A Panic-Prone Pack?
The Behavior of Emerging Market Mutual Funds

Eduardo R. Borensztein and R. Gaston Gelos[1]

International Monetary Fund
700 19th St., N.W.
Washington, D.C. 20431, U.S.A.

Phone: +1-202-623-9427, Fax: +1-202-623-4495

First version: August 1999
This version: April 2000

Abstract

This paper explores the behavior of emerging market mutual funds using a novel database covering the holdings of individual funds over the period 1996:1 to 1999:3. An examination of individual crises episodes shows that funds tended to withdraw money one month prior to the crises. The degree of herding among funds is significant, but not dramatic. Herding is much more widespread among open-ended funds than among closed-end funds, but not more prevalent during crises than during tranquil times. Funds tend to follow momentum strategies, selling past losers and buying past winners, but they are not panic-driven, irrational institutions.

JEL Classification Numbers: F21,G15

Keywords: Mutual funds, contagion, emerging markets, foreign portfolio investment, herding, financial crises

Author's E-Mail Address: eborensztein@imf.org, ggelos@imf.org

---

[1] The authors wish to thank Andrew Berg, Ricardo Caballero, Anna Ilyina, Erik Lundback, Alessandro Rebucci, Sergio Schmukler, Shang-jin Wei, Ian Wilson, and particularly Anthony Richards for help and suggestions. Grace Juhn and Nada Mora provided excellent research assistance.

Contents

I. Introduction 3

II. Contagion, Herding, and Institutional Investors 4

III. Data 7

IV. Flows over time, across funds, and regions 10

V. Flows During Crisis Periods 13

VI. Leaders and Followers 17

VII. Testing for Herding 20

VIII. Testing for Positive Feedback Trading 26

IX. Conclusions 30

References 32

Appendix I. Correlation of Aggregate Flows Across Countries..... 34

Appendix II The Behavior of Funds Withdrawing from Crisis Countries..... 36

Appendix. III Simulating the Herding Measure Distribution..... 40

I. INTRODUCTION

Episodes of high volatility in international capital flows and currency crises in the 1990s have put international investors in the limelight. Frequently, international investors are considered the culprits of the bouts of instability and crises,[2] and casual observation does suggest the presence of episodes of panic and contagion. Yet the fundamental question remains as to whether there is a tendency for certain market participants to disregard fundamental economic conditions in emerging markets, responding only to what other investors are doing, or are expected to do.

The globalization of securities markets is perceived to be an important source of volatility for emerging markets. Calvo and Mendoza (1997), for example, argue that international portfolio managers tend to imitate each other's portfolios (behave as a "herd") rather than trade on the basis of fundamental variables. Fixed cost of gathering information about a relatively large number of emerging markets or manager compensation systems that penalize losses relative to aggregate indices are ingredients of models that rationalize contagion and herding behavior by international portfolio managers. The presence of such behavior, to the extent that it dominates international capital flows, would imply that international securities markets are a permanent source of excessive volatility.

Trying to assess the behavior of international investors in a systematic way, however, poses enormous challenges. Most of the available financial information consists of data on prices. It is nearly hopeless to attempt to control for all "fundamental" news driving changes in asset prices, making it impossible to convincingly establish that a specific change in asset prices was due to irrational (or rational) purely speculative behavior by certain groups of investors.

For this reason, researchers have begun to examine investor behavior in emerging markets directly using transactions data. However, data availability is scarce, and the evidence presented so far is limited. The most comprehensive data set used so far is probably the daily data from State Street Bank & Trust examined by Froot, O'Connell and Seasholes (1998). The authors find

[2] See, for example Aitken (1996). For a differing view, see Richards (1996).

evidence for persistence and trend-following in portfolio flows. In addition, the data indicate that inflows have forecasting power for future returns in emerging, but not mature markets. A shortcoming of their dataset is that they cannot differentiate between different classes of investors. Other studies have had a regional or country-specific focus.

This paper contributes to this literature by exploring a novel dataset that covers around 400 emerging market equity funds on a monthly basis over the period 1996:1-1999:3. While the period is relatively short, it encompasses the Asian, Czech, Russian, and Brazilian crises, allowing us to examine each of these episodes in detail. The aim of the paper is to answer the following questions. How do emerging market funds behave before, during, and after crises? Is there evidence for herding among these investors during tranquil and during turbulent times? Are there meaningful differences in the behavior of different types of funds? Do funds systematically buy past winners and sell past losers? Note that it only makes sense to search for evidence of herding within a subset of investors, since the whole market cannot move in the same direction (overall, for every seller, there must be a buyer). In this regard, our database has the advantage of covering a well-specified subclass of investors, for which it is meaningful and interesting to pose these questions.

We find that overall, the behavior of funds is complex and cannot be explained by simplistic rules. While during tranquil and turbulent times, inflows coexist with outflows, on a net basis, these funds tend to withdraw money one month prior to crises. The degree of herding among dedicated emerging market funds is significantly different from zero, but not dramatic. Herding is less pronounced among closed-end funds, suggesting that herding behavior might to a significant extent be traceable to individual investor's, rather than managerial behavior. Herding is more pronounced in volatile markets. Emerging market funds follow momentum strategies and this type of behavior is more prevalent for sales than for purchases.

II. CONTAGION, HERDING, AND INSTITUTIONAL INVESTORS

In the discussion about recent financial crises, attention has largely focused on the behavior of international investors. It has been argued that some of these—mainly institutional—investors engage in herding strategies, i.e. have a tendency to "follow the pack", mimicking trades by other market participants, without paying due attention to fundamentals. Such behavior could potentially destabilize prices, and, if widespread, would constitute an argument in favor of limiting the free movement of capital flows.

Herding can be rational or irrational. Irrational herding can be the outcome of panics or sudden contagious changes in investor sentiment. This type of change in investor sentiment may in turn induce a switch from a "good" to a "bad" equilibrium for a country and induce a crisis.[3] Herding-like behavior may also occur if a single event that per se does not convey much information about fundamentals, suddenly acts as a wake-up call, reviving faded memories of similar previous events.[4]

Rationalizations of herding behavior, on the other hand, include informational learning (cascades), principal-agent problems or other externalities.[5] Informational cascades occur when actions are observable, but information is partly private. In such a situation, agents' actions provide valuable information to others, and it some cases it may be optimal to rely exclusively on others' actions. This is particularly relevant if there are fixed costs of acquiring information about a company, or in the case of interest here, a country.[6]

Since institutional investors are more informed about each other's trades than individuals, they will tend to herd more.[7] Herding that results from informational cascades constitutes a case for more "transparency", i.e. governments and international providing markets with more and more timely information.[8] An example of a principal-agent explanation of herding, on the other hand, is

---

[3] See Masson (1998).
[4] See Mullainathan (1998).
[5] See Devenow and Welch (1996) for a good overview over rational herding models.
[6] For an example, see Calvo and Mendoza (1997).
[7] See Lakonishok, Shleifer and Vishny (1992) (henceforth LSV).
[8] See Eichengreen et al. (1998), p. 23.

given by the possibility that fund managers are not evaluated based on relative instead of absolute performance, which provides an incentive to mimic the actions of other managers.[9]

A related behavior of investors that may induce herd-like trading is given by "momentum strategies". In the finance literature, it has been documented that domestic U.S. mutual funds engage in "positive feedback trading",[10] buying those assets whose prices have been rising and selling assets whose prices have been falling. This behavior can be the result of extrapolative price expectations, collateral or margin calls, dynamic hedging, or other strategies that prescribe automatic selling or buying in reaction to price movements.[11]

Lastly, international investors may appear to herd if they react simultaneously to the same fundamentals. In this case, their behavior speeds up the adjustment of prices and is not destabilizing.[12] However, in an efficient market, speedy price adjustment should occur without many actual trades having to take place. Moreover, the question remains why international investors react differently to these news than domestic investors. Here, Brennan and Cao (1997) argue that, since foreign investors have a "cumulative informational disadvantage", positive news about a country will result in a reallocation of asset holdings toward foreigners.

The empirical literature examining directly the behavior of international investors is still young. Apart from the aforementioned comprehensive study by Froot, O'Connell and Seasholes (1998), a few researchers have looked at specific regions and time frames. Kim and Wei (1999a) examine the transactions of different types of portfolio investors before and during the Asian crisis, finding that non-resident institutional investors were always positive feedback traders, while resident investors were contrarian traders before the crisis but became positive feedback traders during the crisis. Herding appears to be more widespread among individual and nonresident

---

[9] See Scharfstein and Stein (1990) or Calvo and Mendoza (1997).
[10] See DeLong et al. (1990).
[11] See Eichengreen et al. (1998) and Kim and Wei (1999b). Professional investment managers occasionally recommend this strategy to their clients. For example, the Los Angeles Times quotes Templeton Developing Markets manager Mark Mobius suggesting with respect to holdings of emerging-market funds: "You say, 'If the fund goes down this much, I'm out'." See Lim (1999).

investors than among institutional and resident investors. In another study, Kim and Wei (1999b) compare trading behavior in Korea by offshore investment funds with that of funds registered in the U.S. and the UK, finding herding behavior less prevalent among offshore funds. Choe, Kho and Stulz (1998) also study transaction data from the Korean stock market during the crisis and find evidence for return-chasing and herding among foreign investors before the crisis period, but no evidence for a destabilizing effect of foreign investors over the entire sample period. While their data is of a higher frequency, they are not able to trace trades originating from the same investor.[13] Kaminsky, Lyons and Schmukler (1999) investigate trading strategies for 13 U.S. funds investing in Latin America, reporting evidence for momentum strategies. The present paper is the first one to document the behavior of mutual funds on a global scale.

III. DATA

The data used in this paper are from a comprehensive database purchased from Emerging Market Funds Research, Inc. It covers, on a monthly basis, the geographic asset allocation of hundreds of equity funds with a focus on emerging markets for the period 1996:1-1999:3. While this period is not very long, the frequency of the data is higher than the typical quarterly reporting. Moreover, the years included in the database are particularly interesting ones, given the number of emerging market crises occurred herein.

At the beginning of the sample, the database contains 382 funds with assets totaling US$ 116.5 bill.; at the end of the period, the number of funds covered is 467, managing US$ 118.7 bill. of assets. Note that, while the total number of funds increased over the period, some funds were also dropped from the database if their managers did not wish to continue providing monthly information on their holdings. 309 funds are in the sample throughout the period.

---

[12] See LSV.

[13] Some other studies have used more aggregate data on international portfolio flows. See Bohn and Tesar (1996), Brennan and Cao (1997), and Tesar and Werner (1995). A few studies have investigated the behavior of U.S. mutual and pension funds. See Lakonishok, Shleifer, and Vishny (1992), Grinblatt, Titman and Wermers (1995), and Wermers (1999). Another study of

Slightly more than half of the funds covered are international, global emerging markets, or regional funds, the rest being single-country funds (mainly Asian). In February, 1999, the sample consisted of nine global funds (not focusing mainly on emerging markets), 53 global emerging market funds, 125 Asian regional funds (18 of which included equity holdings in Japan), 170 Asian single-country funds, 13 Latin American single-country funds, 52 regional Latin American funds, and 51 funds focusing on other geographic areas (12 of which were single-country funds). Approximately one quarter of the funds are closed-end funds. The funds' domiciles are mostly in developed economies and offshore banking centers.

Table 1 provides a regional overview over the different types of funds and their holdings. The first interesting observation that can be made is that, while the total holdings of these mutual funds in Latin America, Europe, Middle East and Africa increased, they significantly decreased in Asia. An examination of the time series shows that, not surprisingly, the major drop in the value of the Asian assets occurred during the Asian crisis of 1997. Nevertheless, total holdings in Asia are still more than twice as large as those in Latin America and significantly exceed those in Europe. Asia is also the region with by far the largest number of single-country funds.

---

international, but not emerging, financial markets is Kodres and Pritsker (1996). They analyze herd behavior by large institutional futures participants using daily position data.

Table 1. Total holdings and number of funds by region

	Asia		Latin America		Europe		ME/ Africa	
	Number	Holdings	Number	Holdings	Number	Holdings	Number	Holdings
Single-country								
Feb 1996	167	$15.2	10	$1.9	9	$0.4	3	$0.3
March 1999	174	$7.7	12	$1.9	7	$0.3	4	$0.3
Regional								
Feb 1996	109	$31.4	30	$4.2	7	$0.5	3	$0.3
March 1999	125	$12.5	53	$3.5	24	$1.4	7	$0.2
Global Em. Mkts.								
Feb 1996	38*	$9.4	38*	$6.8	36*	$2.6	37*	$1.3
March 1999	56*	$8.4	56*	$10.3	56*	$4.2	56*	$2.7
International								
Feb 1996	9*	$8.2	9*	$2.2	9*	$15.1	6*	$0.2
March 1999	9*	$15.0	9*	$5.4	9*	$27.7	7*	$0.8
Total								
Feb 1996	323	$64.2	87	$15.0	66	$18.7	49	$2.0
March 1999	363	$43.7	130	$21.1	104	$33.5	74	$4.0

Note: Holdings in billions of US$ at the beginning of the month. * indicates that the provided indicates the number of global emerging markets and international funds with assets in the respective region.

How important are these funds as investors in emerging equity markets? In many cases, the assets of our funds a represent modest, but not insignificant fraction of the total market capitalization. For example, in the case of Argentina, the funds held approximately 6.5 percent of the total stock market capitalization in August of 1998, while the share was around 4.5 percent in Hungary and Korea. It should be pointed out, though, that in many emerging markets, a much smaller fraction of the total capitalization is traded on a regular basis than in mature markets, since ownership is often less dispersed. Therefore, the trading of our funds might actually play a much larger role than suggested by these aforementioned figures.

One limitation of the dataset is that, while for the end of each month, it provides asset positions in each country, we are mainly interested in the *flows* to individual countries. These implied flows need to be calculated under some assumptions concerning the actual stock purchases of the funds. We assume that funds purchase an index of the stock market and we use the IFC US$ total return investable index in order to calculate returns.[14] In other words, for each country *c* and fund *i* in month *t* we calculate the flow in the following way:

$$\text{Flow}_{cit} = \text{Total assets}_{i,c,t} - \text{Total assets}_{i,c,t-1} - \text{Index return}_{ct} \cdot \text{Total assets}_{i,c,t-1} \quad (1)$$

This obviously represents an approximation, and in individual cases, we might be introducing substantial errors through this procedure. If individual fund managers were able to beat the index, we would overstate the flow of the fund into the countries. However, consistency checks for closed-end funds show that our approximation is quite good.[15] Moreover, it is unlikely that this method alters the sign of a fund's transaction, in which case we would erroneously classify net buyers as a net sellers or vice versa.

IV. Flows Over Time, Across Funds, and Regions

In a first attempt to examine the extent to which funds tend to move in tandem, we compute simple correlations of the aggregate flows into individual countries for the whole period. A table in Appendix I shows the flow correlation matrix for all countries, with larger correlation values shaded darker.

The table reveals that correlations are highest within regions. For example, the correlation between flows to Hong Kong and other East Asian markets is very high, similarly to those between

[14] In cases for which the IFC does not compute an investable index, we used the global index. For countries not covered by the IFC, we employed MSCI US$ index data or national indices converted into US dollars.

[15] For closed-end funds, we can compute the growth in total assets calculated on the basis of the IFC return series with the actual growth in assets. Without taking into account returns on fixed income, the correlation between imputed and actual asset growth rates was 0.78.

Mexico and other Latin American countries.[16] To a lesser extent, this is also true for flows to Europe, the Middle East, and Africa. This evidence is in line with that presented by Froot, O'Connell, and Seasholes (1998), and consistent with a redemption-based explanation. If regional funds, of which there are many in our sample, face redemptions by individual investors, they may be forced to sell assets in other countries.[17]

A different way of examining whether all funds move together is to look at gross flows in- and out of regions. Figure 1 displays flows into the four major geographical regions for the whole period, with net flows broken down into gross positive and negative flows. In order to eliminate effects arising from the addition or deletion of funds from the sample, we focus on a balanced subsample of 309 funds.

The pictures indicate that, except for the case of Middle East and Africa, inflows contemporaneously coexist with outflows. Gross flows into and out of Asia are much higher than for other regions. For Asia, we observe sizeable net outflows starting one month before the collapse of the Thai baht in early July, and ending in November of that year. In the case of Europe, there is a substantial drop in net inflows at the outset of the Russian crisis in July and lasting until November. For Latin America, the figures show a sharp outflow one month before the Brazilian devaluation, in December of 1998.

This first look at aggregate figures therefore suggests that, while not all funds always move in the same direction, on a net basis, they tend to pull out together prior to crises. This issue is investigated more closely in the next section, where we examine the behavior of funds around specific events.

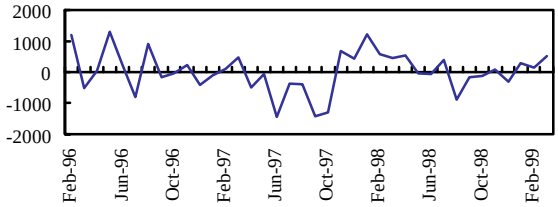
---

[16] Hong Kong is typically classified as a mature market. Given than many emerging market funds hold positions in Hong Kong, we include this market in all our calculations.

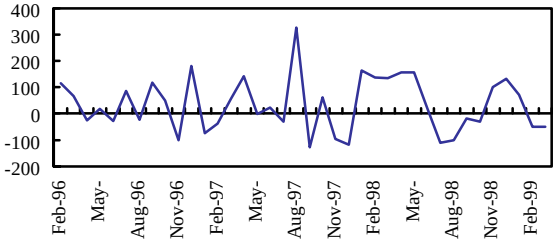
[17] See Masson (1999).

Figure 1. Gross and Net Flows by Region
(Balanced Panel)

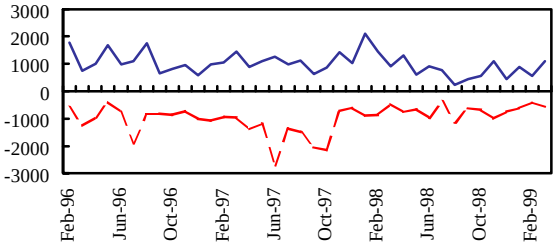
Net Flows into Asia



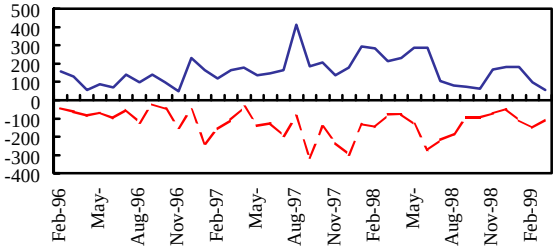
Net Flows into Europe



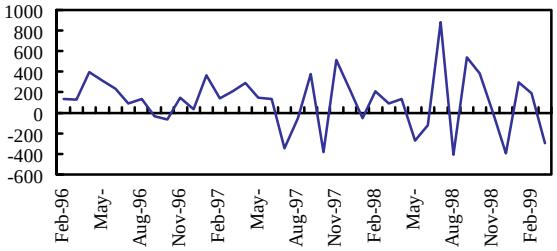
Gross Flows into Asia



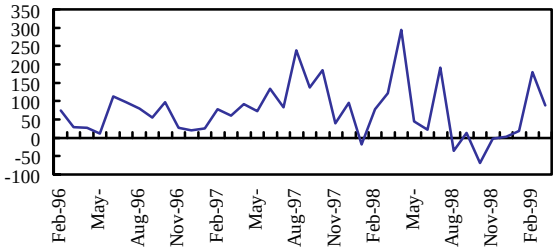
Gross Flows into Europe



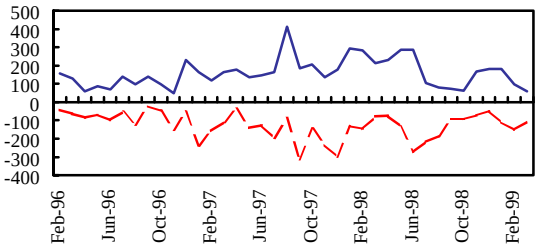
Net Flows into Latin America



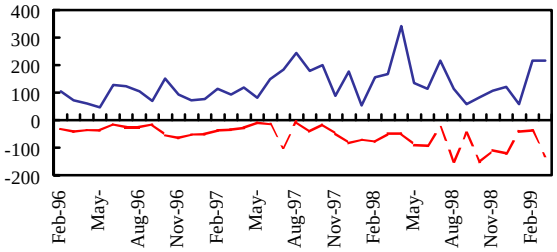
Net Flows into Middle East and Africa



Gross Flows into Latin America



Gross Flows into Middle East and Africa



Source: Authors' calculation based on data from Emergin Market Funds Research, Inc.
Note: All numbers are in millions of US$.

V. FLOWS DURING CRISIS PERIODS

In the following, we characterize the salient features of the flows around individual currency crises. In particular, our data allows us to examine the following episodes in more detail: (i) the Czech crisis of May 1997, (ii) the Asian crisis in the second half of 1997, (iii) the Russian ruble collapse of August 1998, and (iv) the Brazilian devaluation of January '99.

For each of these episodes, we present flows in- and out of the affected countries and other regions, as well as statistics on changes in the allocation of assets within funds. These statistics provide a first insight into whether funds anticipated or possibly caused these crises, whether funds moved simultaneously out of the countries affected, and whether they contemporaneously reduced or increased holdings in other countries in- or outside the region. For example, did the Asian crisis lead to a reduction or increase of holdings in Latin America? The predictions from portfolio theory in this regard are ambiguous.[18]

The findings can be roughly summarized in the following way. Strikingly, in all crises considered here, emerging market mutual funds tended to withdraw funds from the affected country in the month prior to the crisis. This is particularly visible in the cases of Brazil and Russia, and less marked for the Asian and Czech crises (Figure 2). To some extent, this is not surprising, since a withdrawal of investors is exactly what brings about a crisis. This evidence documents however, that mutual funds were not laggards or contrarian investors at the onset of these events. The flows to non-crisis countries and regions around crises show no coherent pattern, but there are more comovements within than across regions. Interestingly, funds did not withdraw indiscriminately: in many cases, the same funds that left a crisis country, invested in other markets that were generally seen as suffering from contagion. For example, while it is true that during the Russian crisis funds withdrew on a massive scale from Latin America and Asia, those funds that actually reduced their exposure in Russia, invested in Latin America.

[18] See Schinasi and Smith (1999).

In the Czech case, after growing pressures on the exchange market in early 1997, the authorities were forced to abandon the target band for the Czech koruna on May 27. Figure 2 shows that substantial outflows began to take place in April, continuing until July. According to Table 2, these movements are not mirrored in other transition economies. For example, inflows to Poland and Russia increased between April and June.

How did the allocation of assets within funds change? One way of examining this issue is to compute the flows into other countries during the crisis *for those funds that withdrew money from the Czech Republic*. The results show that these funds reshuffled portfolios, increasing their assets in other economies in- and outside the region (see Appendix II). This evidence is consistent with the view that there were hardly any "contagion" effects surrounding the Czech crisis.[19]

The abandonment of the exchange-rate peg by the Thai authorities on July 2, 1997 marked the beginning of the Asian crisis. After a dip in May 1997, there was a renewal in inflows from emerging market funds, with a declining tendency in the rest of the year (see Figure 2). From May onwards, outflows actually diminished in size and only intensified again in January 1998. The regional picture is mixed (see Appendix II). It is noteworthy that net outflows from Malaysia and Taiwan were already very large in April 1997, and in the case of Malaysia these outflows continued until October of that year. Moreover, it is apparent that funds reduced their holdings in nearly all Asian countries in October 1997. That month also saw withdrawals from all other regions except Middle East and Africa.

The within-fund statistics show that those funds that withdrew from Thailand also withdrew from other markets in- and outside the region, with the notable exception of China. This is also true when looking at those funds that reduced their assets in any of the other crisis countries: While reducing their assets across the board, funds increased their exposure to China (see Appendix II).

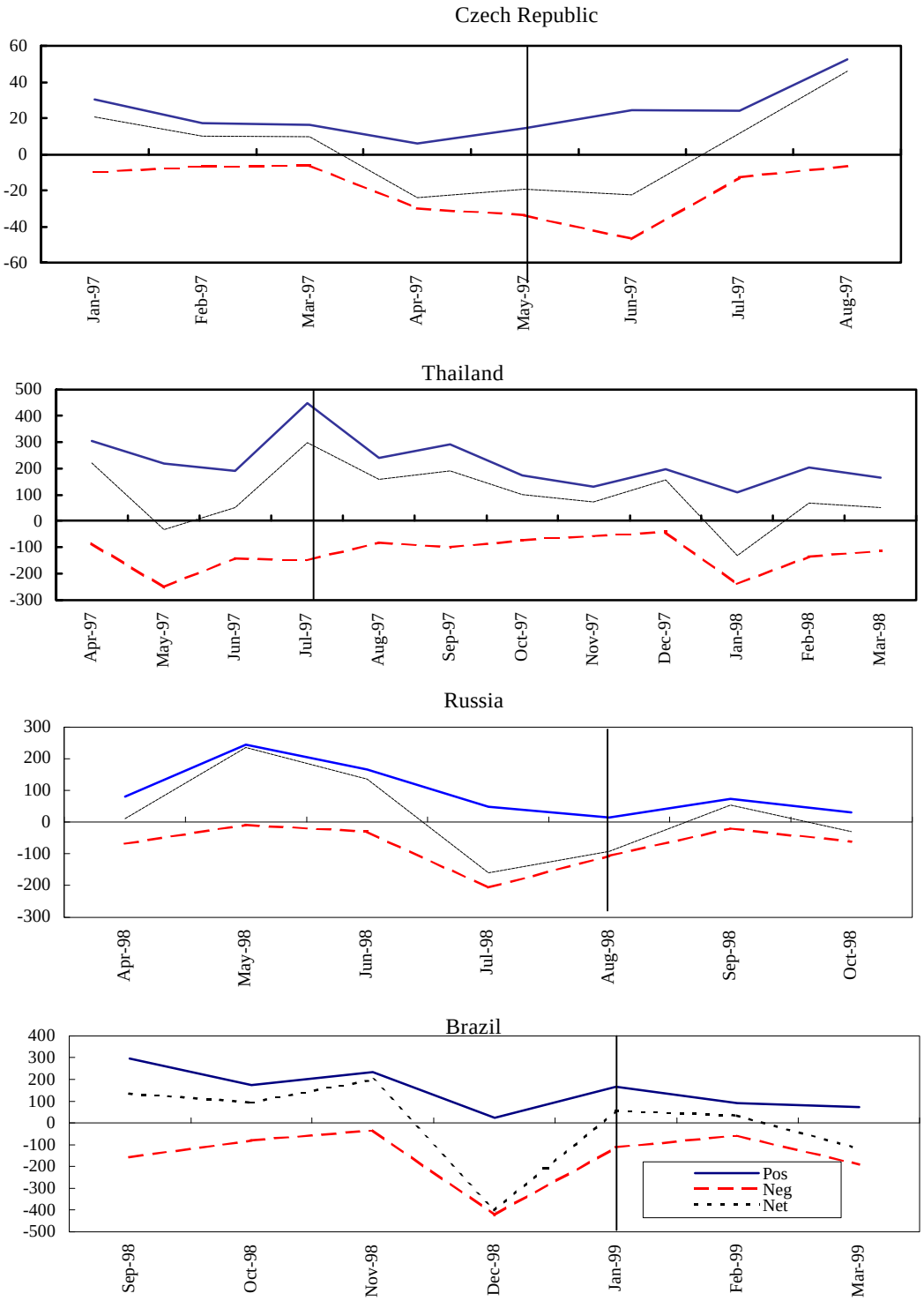
[19] See Gelos and Sahay (1999).

The Russian crisis broke out on August 17, when the authorities devalued the currency. Markets were not calmed, and on September 2, the ruble was allowed to float.
Figure 2 shows that mutual funds withdrew on a large scale from Russia in the month preceding the devaluation. The outflow continued in August, diminishing in September, when a mild positive net inflow was registered. An examination of flows to other countries and regions in the same period reveals that in the aggregate, funds did not reduce their holdings in other European transition economies nor in other regions in July. Interestingly, however, after the crisis erupted in August, there were not only withdrawals from other countries in the region, but also very large net outflows from Asia and Latin America. This is consistent with the widespread perception of "contagion" around the Russian crisis.

While this is broadly supported by a look at changes in flows within funds, it is noteworthy that on average, during the Russian crisis, those funds that withdrew from Russia, *invested* in Hungary, Poland and Latin America (see Appendix II). It therefore seems that the large drops experienced in these stock markets around the Russian crisis may have been due to investors who were not themselves exposed to the Russian market, a fact that contradicts conventional wisdom.

On January 14, 1999, the Brazilian authorities were forced to let the currency float. Funds anticipated and possibly caused this event to some extent, withdrawing funds on a large scale in December. In that month, gross positive flows dipped to nearly zero, and net outflows reached US$ 400 million. However, January again saw net positive, albeit small, inflows. Table 5 shows that net flows to other countries in Latin America were also mostly negative in December 1998, although of much smaller magnitude. Similarly, Asia experienced a net outflow in that month. Again, however, a look at more disaggregated data tells a more subtle story: funds that withdrew from Brazil around the crisis, on average also withdrew from Argentina and Mexico, but invested in Chile (see Appendix II).

Figure 2. In- and outflows around crises



Source: Authors' calculations based on data from Emerging Markets Funds Research, Inc. Numbers are in millions of US$ and based on a sample of funds that were in the database throughout the period.

VI. LEADERS AND FOLLOWERS

After a first assessment of the overall behavior of funds, an interesting question to pose is whether there are leaders and followers within the industry. For example, one could imagine regional or single-country funds to be more familiar with the specific economic situation in the countries they invest in than funds investing globally. This may lead global/international funds to imitate the behavior of single or regional funds. Similarly, if the acquisition of country-specific information involves fixed costs, smaller funds may be at a disadvantage vs. larger funds and may be induced to follow the strategies of the big companies. Possibly, even a small fraction of mutual funds may regularly be the originator of large stampedes in- our out of a country.

While the frequency of our data limits the scope for investigating this question, we make an attempt to examine whether some funds systematically precede others in their trades. For this purpose, we divide funds into four pairs: single-country funds and non-single-country funds, global/international and regional/single country funds, large and small funds, and closed-end and open-ended funds. For each of these categories, we compute the sum of total flows into each country and explore whether, controlling for returns, flows of one category Granger-cause that of others. In order to limit problems of heteroskedasticity, we scale flows by the lagged total assets in the respective country.

In the context of a panel VAR, some issues need to be addressed. It is well known that fixed effects estimates of dynamic panel model estimates will be biased for finite T. In our case, these problems are not likely to be severe. First, our time dimension is quite large (38 months). Second, since we want to investigate Granger causality, we are not primarily interested in the coefficients of the lagged dependent variable, but in the coefficient on the other variable's lags. As shown by Judson and Owen (1997), the bias of these coefficients is typically very small. We therefore test for the presence of fixed effects and include them when appropriate. All variables included in the regressions are stationary. While we include lagged returns in the regressions, here we will not discuss their impact on flows; this issue will be taken up later.

There is no Granger causality running from single-country funds to multiple-country funds or vice-versa, and the same is true for large and small funds (see Table 2). However, the results for regional and single-country funds vs. global and international funds reveal an interesting pattern: in- or outflows by regional or single-country funds Granger-cause flows of global/international funds into the same country with a lag. However, Granger causality runs both ways since regional/single funds tend to react with an outflow to inflows of global/international funds lagged four months. The results also show that lagged open-ended funds' flows Granger-cause closed-end funds investments with a lag of four months, while there is no evidence for Granger-causality when comparing the behavior of small and large funds. One should be careful, however, when interpreting these results since they are somewhat sensitive to the specification and the inclusion or exclusion of certain countries.

Table 2. Vector autoregressions with pairs of fund classes

	Single country funds	Non-single-country	Regional /Single	Global/ Intern.	Closed-end	Open-ended	Small	Large
Own t-1	-0.05	-0.16	-0.01	-0.10	-0.03	-0.19	-0.03	-0.10
	(-1.43)	(-4.25)	(-0.23)	(-3.30)	(-1.15)	(-6.45)	(-1.03)	(-3.37)
Own t-2	0.04	0.02	-0.02	-0.09	-0.02	-0.10	-0.04	-0.19
	(0.91)	(0.41)	(-0.56)	(-3.15)	(-0.62)	(-3.09)	(-1.08)	(-5.84)
Own t-3	0.15	0.23	0.01	-0.13	0.02	-0.11	-0.04	-0.05
	(4.02)	(5.32)	(0.18)	(-4.41)	(0.69)	(-3.59)	(-1.07)	(-1.53)
Own t-4	0.11	0.13	-0.03	-0.12	-0.04	0.08	-0.04	0.03
	(3.01)	(2.78)	(-0.90)	(-3.80)	(-2.54)	(2.73)	(-1.26)	(0.78)
Own t-5	-	-	0.16	-0.06	-	-	-0.05	-0.08
	-	-	(5.73)	(-2.00)	-	-	(-1.54)	(-2.42)
Other t-1	0.03	0.06	-0.03	**0.09**	0.02	0.00	0.25	0.00
	(0.94)	(1.47)	(-1.19)	**(2.72)**	(1.80)	(-0.05)	(0.55)	(1.05)
Other t-2	0.02	-0.01	-0.03	-0.06	0.01	-0.03	0.23	0.00
	(0.57)	(-0.25)	(-1.03)	(-1.81)	(0.54)	(-0.33)	(0.50)	(0.03)
Other t-3	0.08	**-0.08**	-0.02	0.07	0.02	0.10	0.06	0.00
	(0.04)	**(-1.96)**	(-0.85)	(1.92)	(1.78)	(1.24)	(0.13)	(0.74)
Other t-4	-0.07	0.00	**-0.08**	**0.14**	**0.03**	**-0.11**	0.14	0.00
	(-1.65)	(-0.02)	**(-2.90)**	**(4.57)**	**(2.58)**	**(-2.27)**	(0.31)	(-0.15)
Other t-5	-	-	**-0.13**	**0.18**	-	-	-0.20	0.00
	-	-	**(-4.62)**	**(5.64)**	-	-	(-0.43)	(1.04)
Fixed Effects	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Granger-causality	S⇒NS?	No(p=0.20)	R⇒G?	Y(p=0.00)	C⇒O?	N(p=0.13)	S⇒L?	No(p=0.76)
	NS⇒S?	No(p=0.12)	G⇒R?	Y(p=0.00)	O⇒C?	Y(p=0.04)	L⇒S?	No(p=0.98)

Source: Authors' calculations based on data from Emerging Markets Funds Research, Inc. Note: "Own t-x" denotes values of the lagged dependent variable, lagged x periods. "Other t-x" denotes values of the other endogenous variable included in the VAR, lagged x periods. Time dummies and lagged returns included in the regressions (not shown). T-statistics are shown in parentheses. Significant coefficients (at the 5% level) in the "other" variable group are marked bold. Small and large funds are defined as funds in the lower and upper size quintiles.

VII. TESTING FOR HERDING

In this section, we compute and discuss a quantitative measure for the degree of herding among funds. This measure, originally introduced by LSV, allows to assess whether funds move in the same direction more often than one would expect if they traded independently and randomly. The indicator, denoted HM, is given by:

$$HM_{it} = |p_{it}-E[p_{it}]| - E|p_{it}-E[p_{it}]|, \qquad (2)$$

where p_{it} is the proportion of all funds active in country *i* in month *t* that are buyers,[20] and $E[p_{it}]$ is its expected value. $E[p_{it}]$ may vary over time, and we approximate it by the total number of net buyers across all countries divided by the total number of active funds in that year.[21] Since the distribution of the absolute value of the first expression is not centered around zero, we need to subtract its expected value. Under the null hypothesis of no herding, this expected value is calculated assuming that the number of buyers follows a binomial distribution.

In order to restrict our attention to a meaningful notion of a "herd", we calculate the herding measure only for those cases in which N_{it} exceeds five.[22] Moreover, in order to limit the impact of errors introduced by our calculation of flows, we classify a fund as buyer or seller only if the absolute value of the calculated (out-) flow into (or from) a country is larger than one percent.[23] HM_{it} can be calculated for different subgroups of funds, different types of emerging markets, and different time periods. Note that our data does not allow us to differentiate between herding at the

[20] We adopt the same notation as Wermers (1999).

[21] Using yearly estimates for p_{it} reflects a compromise between an attempt to control for variations in overall capital flows to emerging markets (in order not to overestimate herding) and, on the other hand, not underestimate herd behavior by overcorrecting for such general trends. However, we also experimented with a monthly estimate for p_{it}, obtaining slightly lower, but qualitatively similar results for our herding measure.

[22] We repeated the computations considering only cases with a minimum of 15 transaction. The results were very similar.

manager or individual investor level; however, we are able to obtain some indirect evidence on the issue, which will be discussed below.

The results indicate the presence of significant, but not dramatic herding. Table 3 reports average values for HM for the four major regions and three subperiods.[24] The overall mean is 7.2 percent. In other words, this implies that for a given country, the number of funds moving in the same direction was approximately 7 percent larger than one would have expected if they acted independently and randomly. This number is approximately twice as large as the values found by Wermers (1999) for U.S. mutual funds, and more than twice the value reported by LSV for U.S. pension funds. However, it is not as large a figure as conventional wisdom may have led one to expect. There is little variation in this average across regions and over time. The numbers for Europe are initially lower, but they increased over time. We also looked more specifically at the results for Asia, Latin America and Europe around crisis episodes, without finding evidence for higher herding.

In contrast of herding into and out of individual countries, herding might be very prevalent at the regional level; for example, at a particular time, everybody may want to move into Latin America, but not necessarily into the same markets. We investigated this possibility by treating whole regions as individual assets, finding somewhat weaker evidence for herding (not shown).[25]

---

[23] We also carried out the calculation using five percent as the error margin, without significantly altering the results.
[24] As a result of the large samples, all results are significant.
[25] See LSV for an analogous exercise using industries instead of individual stocks.

Table 3. Mean herding measures by region (in percent)

	All	Asia	Latin America	Europe	Middle East/Africa
1996	7.4	7.1	9.2	5.0	9.1
	(0.5)	(0.7)	(1.2)	(1.1)	(1.4)
1997	7.4	6.7	5.9	7.1	10.8
	(0.5)	(0.7)	(0.9)	(1.1)	(1.5)
1998-99	6.9	8.0	7.0	7.5	3.4
	(0.4)	(0.6)	(0.9)	(0.9)	(1.0)
Whole period	7.2	7.3	7.3	6.7	7.5
	(0.3)	(0.4)	(0.6)	(0.6)	(0.8)

Source: Authors' calculations based on data from Emerging Market Fund Research, Inc.
Note: Around Crises includes Asia 1997:7-1998:1; Europe 1998:7-1998:10, Latin America 1999:1-1992:2. The standard error of the mean is given in parentheses. All results are significant at the one percent level.

Nevertheless, there might still be important differences across different types of funds or different countries. For example, the inclusion of single-country funds may tend to lower the overall herding measure if these funds are required to hold a specific fraction of their assets in a particular country and if they are limited in their ability to hold cash instead. Similarly, offshore investment funds may display different investment patterns due to the lower regulatory constraints they face. Closed-end funds are not subject to redemptions and are therefore less likely to herd, as explained earlier.[26] Table 4 shows the herding measures for different types of funds.[27]

[26] See Kaminsky, Lyons, and Schmukler (1999) for an attempt to distinguish between herding at the manager and at the individual investor level.

[27] Offshore funds are defined as those having their domicile in tax heavens. An alternative definition would have classified all those funds as "offshore" if they did not invest primarily in the country they were located. However, there are few single-country funds focusing on the stock market of the country in which they have their domicile (Korean funds are among thre exceptions). Excluding those "onshore" funds did not affect the main results.

Table 4. Mean herding measures by types of funds

	Smallest 20%	Largest 20%	Closed -End	Intern. & Global Emerg.	Single -country	Offshore
1996	1.6*	7.0	4.3	7.4	5.6	4.9
	(0.8)	(0.6)	(0.7)	(0.6)	(1.0)	(1.0)
1997	4.3	7.0	4.7	7.4	8.4	8.0
	(0.9)	(0.5)	(0.7)	(0.6)	(1.1)	(0.9)
1998-99	4.4	6.8	4.7	6.4	8.0	6.3
	(0.6)	(0.5)	(0.6)	(0.5)	(0.9)	(0.9)
Whole period	3.8	6.9	4.6	7.0	7.4	6.5
	(0.5)	(0.3)	(0.4)	(0.3)	(0.6)	(0.5)

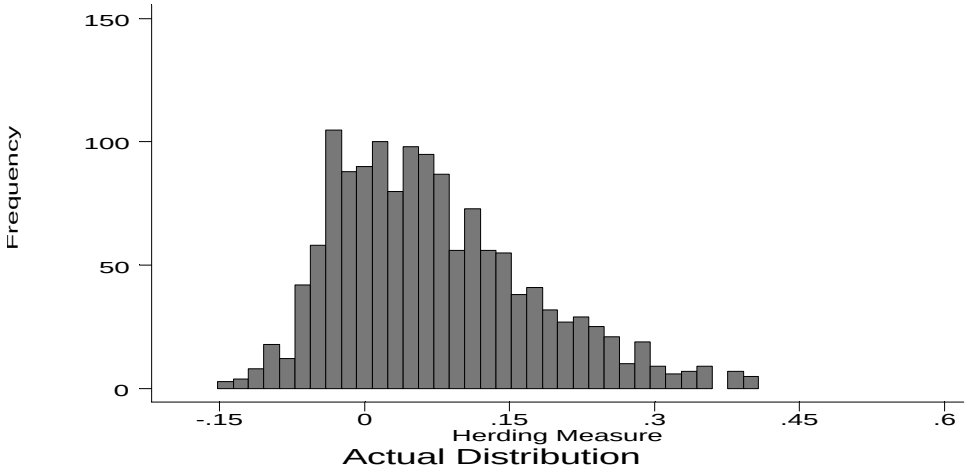
Source: Authors' calculations based on data from Emerging Market Fund Research, Inc.
Based on average size of all funds over time. Note: Standard error in parenthesis. *All results are significant at the one percent level except in the case of smallest 20% funds in 1996 where the result is significant only at the 10 percent level. The smallest funds are exclusively Asian funds.

The results show that, contrary to our presumption, but in line with the results of Kim and Wei (1999b), offshore funds tend to herd less than other funds. Confirming our expectations, there is also less herding among small country funds.[28] Large, global and international do not differ strongly in their herding behavior from the average. In line with our a-priori reasoning, herding is also less pronounced among closed-end funds, suggesting that the observed tendency for herding might to a significant extent be traceable to the behavior at the individual investor's level.

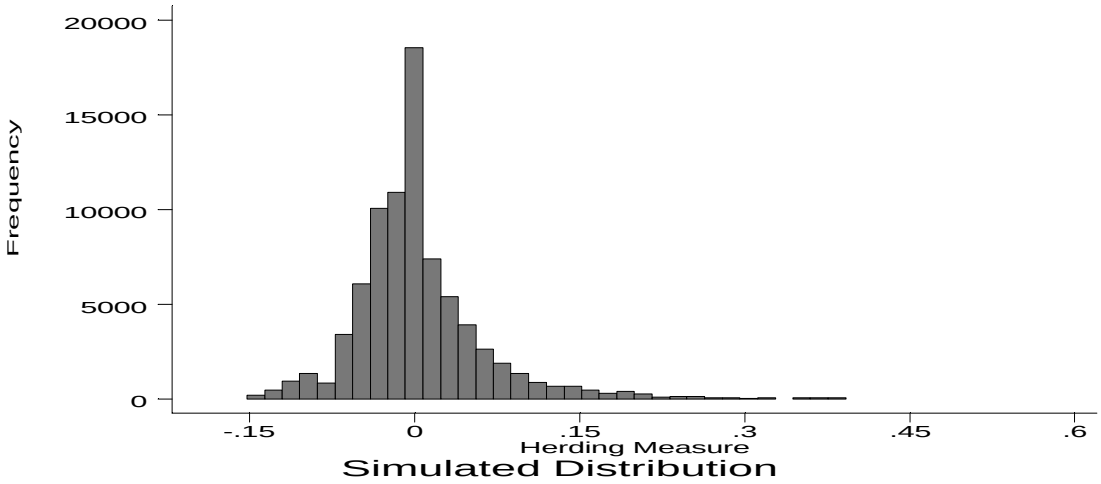
How important are these results quantitatively? In order to answer this question, we proceed similarly as Wermers (1999), comparing the distributions of the actual monthly herding measures to a simulated distribution obtained under the assumption that funds make their buying decisions independently.[29] The distributions differ sharply: in contrast to the actual distribution, the simulated distribution is nearly symmetric around zero.

Figure 3. Actual and simulated herding measure distributions

[28] Note however, that the smaller figure for small funds may reflect the fact that these funds experienced a lower-than-average growth of inflows.
[29] Details of the Monte Carlo simulation are given in Appendix III.



No. of obs.: 1413
Mean: 0.072
Median: 0.056



No. of obs.: 79800
Mean: 0.0036
Median: 0.00

Source: Authors' calculations based on data from Emerging Market Fund Research, Inc.

One could argue that, despite controlling for time-varying propensities to buy, the herding measure might overstate the extent of actual herding if there are many funds entering our sample, since these funds will naturally tend to grow and therefore buy frequently. We therefore carried out the calculations with a balanced subsample, i.e. only with funds that stayed within the sample throughout the 39 months, obtaining very similar results (the mean herding measure was 7.1).

There might be sizeable differences in the degree of herding depending on market size. For smaller markets, it may be more difficult or at least relatively more costly to obtain accurate information about fundamentals. If that is true, fund managers may be more inclined to imitate the behavior of other funds.[30] One the other hand, when they are subject to large inflows or outflows, fund managers may go first to the most liquid markets, and gradually to the less liquid ones. Table 5 displays the herding measures for the smallest and largest ten stock markets that are covered by the IFC.[31] It appears that there is more herding in the case of the largest stock markets than for the lowest, suggesting that the liquidity story is more relevant than the informational explanation.

Table 5. Mean herding measures by stock market capitalization

	Smallest ten	Largest ten
1996	6.7	6.4
	(1.0)	(0.8)
1997	5.5	8.3
	(0.9)	(0.8)
1998-99	4.8	8.7
	(0.8)	(0.8)
Whole period	5.6	7.9
	(0.5)	(0.5)

Source: Authors' calculations based on data from Emerging Market Fund Research, Inc. Note: Standard error in parenthesis. All results are significant at the one percent level.

Finally, we also calculated the herding measure aggregating all funds that belong to the same firm. This would be appropriate in the extreme case in which there was only one fund manager managing all the mutual funds of a firm. After aggregation, we are left with an average of only 74 funds per month. The mean herding measure obtained in this way is somewhat lower, namely 5.4 percent. The lowest value was obtained for Europe (4.2 percent) and the highest for Asia (6.3 percent).

[30] See Banerjee (1992) and Calvo and Mendoza (1997) for models illustrating similar arguments.
[31] While we have even smaller markets in our sample, comparability of market capitalization figures, and more importantly, the often very small number of transactions in these other markets led us to focus on stock markets covered by the IFC for this comparison.

What is the impact of herding on stock return behavior? If the amount of herding that we detected among our group of investors had important effects on stock markets, we would expect to observe a positive correlation between the degree of herding and stock return volatility. In order to investigate this issue, we regressed the variance of stock-index returns (computed for each country over the whole period) on the country-mean of the computed herding measures. The result from an OLS regression using 41 countries, reveals a statistically significant relationship between the two variables. The coefficient on the mean herding variable is 0.44, with a t-statistic of 11.6. The R^2 is quite high, namely 0.08. This means that we can explain nine percent of the variability in stock return variance by differences in herding among our investors. Note however, that this result should not be overinterpreted, given that we made no attempt to control for other factors, such as business cycle volatility (which in itself may be endogenous).

Overall, the data shows evidence for herding behavior, although not of dramatic proportions. There is no indication that herding is more prevalent during crisis than during tranquil times. However, herding is strongly associated with volatility.

VIII. TESTING FOR POSITIVE FEEDBACK TRADING

Another way of gaining more information about the potential destabilizing effect of their investment strategies is to examine the extent to which funds follow "positive feedback" or "momentum" strategies. For this purpose, we first compute two measures of excess demand proposed by LSV and relate these measures to the prior performance of individual stock markets. The first measure, defined by LSV as the Numbers Ratio (NR) is given for every given month t and country i by the total number of buyers divided by the total number of funds active in that country:

$$NR(i,t) = \#buyers(i,t)/\#active(i,t), \qquad (4)$$

The second measure, called the Dollar Ratio (DR), is the difference between in-and outflows divided by the sum of in- and outflows to a country:

$$DR = (inflows(i,t)-outflows(i,t))/(inflows(i,t)+outflows(i,t)) \quad (5)$$

Note that, in principle, both methods of measuring excess demand can yield opposite results; in any given period, the majority of funds may be sellers, but a few large buyers may dominate the picture.

While there is no clear relation visible between the country's prior stock performance and the subsequent number of funds buying in that market, the imbalance measured in dollars (by DR) shows that funds tended to buy past winners. This can be seen in Tables 6 and 7 which present simple averages for NR and DR by past-month performance. The findings for DR are in line with findings by Kaminsky, Lyons, and Schmukler (1999). Interestingly, the figures indicate that positive-feedback trading is less pronounced in the case of single-country funds. Moreover, there is no evidence that this behavior is accentuated in the Asian countries during the crisis.

Table 6. Past-month performance and numbers ratio by fund type and market size

Past-month performance Quintiles	All Funds	Single-Country Funds	Large Funds (largest 20%)	Small Funds (smallest 20%)	Largest 10 Markets	Smallest 10 Markets	All Funds during Crises*
1 (worst)	0.49	0.40	0.50	0.50	0.45	0.47	0.45
2	0.50	0.42	0.53	0.48	0.49	0.46	0.46
3	0.51	0.52	0.52	0.50	0.51	0.46	0.45
4	0.49	0.41	0.50	0.52	0.50	0.48	0.48
5 (best)	0.50	0.47	0.51	0.47	0.49	0.48	0.46

* Periods include 1997:08-1997:12, 1998:06-1998:10 and 1998:11-1999:02, which correspond to crises in Asia, Russia, and Brazil, respectively.

Table 7. Past-month performance and dollar ratio by fund type and market size

Past-month performance Quintiles	All Funds	Single-Country Funds	Large Funds (largest 20%)	Small Funds (smallest 20%)	Largest 10 Markets	Smallest 10 Markets	All Funds during Crises*
1 (worst)	-0.03	-0.38	-0.02	-0.21	-0.06	-0.13	-0.07
2	-0.01	-0.34	0.01	-0.25	0.04	-0.15	-0.12
3	-0.06	-0.26	-0.05	-0.25	0.11	-0.20	-0.07
4	-0.01	-0.43	-0.01	-0.16	0.08	-0.05	-0.06
5 (best)	0.05	-0.25	0.06	-0.12	0.07	-0.05	-0.02

*Periods include 1997:08-1997:12, 1998:06-1998:10 and 1998:11-1999:02, which correspond to crises in Asia, Russia, and Brazil, respectively.

A different methodology to assess the importance of momentum strategies has been proposed by Grinblatt, Titman, and Wermers (1995). Their momentum measure is given by:

$$M = \frac{1}{T}\sum_{t=1}^{T}\sum_{j=1}^{N}(w_{j,t} - w_{j,t-1})R_{j,t-1}, \qquad (6)$$

where $w_{j,t}$ and $R_{j,t}$ denote portfolio weights and returns of country j at time t. This is a momentum measure based on changes in portfolio weights in reaction to returns in the previous period. It is positive if there is momentum trading. A feature of the measure is that it allows to focus on strategies pursued by managers rather than individual investors, since a withdrawal by individual investors would not per se result in a change of weights.

According to this measure, emerging market fund managers seem to sell following bad performance, but not buy following good performance. We computed M separately for buys and sales, i.e. for cases where $w_{j,t} - w_{j,t-1}$ is greater or less than zero.[32] In our sample, the mean of Sell M across funds was 0.07 and significantly different from zero at the one percent level, whereas the average of Buy M was 0.01 and not significant. The numbers are not significantly different during crisis times.[33]

[32] Note that this terminology is not completely accurate, since portfolio weights might in- or decrease without any actual trades.

What is the relation between contemporaneous price movements and trading activity? Tables 8 and 9 present the NR and DR excess demand measures sorted by current stock market performance. Here, the picture looks quite different: As the first column in Table 8 indicates, funds tended to invest in stock markets which were performing poorly (the numbers are monotonically decreasing with performance quintiles). According to the NR measure in Table 8, this is true for single-country funds as well as large funds, and for small as well as large markets. However, it is not the case for small funds. By and large, these results are confirmed by the DR figures presented in Table 9. Again, small funds are the exception: for these smaller funds, there is some evidence for positive contemporaneous momentum strategies.[34]

Two caveats should be mentioned here. First, it is clear that the frequency of the data is too low to make very precise inferences about the trading patterns of these investors. For example, the observed price movements may be the result as well as the cause of the trading activity recorded for that month. However, given that we find a negative association between contemporaneous trading and price movements, it is unlikely that the effect running from trades to prices is the predominant one. Second, our results might be contaminated by errors in our measurement of flows. Note, however, that similar results were obtained when using more conservative flow estimates.[35] Overall, there is no evidence that excess demand by emerging market funds had a noticeable impact on prices.

---

[33] This contrasts with the results from Kaminsky, Lyons, and Schmukler (1999).

[34] We did not compute the Grinblatt, Titman, and Wermers (1995) momentum measure using contemporaneous returns since this measure would be strongly biased upwards. This is true since it would be strongly influenced by increases in weights that are not the result of active investments, but merely due to high returns in that period

[35] As noted earlier, for every month we classified an increase in asset holdings in a particular country beyond that explained by the total return in that month as an inflow if it exceeded one percent of the fund's assets in that country. Raising this threshold to five percent did not substantially alter the results.

Table 8. Contemporaneous performance and numbers ratio by fund type and market size

Same-month performance Quintiles	All Funds	Single-Country Funds	Large Funds (largest 20%)	Small Funds (smallest 20%)	Largest 10 Markets	Smallest 10 Markets	All Funds during Crises*
1 (worst)	0.53	0.43	0.57	0.45	0.48	0.52	0.48
2	0.53	0.47	0.56	0.60	0.52	0.51	0.51
3	0.53	0.44	0.55	0.51	0.52	0.48	0.50
4	0.47	0.42	0.49	0.51	0.45	0.45	0.40
5 (best)	0.42	0.34	0.42	0.47	0.45	0.37	0.40

* Periods include 1997:08-1997:12, 1998:06-1998:10 and 1998:11-1999:02, which correspond to crises in Asia, Russia, and Brazil, respectively.

Table 9. Contemporaneous performance and dollar ratio by fund type and market size

Same-month performance Quintiles	All Funds	Single-Country Funds	Large Funds (largest 20%)	Small Funds (smallest 20%)*	Largest 10 Markets	Smallest 10 Markets	All Funds during Crises*
1 (worst)	0.02	-0.22	0.01	-0.30	-0.05	-0.08	-0.09
2	0.02	-0.20	0.03	-0.12	0.10	0.02	-0.03
3	-0.01	-0.34	0.01	-0.21	0.14	-0.20	-0.04
4	-0.03	-0.47	0.00	-0.14	0.03	-0.17	-0.13
5 (best)	-0.06	-0.46	-0.04	-0.19	0.02	-0.15	-0.06

* Periods include 1997:08-1997:12, 1998:06-1998:10 and 1998:11-1999:02, which correspond to crises in Asia, Russia, and Brazil,respectively.

IX. CONCLUSIONS

Having presented a variety of different results, it is useful to summarize the main ones:

1) Inflows contemporaneously coexist with inflows.

2) The correlation of flows within regions is higher than across regions.

3) In all four crises inspected, emerging market mutual funds withdrew large sums from the affected country in the month prior to the crisis. This is particularly visible in the cases of Brazil and Russia, and less marked for the Asian and Czech crises.

4) The investment behavior of emerging market funds is more complex than often suggested: in many cases, those funds that withdrew money from a crisis country, invested in other countries that were seen as suffering from contagion effects.

5) Inflows of regional and single-country funds tended to precede those of global and international funds. Similarly, open-ended funds' investments Granger-cause closed-end funds. However, these results do not appear to be particularly robust

6) There is some, but not dramatic evidence for herding behavior. There are no dominant patterns across funds and over time, although herding is more prevalent in large emerging markets. Herding is less pronounced among closed-end funds, suggesting that herding behavior might to a significant extent be traceable to individual investor's behavior. Differences in the degree of herding explain about eight percent of the variation in stock return volatility across countries.

7) Emerging market funds tend sell past losers and buy past winners, but this behavior was less visible in the case of the Asian countries during the crisis. The contemporaneous correlation between excess demand and performance is negative.

While herding and positive feedback trading appear to be relevant phenomena within this class of investors, the results do not support the view that their behavior is mainly determined by sudden irrational panics and mere imitating behavior.

References

Aitken, Brian (1996), "Have Institutional Investors Destabilized Emerging Markets?", IMF Working Paper 96/34

Banerjee, Abhijit (1992), "A Model of Herd Behavior," *Quarterly Journal of Economics*, 107(3), pp. 797-817

Bohn, Henning and Linda L. Tesar (1996), "U.S. Equity Investment in Foreign Markets: Portfolio Rebalancing or Return Chasing?," *American Economic Review*, May, pp. 77-81

Brennan, Michael J. and H. Henry Cao, "International Portfolio Investment Flows," *Journal of Finance*, 52, pp. 1851-80

Calvo, Guillermo A. and Enrique G. Mendoza (1997), "Rational Herd Behavior and the Globalization of Securities Markets," Discussion Paper 120, Institute for Empirical Macroeconomics, Federal Reserve Bank of Minneapolis

Choe, Hyuk, Bong-Chan Kho, and René Stulz (1998), "Do Foreign Investors Destabilize Stock Markets? The Korean Experience in 1997," *NBER Working Paper* No. 6661

Eichengreen, Barry, Donald Mathieson, Bankim Chadha, Anne Jansen, Laura Kodres, and Sunil Sharma (1998), "Hedge Funds and Financial Market Dynamics," *IMF Occasional Paper* No. 166

DeLong, J. Bradford , Andrei Shleifer, Lawrence H. Summers and Robert J. Waldmann (1990), "Positive feedback Investment Strategies and Destabilizing Rational Speculation," *Journal of Finance*, June 1990, 45(2), pp. 379-96

Devenow, Andrea and Ivo Welch (1996), "Rational Herding in Financial Economics," *European Economic Review* 40, pp. 603-615

Froot, Kenneth A., Paul G.J. O'Connell, and Mark Seasholes (1998), "The Portfolio Flows of International Investors, I," *NBER Working Paper* No. 6687

Froot, Kenneth A., David Scharfstein and Jeremy Stein (1992), "Herd on the Street," *Journal of Finance*, 47, September, pp. 1461-1484

Gelos, R. Gaston and Ratna Sahay (1999), "Comovements and Crises – Financial Market Spillovers in Transition Economies," mimeo, International Monetary Fund

Grinblatt, Mark, Sheridan Titman, and Russ Wermers (1995), "Momentum Investment Strategies, Portfolio Performance, and Herding: A Study of Mutual Fund Behavior," *American Economic Review* 85, pp. 1088-1105

Judgson, Ruth A. and Ann L. Owen (1996), "Estimating Dynamic Panel Models: A Practical Guide for Macroeconomists," Working Paper, Federal Reserve Board of Governors

Kaminsky, Graciela, Richard Lyons and Sergio Schmukler (1999), "Managers, Investors, and Crises: Mutual Fund Strategies in Emerging Markets," mimeo, The World Bank

Kim, Woochan and Shang-Jin Wei (1999a), "Foreign Portfolio Investors Before and During a Crisis," mimeo, Harvard University

Kim, Woochan and Shang-Jin Wei (1999b), "Offshore Investment Funds: Monsters in Emerging Markets?," *NBER Working Paper* No. 7133

Kodres, Laura E. and Matthew Prisker (1996), "Directionally Similar Position Taking and Herding by Large Futures Market Participants, " in: "Risk Measurement and Systemic Risk – Proceedings of a Joint Central Bank Research Conference," Board of Governors of the Federal Reserve Systems, Washington, D.C.

Lakonishok, Josef, Andrei Shleifer, and Robert W. Vishny (1992), "The Impact of Institutional Trading on Stock Prices," *Journal of Financial Economics* 32, pp.23-44

Lim, Paul J. (1999), "Your Investment: Midyear Outlook and Fund Review: Why Foreign Stocks Mean Opportunity," *Los Angeles Times*, July 6

Masson, Paul R. (1999), "Multiple Equilibria, Contagion, and the Emerging Market Crises," IMF Working 99/164

Mullainathan (1998), "A Memory-Based Model of Bounded Rationality", mimeo, Massachussets Institute of Technology

Richards, Anthony (1996), "Volatility and Predictability in National Stock Markets: How Do Emerging and Mature Markets Differ?," *IMF Staff Papers*, Vol. 43, pp. 461-501

Scharfstein, David S. and Jeremy C. Stein (1990), "Herd Behavior and Investment," Amer*ican Economic Review* 80, no. 3, pp. 465-479

Schinasi, Garry J. and R. Todd Smith (1999), "Portfolio Diversification, Leverage, and Financial Contagion," mimeo, IMF

Tesar, Linda L. and Ingrid M. Werner (1995), "U.S. Equity Investment Barriers in Emerging Equity Markets," *The World Bank Economic Review*, Vol. 9, No. 1

Wermers, Russ (1999), "Mutual Fund Herding and the Impact on Stock Prices," *Journal of Finance*, Vol. LIV, No. 2, pp. 581-622

Appendix I. Correlation of Aggregate Flows Across Countries

	fbangladesh	fchina	fhongkong	findia	findonesia	fkorearep	fmalaysia	fpakistan	fphilippines	fsingapore	fsrilanka	ftaiwan	fthailand	fvietnam	fargentina	fbrazil	fchile	fcolombia
fbangladesh																		
fchina	0.00																	
fhongkong	0.00	0.04																
findia	0.01	-0.02	-0.01															
findonesia	0.00	-0.05	0.32	-0.03														
fkorearep	0.00	-0.02	0.06	0.06	0.11													
fmalaysia	0.00	-0.02	0.31	0.07	0.31	-0.27												
fpakistan	0.00	-0.01	-0.04	0.04	0.06	0.04	-0.01											
fphilippines	0.01	0.04	0.31	0.08	0.30	0.06	0.32	-0.01										
fsingapore	0.00	0.00	0.56	0.02	0.32	0.09	0.33	-0.02	0.26									
fsrilanka	0.00	0.00	0.00	0.01	0.01	-0.01	0.00	0.03	0.00	-0.12								
ftaiwan	0.00	0.00	0.05	0.09	0.07	0.16	0.05	0.01	0.00	0.03	0.00							
fthailand	0.00	-0.01	0.20	0.07	0.26	0.13	0.18	0.03	0.20	0.21	0.01	0.01						
fvietnam	0.00	0.03	0.00	0.03	0.08	-0.01	-0.02	0.21	0.09	0.01	0.01	0.01	0.00					
fargentina	0.00	0.02	0.10	0.13	0.12	0.11	-0.01	0.00	0.16	0.06	-0.01	-0.03	0.01	0.01				
fbrazil	0.00	0.05	0.04	0.10	0.13	0.13	0.01	-0.05	0.11	0.03	-0.01	0.04	0.04	0.02	0.33			
fchile	0.00	0.02	0.03	0.03	0.09	0.11	0.02	0.06	0.04	0.04	0.00	0.17	0.01	0.10	0.12	0.05		
fcolombia	0.00	0.02	0.02	0.06	-0.02	0.00	-0.02	0.03	-0.03	0.02	0.01	-0.02	0.10	0.03	0.03	0.05	-0.02	
fmexico	0.00	0.02	0.05	0.16	0.07	0.14	0.02	0.06	0.08	0.03	-0.01	0.00	0.04	0.02	0.28	0.34	0.28	0.06
fperu	0.00	0.04	0.05	0.05	0.04	0.10	0.02	-0.07	0.09	0.05	0.01	0.03	0.09	0.03	0.04	0.11	0.14	0.01
fvenezue	0.00	0.06	0.02	0.00	0.08	-0.01	-0.01	0.12	0.08	0.04	0.01	0.05	0.02	0.12	0.14	0.07	0.15	0.12
fecuador	0.00	-0.03	-0.03	0.02	-0.02	0.04	0.03	0.02	-0.05	0.01	0.00	-0.07	0.04	-0.01	-0.05	-0.04	-0.05	0.07
fpanama	0.00	-0.01	0.00	0.00	0.02	0.00	-0.01	-0.02	0.00	0.00	0.01	0.00	0.00	0.04	-0.02	-0.01	-0.02	0.02
fcroatia	0.00	-0.02	0.00	-0.02	0.06	0.10	0.00	-0.05	-0.02	0.01	-0.01	-0.02	0.01	-0.01	-0.04	0.00	0.19	-0.02
fczechre	0.00	0.05	0.01	0.08	0.02	0.04	0.02	0.03	-0.01	0.00	0.01	0.06	0.03	0.00	0.08	0.05	0.08	0.10
fgreece	0.00	0.07	0.03	-0.01	0.01	-0.02	-0.02	0.07	0.04	0.02	0.00	0.05	0.00	0.00	0.09	0.05	0.02	0.07
fhungary	0.00	0.02	0.00	0.11	0.03	0.04	0.04	0.00	0.05	0.00	0.00	0.09	0.01	0.03	0.15	0.09	0.13	0.01
fpoland	0.00	0.05	0.00	0.11	0.06	0.10	0.05	0.02	0.04	0.04	0.00	0.13	0.02	0.03	0.13	0.04	0.10	0.04
fportuga	0.00	0.04	0.03	0.03	0.02	-0.05	0.00	0.03	0.02	0.01	0.00	-0.07	0.02	0.05	0.03	-0.05	-0.17	0.05
fromania	0.00	0.00	0.01	0.02	0.00	0.00	0.01	-0.01	0.01	0.00	0.00	0.01	0.00	0.00	-0.01	-0.01	-0.01	0.00
frussiac	0.00	-0.05	0.05	0.04	0.13	0.04	0.01	-0.02	-0.01	-0.02	0.02	0.20	0.02	0.02	-0.13	-0.10	0.07	0.00
fslovaki	0.00	0.01	-0.01	0.07	0.06	0.04	0.02	0.04	0.03	0.02	0.00	0.05	0.03	-0.01	0.05	0.04	0.02	0.02
fturkey	0.00	0.02	0.00	0.13	0.10	-0.01	0.03	-0.01	0.09	0.03	0.00	0.04	0.04	-0.01	0.29	0.12	0.10	0.00
fbotswan	0.00	0.02	0.00	0.01	0.00	-0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.07	0.00	0.00	0.00	0.00
fegypt	0.00	-0.05	0.01	0.02	0.03	0.02	0.04	-0.03	0.02	-0.01	-0.02	-0.03	0.04	-0.02	-0.01	0.03	0.05	-0.13
fghana	0.00	0.03	-0.03	0.06	-0.01	0.07	0.02	0.02	-0.07	0.03	0.00	0.00	0.06	-0.02	-0.08	-0.01	-0.01	0.09
fisrael	0.00	-0.08	0.00	0.11	0.07	0.05	0.04	0.04	0.04	0.00	0.01	0.07	0.03	0.06	0.06	-0.01	0.09	0.02
fjordan	0.00	0.00	-0.03	0.00	-0.02	0.00	0.00	0.00	0.01	-0.03	-0.01	0.00	-0.02	0.00	0.00	-0.03	0.02	0.03
fkenya	0.00	0.00	0.00	-0.01	0.00	0.00	-0.01	0.02	0.00	0.00	0.00	0.00	0.01	-0.03	0.05	0.02	-0.02	0.02
fmauriti	0.00	-0.02	0.01	0.02	0.01	-0.03	0.00	0.00	0.03	0.00	-0.01	0.03	0.00	0.00	0.05	0.03	0.02	0.01
fmorocco	0.00	0.03	0.00	0.01	0.00	0.00	0.05	0.03	0.03	0.03	0.00	0.05	0.00	0.00	0.02	-0.02	-0.15	0.00
fsafrica	0.00	-0.05	0.05	0.18	0.14	0.07	0.07	-0.02	0.13	0.09	0.01	0.01	0.14	0.02	0.28	0.09	0.16	-0.01
fzimbabw	0.00	0.00	0.00	0.03	0.00	0.01	0.02	0.03	-0.02	0.00	0.01	0.00	0.02	0.02	0.00	-0.01	0.00	-0.05

	fvenezue	fecuador	fpanama	fcroatia	fczeche	fgreece	fhungary	fpoland	fportuga	fromania	frussiac	fslovaki	fturkey	fbotswan	fegypt	fghana	fisrael	fjordan
fecuador	-009																	
fpanama	002	003																
fcroatia	000	007	000															
fczeche	009	002	-003	002														
fgreece	012	001	000	-002	-003													
fhungary	007	-007	-001	002	016	-022												
fpoland	002	002	-001	007	028	-003	039											
fportuga	002	007	000	-005	-001	036	-008	-001										
fromania	000	-003	000	001	003	002	000	000	-004									
frussiac	005	-004	000	002	007	002	000	-003	003	001								
fslovaki	-001	005	000	-002	-027	000	003	000	-002	000	004							
fturkey	006	005	-001	007	008	022	007	021	013	000	001	006						
fbotswan	000	001	004	-001	000	000	001	000	001	000	000	000	-001					
fegypt	-004	001	002	004	004	-007	006	-001	-004	-001	-006	002	005	006				
fghana	-003	015	000	006	005	-002	-003	001	003	-001	001	001	-004	003	-001			
fisrael	002	-004	001	002	014	-031	042	026	-006	000	-003	001	003	000	015	-002		
fjordan	001	004	000	000	001	-011	-002	000	-003	-001	-001	-002	-007	000	007	001	-005	
fkenya	001	001	000	001	000	008	-001	002	-006	000	000	000	006	-003	-008	002	-010	-001
fmauriti	007	-002	000	-007	-001	005	004	000	-002	000	-003	000	-003	005	010	000	001	000
fmorocco	-003	-002	000	-014	-004	001	-001	-001	003	-001	-001	002	003	001	-001	-004	-004	003
fsafrica	006	005	-001	006	008	-006	014	016	-001	005	002	003	025	-002	007	-003	023	-001
fzimbabw	-005	001	001	000	002	001	002	000	001	000	001	001	002	004	005	002	000	-001

Source: Authors' calculations based on data from Emerging Markets Funds Research, Inc.

Appendix II The Behavior of Funds Withdrawing from Crisis Countries

Aggregated flows to different countries and regions around Czech crisis

	Jan-97	Feb-97	Mar-97	Apr-97	May-97	Jun-97
Czech Stock Mtk. Return %	4.2	4.1	-10.0	-7.5	-10.9	4.0
Net Flows						
Czech Rep.	20	10	10	-24	-20	-23
Hungary	-9	-6	4	1	-40	-6
Poland	-32	-18	-2	6	31	37
Russia	-58	-83	60	154	113	-38
Slovakia	0	1	5	2	2	-1
Europe	-114	-83	-19	181	53	30
Asia	-170	175	619	-559	-84	-1313
Latin America	335	148	217	278	86	214
Middle East & Africa	41	72	107	107	115	179

Source: Authors' calculation based on data from IFC and Emerging Market Funds Research, Inc.
Note: Based on balanced sample of funds. Flows are in millions of dollars

Mean investment of funds that withrew money from the Czech Republic around the Czech crisis, by country (1997:04-1997:06, millions of US$)

Country	Obs	Mean	Std. Dev.	Min	Max
Czech Rep.	57	-2.0	2.9	-12.3	-.0
Hungary	57	0.5	2.3	-5.1	11.5
Poland	57	0.7	4.2	-6.6	27.6
Russia	57	2.7	13.3	-11.6	82.6
Slovak Rep.	57	0.0	0.3	-1.1	1.4
Latin Am.	57	5.1	19.2	-15.3	87.8
Europe	57	2.4	16.1	-16.9	93.1
Asia	57	14.6	55.1	-54.2	334.5

Aggregated flows to different countries and regions around Asian crisis

	Apr-97	May-97	Jun-97	Jul-97	Aug-97	Sep-97	Oct-97	Nov-97	Dec-97	Jan-98	Feb-98	Mar-98
Thai Mkt Return %	-5.3	-12.9	-9.7	6.7	-33.1	5.9	-32.5	-12.7	-22.2	35.8	28.2	-6.5
Hong Kong Mkt Ret. %	3.0	14.3	3.0	7.8	-13.7	6.6	-29.3	-0.9	1.6	-13.6	24.0	0.3
Korea Mkt Return %	3.1	7.9	1.7	-3.6	-3.8	-9.6	-29.7	-26.9	-33.0	69.8	-7.6	0.7
Net Flows												
Thailand	221	-33	50	298	159	191	101	73	156	-131	68	51
Indonesia	25	-88	-57	-38	77	-66	89	125	149	75	-27	-10
Korea	27	312	345	131	-40	92	-600	87	133	209	357	-78
Malaysia	-435	-398	-369	-128	-399	-364	-25	13	131	-14	8	97
Philippines	-44	-102	-110	18	-34	46	47	-1	18	31	-63	120
Hong Kong	123	-216	-908	-361	35	-808	-344	152	-6	324	291	27
China	-19	147	64	-105	177	96	19	173	-81	147	-51	142
Taiwan	-232	37	151	12	-98	-598	-658	86	-61	255	210	222
Singapore	-73	118	-274	129	-215	-40	-47	-79	-46	182	73	-4
Europe	164	38	47	-70	348	-198	-11	-189	-258	122	179	84
Middle East & Africa	103	111	177	126	283	202	220	-30	46	-45	44	109
Asia	-539	-30	-1300	-23	-306	-1287	-1404	554	413	1047	785	531
Latin America	272	89	204	-279	81	395	-479	305	218	-158	156	106

Source: Authors' calculation based on data from IFC and Emerging Market Funds Research, Inc.
Note: Based balanced sample of funds.

Mean investment of funds that withrew money from Thailand around the Asian crisis, by country (1997:04-1998:03, millions of US$)

Country	Obs	Mean	Std. Dev.	Min	Max
Thailan	874	-1.8	4.1	-68.3	0.0
Indones	874	-.4	3.5	-66.4	38.1
Koreas	874	.2	7.0	-67.7	105.1
Malaysi	874	-1.7	7.6	-161.4	17.1
Philipp	874	-.3	3.1	-41.4	32.8
Hongkon	874	-1.6	37.6	-991.0	322.9
China	874	.3	4.3	-49.0	68.9
Taiwan	874	.5	9.8	-39.7	172.0
Singapo	874	-.7	11.5	-317.5	53.2
Europe	874	-.1	8.1	-74.0	100.7
M.E.& N.A.	874	.2	5.5	-32.6	85.7
Latin Am.	874	-.0	14.1	-134.3	166.9

Aggregated flows to different countries and regions around Russian crisis

	Apr-98	May-98	Jun-98	Jul-98	Aug-98	Sep-98	Oct-98
Russia Stock Mtk. Return %	-3.1	-39.9	-20.5	0.6	-58.7	-41.9	48.4
Net Flows							
Russia	11	236	137	-159	-92	53	-30
Czech Republic	6	13	3	9	-5	-5	-22
Poland	-15	-5	-7	31	16	-8	17
Hungary	-2	-34	-3	18	-29	-3	21
Slovakia	-2	-3	2	5	-2	-2	-4
Europe	148	202	36	-130	-118	-4	-47
M.E. & Africa	280	39	19	181	-37	2	-74
Asia	546	-72	-184	317	-1003	-167	-95
Latin America	124	-301	-142	867	-427	529	385

Source: Authors' calculation based on data from IFC and Emerging Market Funds Research, Inc.
Note: Based on balanced sample of funds. Flows are given in millions of U.S. dollars.

Mean investment of funds that withrew money from Russia around the Russian crisis, by country (1998:06-1998:11, millions of US$)

Country	Obs	Mean	Std. Dev.	Min	Max
Russia	120	-3.3	9.4	-90.2	0.0
Czech Rep.	120	-0.2	2.4	-14.4	9.3
Hungary	120	0.2	3.9	-10.3	31.8
Poland	120	0.6	2.9	-5.4	13.9
Slovak. Rep.	120	-0.0	0.4	-1.9	3.1
Europe	120	-3.6	9.4	-57.2	16.6
Latin Am.	120	10.2	60.3	-41.4	588.9
M.E. & N.A.	120	0.8	9.5	-46.0	65.0

Table 5. Aggregated flows to different countries and regions around Brazilian crisis

	Sep-98	Oct-98	Nov-98	Dec-98	Jan-99	Feb-99	Mar-99
Brazil Stock Mtk. Return %	-0.5	5.0	19.8	-18.8	-28.1	5.9	40.3
Net Flows							
Brazil	136	94	198	-400	56	33	-119
Argentina	63	-65	-72	-61	92	-37	-104
Chile	75	22	-93	80	42	-3	-40
Colombia	-3	-2	-2	2	-2	0	-1
Mexico	176	308	45	-89	74	219	33
Venezuela	11	-22	-3	-7	-4	-7	5
Europe	-21	-24	98	132	74	-49	-54
M.E. & Africa	14	-68	-2	1	17	179	88
Asia	-148	-106	145	-319	261	132	491
Latin America	536	380	-4	-396	292	186	-298

Source: Authors' calculation based on data from IFC and Emerging Market Funds Research, Inc.
Note: Based on balanced sample of funds. Flows are given in millions of U.S. dollars.

Mean investment of funds that withrew money from Brazil around the Asian crisis, by country (1998:11-1999:02, millions of US$)

Country	Obs	Mean	Std. Dev.	Min	Max
Brazil	214	-3.3	10.9	-121.4	0.0
Argentina	214	-1.0	8.1	-103.5	16.3
Chile	214	0.4	3.3	-3.7	36.8
Colombia	214	0.0	0.3	-1.8	3.0
Mexico	214	-0.4	4.7	-24.2	41.6
Venezuela	214	0.0	0.6	-5.1	3.5
Europe	214	0.7	9.3	-21.3	116.8
M.E.& N.A.	214	0.2	6.9	-44.4	74.4
Asia	214	0.5	27.0	-139.3	312.0

Appendix. III Simulating the Herding Measure Distribution

Following Wermers (1999), we use a Monte Carlo simulation procedure to generate a simulated distribution of herding measures under the null hypothesis of independent trading. For each month t, the number of funds investing in a given country *i* in month *t*, is generated as a draw from a binomial distribution. More precisely, if n_{it} is the number of actual trades in a country, (if n_{it} is greater or equal than five), we produce n_{it} draws from a *U(0,1)* distribution with a random number generator. Each draw is rounded up to one if it is greater than 1- $E[p_{it}]$ (where $E[p_{it}]$ is the actual proportion of funds buying in that year, as explained in Section VII); other wise it is rounded down to zero. These outcomes are summed up, yielding a draw from a binomial distribution $b(n_{it}, E[p_{it}])$. Based on this simulated data, we calculate the simulated herding measures. We repeat this procedure 50 times, obtaining a sample of 79800 simulated herding measures.