruments are detailed in Table 3a. The  $\bar{R}^2$  statistics are adjusted for degrees of freedom. The value of the chi-squared test statistic associated with the Wald test of the null hypothesis that the coefficients on the explanatory variables are jointly equal to zero is shown in the column ( $\chi^2$ ) along with its asymptotic marginal significance level ( $P$ -value). In some of the tests, the degrees of freedom are adjusted lower due to multicollinearity of the regressors.

	Instrument Set							
	(A) lagged flow		(B) lagged flow + global instruments		(C) lagged flow + global + local instruments		(D) lagged flow + squared residuals	
	$\bar{R}^2$	$\chi^2(6)$ lagged flow $P$ -value	$\bar{R}^2$	$\chi^2(5)$ for global variables $P$ -value	$\bar{R}^2$	$\chi^2(4)$ for local variables $P$ -value	$\bar{R}^2$	$\chi^2(4)$ for squared residuals $P$ -value
Germany	0.852	1540.57 <0.001	0.854	12.84 0.025	0.859	23.44 <0.001	0.851	13.14 0.156
Japan	0.945	2592.18 <0.001	0.945	4.87 0.432	0.945	6.11 0.191	0.946	18.23 0.033
UK	0.953	4983.23 <0.001	0.953	9.39 0.095	0.953	6.89 0.142	0.954	23.93 0.004
France	0.289	164.57 <0.001	0.315	19.82 0.001	0.311	7.26 0.123	0.287	24.0 0.004
Canada	0.780	1162.60 <0.001	0.779	10.49 0.063	0.782	9.55 0.049	0.776	8.46 0.488
Netherlands	0.644	708.51 <0.001	0.664	20.21 0.001	0.677	15.03 0.005	0.639	11.10 0.269
Switzerland	0.303	113.52 <0.001	0.311	9.58 0.088	0.320	11.10 0.025	0.299	25.63 0.002
Italy	0.434	205.21 <0.001	0.448	10.47 0.063	0.447	4.60 0.331	0.422	8.23 0.511



**Table 3c**  
**Summary Statistics from OLS Regressions of US Investor's Net Purchases**  
**of Foreign Equities on Different Information Sets**

The table presents summary statistics from OLS regressions of net purchases of foreign equities by US investors on four information sets: (A) the lagged value of the net purchases; (B) lagged net purchases plus the global instruments; (C) lagged net purchases plus global and local instruments; and (D) lagged net purchases plus lagged squared residuals from a vector autoregression of the US excess stock return, the foreign country excess stock return and the change in the exchange rate. The global instruments are detailed in Table 1b while the local instruments are detailed in Table 3a. The  $\bar{R}^2$  statistics are adjusted for degrees of freedom. The value of the chi-squared test statistic associated with the Wald test of the null hypothesis that the coefficients on the explanatory variables are jointly equal to zero is shown in the column ( $\chi^2$ ) along with its asymptotic marginal significance level ( $P$ -value). In some of the tests, the degrees of freedom are adjusted lower due to multicollinearity of the regressors.

	Instrument Set							
	(A) lagged flow		(B) lagged flow + global instruments		(C) lagged flow + global + local instruments		(D) lagged flow + squared residuals	
	$\bar{R}^2$	$\chi^2(6)$ lagged flow $P$ -value	$\bar{R}^2$	$\chi^2(5)$ for global variables $P$ -value	$\bar{R}^2$	$\chi^2(4)$ for local variables $P$ -value	$\bar{R}^2$	$\chi^2(3)$ for squared residuals $P$ -value
Germany	0.117	49.43 <0.001	0.119	7.19 0.207	0.130	10.2 0.037	0.130	28.96 0.001
Japan	0.310	178.42 <0.001	0.311	6.76 0.239	0.305	2.374 0.667	0.307	9.44 0.398
UK	0.166	59.25 <0.001	0.187	17.74 0.003	0.201	10.89 0.028	0.180	30.47 <0.001
France	0.135	32.24 <0.001	0.174	19.53 0.002	0.171	3.01 0.541	0.136	17.96 0.036
Canada	0.195	72.06 <0.001	0.218	16.27 0.006	0.229	6.96 0.138	0.186	10.33 0.325
Netherlands	0.164	85.03 <0.001	0.181	12.28 0.031	0.204	18.14 0.001	0.157	14.77 0.098
Switzerland	0.086	17.35 0.008	0.105	14.52 0.012	0.112	10.28 0.036	0.104	21.47 0.011
Italy	0.015	9.45 0.150	0.010	5.03 0.412	0.009	5.62 0.229	-0.002	9.87 0.361

**Table 4**  
**Variance Ratios and Specification Tests of Net Flow Regressions**

The table presents two numbers to compare two ways to model expected net flows. The first number in each cell (var. ratio) shows the ratio of the variance of the expected net flow series constructed by two methods. In the numerator, the expected net flow is obtained from a regression of the net flows on the given instrument set, as in Table 3c. In the denominator, the expected portion of the gross flows regressions from Tables 3a and 3b are used to construct an implied expected net flow. A number below 1.00 indicates that we obtain more explanatory power for net flows by using the expected gross flows to construct an expected net flow rather than by using the net flow in a regression directly. The second number in each cell (*P*-value) is the marginal significance level of a  $\chi^2$  test statistic from a regression of the net flows on the lagged gross purchases and sales. The test is that the coefficients on the lagged gross purchases are equal and opposite in value to the coefficients on the lagged gross sales. A small value indicates significantly different time series dynamics for the gross purchases and sales.

		Instrument Set			
		(A)	(B)	(C)	(D)
Country		lagged flow	lagged flow + global instruments	lagged flow + global + local instruments	lagged flow + squared residuals
Germany	var. ratio	0.306	0.387	0.461	0.365
	<i>P</i> -value	0.319	0.338	0.068	0.379
Japan	var. ratio	0.567	0.614	0.642	0.591
	<i>P</i> -value	<0.001	<0.001	<0.001	<0.001
UK	var. ratio	0.382	0.468	0.514	0.440
	<i>P</i> -value	0.052	0.186	0.037	0.116
France	var. ratio	0.624	0.738	0.771	0.668
	<i>P</i> -value	<0.001	0.743	0.559	0.176
Canada	var. ratio	0.391	0.462	0.543	0.416
	<i>P</i> -value	<0.001	0.123	0.015	0.006
Netherlands	var. ratio	0.459	0.873	0.929	0.490
	<i>P</i> -value	0.527	0.934	0.442	0.446
Switzerland	var. ratio	0.337	0.494	0.568	0.440
	<i>P</i> -value	<0.001	<0.001	<0.001	<0.001
Italy	var. ratio	0.158	0.291	0.357	0.207
	<i>P</i> -value	<0.001	<0.001	<0.001	<0.001

**Table 5**  
**Factor Analysis of Broad Measures of Private Information**  
**in International Portfolio Equity Flows**

The table presents results of a factor analysis on the residuals from the gross flows regressions using beginning-of-month values of instrument set C (lagged flows, plus global and local instruments) shown in Tables 3a and 3b. The first column presents the cumulative variance of residuals explained by the first three factors obtained from an iterated principal factor analysis. The second column presents a chi-squared test statistic that the covariance matrix does not display a factor structure against an alternative one factor representation. The third column presents a chi-squared test statistic that the covariance matrix contains more than one factor. The latter two tests are obtained from a maximum likelihood analysis and are presented along with their marginal significance levels (*P*-values).

Factor	Cumulative Variance (%)	Test of 0 factors against 1 factor $\chi^2(7)$ <i>P</i> -value	Test of 1 factor against >1 factor $\chi^2(14)$ <i>P</i> -value
Gross Purchases			
1	0.526	105.74	32.87
2	0.743	<0.001	0.003
3	0.854		
Gross Sales			
1	0.553	80.32	14.14
2	0.748	<0.001	0.439
3	0.857		

**Table 6**  
**Joint Significance Tests of the Effects of the Broad and Conservative Measures of the Global Factor in Private Information on International Stock Returns**

The table shows the values of the chi-squared test statistics associated with the Wald tests of the null hypothesis that all of the  $\gamma_H$  coefficients on the broad and conservative private information measures are jointly equal to zero. In the first part of the table, the tests are for the joint significance of the broad measures of the global factor in private information of US investors across the equity returns in the U.S. and the eight foreign countries (Germany, Japan, UK, France, Canada, Netherlands, Switzerland and Italy). In the second part of the table, the tests are for the joint significance of the conservative measure of the global factor in the private information of US investors across the equity returns of the same countries plus the US. The statistics are  $\chi^2(9)$  distributed and obtained from a Generalized Method of Moments estimation of the model and presented with their small-sample marginal significance levels ( $P$ -values).

	Instrument Set			
	(A)	(B)	(C)	(D)
	lagged flow	lagged flow + global instruments	lagged flow + global + local instruments	lagged flow + squared residuals
<b>Broad measure</b>				
$H = 0$	19.603 0.021	20.118 0.017	21.652 0.010	23.727 0.005
$H = 1$	38.198 <0.001	30.931 <0.001	34.387 <0.001	43.331 <0.001
$H = 2$	24.776 0.003	25.254 0.003	29.010 0.001	28.472 0.001
$H = 3$	48.636 <0.001	46.821 <0.001	54.439 <0.001	42.921 <0.001
<b>Conservative measure</b>				
$H = 1$		26.999 0.001	28.124 0.001	35.823 <0.001
$H = 2$		19.175 0.024	24.995 0.003	25.892 0.002
$H = 3$		30.706 <0.001	30.214 <0.001	38.728 <0.001

**Table 7**  
**Summary Statistics of Regressions of International Excess Equity Returns**  
**on Global Instruments, Local Instruments, and Lagged Equity Flows**

The table shows summary statistics from OLS regressions of the excess equity returns on US and foreign stocks on two instrument sets: (i) the set of global instruments shown in Table 1b; and (ii) the global and local instruments. The  $\bar{R}^2$  statistics are adjusted for degrees of freedom. The value of the chi-squared test statistic associated with the Wald test of the null hypothesis that the coefficients on the explanatory variables are jointly equal to zero is shown in the column ( $\chi^2$ ) along with its asymptotic marginal significance level ( $P$ -value).

Country	(i) Global instruments		(ii) Global plus local instruments	
	$\bar{R}^2$	$\chi^2$ (4) <i>P</i> -value	$\bar{R}^2$	$\chi^2$ (4) for local <i>P</i> -value
US	0.019	9.301 0.054	0.018	0.815 0.665
Germany	0.038	14.654 0.005	0.046	5.868 0.209
Japan	0.032	13.455 0.009	0.030	4.873 0.301
UK	0.016	6.451 0.168	0.037	8.104 0.088
France	0.028	7.044 0.134	0.018	0.649 0.957
Canada	0.022	6.162 0.187	0.016	3.408 0.492
Netherlands	0.041	10.603 0.031	0.052	4.919 0.296
Switzerland	0.065	18.727 0.001	0.055	0.657 0.957
Italy	-0.003	3.128 0.537	-0.013	1.246 0.870

**Table 8a**  
**Coefficients on Global Instruments in the One Factor Latent Variable**  
**Model of International Stock Returns**

The table shows the  $\alpha_H$  coefficients on the global instruments in the latent variable model of international stock returns. The global instruments are a constant, the US short-term interest rate ( $r_{t-1}^{US}$ ), the US credit spread ( $crsp_{t-1}^{US}$ ), the dividend yield on the global equity market ( $div_{t-1}^{all}$ ), the slope of the US term structure ( $sl_{t-1}^{US}$ ) and the excess returns on US stocks ( $rs_{t-1}^{US}$ ). The model is estimated separately by Generalized Method of Moments for each holding period of  $H$  months. The beta coefficient on the US stock return is normalized to 1.00 for identification. The small-sample adjusted version of the Newey-West standard errors (s.e.) are calculated assuming an overlap of  $H+3$  terms in the error process. The small-sample adjustment follows the procedure outlined in Ferson and Foerster (1994). The small-sample marginal significance levels ( $P$ -values) are shown below the standard errors.

Holding period	$\alpha_H$ coefficient in latent variable model					
	constant	$r_{t-1}^{US}$	$crsp_{t-1}^{US}$	$div_{t-1}^{all}$	$sl_{t-1}^{US}$	$rs_{t-1}^{US}$
	(s.e.) $P$ -value	(s.e.) $P$ -value	(s.e.) $P$ -value	(s.e.) $P$ -value	(s.e.) $P$ -value	(s.e.) $P$ -value
$H = 0$	0.006 (0.004) 0.117	-1.401 (0.810) 0.085	-7.905 (4.259) 0.064	4.805 (2.372) 0.044	-0.347 (0.817) 0.671	0.066 (0.032) 0.037
$H = 1$	0.039 (0.013) 0.002	-3.612 (1.731) 0.038	-38.642 (12.215) 0.002	13.864 (5.033) 0.006	-6.948 (2.766) 0.013	-0.006 (0.029) 0.841
$H = 2$	0.009 (0.011) 0.419	7.280 (2.080) 0.001	-88.045 (16.134) 0.000	16.024 (7.184) 0.026	9.597 (3.524) 0.007	-0.103 (0.038) 0.007
$H = 3$	0.014 (0.013) 0.263	12.340 (2.616) <0.001	-113.657 (20.586) <0.001	7.848 (6.881) 0.255	16.036 (3.305) <0.001	-0.030 (0.043) 0.488

**Table 8b**  
**Coefficients on the Implied Global Risk Premium in the One Latent Factor**  
**Model of International Stock Returns**

The table shows the  $\beta_H$  coefficients on the implied global risk premium from the latent variable model of international stock returns. The implied global risk premium is the linear combination of the instruments given in Table 8a. The beta coefficient on the US stock return is normalized to 1.00 for identification. The model is estimated separately for each holding period of  $H$  months by Generalized Method of Moments. The small-sample adjusted version of the Newey-West standard errors (s.e.) are calculated assuming an overlap of  $H+3$  terms in the error process. The small-sample marginal significance levels ( $P$ -values) are shown below the standard errors. The small-sample adjustment follows the procedure outlined in Ferson and Foerster (1994).

Country	Holding period			
	$H = 0$	$H = 1$	$H = 2$	$H = 3$
	$\beta$	$B$	$\beta$	$\beta$
	(s.e.)	(s.e.)	(s.e.)	(s.e.)
	$P$ -value	$P$ -value	$P$ -value	$P$ -value
US	1.00	1.00	1.00	1.00
Germany	2.107 (0.878) 0.017	1.248 (0.326) <0.001	1.096 (0.187) <0.001	1.152 (0.187) <0.001
Japan	1.880 (1.106) 0.090	-0.127 (0.406) 0.755	-0.277 (0.262) 0.292	-0.735 (0.277) 0.008
UK	1.646 (0.589) 0.006	1.114 (0.234) <0.001	0.681 (0.148) <0.001	0.740 (0.145) <0.001
France	2.557 (1.158) 0.028	1.952 (0.486) <0.001	0.812 (0.238) 0.001	0.829 (0.193) <0.001
Canada	1.966 (0.599) 0.001	1.230 (0.223) <0.001	0.183 (0.153) 0.233	0.179 (0.165) 0.277
Netherlands	2.076 (0.726) 0.005	1.395 (0.251) <0.001	1.074 (0.138) <0.001	1.113 (0.131) <0.001
Switzerland	3.388 (1.467) 0.022	1.681 (0.378) <0.001	1.492 (0.229) <0.001	1.237 (0.190) <0.001
Italy	1.845 (0.991) 0.063	1.638 (0.415) <0.001	0.031 (0.249) 0.902	0.200 (0.255) 0.434

**Table 8c**  
**Summary Statistics of the One Factor Latent Factor Model of International Stock Returns**

The top part of the table presents variance ratio measures of the statistical fit of the latent variable model. The ratio shows how the latent variable model without any private information captures the expected return variation in the data. The numerator is the variance of the expected return from the latent variable model while the denominator is the variance of the expected return from an OLS regression of the return on the global instruments. The bottom part of the table presents the value of the  $J$ -statistic associated with the Wald test of over-identifying restrictions of the model. The statistics are distributed as  $\chi^2(40)$  and are presented along with their asymptotic marginal significance levels ( $P$ -value).

Country	Holding period			
	$H = 0$	$H = 1$	$H = 2$	$H = 3$
Variance ratios				
US	0.320	1.384	1.924	2.132
Germany	0.581	0.641	0.874	0.943
Japan	0.140	0.003	0.026	0.174
UK	0.765	0.867	0.375	0.447
France	0.710	1.047	0.243	0.230
Canada	0.446	0.791	0.030	0.030
Netherlands	0.789	1.541	1.210	1.308
Switzerland	1.751	1.271	1.490	0.996
Italy	0.339	0.790	0.000	0.023
$J$ -statistic model test				
$\chi^2(40)$	19.498	25.272	22.617	21.576
$P$ -value	0.997	0.966	0.986	0.992