BIG FISH IN SMALL PONDS: THE TRADING BEHAVIOUR AND PRICE IMPACT OF FOREIGN INVESTORS IN ASIAN EMERGING EQUITY MARKETS

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Abstract

This paper analyses data for the aggregate daily trading of all foreign investors in six Asian emerging equity markets and provides two new findings. First, foreigners' flows into several markets show positive-feedback trading with respect to global, as well as domestic, equity returns. In particular, foreigners tend to be buyers in these markets on the day after rises in these markets or in US markets. The nature of this trading suggests it is due to behavioural factors or foreigners extracting information from recent returns, rather than portfolio-rebalancing effects. Second, the price impacts associated with foreigners' trading are much larger than earlier estimates. The results suggest that foreign investors and external conditions have a larger effect on emerging markets than implied by previous work.

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1. Introduction

The rapid growth of cross-border equity investment in recent years has generated much interest in the behaviour and impact of foreign investors, especially in emerging markets. Foreigners are frequently viewed as influencing prices in these countries and their trading is closely watched. Although there is a growing body of research in this area, there are still many open questions. For example, many observers have labelled foreign investors as momentum investors, but there is limited evidence as to whether the trading of foreigners occurs subsequent to price changes, or is concurrent with them. Furthermore, although there is a literature that attempts to ascertain the effect of greater participation of foreign investors on the volatility of returns, there is actually very limited evidence about the magnitude of the impact of the trades of foreign investors on the level of returns. Finally, although it has been argued that investment in emerging markets is substantially affected by conditions in mature markets ('push' factors), it remains unclear whether external or internal ('pull') factors are dominant in explaining flows to emerging markets.

The most comprehensive study to date of the relationship between flows and returns is the work of Froot, O'Connell and Seasholes (2001) who use proprietary data for flows from State Street Bank and Trust. One of the strengths of the State Street data is that they are available for a very large number of countries, and Froot *et al* include 44 countries in their study. However, the data are only a partial measure of the flows of foreign investors, since they relate only to the trades of one particular custodian. Further, the data from State Street are not for the actual trades of foreign investors but are based on contractual settlement dates. Froot *et al* use

data on settlement conventions in each country to infer the dates that trades actually occurred.[1]

The possible shortcomings of the State Street data suggest that it may be worthwhile to instead analyse precise daily data for the actual trades of all foreign investors. Accordingly, this paper provides new evidence on the determinants of foreign investment flows and the impact of foreign trading on domestic asset prices, using daily data over 1999–2002 on total foreign net inflows into six Asian equity markets. The markets comprise the Jakarta Stock Exchange, Korea Stock Exchange, Philippine Stock Exchange, Stock Exchange of Thailand, Taiwan Stock Exchange, and Kosdaq Stock Market. The sample size of six markets is large enough to provide results that are potentially fairly general, yet is small enough to allow more attention to market-specific data and modelling issues than might be possible in datasets with a larger number of markets. In addition, the use of daily data allows closer analysis of high-frequency relationships between flows and returns than is possible in previous studies using weekly, monthly or quarterly data (e.g., Bohn and Tesar 1996; Brennan and Cao 1997; Clark and Berko 1997; Karolyi 2002; Dahlquist and Robertsson 2004). And because the dataset includes the purchases of all foreign investors, it has broader coverage than datasets that cover only one group of investors – for example US investors in the numerous studies using the US Treasury data (e.g., Bekaert, Harvey and Lumsdaine 2002), or mutual funds (e.g., Borensztein and Gelos 2003) or customers of a particular custodian (Froot *et al* 2001).[2]

The use of precise data for the daily trading of all foreign investors allows the discovery of two new 'stylised facts' that have not been apparent in earlier work. First, foreigners' flows into several markets show strong positive-feedback trading with respect to *foreign* (especially US) returns, particularly in the two largest markets. Indeed, analysis using vector autoregressions (VARs) suggests that foreign returns on average explain a greater proportion of the variance of net

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[1] However, it is quite possible that this introduces errors, because the data used in the study appear to show trading on all weekdays, including on public holidays in each market, but appear not to show Saturday trading in those markets where trading occurred on Saturdays for some or all of the sample period.

[2] The study that is closest in design to this paper is a concurrent paper by Griffin, Nardari and Stulz (2003) that looks at the five main boards studied here (but not the Kosdaq), as well as the markets of India, Sri Lanka, South Africa and Slovenia.

inflows than domestic returns, suggesting that 'push' factors may be as important as, or more important than, 'pull' factors in explaining the dynamics of inflows into emerging markets. The paper considers possible explanations for these effects, and suggests it is unlikely to be due to portfolio-rebalancing effects or microstructure effects from differences in the use of limit orders by domestic and foreign investors. Instead, the importance of foreign and domestic returns in driving inflows is more likely because shocks to returns lead some foreign investors to revise their expectations about prospects for emerging markets. This would be consistent with the very strong finding that returns on US technology stocks are most important in explaining inflows into the technology-oriented Korean and Taiwanese markets, where these returns can be viewed as news about fundamentals. Alternatively, the explanation may be more behavioural, and based on the sentiment of foreign investors being affected by returns in both emerging markets and their home markets.

The second major result of the paper is the identification of a strong positive correlation between the net purchases of foreigners in a market and same-day returns in that market. VAR analysis provides some evidence that surprises in inflows have ongoing effects on prices beyond the day of the inflow, though most of this impact is complete within a few days. These results stand in marked contrast with the results of Froot *et al* (2001) that the contemporaneous price impact of the trades of foreigners is small, but that there is a substantial impact seen in the weeks and months following their trades. The paper discusses the question of what type of model can best explain why net purchases by foreigners tend to be associated with increases in stock prices. The most likely explanation would seem to be that the net purchases of foreigners represent substantial shocks to net investor demand in these markets. However, such a 'price pressure' explanation need not be entirely independent of an information explanation – foreign inflows are presumably not completely uninformed, but may be based on perceptions that valuations are cheap or that increased allocations to emerging markets offer other portfolio benefits. Although the estimated price impact of foreign inflows is substantially larger than previous estimates for emerging markets, it is in line with estimates of price impacts of order flow in the US market. Overall, the results of the paper suggest a much larger role for foreign investors and conditions in mature markets than has been suggested by previous work.

2.   Data

2.1   Basic Data

The six Asian markets studied in this paper are the Jakarta Stock Exchange (JSX), Korea Stock Exchange (KSE), Philippine Stock Exchange (PSE), Stock Exchange of Thailand (SET), Taiwan Stock Exchange (TWSE), and Kosdaq Stock Market.[3] The first five are 'main boards', while the sixth, which focuses on Korean start-up and technology-related companies, is a 'second board', but nonetheless has a larger market capitalisation than many main boards in other emerging markets. Data on daily net purchases were obtained from the exchanges and from CEIC and Bloomberg, two secondary providers.[4] Other data used in the study are taken from Bloomberg and include data for the capitalisation-weighted price index and market capitalisation of each local market, as well as data for various mature market equity price indices.

Foreign investors in these markets must register with the local exchange or regulator, and brokers must report the nationality of the buyer and seller in each transaction that occurs.[5] The resulting data capture the trading of all registered foreign investors. One possible shortcoming with the data is that they do not capture net purchases by foreigners of ADRs or country funds in foreign markets,

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[3]   Some other studies have also used data from these exchanges. For example, Choe, Kho, and Stulz (2004) have used the KSE data at the individual stock level, Seasholes (2001) has used the Taiwanese and Thai data, Bonser-Neal *et al* (2002) have used the Indonesian data, and Griffin, Nardari and Stulz (2003) have studied data for five of the exchanges, but not the Kosdaq.

[4]   Net purchases data from different sources were checked against each other, and numerous errors were corrected. A few potential outliers remained for Indonesia and Philippines, so eight observations (all cases of apparent very large net inflows) were omitted because they appeared to be data errors. In several of these cases, the observation coincided with a large privatisation sale, suggesting that large off-market privatisation transactions had somehow shown up in the trading data.

[5]   There was no general limit on foreign investment for four of the six markets (the KSE, Kosdaq, JSX, and PSE) during the period of the study. Taiwan saw a substantial relaxation of foreign ownership limits during the sample period, with the limit for each firm being increased from 30 to 50 per cent in March 1999, then to 75 per cent in October 2000, before its removal at the end of 2000. Thailand had a general limit of 49 per cent throughout the sample period. In addition, all markets had specific foreign ownership limits for a few particular firms or industries.

or equity futures trading in the domestic market. In the first two cases, the omission is unlikely to be serious, since trading in these is likely to be largely between foreigners, and is unlikely to result in substantial net purchases or sales by foreigners. The omission of futures (and other derivatives) trading might be more serious. Fortunately, daily data on the net purchases of foreigners are available for the Korea Stock Exchange's equity futures contract. Thus in one case the data capture essentially all changes in foreign investors' equity exposures.

The study uses data for January 1999 to September 2002, except for the Philippines which begins in March 1999. The sample corresponds fortuitously to the period after which trading on the two Korean exchanges switched (in December 1998) from six- to five-day trading.[6] Trading on all six markets is order-driven and fully computerised. To facilitate price discovery, all six markets have call auctions to determine opening and closing prices. The trading hours of the six exchanges all correspond to periods when US markets are closed.

Summary data for each market and the role of foreigners are provided in Table 1. The markets include two exchanges, the KSE and TWSE, which are among the largest of all emerging markets and are comparable in capitalisation to some mid-sized mature equity markets. Trading on these two markets is also highly active, with 2001 annual turnover ratios well above most mature markets (including the New York Stock Exchange's 2001 turnover ratio of 0.89). The Kosdaq market is even more active, with annual turnover equivalent to about ten times market capitalisation, making it the most active exchange in the world. Turnover ratios for the JSX, and especially the PSE, are quite low. The latter two exchanges are also those where there is least variation in the daily net purchases of foreign investors (normalised by dividing by the previous day's market capitalisation). In those cases where a comparison is feasible, the share of foreign investors in total trading is lower than their ownership share, suggesting that foreigners trade less actively than domestic investors. Moreover, with the development of institutional investors still at a relatively early stage in these markets, trading tends to be dominated by individual investors: the share of individual investors in total trading in 2001 was

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[6] However, Saturday trading continued in Taiwan in 1999 and 2000 on the first, third and fifth Saturdays of each month. On those 51 occasions when there was Saturday trading, the data for Saturday were merged into the following Monday, with Monday returns being measured relative to Friday close, and Saturday net inflows included in Monday's flows.

73 per cent on the KSE, 77 per cent in Thailand, 84 per cent in Taiwan, and an amazing 94 per cent on the Kosdaq.[7]

	Table 1: Summary Data on Six Asian Emerging Equity Markets					
	Market capitalisation, US$b	Annual turnover ratio	Per cent of trading by foreigners	Per cent foreign ownership share		Standard deviation of daily inflows
	End-2001	2001	1999–2001	End-1998	End-2001	1999–2002
Indonesia (JSX)	23	0.38	23.0	na	na	0.016
Korea (KSE)	193	2.32	10.5	na	36.6	0.050
Korea (Kosdaq)	39	9.85	1.1	3.4	10.4	0.033
Philippines (PSE)	43	0.07	29.8	na	na	0.012
Taiwan (TWSE)	292	2.08	3.7	7.4	13.4	0.032
Thailand (SET)	36	1.05	25.9	na	na	0.030

Notes: The turnover ratio is the sum of daily turnover divided by the previous day's market capitalisation. The share of foreign ownership and foreign trading are both in value terms. The last column shows the standard deviation of daily net purchases by foreigners (expressed in per cent of the previous day's market capitalisation) over the full sample period, January 1999–September 2002.

Sources: Bloomberg; CEIC; JSX; KSE; Kosdaq Stock Market; PSE; SET; TWSE

2.2   Descriptive Statistics for Net Purchases of Foreign Investors

Data on the properties of daily net inflows (or 'flows') are shown in Table 2. Here and subsequently, flows are expressed as a percentage of the previous day's market capitalisation. The data in the top panel show substantial positive autocorrelation in daily inflows, consistent with Froot *et al* (2001), with a median autocorrelation of 0.47. Daily returns in these markets are far less autocorrelated, with a median autocorrelation of 0.09. This positive autocorrelation in flows could be due to particular investors establishing positions slowly (perhaps to reduce market

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[7]   Data on the average size of individual trades of foreigners were not available, although data on the trades of foreign investors in Froot *et al* (2001) indicate an average trade size of about $200 000. This suggests that foreign investors are indeed 'big fish' in these markets even if they trade less actively than domestic investors.

impact), or to investors of similar types responding in the same direction – but with different speeds – to new information. In those four markets where net purchases data are available separately for domestic institutions and individuals, the net flows of these groups are not surprisingly also highly autocorrelated.

Table 2: Descriptive Data for Net Purchases of Different Investor Groups

	Foreigners	Institutions	Individuals			
First-order autocorrelations in daily net purchases						
Indonesia (JSX)	0.54	na	na			
Korea (KSE)	0.43	0.17	0.34			
Korea (Kosdaq)	0.35	0.23	0.29			
Philippines (PSE)	0.48	na	na			
Taiwan (TWSE)	0.46	0.32	0.42			
Thailand (SET)	0.43	0.31	0.42			
Correlation between net purchases and same-day returns within each market						
Indonesia (JSX)	0.37	na	na			
Korea (KSE)	0.39	0.11	−0.44			
Korea (Kosdaq)	0.16	−0.06	−0.04			
Philippines (PSE)	0.31	na	na			
Taiwan (TWSE)	0.34	0.57	−0.52			
Thailand (SET)	0.32	0.11	−0.36			
Correlations between daily foreign inflows into different markets						
	JSX	KSE	Kosdaq	PSE	SET	TWSE
Indonesia (JSX)	na	0.07	−0.11	0.18	0.17	0.02
Korea (KSE)	0.07	na	0.34	0.09	0.24	0.47
Korea (Kosdaq)	−0.11	0.34	na	−0.09	0.12	0.28
Philippines (PSE)	0.18	0.09	−0.09	na	0.28	0.09
Taiwan (TWSE)	0.17	0.24	0.12	0.28	na	0.24
Thailand (SET)	0.02	0.47	0.28	0.09	0.24	na

Notes: Data are for 1999–2002, with net purchases expressed in terms of per cent of the previous day's market capitalisation. The 2.5 per cent critical values for the correlation coefficients are approximately ±0.08.

Within each market, there is a strong positive same-day correlation between net foreign inflows and returns, with a median correlation coefficient of 0.33 (middle panel). By contrast, the net purchases of domestic individuals are strongly negatively correlated with returns, while the pattern is more mixed for domestic institutions, with median correlations of –0.40 and 0.11, respectively. In most cases there is also strong positive correlation between net inflows across different exchanges (bottom panel), although it is not as strong as the cross-exchange correlations in returns, with median correlation coefficients of 0.17 and 0.22, respectively. The positive correlations in net inflows suggest that there are common or related factors influencing flows, as will be confirmed in Section 3.2.

Finally, some preliminary data for the relationship between physical and futures trading on the KSE are shown in Table 3. In contrast to the results in Table 2, the data show significant *negative* first-order autocorrelation in the net purchases of foreigners in the Kospi 200 contract on the KSE futures market. Somewhat surprisingly, there is only weak positive correlation between net purchases in the physical market and same-day net purchases on the futures market. However, there is a strongly significant positive correlation between net purchases in the physical market and previous-day net purchases on the futures market. Together, these correlations are highly suggestive of a pattern whereby some foreign investors wishing to effect a change in their exposure do so by first taking a short-term position in the futures market, and then unwinding the futures market position on the next day as they carry out the desired change in their longer-term position in the physical market. Foreign investors trading on the futures market is significant; the standard deviation of daily futures market net purchases is 0.044 per cent of market capitalisation, only modestly smaller than the equivalent figure for the physical market. Accordingly, and given the different trading behaviour in the two markets, it follows that concentrating only on physical market transactions in this market may give an incomplete picture of the timing and impact of foreign investors' trading. To conserve space, the results presented in the remainder of the paper for the KSE are based on the sum of the net purchases of each investor group on both the physical and futures markets, although results for the physical market alone are discussed at a few points, and are available upon request.

Table 3: Relationship between Physical and Futures Market Trading

First-order autocorrelations in daily net purchases of foreign investors

KSE (physical) equity market	0.43
KSE futures market	−0.27
Total	0.21

Correlations between daily net purchases on the physical and futures markets

Physical (t), futures (t)	0.06
Physical (t), futures (t–1)	−0.19
Physical (t), futures (t+1)	0.00

Note: Data are from the KSE for 1999–2002, with net purchases expressed in terms of per cent of the previous day's physical market capitalisation.

3. How Are the Net Purchases of Foreign Investors Related to Prior Returns?

3.1 Introduction

Daily data allow a very precise analysis of the short-term determinants of net investor demand. In particular, if net purchases by foreigners (or any other group of investors) respond systematically to recent returns, daily data should be able to capture these linkages. The most comprehensive work to date in this area is by Froot *et al* (2001) who find strong evidence that flows into a market are positively correlated with lagged returns in that market. They suggest that this positive-feedback trading may be evidence that some foreign investors use returns to extract information about future returns.

However, as is discussed in Section 3.2, it is also plausible that flows into a market could be driven by returns in other markets, so that the Froot *et al* bivariate empirical model might be too restrictive. Indeed, given that returns in different markets are positively correlated, there is a possibility that the significance of lagged domestic returns may actually be proxying for the effect of lagged returns in foreign markets. Hence, the strategy in this section will be to confront the flows data with a group of returns series, and find which of these series can best explain flows. VAR systems including foreign returns are then estimated to get a more complete picture of the dynamics of the impact of returns on flows.

3.2   Regression Analysis of the Effect of Returns on Inflows

This section begins by proposing several different types of returns that might plausibly influence the net inflows of foreigners into Asian emerging equity markets. The possible explanators of inflows include:

Returns in the domestic market: Models such as Brennan and Cao (1997) suggest that if foreigners have an informational disadvantage in emerging markets, they may use recent returns as an input in forming their expectations about future returns. Hence, net inflows may be partly explained by lagged domestic returns. In each case, domestic returns are proxied by the capitalisation-weighted index for the total market, in local currency.[8]

Returns in major mature markets: Investors in large mature markets might increase their allocations to emerging markets following increases in their home markets, due to portfolio rebalancing effects. For example, Stulz (1999) notes that it may be perfectly rational for US investors to invest more in emerging markets when their wealth increases, and Griffin, Nardari and Stulz (2003) propose a model that contains such an effect. Alternatively, returns in mature markets might influence flows because investors extract information from global returns about prospects for emerging markets. Finally, a response of flows to returns in global markets may be more behavioural, and based more on sentiment than rational information extraction. These possibilities are tested by the inclusion of daily returns on broad portfolios of US stocks (the S&P 500 index) and stocks in all mature markets (the MSCI World index), both expressed in US dollars.

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[8] These indices are also the 'headline' indices used in newswire stories reporting the performance of each market, and are available to investors on a real-time basis, unlike some of the (narrower) indices provided by international providers such as MSCI and S&P/IFC. The analysis uses domestic currency returns, but the results are little changed using US dollar returns.

Returns in all emerging markets: Much investment in emerging markets occurs not via managers with a global mandate but rather via specialist managers investing only in emerging markets.[9] Hence if portfolio rebalancing effects are important, the relevant return might not be a global *mature* markets return, but rather the return on a basket of *emerging* market equities. Accordingly, the return on a broad emerging markets index (the MSCI Emerging Markets Free index) is also included as a possible explanator.

Returns on US technology stocks: Several markets in Asia are highly dependent on the global technology sector. For example, Taiwan and Korea are the homes of companies (Taiwan Semiconductor and Samsung Electronics) that are – by many measures – the world's two largest semiconductor companies.[10] Hence, news about technology stocks in global markets represents news about 'fundamentals' that might influence the flows of foreigners. Accordingly, the return on the technology-intensive Nasdaq Composite Index is included as a potential determinant of flows, along with the Philadelphia Semiconductor Index, which includes the stock prices of around 16 semiconductor stocks traded in US markets and is closely watched in some Asian markets.[11]

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[9] For example, although it may under-represent global fund managers, the sample of emerging market equities used by Borensztein and Gelos (2003) included $71 billion of assets managed by dedicated emerging markets managers at end 2000, versus only $12 billion by non-dedicated managers.

[10] As of late 2002, the weights of these two companies in their national indices were 18 and 20 per cent, respectively. The total weight of the technology sector in the Taiwan and Kosdaq markets was around 60 per cent.

[11] These technology-related indices were the only industry returns investigated; the strong significance of these indices is not the out-turn of a larger search using other industry series. The inclusion of these indices seems easily justified based either on the importance of computer-related sectors for several markets in Asia, or the observation that the defining industry effect in global equity over 1999–2002 was the Nasdaq/technology effect. It is noteworthy that the stocks in the Philadelphia Semiconductor Index represent a very small proportion of the total US market, so the finding that this index is often substantially more significant in regressions than the S&P 500 index is strongly suggestive of its significance being due to its industry-level information rather than to it being a proxy for overall US equity returns.

The basic empirical model regresses the net purchases of foreign investors (as a percentage of total market capitalisation) in market i ($f_{i,t}$) upon lagged net inflows, contemporaneous own-market (or domestic) returns ($r_{i,t}$), and also on various lagged returns series (x_t):

$$f_{i,t} = a_{i0} + a_{i1}f_{i,t-1} + \dots + a_{i5}f_{i,t-5} + a_{i6}r_{i,t} + a_{i7}x_{t-1} + \dots + a_{i11}x_{t-5} + \varepsilon_{it} \qquad (1)$$

Returns are measured as the daily, log-differenced change in the relevant price index. The lag length is set at five, based on preliminary regressions and tests (discussed below) using the final full VAR systems.[12]

Contemporaneous domestic returns are included for the following reason. As is seen in Table 2, contemporaneous flows and returns are strongly correlated in every market. But returns in each domestic market on day t are strongly influenced by the prior overnight (day $t-1$) US return. If the day t domestic return is not included in the flows equation, there is a risk that day $t-1$ US returns will be found to be a significant explanator of flows, but that this might be spurious because it is picking up the omitted day t correlation between flows and domestic returns. To avoid the possibility of any such spurious correlation, but without any implications for causation, contemporaneous returns are included as a control variable in the flows equation.

The process of model selection based on Equation (1) is summarised in Table 4. For reference, the top panel first provides the adjusted R^2 from equations with only lagged flows, and lagged flows plus contemporaneous domestic returns. The middle panel then presents the adjusted R^2 for the equations that separately include five lags of each of the return variables, and the p-values for the hypothesis that the particular return series can be excluded. The bottom panel shows the results of

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[12] The use of daily data with five lags means that market-specific holidays would result in the loss of many observations due to missing values. Rather than assuming unchanged price levels when markets are closed, I deal with the problem as follows. I omit any day when there is no trading in the market that is the subject of the regression and calculate the price change from the last time the market was open. I also omit any observation when the US market was closed on day $t-1$ and aggregate the daily net inflows in cases where the domestic market has traded while the US market was closed. Thus, each observation in the VARs corresponds to the minimum period necessary to get synchronised close-to-close data for both the US and domestic market.

testing for the statistical significance of additional returns series, after controlling for the correlation with the returns series that was the most significant series in the middle panel. The results suggest that domestic returns influence flows in five of the six markets.[13] However, in four of the six cases, foreign returns are also significant explanators of flows, in some cases providing a very dramatic increase in explanatory power compared with equations including only domestic returns. In three of the four cases, the most significant foreign return is a US technology index. Overall, the regressions summarised in this table suggest that the high-frequency net purchases of foreign investors can be surprisingly well explained by just a few variables: the regressions including lagged domestic and foreign returns variables show a median adjusted R^2 of 0.38. The substantial explanatory power of these equations stands in contrast to the finding of Brennan and Cao (1997) that equations for quarterly flows (of US investors) could explain only a small proportion of the variance.

The evidence that foreign inflows can be quite well explained by simple regressions such as these can be viewed as evidence that foreign investors tend to respond in a similar way to price movements or the information that drives those movements. This similarity in trading patterns could be interpreted as a form of herding by those investors, even if it is unconscious. It suggests therefore that evidence of herding by foreign investors in other work might be at least partly due to a common response to price movements or other types of 'fundamental' information, rather than any deliberate attempt to trade in similar ways to other foreign investors.

Another important point from the regressions is that in almost every case the sum of the coefficients on lagged returns is positive, indicating that higher returns lead to higher inflows. The significance of some of the individual coefficients is striking (detailed results for the VARs are available from the author). For example, the overnight return on US equities has a t-statistic of over 5 for the Kosdaq, KSE, and Thai markets, and over 15 in the case of the TWSE. And the first lag of domestic

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[13] The exception is the KSE, where domestic returns are not significant when added to a regression for total (physical and futures) net purchases that already includes foreign returns: this finding reflects a positive significant impact of domestic returns on physical market inflows being offset by a negative impact on futures market net purchases.

returns is often also highly significant, with *t*-statistics of over 12 for Thailand, and averaging around 5 for the JSX, Kosdaq and TWSE.

Table 4: Testing for the Significance of Lagged Domestic and Foreign Returns in Explaining Net Inflows

	JSX	KSE	Kosdaq	PSE	SET	TWSE
Adjusted R^2 from equations with no lagged returns						
With only lagged flows	0.304	0.048	0.167	0.286	0.196	0.227
With lagged flows and day *t* returns	0.397	0.296	0.177	0.360	0.263	0.305
Adjusted R^2 from adding lagged returns series (with p-value in parentheses)						
Domestic returns	0.410	0.295	0.228	0.369	0.377	0.335
	(0.000)	(0.657)	(0.000)	(0.007)	(0.000)	(0.000)
S&P 500 returns	0.399	0.334	0.205	0.357	0.284	0.426
	(0.205)	(0.000)	(0.000)	(0.969)	(0.000)	(0.000)
Nasdaq return	0.396	0.342	0.212	0.357	0.282	0.465
	(0.743)	(0.000)	(0.000)	(0.971)	(0.000)	(0.000)
Philadelphia Semiconductor index return	0.397	0.357	0.211	0.358	0.280	0.454
	(0.416)	(0.000)	(0.000)	(0.828)	(0.000)	(0.000)
MSCI world index return	0.397	0.330	0.210	0.359	0.290	0.430
	(0.388)	(0.000)	(0.000)	(0.628)	(0.000)	(0.000)
MSCI emerging markets return	0.401	0.307	0.217	0.364	0.281	0.380
	(0.106)	(0.000)	(0.000)	(0.099)	(0.000)	(0.000)
Adjusted R^2 from equation including the most significant lagged returns series from the middle panel, then adding additional lagged return series (with p-value in parentheses)						
Domestic returns	na	0.359	na	na	na	0.480
	…	(0.139)	…	…	…	(0.000)
S&P 500 returns	0.409	0.366	0.246	0.365	0.396	0.464
	(0.599)	(0.003)	(0.000)	(0.989)	(0.000)	(0.669)
Nasdaq return	0.407	0.357	0.253	0.366	0.396	na
	(0.943)	(0.417)	(0.000)	(0.900)	(0.000)	…
Philadelphia Semiconductor index return	0.408	na	0.253	0.366	0.394	0.475
	(0.700)	…	(0.000)	(0.890)	(0.000)	(0.001)
MSCI world index return	0.408	0.367	0.250	0.367	0.398	0.468
	(0.783)	(0.003)	(0.000)	(0.778)	(0.000)	(0.076)
MSCI emerging markets return	0.410	0.364	0.242	0.370	0.376	0.473
	(0.312)	(0.011)	(0.001)	(0.194)	(0.582)	(0.003)
Number of observations	880	882	882	851	886	879

Notes: This table shows the results of regressions to determine the variables that best explain the daily net inflows of foreign investors (expressed as a per cent of the previous day's market capitalisation) in the six equity markets over 1999–2002. The top panel shows the adjusted R^2 from a regression with only a constant and five lags of net inflows, and an equation that also includes the contemporaneous return in the market. The middle panel shows the adjusted R^2 from separately adding five lags of the returns series. The *p*-values are for the hypothesis that the particular lagged returns series can be excluded. The bottom panel shows the adjusted R^2 for equations that include the most significant lagged returns series from the middle panel, and also separately includes five lags of the other returns series. The *p*-values in this panel test the hypothesis that these additional returns series do not add explanatory power relative to an equation including the most significant return series from the middle panel.

3.3   VAR Analysis of the Effect of Returns on Inflows

Based on the results in Table 4, results are now presented from VAR equations for flows and returns. VARs have been used by Froot *et al* (2001), Karolyi (2002), Dahlquist and Robertsson (2004), and others to examine the correlation between inflows and returns in other contexts. The results presented here go beyond the bivariate VARs used in Froot *et al* with flows and domestic returns. In particular, the analysis also includes US returns, since the above results for four of the six markets would suggest the inclusion of US returns as a determinant of flows. There is a strong case for including US returns in the domestic returns equation, where they may also have an indirect effect on flows.

In setting up the VAR, the considerations discussed above suggest treating the global trading day as notionally beginning with day t–1 US (and European) trading, and then continuing into day t Asian trading. Hence, the VAR that is estimated is as follows:

$$y_{i,t} = A_{i0} + A_{i1}y_{i,t-1} + \ldots + A_{i5}y_{i,t-5} + \varepsilon_{it} \tag{2}$$

where:

$$y_{i,t} = \begin{pmatrix} r_{us,t-1} \\ f_{i,t} \\ r_{i,t} \end{pmatrix} \tag{3}$$

and $r_{us,t-1}$ is the relevant US return on day t–1, $f_{i,t}$ is the net purchases (or flows) of foreigners in market i on day t, and $r_{i,t}$ is the return on market i on day t.

The Akaike and Schwartz-Bayes criteria were used to investigate the appropriate lag length. The former suggests lag lengths of two (TWSE, JCI), three (KSE, SET), four (Kosdaq), or five (PSE), whereas the latter suggests a lag length of one in every case. Since degrees of freedom are not a constraint, a common lag length of five lags was adopted for all six markets. This lag length is far shorter than the 40 lags used by Froot *et al*. However the shorter lags found here are consistent with the work of Griffin, Nardari and Stulz (2003) and would seem plausible given

that the decay in autocorrelations in flows is fairly rapid and smooth, and that market efficiency (if it holds) would suggest that returns should respond immediately to innovations in flows.

With only five lags on each variable, the degrees-of-freedom concerns that may have prompted Froot *et al* to restrict parameters to be equal across all countries are not relevant. Accordingly, given the earlier clear evidence for different empirical models for different markets, empirical models are estimated for each market separately. For the two Korean markets, the Philadelphia Semiconductor Index is the most significant foreign returns series and is included as the US index, while the Nasdaq index is included for Taiwan. For the Thai market there is little to distinguish between several foreign indices, so a broad US index, the S&P 500, is included; the S&P 500 return is also included for Indonesia and the Philippines. To conserve space, the estimated equations for the VARs are not shown, but are available on request.

The impulse response analysis and variance decompositions presented below use the Choleski decomposition or 'identification by ordering' to define the channels of contemporaneous causality. Returns in the US market on day t–1 are assumed to be able to affect both day t net flows and day t returns in the markets studied in this paper, with no reverse effect. This assumption makes sense from strict temporal considerations (and the more general observation that most global price determination seems to originate in US markets rather than in these Asian emerging markets). Within the domestic market, the contemporaneous causality is assumed to run from net inflows to prices, but not vice versa within the same day. This assumption is standard in the empirical literature using actual trade-by-trade data, starting with Hasbrouck (1991), and it is also the same assumption made in the papers cited earlier in this section.

The first impulse responses studied are the response of net inflows to innovations in returns. The impacts of one percentage point innovations in US and domestic returns are shown in Figures 1 and 2 over a 20-day period. The scale corresponds to the cumulative net inflows in basis points (i.e., hundredths of a percentage point) of market capitalisation that would result from a one percentage point innovation in returns. In five out of six markets, the cumulative response of net inflows to an innovation in *US* returns is positive and significant, and in the sixth case (the

Philippines) the point estimate is also positive, though insignificant. Hence US returns have a significant effect on flows into emerging markets, even in one case (Indonesia) where they did not appear to have a significant direct effect in the flows equation.
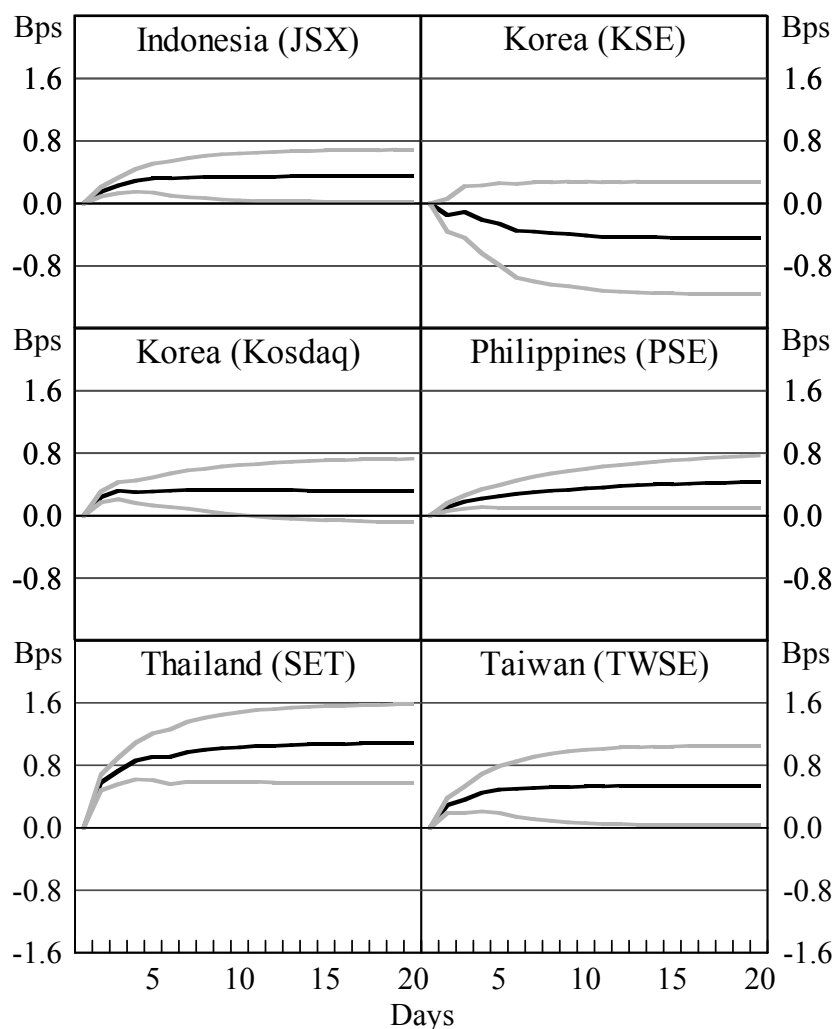
Figure 1: Cumulative VAR Impulse Responses of Net Inflows to Innovations in US Returns

In basis points of market capitalisation
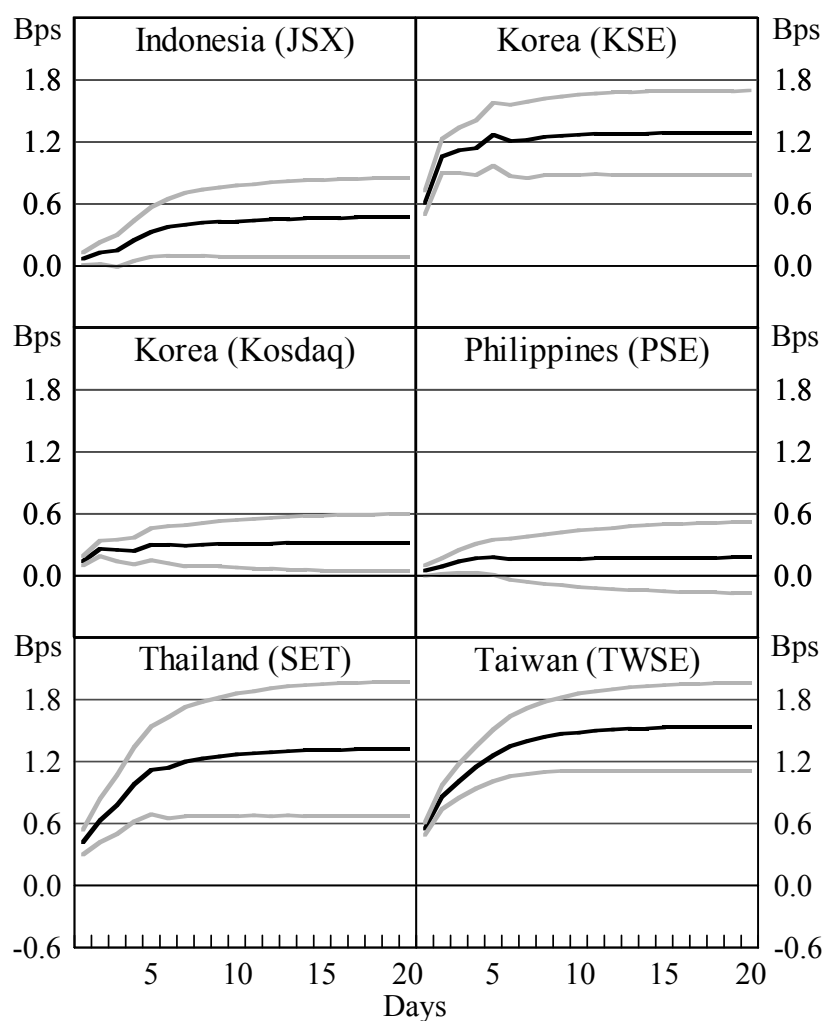
Notes: This figure shows the cumulative response of net inflows (in basis points of market capitalisation) to an innovation of one percentage point in US equity returns. The estimates are obtained from 3-variable VAR systems, which are described in Section 3.3 and estimated using daily data over 1999–2002. The grey lines are 90 per cent confidence intervals based on asymptotic standard errors.

Figure 2: Cumulative VAR Impulse Responses of Net Inflows to Innovations in Domestic Returns

In basis points of market capitalisation

Notes: This figure shows the cumulative response of net inflows (in basis points of market capitalisation) to an innovation of one percentage point in domestic equity returns. The estimates are obtained from 3-variable VAR systems, which are described in Section 3.3 and estimated using daily data over 1999–2002. The grey lines are 90 per cent confidence intervals based on asymptotic standard errors.

The response of net inflows to an innovation in *domestic* returns is positive and significant in four of the six cases. The exceptions are the two Korean markets. In the case of the Kosdaq, the response is positive but only borderline significant, while the response in flows into the KSE is negative, although insignificant. The results also suggest that innovations to US returns typically have larger effects than equivalent innovations in domestic returns. The median effect of a one percentage point innovation in US returns is a cumulative increase in inflows equivalent to

0.88 basis points of market capitalisation, versus a median effect of 0.39 basis points of market capitalisation for a similar innovation in domestic returns.

An alternative way to assess the relative impact of domestic and foreign returns is via variance decompositions of the VAR systems. In results available upon request, the proportion of the variance in net inflows that is explained after 20 days by earlier innovations in the three variables in the VAR system is examined. Not surprisingly, most of the variance in net inflows is due to lagged own innovations. However, the remaining variance in flows can be decomposed to see whether domestic or US returns are more important. In three cases (Indonesia, the Philippines and Thailand), domestic returns are more important than foreign returns. For the three other markets, foreign returns appear more important, dramatically so in the case of the KSE and the Taiwanese market. Taking the median for the six markets, foreign returns account for about 6.1 per cent of the variance in net inflows, nearly twice as much as the 3.3 per cent figure for domestic returns.

Based on these estimates, one might conclude that conditions in mature markets (push factors) on average affect flows more than conditions in domestic markets (pull factors), at least so far as these can be captured by returns variables. The influence of foreign returns is via two channels: via direct effects on flows, and indirectly via their effect on domestic returns which then affect flows. The relationship between inflows and prior US returns is reminiscent of the argument by Calvo, Leiderman and Reinhart (1993) and others that flows to emerging markets are substantially driven by conditions in mature markets. However, the current finding is somewhat different to the channel proposed by Calvo *et al* in which flows to emerging markets were driven by low interest rates in mature market countries.
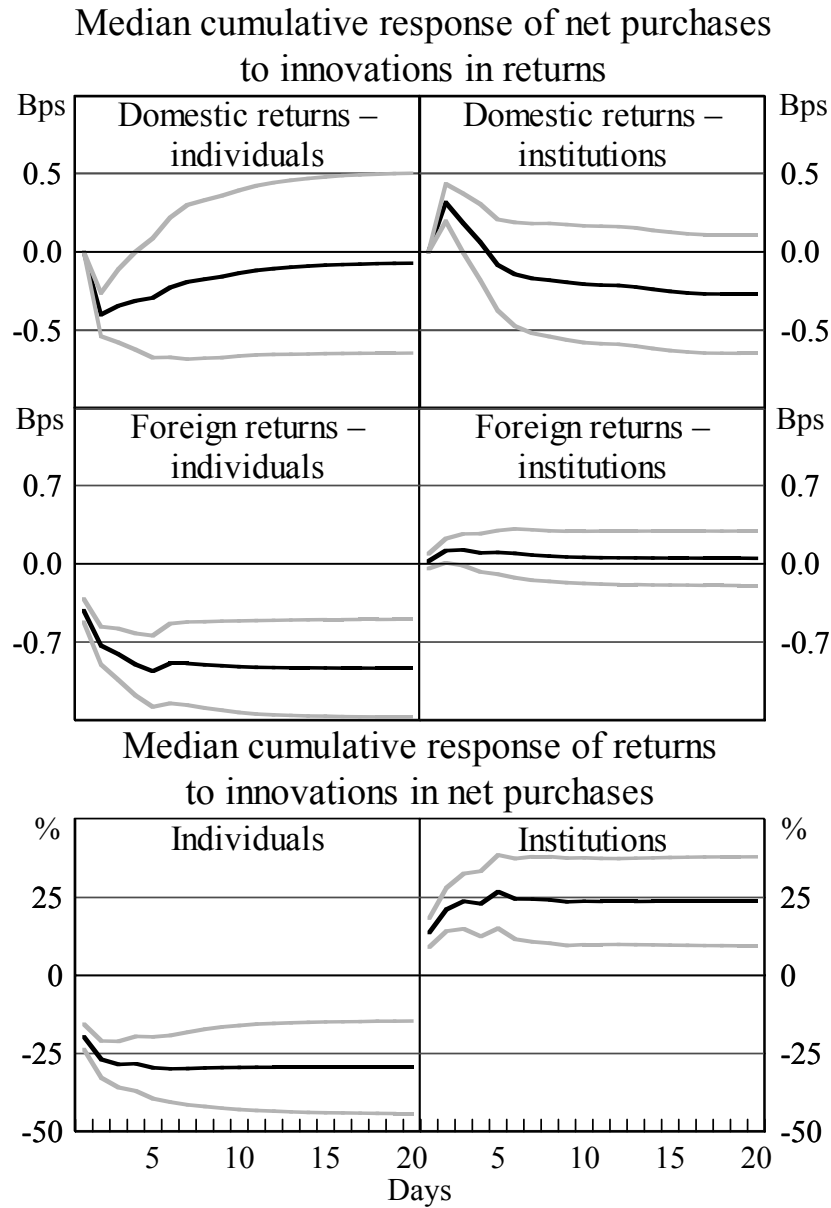
3.4   The Trading Behaviour of Domestic Investors

Of course, foreigners are not the only participants in these equity markets, and if foreigners typically are buyers in particular circumstances then it follows that domestic investors in aggregate must be sellers in response to the same circumstances. In this section, there is an examination of the four markets (the KSE, Kosdaq, TWSE and SET) where there are data on the trading of subgroups of

domestic investors, to see if the different types of domestic investors behave similarly, or if there is one particular group that tends to be on the other side of the trades involving foreign investors. For simplicity, the focus is on individual investors and institutional investors (defined as all other domestic investors) rather than on more detailed categorisations where they are available.

Figure 3 presents a summary of the impulse response functions from VARs similar to those estimated in Section 3.3, except that the net purchases of foreigners are replaced separately by the net purchases of domestic individuals and institutions. To conserve space, only the median estimate for the four markets is shown, along with confidence intervals based on the median standard errors. In the case of the response of net purchases to US returns, the top panel suggests little response from domestic institutions. By contrast, domestic individuals tend to be net sellers following positive shocks to US returns, with three out of the four markets showing a strongly statistically significant response. The pattern and magnitude of this cumulative impulse response is reasonably close to the opposite of the response of foreigners. In the case of innovations in domestic returns, the evidence is less clear. In the first few days following the shock to domestic returns, the median response suggests that individuals are net sellers and institutions are net buyers, but over a longer horizon the cumulative flows of both groups tend to be negative, albeit not always statistically significantly so.

These results suggest that it is individual investors who as a group tend to be more often on the other side of the trading of foreign investors. This is not surprising given the adding-up constraint and the fact that individual investors account for the largest share of trading in all markets. In every case where the cumulative response of individuals' flows is significant, the coefficient is negative, indicating that their trading pattern can be characterised as contrarian with respect to recent returns. The results for institutional investors are less clear, and indeed the VAR equations for their net purchases show a substantially lower degree of explanatory power than for the other two groups. This may reflect the more heterogeneous nature of this group, which includes both institutions such as dealers trading on their own behalf, and others such as investment trusts (equivalent to mutual funds) whose trading flows may largely reflect the investment decisions of individuals.

Figure 3: VAR Impulse Responses for Net Purchases of Domestic Investors

Median cumulative response of net purchases
to innovations in returns

Median cumulative response of returns
to innovations in net purchases

Notes: This figure shows the cumulative impulse responses for 3-variable VAR systems, which are described further in Sections 3.3, 3.4 and 4.4, and estimated using daily data over 1999–2002. The variables in the VARs are the prior overnight return in the US market, net purchases of either domestic individuals or domestic institutions, and the return on the domestic market. The top panel shows the cumulative response of net purchases (in basis points of market capitalisation) of the two investor groups to innovations of one percentage point in US and domestic equity returns. The bottom panel shows the cumulative response of domestic returns to innovations in net purchases equivalent to 1 per cent of market capitalisation. To conserve space, the panels show the median responses for four markets (the KSE, Kosdaq Stock Market, SET and TWSE). The grey lines are 90 per cent confidence intervals based on the median value of the asymptotic standard errors.

The results above for foreign and domestic investors appear reasonably consistent with research into other markets. For example, Grinblatt and Keloharju (2000) find that foreign investors and sophisticated domestic institutional investors tend to be momentum investors in the Finnish market, whereas households and less sophisticated institutions tend to be contrarians. For Australia, Jackson (2003) has shown that individual investor flows demonstrate negative feedback trading with respect to recent returns. And in the US market, Griffin, Harris and Topaloglu (2003) have found that institutions tend to be net buyers of Nasdaq stocks that rose the previous day and that individuals tend to be net sellers of these stocks.

3.5   Why Are Foreign Investors Positive-feedback Traders?

The findings above raise the question of why foreign investors in these markets are positive-feedback investors with respect to domestic and foreign returns. One possibility is that it is largely a microstructure effect related to differences in order submission strategies. It is indeed possible to imagine a model where the positive-feedback trading of foreigners with respect to *foreign* returns was entirely unconscious and a product of the order submission strategies of households.[14] However, it seems unlikely that all the observed positive-feedback trading of foreigners is unconscious, and Linnainmaa (2003) concludes in related work using Finnish data that the momentum trading of foreigners and institutions in Finland is indeed 'intended'. In addition, such unintended order-submission effects could not explain why foreigners appear to be positive-feedback traders with respect to the previous day's return in the *domestic* market.

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[14] Suppose that each morning, one group of investors (i.e., foreigners) assessed the implications of overnight US returns for domestic prices, and stood ready to buy (sell) at prices just below (above) the new equilibrium price. If another group of traders (i.e., individuals) placed only limit orders and did not actively monitor them, we would see the first group transacting with the second group whenever there were overnight US price changes that implied an increase in domestic stock prices and thereby activated the limit orders of the second group. In this case, the first (second) group would appear to behave as positive-feedback (contrarian) traders with respect to returns in other markets, although in neither case would this really be a conscious strategy. The result would be that foreigners' flows into these markets would represent part of the adjustment of domestic prices to global equity market developments. This is perhaps consistent with the finding of Evans and Lyons (2003) that order flow in the foreign exchange market represents part of the process of price adjustment following macroeconomic news.

A second possible explanation for the feedback trading with respect to *foreign* returns would be the portfolio rebalancing model proposed by Griffin, Nardari and Stulz (2003). The stylised model of those authors assumes that the stock markets of the home (mature) market and host (emerging) market are uncorrelated, so that shocks to returns in mature markets are shocks relative to the emerging market, and change the portfolio weights of both foreign and domestic investors. These changes in portfolio shares (plus the assumption of home bias) bring forth portfolio flows following price changes in mature markets. However, in reality, prices in virtually all emerging markets appear to move immediately following price shocks in major mature markets, with some responding approximately one-for-one. This would imply that on average there is no change in investors' portfolio weights, so it would be hard to see how a portfolio rebalancing model can explain the response of flows to foreign returns.[15] More generally, the type of calculated portfolio rebalancing implicit in the Griffin, Nardari and Stulz model seems more likely to occur in annual portfolio reviews rather than on a day-by-day basis. This is especially likely given that much investment in emerging markets is via mandates to managers that only invest in these markets, and in these instances it is unrealistic that funds could be shifted so quickly from a manager with a US or mature markets mandate to a specialist emerging markets manager.

It is also noteworthy that in those cases where foreign returns are significant explanators of flows, the most significant foreign returns – by a very strong margin in the two largest markets – are often technology-based indices rather than the broad indices that might be most relevant to the wealth of foreign investors. Given that the Taiwanese market and two Korean markets are heavily weighted in technology stocks (and their broader economies are dependent on the technology cycle) the significance of the US technology indices seems more consistent with a third explanation for the positive-feedback trading of foreigners, namely a story of extraction of information about fundamentals. An information extraction or

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[15] Indeed, in regressions available upon request, I estimate a simple regression for each of the six Asian markets which suggests that returns in four markets (the KSE, Kosdaq, TWSE and SET) typically moved about one-for-one (or more) with movements in mature markets in this sample period. By contrast, the two other markets (Indonesia and the Philippines) moved less than one-for-one. A portfolio rebalancing model would predict that increases in foreign returns should lead to net inflows into the latter group of markets, but should not lead to inflows into the first four markets. However, this is broadly the opposite of what is observed in Figure 1 and Table 4.

extrapolative expectations explanation is presumably also the prime candidate for explaining the importance of lagged *domestic* returns in explaining the inflows of foreigners. Information asymmetry models (e.g., Brennan and Cao 1997) would suggest foreigners might rationally derive information about future domestic returns from lagged returns. Whether this is entirely rational or based more on sentiment is, of course, impossible to assess. Indeed, the line between a rational information-extraction or extrapolative expectations explanation and a behavioural or sentiment model is presumably a fine one, and some authors (e.g., Brown *et al* 2003) have suggested that investor flow variables can be viewed as measures of investor sentiment.

4.   How Do Net Inflows Affect Domestic Equity Prices?

4.1   Introduction

The second major issue studied in this paper is the relationship between the net inflows of foreign investors and contemporaneous and future returns. Froot *et al* (2001) suggest that correlation between flows and future returns (or returns and lagged flows) accounts for a much greater proportion of the longer-run covariance between flows and returns than the contemporaneous impact. Indeed, the impulse response analysis in Froot *et al* suggests that there is essentially no contemporaneous price movement associated with trading of foreigners, but that prices rise (fall) in the 60 days following their purchases (sales), and that it takes about 15 days for half of the price impact to be observed. The authors note that one possible explanation for the extremely protracted impact of flows on prices is that foreigners have informational advantages in these markets. However, their result has two important implications that are worthy of further study. First, the lack of a contemporaneous impact implies that foreigners are able to transact in emerging markets with essentially no price impact. Second, the result that prices rise in the weeks and months following the purchases of foreigners is suggestive of a fairly strong type of inefficiency in these markets, since returns could be predicted by lagged information. Accordingly, this section investigates the relationship between net inflows and contemporaneous and future returns using data that capture the flows of all foreign investors.

The analysis of the possible price impacts of inflows begins with the calculation of average returns with the sample divided into days when foreigners' net purchases are positive or negative. The results are shown in the top panel of Table 5. There are sharp differences in average returns, with median average returns of 0.33 per cent (117 per cent annualised) on days with inflows and returns of –0.44 per cent (–65 per cent annualised) on days with outflows. Part of this difference is due to the fact that foreigners tend to be buyers following increases in US markets, and the markets studied here also tend to rise the day after US market increases. Accordingly, 'abnormal' returns are calculated for each market by controlling for returns in the US market on the previous night, and for same-day returns in Japan, Hong Kong and Singapore. The differences between abnormal returns on days with inflows and outflows remain strongly statistically significant, except in the case of the Kosdaq. The median estimate is that average abnormal returns are 0.27 per cent on days with net inflows and –0.26 per cent on days with net outflows, a remarkable difference of 0.53 per cent, and clear evidence against the proposition that there is no contemporaneous price impact associated with the trading of foreign investors.

4.2 Regression Estimates of the Price Impact of Daily Net Inflows

Further analysis of the price changes that are associated with the net purchases of foreigners is based on a simple bivariate regression of domestic returns on net inflows. Consistent with the data in Table 2, the results in the second panel of Table 5 indicate an extremely strong contemporaneous correlation between flows and returns, with a median *t*-statistic of around 10. The strength of the linkage will henceforth be described in terms of the price increase that would be associated with net inflows equivalent to one per cent of market capitalisation (although daily flows are always far smaller than this). In the current case, the median regression coefficient implies that flows equivalent to one per cent of market capitalisation would be associated with a contemporaneous price increase of around 21 per cent.

In the third panel, global or regional returns are included as control variables so as to account for the movement in the local equity market that presumably would have occurred regardless of the particular portfolio decisions taken by foreign (and

domestic) investors.[16] These variables include the previous overnight return on three US indices (the S&P 500, the Nasdaq Composite, and Philadelphia Semiconductor Index) and the same-day return on three Asian mature markets (Tokyo, Singapore and Hong Kong). The adjusted R^2 statistics of the equations rise substantially following the inclusion of these control variables, with a median increase of nearly 0.15. In addition, the coefficients on net inflows are invariably smaller when these control variables are added to the regressions; the median parameter estimate falls by about 30 per cent, suggesting that omitted variables may be a problem in simple bivariate regressions of returns and flows. However, flows remain a highly significant explanator of returns in all cases.

To the extent that flows are somewhat predictable, it might only be the surprise or unexpected component of flows that affects prices, with the expected component having little or no effect (Warther 1995). To test this, a series for 'expected' foreign flows on day t was constructed based on the flow regressions in the VAR systems, using only variables pre-determined at the end of domestic trading on day t–1, i.e., excluding overnight US returns and same-day domestic returns. Unexpected flows were then derived as actual flows less expected flows. The bottom panel shows the results of the regressions explaining returns by the control variables and this decomposition of net inflows. In all cases except the Kosdaq, the coefficient on unexpected inflows is larger than the earlier coefficient on total flows, and highly significant, in accord with the prior expectation. However, in all cases, the coefficient on expected inflows remains positive and statistically significant. Nevertheless, given the larger regression coefficient on unexpected inflows and the greater variance in unexpected inflows (relative to expected flows), it follows that the majority of the contemporaneous impact of flows on returns is attributable to the surprise component of inflows as opposed to the component that might be considered to be expected.

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[16] A simple example illustrates the problems from omitting relevant control variables. Regressions of stock returns in Japan or Australia on same-day net inflows into the KSE both yield highly significant regression t-statistics. However, the reason is presumably not because net flows into the KSE drive returns in Tokyo and Sydney, but because Korean inflows are correlated with the previous night's return in US markets, and Tokyo and Sydney returns also respond to the previous day's US return. Indeed, the significant correlations with KSE inflows disappear once one controls for the overnight US return.

Table 5: The Price Impact of the Net Purchases of Foreign Investors

	JSX	KSE	Kosdaq	PSE	SET	TWSE
Average percentage daily return on local market when foreign investors are net purchasers or net sellers						
Raw returns on days with net inflows	0.28	0.89	0.23	0.32	0.33	0.52
Raw returns on days with net outflows	–0.48	–1.04	–0.40	–0.35	–0.69	–0.39
Abnormal returns on days with net inflows	0.24	0.47	0.03	0.29	0.19	0.29
Abnormal returns on days with net outflows	–0.41	–0.56	–0.04	–0.21	–0.32	–0.21
Regressions of returns on a constant and net flows (with t-statistics in parentheses)						
Coefficient on net flows	0.381 (11.1)	0.183 (17.4)	0.149 (4.7)	0.391 (9.4)	0.202 (10.0)	0.217 (10.8)
Regressions of returns on a constant, net flows, and control variables (with t-statistics in parentheses)						
Coefficient on net flows	0.360 (11.1)	0.119 (11.9)	0.067 (2.3)	0.356 (9.0)	0.142 (7.9)	0.161 (7.3)
Regressions of returns on a constant, unexpected flows, expected flows, and control variables (with t-statistics in parentheses)						
Coefficient on unexpected flows	0.424 (10.7)	0.128 (12.2)	0.021 (0.6)	0.409 (8.6)	0.163 (7.4)	0.163 (6.1)
Coefficient on expected flows	0.234 (4.2)	0.052 (1.8)	0.216 (3.7)	0.239 (3.4)	0.101 (3.2)	0.157 (4.2)
Number of observations	880	882	882	851	886	879

Notes: The sample period is 1999–2002. Abnormal returns in the first panel are calculated as the residual from a regression of returns on control variables including a constant, the lagged domestic return, the prior overnight return on the S&P 500, Nasdaq Composite and Philadelphia Semiconductor indices, and the same-day return on the Hong Kong, Singapore and Tokyo markets. The other three panels show the results of regression of daily returns in these markets on the net purchases (or 'flows') of foreigners and a series of control variables. The regressions in the fourth panel decompose net inflows into expected and unexpected flows, with expected flows defined as the fitted value from a regression similar to those in the VARs described in Section 3, including only those variables pre-determined at the end of the previous domestic trading day.

4.3 VAR Analysis of the Price Impact of Daily Net Inflows

The VAR systems from Section 3.2 allow a more complete examination of the effect of inflows on returns. In this case, the relevant impulse response function is the response of domestic returns to innovations in net inflows. These are illustrated in Figure 4, and rely on the same identification assumptions as before. In all six markets, the cumulative impact on returns is positive and highly significant over the entire 20-day horizon shown. The median impulse response suggests that
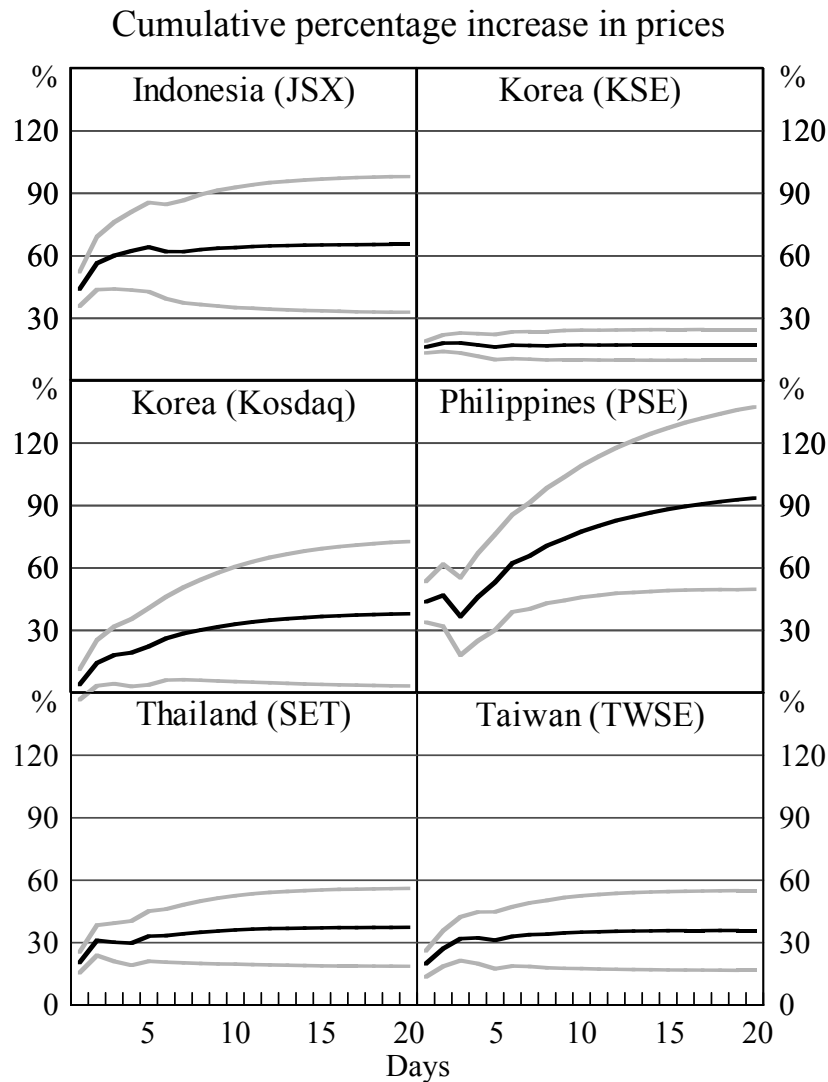
innovations to net inflows equivalent to one per cent of market capitalisation would be associated on average with a cumulative boost to equity prices of about 38 per cent. As will be discussed below, the magnitude of this estimated effect is large by the standards of earlier work.

It is also noteworthy that the estimated timing of the impact of flows on returns in Figure 4 is substantially different to the timing of the impacts estimated by Froot *et al* (2001, Figure 8). Just over half of the price impact is typically observed on the day of the surprise in inflows, and about 80 per cent of the effect is complete by the next day. The total effect is essentially complete within 10 days. In contrast, in their pooled results for all emerging markets, Froot *et al* find that almost none of the effect is contemporaneous and that it takes about 15 days for half of the price effect to be observed.[17]

Although the timing of the impact is estimated to be much faster than estimated in Froot *et al*, the fact there is any impact beyond the day of the impact is somewhat puzzling. In particular, pure price pressures from foreigners' demand shocks might be expected to be instantaneous and not protracted. Alternatively, if the fact that foreigners have been net purchasers of domestic equities has some information content, market efficiency would suggest that the price impact of this information should be felt as soon as it is revealed – on the day of trading in those cases where this information is available on a real-time basis, or at the start of the next day's trading in those cases where the net purchases data are not available until after the market has closed. In either case, net purchases on day t should have no effect on prices beyond day $t+1$. In addition, the fact that net purchases are positively autocorrelated should not provide a reason for any ongoing price impact – market participants should understand that flows are autocorrelated and the full price impact should be registered immediately upon the initial innovation in flows.

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[17] Indeed, the differences between these results and those of Froot *et al* are actually greater than suggested by this difference in timing of effects. In particular, their estimate for emerging East Asia in their Table 9 actually suggests that increases in inflows are associated with large long-run falls in equity prices, a result that is not discussed. The eight countries in their emerging East Asia group include five of the markets in this study.

**Figure 4: VAR Impulse Responses of Domestic Returns to
Innovations in Net Inflows**

Cumulative percentage increase in prices

However, it is worth noting that a substantial part of the ongoing price effect is estimated to occur the day after the inflow, and is therefore plausibly due to non-trading or other such effects. Accordingly, it is unlikely that it would be possible to take advantage of this apparent predictability for trading purposes. Indeed, the finding of a large price impact for foreign investors suggests a caveat for studies of the profitability of their trading (unless they are based on actual realised profits). In

particular, if foreign investors have a major price impact when buying and have increased their holdings of equities substantially, then any paper profits would presumably be substantially reduced if they ever tried to unwind their purchases and reduce their holdings.

4.4   The Role of Domestic Investors

If net purchases by foreigners are associated with price increases, then it follows that net purchases by domestic investors must be accompanied by price falls. To investigate the behaviour of different types of domestic investors, the bottom panel of Figure 3 presents impulse response functions similar to those in Figure 4, except that it shows the cumulative response of returns to innovations in the net purchases of domestic investors. The results indicate that innovations in the net purchases of individuals are associated with price declines, consistent with the correlations in Table 2. This confirms the finding in Section 3.4 that individuals tend to be more often on the opposite side of trading to foreigners. By contrast, innovations in the net purchases of domestic institutions are associated with price increases. As was the case for foreigners, the median case suggests that more than half of the price responses are contemporaneous.

The standard demand and supply analysis (see, e.g., Boyer and Zheng 2003) would suggest that if net purchases by one group and net sales by another group are associated with price increases, then the former group is tending to initiate trades by shifting its demand curve, whereas the latter group is more passively responding by moving *along* its demand curve. Based on this framework, the evidence for these markets would suggest that the trades of foreigners represent demand shocks, and domestic investors – especially individuals, who account for most of the trading in these markets – are providing the liquidity to enable foreigners to change their net positions.

The question then arises as to whether this provision of liquidity by individual investors is deliberate or perhaps less conscious. As has been pointed out by Linnainmaa (2003), if one group of investors is a much more extensive user of limit orders, then *ex post* they will show up as contrarian investors. Park, Lee and Jang (2003) study the use of limit orders on the KSE, and their data show that in May 2001, the proportion of limit orders in total orders placed was around

70 per cent for institutions, 75 per cent for foreigners, and 81 per cent for individuals. Hence, it is likely that a part of the liquidity provision of Korean individual investors is due to their relatively greater use of limit orders, particularly if their limit orders are monitored less actively. Although data are not available for the other five markets studied here,[18] the similarity between the KSE data and the Finnish evidence of Linnainmaa suggests that greater use of limit orders by households may be a fairly widespread phenomenon. It is therefore likely that order-submission effects are a substantial cause of the finding that domestic individual investors in Asian equity markets appear to be contrarian investors.

4.5   What Explains the Price Increases Associated with Net Inflows?

The results in this section also raise the question of why net purchases by foreign investors are associated with large contemporaneous price changes. One possibility that has not been explicitly examined is whether the correlation that appears to be contemporaneous at the daily level might actually reflect intra-day momentum trading by foreigners, with foreigners actually increasing their holdings after price increases. A second possibility that has also not been addressed is whether the positive correlation between inflows and returns might reflect superior information of foreigners that is impounded into prices through their trading. This question warrants further research but seems somewhat unlikely given the perceptions of many (e.g., Brennan and Cao 1997) that foreigners should be expected to have an informational *dis*advantage. In addition, there is mixed evidence in other empirical work as to whether the trading of foreign investors is consistent with them having an informational advantage over domestic investors (e.g., Seasholes 2001; Dvořák 2003; Choe, Kho and Stulz 2004). Further, the flow regressions indicate that much of the variance in daily net inflows can be explained by a few variables for lagged returns and lagged flows. This is suggestive of a model where foreign investors respond more to lagged information than to any informational advantage.

Instead, the most logical explanation for these price effects would seem to be a simple story of demand shocks. That is, holding the portfolio preferences of domestic investors unchanged, decisions by foreigners to buy or sell are demand

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[18] Indeed, several of the other Asian markets do not have market orders and only have limit orders, so for these markets detailed data on the placement or 'aggressiveness' of limit orders would be necessary to better understand order submission effects.

shocks that cause the aggregate demand curve to shift, resulting in price changes as domestic investors are paid to shift along their demand curves. If the demand curve for stocks is downward sloping (rather than flat as traditionally assumed – with prices purely determined by fundamentals and not demand and supply), then foreign inflows represent an outward shift in the aggregate demand curve and should result in permanently higher prices. This price pressure explanation would be consistent with US evidence that investor demand shocks have substantial and permanent impacts on returns (e.g., Edelen and Warner 2001; Goetzmann and Massa 2003) and that there can be substantial price effects following announcements of inclusions or deletions to benchmark equity indices (e.g., Shleifer 1986; Kaul, Mehrotra and Morck 2000). A price pressure explanation would also appear consistent with a recent study by Chakrabarti *et al* (2002) showing that changes in the composition of the MSCI indices have substantial permanent effects on stock prices in emerging markets, including most of those markets studied in this paper. Overall, it would be somewhat surprising if foreign inflows, which can be quite substantial at times, did not have an impact on prices through pure demand pressures, and it is noteworthy that the results from the VARs provide no evidence that price pressures might be temporary.

Indeed, if the correlation is measuring a price pressure effect, its magnitude should perhaps be negatively correlated with the liquidity of the different markets. This is exactly what is observed in the results. The price impact is largest in the two least liquid markets (the PSE and JSX, which have the lowest annual turnover ratios) and smallest in the markets that are most liquid by turnover measures (the Kosdaq, KSE and TWSE). In addition, if demand shifts by foreign investors are associated with price pressures in the equity market, they might also be associated with price pressures in the foreign exchange market (since foreign investors must buy the domestic currency in order to buy domestic equities), a result that is confirmed for three of the five currencies.[19] Of course, the demand shock explanation need not be completely independent of an information-based explanation. Foreign inflows are presumably not completely uninformed, and are no doubt based on perceptions – perhaps based on an informational advantage about global valuations – that local

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[19] For three of the five currencies, impulse response functions from trivariate VAR systems (with US returns, net inflows, and currency returns) suggest that (positive) innovations in flows are associated with statistically significant appreciations of the domestic currency. These results (available upon request) are perhaps not surprising given that there is evidence (see, e.g., Lyons 2001) that order flow has significant persistent impacts upon exchange rates.

valuations are cheap or that increased allocations to emerging markets offer other portfolio benefits.

4.6 Comparison with Other Estimates of Price Impacts

There are only a few earlier papers that provide estimates of the price impact of net purchases by foreign investors, and some of these are not directly comparable with the estimates of this paper. The studies that are closest are those of Clark and Berko (1997) and Dahlquist and Robertsson (2004), who use monthly flows data that cover virtually all foreign investment into Mexico and Sweden, respectively. In the Mexican case, the estimates suggest that unexpected inflows equivalent to one per cent of market capitalisation boost returns by about 8 per cent, while for Sweden the price impact is about 10 per cent. The estimates of this paper are clearly substantially larger, with the median of the estimates from the VARs suggesting an equivalent figure of about 38 per cent.

The results of Froot *et al* (2001, Table 9) appear at first glance to be more consistent with the current estimates, since their average impact for all emerging markets is that inflows equivalent to one per cent of market capitalisation boost stock prices in the long run by about 39 per cent. However, the price impacts here are not directly comparable with those of Froot *et al* for two reasons. First, the latter estimates do not control for returns in US markets, and the effect of doing so would most likely be to lower the estimated price impact. Second, those results relate only to a subset of all foreign investors, the customers of State Street Bank. If the trades of foreign investors who are not included in those data are substantially correlated with the trades of those who are included, then the price impact of a much larger group of investors is being attributed to the State Street customers, and the price impacts reported by Froot *et al* would be an overestimate of the price impact of the universe of foreign investors.

Although they are substantially larger than the limited existing evidence for emerging markets, the above results appear to be quite consistent with some estimates of the price movements that accompany flows in the US equity market. One such estimate is given by Warther (1995, Table 4) who finds that unexpected flows into mutual funds equivalent to one per cent of US market capitalisation are associated with a contemporaneous return of 52 per cent. An additional relevant

comparison is provided by the results of Edelen and Warner (2001) who calculate daily market-level abnormal returns associated with US mutual fund inflows and outflows. Their results show mean abnormal returns of 0.25 per cent on days with inflows and −0.25 per cent on days with outflows. In addition they cite four earlier studies on the price movements associated with the trades of institutions in individual stocks, which suggest that abnormal returns differ by around 0.52 per cent between days with net buying and net selling. These US estimates are strikingly similar to the results in the first panel of Table 5 where the median estimates show average abnormal returns of 0.27 per cent on days with net inflows and −0.26 per cent on days with net outflows, a difference of 0.53 per cent. One possibility is that the consistency of results reflects consistency in the way that institutional investors operating in both types of markets behave in adjusting the size of their trades to limit market impact costs to acceptable levels. Regardless of the explanation, if trades and flows have substantial price effects in the deep and liquid markets of the United States, the apparently large price impacts estimated in this paper for Asian markets may not be all that surprising.

5. Conclusion

This paper has used new data for the daily net purchases of foreign investors in six Asian equity markets to examine the relationship between returns and investor flows. The use of precise daily data for the purchases of all foreign investors has enabled the discovery of two new 'stylised facts' about the role of foreign investors that have not been apparent in earlier work using less comprehensive or lower frequency data.

First, the trading decisions of foreign investors in the equity market studied here are substantially influenced by recent returns in global equity markets in addition to returns in the domestic market. The estimates of the relative importance of foreign and domestic returns in explaining flows would indeed suggest that 'push' factors on average are at least as important as 'pull' factors in explaining flows to these emerging markets. Since foreigners are essentially all institutional investors, this finding presents a very strong example of a form of high-frequency momentum trading by institutional investors (and contrarian trading by individuals), adding to the evidence for this form of trading in other studies using

lower-frequency data (e.g., Grinblatt, Titman and Wermers 1995). This adds to the growing body of evidence that investor heterogeneity is an important element in understanding the dynamics of financial markets. What is most surprising about this evidence of positive-feedback or momentum-type investing is its timing: that the trading of foreigners responds so quickly, to price changes that have occurred the previous day or overnight. There is scope for further research into the possible causes of this positive-feedback trading, but it seems reasonable to conjecture that it is the result of some combination of foreign investors using recent returns to extract information about future returns, and sentiment-driven trading or behavioural effects.

The second major result is that there are substantial price movements associated with the trades of foreign investors. In contrast to the work of Froot *et al* (2001), which suggested that the contemporaneous price impact of foreigners' trades was very small, with prices moving only in the weeks and months following the trades, the analysis here shows that most of the impact occurs on the same day as the trades. The primary reason for the divergence in findings appears to be the use of daily data for the actual trades of all investors, rather than data for a subgroup of foreign investors where the timing of their trades has to be inferred from settlement conventions in each country.[20] The estimated price impact of foreign inflows is much larger than has been suggested by previous work on emerging markets. However, it is quite similar to the price impacts of trading that are reported in some earlier studies using US data. This suggests that price pressure is a phenomenon

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[20] Differences in methodology would not appear to be able to explain the differences in results. For example, if I replicate the VARs in Froot *et al* by using their bivariate system with 40 lags, and calculate impulse responses over 60 days, my data still suggest a very rapid impact of flows on returns. In addition, when I replicate the quarterly covariance decomposition in their Table 8, I find a far higher proportion of the total covariance is attributable to the contemporaneous covariance and a much smaller proportion to the covariance between flows and returns 6–60 days later. Since our data are for different periods, it is possible that the differences in results might be due to structural change in the relationships. One possibility is that the period leading up to and including the crisis period was a rather special period for these markets, and it may not be surprising if the subsequent, more normal market conditions lead to more reasonable and intuitive empirical results.

that is widespread in financial markets and largely independent of the extent of market development.[21]

Together, these results suggest that foreign investors and conditions in mature markets have a much larger effect on emerging markets than has been suggested by previous work. However, the combination of trading driven substantially by conditions in other markets and large price pressures from the trading of foreigners raises the possibility that foreign trading can be destabilising in emerging markets. Indeed, the experience of the mid 1990s and then the Asian crisis of 1997 suggests that foreign flows can contribute to both rising and falling prices in emerging markets. These effects may be an unavoidable phenomenon in emerging markets, so the efforts of policy-makers should be directed at ensuring that their markets and institutions are sufficiently strong to be robust to inflows and outflows and the price changes that accompany them.

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[21] Indeed, by some measures the global foreign exchange market might be considered the most liquid financial market in the world, yet even there it has been noted that estimates of the elasticity of exchange rates to customer order flow are puzzlingly high (Lyons 2001, p 265).

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