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# Herding Behavior by Equity Foreign Investors on Emerging Markets

Barbara Alemanni*
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**Abstract**

This article analyzes empirically the herding behavior on emerging markets, measuring the degree of herding by foreign investors on emerging equity markets, and evaluating the effects of this behavior on the riskiness of the markets. We use an adaptation of the LSV Herding measure and calculate this measure for a sample of 9 emerging markets over the period 2000-2005. Our overall mean, 4.75, although is lower than previous studies with emerging equity markets during the late 1990's, still indicates the presence of herding behavior. Therefore we have evidence to support the hypothesis of herding decreasing from the period 1995-2000 to 2000-2005. However, the difference of the sample characteristics between our study and the previous ones may be the responsible for these results. The two main differences on our sample is that we use country allocation, instead of stock allocation (as in Bowe and Domuta (2004) and Kim and Wei (2002)), and the all universe of foreign investors, instead of only funds as in Borensztein and Gelos (2003). In this way an alternative hypothesis would be that funds herd in a higher intensity than the other types of investors. Regarding the effects of Herding on the risk measures, our results are mixed. Our regression analysis showed no effects of the Herding on the volatility, which is one of the main risk measures used by investors. However, the fat tails of equity return's distribution may be caused by this herding behavior of foreigners. Further studies should address this issue in more in depth since the fat tails may be due to herding of other types of investors also.

**Keywords:** Herding, Behavior, Emerging Markets.
**JEL Classification:** G14, G15.

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## 1) Introduction

Foreign investors are often blamed to enter and exit emerging markets in herds, bringing instability to these markets especially during crisis. The empirical research of herding behavior has been applied not only for emerging markets, but also to developed countries, using on different groups of investors. A stream of the herding literature on emerging markets focuses especially the period of crisis of the late 1990's. This article analyzes empirically the herding behavior on emerging markets after this period, measuring the degree of herding by foreign investors on a set of 9 emerging equity markets, and evaluating the effects of this behavior on the market.

This paper contributes to the literature by analyzing the herding behavior of all foreign investors of 9 emerging markets, while previous papers either were focused on single countries only (Bowe and Domuta (2004), Kim and Wei (2002)) or use data only from emerging equity funds (Borensztein and Gelos (2003)). Also, we consider the period of time from 2000 to 2005, while previous studies covered the late 1990's, a period of crisis on emerging markets. Our paper obtains evidence of herding during relatively tranquil times, although some negative events like the burst of the internet bubble in 2000 are present on this time period. Furthermore, we empirically investigate the relationship between herding behavior and fat tails of return's distribution, in order to test models like Bak et al (1997), Lux (1998), and Cont and Bouchaud (2000). As far as we know, this has never been done before.

The herding behavior can happen because investors are imitating or following other investors, or can be due to an external common factor. On the first case, we would have the *true* herding behavior and in the second the *spurious* herding. As it is very difficult to identify if herd behavior is spurious or not, on this paper we concentrate in identifying the herd behavior on foreign investors no matter if it is spurious or genuine.

The remaining of the paper is structured as follows: section 2 reviews the literature of Herding. Section 3 describes the sample and the herding measure used. Section 4 shows the results in our sample, comparing the mean value of the measure across countries. Section 5 extends the analysis to consider the all herding measure distribution characteristics, and not only the mean. Section 6 investigates the relationship between the herding measure and the kurtosis of stock indices returns, while section 7 analyzes the impacts of herding on the volatility of equity indices. Section 8 concludes the paper.

## 2) Literature Review

The herding behavior is considered an anomaly that challenges the efficient market paradigm. Although this behavior is blamed to be irrational, in some cases it can be rational at an individual level. Anyway, it is still irrational at group level since it can lead to mispricing, especially bubbles.

One general concept of herding is a simple *convergence of behaviors* (see Hirshleifer and Teoh (2003)). However, many researchers argue that the "true" herding arises from the interaction among the agents, when agents tend to copy each other's decisions. But it may happen that the behavior convergence is due to some common external factor or information available for the group that is supposedly herding. In this case we would have a "spurious herding" as defined by Bikhchandani and Sharma (2001). It is very difficult to empirically identify whether a herding behavior is spurious or not since the number of factors that may influence an investment decision is very ample.

Several theoretical models of herding behavior have been proposed in the literature. Scharfstein and Stein (1990), Bannerjee (1992) and Bikhchandani et al (1992) considered that agents follow the behavior of other individuals, sometimes ignoring private information. Although this behavior is inefficient from a collective point of view, it can be rational from the individual perspective. The motivation for this kind of individual behavior may be the group pressure.

The models of Bikhchandani et al (1992) and Bannerjee (1992) consider that individuals make their decisions sequentially at a time, taking into account the decisions of the individuals preceding them. This seems not to be a realistic assumption since traders submit orders simultaneously. The model proposed by Cont and Bouchaud (2000) avoids this sequential decision process by considering a random communication structure, with groups of agents making independent decisions. These random interactions between agents lead to a heterogeneous market structure.

Another stream of the literature combines herding behavior with the statistical properties of empirical returns, giving special emphasis to fat tails. For example, the articles of Bak et al (1997), Lux (1998), and Cont and Bouchaud (2000) have tried to explain the fat tail feature of returns' distribution as a consequence of a market, where fundamentalist traders interact with noise traders, which use to herd. Bak et al (1997) use a model with heterogeneous investors, considering several types of trading rules. Results from computer simulations show that fat-tailed distributions arise from this setting. Cont and Bouchaud (2000) propose a similar model, but some simplifications allowed them to make analytic calculations.

The article of Persaud (2002) argues that Value at Risk (VaR) models led banks to herd and that this is not offset by other classes of investors, causing a lack of liquidity on equity markets. As investors are increasingly using the same VaR models, the tendency is convergence of the behavior of market participants. So he argues that regulators should incentive diversity of behavior among the market participants, through the use of different risk management systems.

The empirical research of herding behavior in financial markets has different methodologies and relies on different kinds of data. Also, it has been applied to different markets and group of investors.

Several measures have been developed to investigate herd behavior in financial markets. Lakonishok, Shleifer, and Vishny (1992) based their criterion on the trades conducted by a group of market participants (fund managers on their empirical application), comparing the actual behavior with an ideal behavior considering independent and random trades. The Lakonishok, Shleifer, and Vishny measure (hereafter LSV) is:

$$LSV_{i,t} = \left|p_{i,t} - \mathrm{E}\left[p_{i,t}\right]\right| - \mathrm{E}^{NH}\left[\left|p_{i,t} - \mathrm{E}\left[p_{i,t}\right]\right|\right] \qquad (1)$$

Where:

$p_{i,t}$ is the actual percentages of fund managers that buy stock $i$ at time $t$.

$\mathrm{E}[P_{i,t}]$ is the expected value of $p_{i,t}$, defined as the average buying percentage of all managers trading at period $t$.

$\mathrm{E}^{\mathrm{NH}}[.]$ is the expectation operator under the hypothesis that there is no herding.

$\mathrm{E}^{\mathrm{NH}}[|p_{i,t-} \mathrm{E}[p_{i,t}]|]$ is an adjustment factor which is the expected value of the first term under the null hypothesis that there is no herding. The theoretical distribution of $p_{i,t}$ considering independent and random trades for each manager is a binomial distribution with mean $\mathrm{E}\left[p_{i,t}\right]$.

Therefore, if there is no herding the LSV measure tends to zero. This measure has one major drawback: it does not consider the volume of manager's trading. The measure uses only the number of managers buying and selling, without regard to the monetary value they trade. Note that this measure is not able to identify if the herding is spurious, i.e., due to common external factors.

LSV empirically use their measure to test for herd behavior using a sample of US tax-exempt equity funds covering the period 1985 to 1989. They concluded that managers do not exhibit significant herding. There is some evidence of herding being more intense among small companies compared to large stocks.

Wermers (1999) proposes a modification of this herding measure in order to capture differences of behavior when traders are buying or selling. So they have two measures, one for buying and another for selling. He used a dataset of the US mutual fund industry from 1975 to 1994, finding little herding by mutual funds in the average stock, but much higher levels of herding for small stocks and growth-oriented funds.

Grinblatt, Titman and Wermers (1995) also focus on mutual funds, finding a herding behavior strongly correlated with a tendency to buy past winners as well as with its portfolio performance.

Studies of herding behavior among foreign investors on emerging markets are also found in the literature. These studies are especially concerned on the herding during crisis periods. Choe, Kho and Stulz (1999) investigate the Korean Stock Market around the Asian crisis of 1997 with daily data (purchases and sales) for each stock. They used the LSV herding measure and find strong evidence of herding by foreign investors before the Asian crisis of 1997. Nevertheless, the evidence is much weaker during the crisis period.

Kim and Wei (2002) also use the LSV herding measure and data from Korean Stock Market around the 1997 crisis. They use a dataset of monthly portfolio holdings at individual account level. Their results show that non-resident investors herd significantly before, during and after the crisis. But the intensity is slightly lower during the crisis. Individual residents also herd (but with lower intensity than foreigners) while local institutions exhibit no herding behavior.

The article of Bowe and Domuta (2004) uses data from Jakarta Stock Exchange to analyze the investment patterns of foreign and domestic investors around the Asian crisis of 1997. Their results indicate that both foreign and local investors herd, foreigners herd more than locals, and foreign herding increases following the onset of the crisis.

Borensztein and Gelos (2003) do not focus on a particular country, but instead uses monthly data from Emerging Markets Funds from 1996 to 2000. They found significant herding by these funds, and there is a small variation between crisis and non-crisis periods. An interesting finding is that herding is more intense in larger markets, which is consistent with the hypothesis that these funds prefer to adjust their portfolios more often on markets that offer higher liquidity.

An additional assessment of herding is done by Borensztein and Gelos (2003) and Wermers (1999). Besides comparing the actual and theoretical expected value of $|p_{i,t}- E[p_{i,t}]|$, they compare also the actual distribution with a theoretical distribution using Monte Carlo simulation. The theoretical distribution is built considering independent and random trades for each manager. They plot both distributions and make a visual assessment concluding that there are significant differences between them, corroborating the evidence of herding. It is worth to note that they do not make a statistical test like the Kolmogorov-Smirnov or Kuiper to evaluate if the two distributions are different.

Other kind of herding measures relies only on price data such as those proposed in Christie and Huang (1995), Hwang and Salmon (2001) and Demirer and Lien (2001). These measures look at whether the returns on individual stocks cluster more intensively around the market during periods of market stress. However a major critique can be made to this kind of herding measures: it is just a clustering measure. Perhaps stocks are moving in a similar way due to parallel independent influence of a common external factor, like macroeconomic factors. For example, a movement of the Term Structure of Interest Rates would affect all stocks at the same time. So we cannot say whether the convergence is due to investors updating their valuation models using the new information or due to actual interactions among investors, i.e., we cannot distinguish between *spurious* herding and the *true* herding.

Hwang and Salmon (2001) find statistically significant evidence of herding towards the market portfolio during relatively quiet periods rather than when the market is under stress, using data from US, UK, and South Korean stock markets. Chang, Cheng and Khorana (2000) find no evidence of herding for US and Hong Kong and partial evidence of herding in Japan. However, for South Korea and Taiwan, significant evidence of herding is found. In all five markets, the rate of increase in security return dispersion as a function of the aggregate market return is higher in the up market, relative to the down market days (directional asymmetry). Demirer and Lien (2001) find evidence of herding during periods of unusually large upward and downward movements, for US data. However, no evidence of the directional asymmetry is found.

There are also interesting event studies such as Golec (1997), which provides an empirical example of herding on noise: Johnson Redbook's case. Johnson Redbook used to publish weekly retail sales figures that somehow predicted bond returns for a short time, probably because a significant number of bond traders used this data to trade. This significant relationship between the data and bond returns disappeared just after the Wall Street Journal started to report it.

### 3) Herding Measure and Sample Description

Our methodology adapts the herding measure proposed by LSV (1992). A stock in the LSV setting will be a national market in our data. Also, instead of counting the number of funds buying a stock divided by the total number of funds trading that stock, we use the buying volume of a national market divided by the foreign turnover *FT* of the same market. So, using the volume instead of counting the number of buyers, we can account for the buying intensity, resolving one of the drawbacks of the original LSV measure. Our adapted LSV measure is:

$$LSV_{i,t} = \left| p_{i,t} - \mathrm{E}\left[ p_{i,t} \right] \right| - \mathrm{E}\left[ \left| p_{i,t} - \mathrm{E}\left[ p_{i,t} \right] \right| \right] \qquad (2)$$

Where in our case:

$$p_{i,t} = FB_{i,t} / FT_{i,t}$$

$$\mathrm{E}\left[ p_{i,t} \right] = \sum_i FB_{i,t} \div \sum_i FT_{i,t}$$

and $FT_{i,t}$ is the Turnover in USD of Equity Foreign Portfolio Investors of country $k$ at time $t$ , $FB_{i,t}$ is the USD amount of the foreign purchases of country $k$ at time $t$.

The term $\mathrm{E}\left[ \left| p_{i,t} - \mathrm{E}\left[ p_{i,t} \right] \right| \right]$ assumes that $FB_{i,t}$ follows a binomial distribution with mean $\mathrm{E}[p_{i,t}]$, i.e., this is the theoretical distribution with a behavior considering independent and random trades for each country. The other parameter of the binomial distribution above is the number of investors trading at that period. This term, also called Adjustment Factor, is used to correct for the mean of the first term of (2) so that the herding measure would tend to zero under the hypothesis of no herding (or independent trading). This correction is especially important when the number of investors is small.

Table 1 shows the sample of markets where the purchases and sales of foreign investors were available. This table shows also the source of information, the number of observations and time period. This sample was obtained after a search on websites of stock exchanges, central banks and market regulators of over 60 emerging markets.

**TABLE 1 - Sample of Foreign Flow Data**

| Country | Time period | | Number Observ. | Source |
|---|---|---|---|---|
| **Brazil** | 01/2000 | 08/2005 | 68 | Central Bank of Brazil |
| **Indonesia** | 01/2000 | 09/2005 | 69 | Jakarta Stock Exchange |
| **India** | 01/2000 | 09/2005 | 69 | SEBI - Securities & Exchange Board of India |
| **South Korea** | 01/2000 | 08/2005 | 68 | Korea Stock Exchange |
| **Philippines** | 01/2000 | 08/2005 | 68 | Central Bank of Philippines |
| **Romania** | 01/2000 | 08/2005 | 68 | Bucharest Stock Exchange |
| **Turkey** | 01/2000 | 09/2005 | 69 | Istanbul Stock Exchange |
| **Taiwan** | 01/2000 | 08/2005 | 68 | Taiwan Stock Exchange |
| **South Africa** | 01/2000 | 08/2005 | 68 | Johannesburg Stock Exchange |

The period of time covers approximately 5 years from 2000 to 2005, which is almost entirely after the period of the papers in this area. Also, the sample of countries used here contains a set of emerging countries from all main regions, including two European countries, five Asian markets, one African and one from South America.

Information regarding the number of investors (which is needed to calculate the adjustment factor) is not available for most of the markets. We have this information on a monthly basis only for India. For South Korea and Brazil we have annual data. While for Brazil and India the information is actually the number of registered investors (not necessarily trading), for South Korea the data is about shareholdings. We believe that both are good proxies for the number of investors trading. For Romania, data is available only for the year of 2005, showing around 600 foreign investors trading each month.

As this adjustment factor has small variations for numbers of investors above 600, it is not a problem to have poor estimates of these numbers. For example, the adjustment factor for 600 and 1,000 investors with $E[p_{i,t}]$ = 0.50 is respectively 1,63% and 1,26%. For $E[p_{i,t}]$=0.50 with 4,000 and 6,000 investors the difference is still lower: 0.63% and 0.52%. For India, South Korea and Brazil, we used the actual data – monthly for the first and annual for the others. For the other markets, we choose the number of investors by matching them with a similar market in terms of foreign flow volume. For Taiwan we used 10,000 investors (similar to South Korea), for Turkey and South Africa we used 4,000 (similar to Brazil), for Indonesia we used 1,000 and for Philippines we used 600 (similar to Romania). These numbers of investors may be downward biased. A smaller number of investor lead to a higher adjustment factor and a smaller Herding measure, so that our herding measure may be downward biased if the number of investors is also downward biased. As we will see later, our results support herding measures significantly different from zero, even with this bias.

## 4) Herding Measure Mean Results

For each month and country, we calculate the Herding measure according with equation (2). Our first assessment will be to analyze the mean of the Herding measure for each country during the 68 months of the sample. Results are on Table 2. For all countries the herding measure is significantly different from zero, corroborating previous studies of foreign trading herding. The values of the two smallest markets (Romania and Philippines) are higher, and this is expected since they have little influence on the $E[p_{i,t}]$. Our overall mean, 4.75, is lower than previous studies with emerging equity markets. Borensztein and Gelos (2003) found an average measure of 7.7 using 400 dedicated emerging equity funds. Bowe and Domuta (2004) found values over 11 using Indonesian data. Kim and Wei (2002), using Korean data, found measures above 8 for individual non-residents, however for institutional investors, the measures were lower: during tranquil periods the measure was 5.8, but interestingly, during the Asian crisis of 1997, the measure was only 2.5.

It is worth to mention that the above studies, using single countries, use data at individual stock level. The exception is Borensztein and Gelos (2003) which is the most similar to our study, since it uses the country allocation as we do, and not stocks. However, they are restricted to funds, while we use all foreign investors universe (except for India). Also, the previous studies use a time period between 1995 and 2000, while our period starts on 2000. Therefore, it may also be the case that the herding on emerging markets has diminished. In the end, we cannot distinguish between the hypothesis of herding decreasing from 1995-2000 to 2000-2005, and the hypothesis that the funds have a herding intensity higher than the whole universe of foreign investors. Another difference between our study and the previous one is that we use the amount of money invested instead of the number of buyers. But we may think that our measure is the LSV measure where the number of buyers is weighted by the volume.

One may think that our downward biased estimate of the number of investors may alter significantly our herding measure so that our conclusions may change. Table 2 shows that our adjustment factor is not very significant for most of the markets. Recall that this factor has a minus signal on the formula, and therefore even if we cut them all (by increasing indefinitely the number of investors), our herding measure will still have values around 5.7, which is still lower than previous emerging market studies.

Although the herding measures of Table 2 are lower than previous emerging market studies, they are higher than studies with US funds, like the seminal paper of LSV(1992), Grinblatt, Titman and Wermers (1995) and Wermers(1999). These papers use quarterly data at individual stock level from mid 1970's to mid 1990's, finding herding measures from 2.5 and 2.7 (LSV(1992) and Grinblatt, Titman and Wermers(1995)) to 3.5 (Wermers (1999)).

**TABLE 2 – LSV Herding Measure**

| Market | LSV Herding Measure | | Adjustment Factor Mean |
|---|---|---|---|
| | Mean | Standard Error | |
| **Brazil** | 5.34 | 0.57 | 0.57 |
| **Indonesia** | 5.62 | 1.19 | 1.26 |
| **India** | 1.92 | 0.36 | 1.71 |
| **South Korea** | 2.06 | 0.22 | 0.33 |
| **Philippines** | 9.90 | 0.84 | 1.62 |
| **Romania** | 8.80 | 1.27 | 1.63 |
| **Turkey** | 3.63 | 0.38 | 0.63 |
| **Taiwan** | 2.57 | 0.26 | 0.40 |
| **South Africa** | 2.97 | 0.36 | 0.63 |
| **All Markets** | 4.76 | 0.26 | 0.98 |

Mean and standard errors calculated for each country considering the all sample period.
Values in percentage.
All means are significantly different from zero at 1%.

## 5) The Distribution of Herding Measure

The analysis of the previous section is limited to the mean of the herding measure, and no consideration is given to the other moments and to the whole distribution. Although the difference of the means is a good indicator that the distributions are different, the analysis of the whole distribution may bring a better understanding of the magnitude of this difference. Therefore, on this section we follow Wermers (1999) and Borensztein and Gelos (2003) in comparing the actual herding distribution to a distribution generated by a Monte Carlo Simulation considering independent trading decisions by investors (see appendix for details of the Monte Carlo Simulation).

Panels A and B of Table 3 show the statistical properties of the actual and simulated distributions respectively. Besides the higher mean, the range and standard deviation of the actual distribution are also larger than the simulated one. On Figure 1 we see the histograms of the actual and simulated distributions for the whole sample. The actual distribution has a substantially greater probability mass on the positive herding area, with the simulated distribution being more peaked around zero. These results are similar to those of Borensztein and Gelos (2003). Panel C of Table 3 shows two formal statistical tests – Komolgorov-Smirnov and Kuiper - with the null hypothesis that both distributions are equal (see Appendix for details). Results show approximately the difference between the two distributions.

The above analysis refers to the unconditional distribution of the herding measure, but its evolution along the time can also be examined. Table 4 shows the autocorrelation coefficients of the herding measure by country and for the whole sample. Overall, there is little evidence of persistence on herding. The correlation coefficients are significantly positive for only three countries (Indonesia, Philippines and Turkey), while for the others and for the whole sample there is no evidence of autocorrelation. So it is not possible to forecast future herding behavior using past information of herding.

**TABLE 3 – LSV Herding Measure Distribution Statistics**

| PANEL A - Actual Distribution | | | | | | |
|---|---|---|---|---|---|---|
| **Market** | **Mean** | **Maximum** | **Minimum** | **Standard Deviation** | **Skewness** | **Kurtosis** |
| **Brazil** | 5.34 | 23.30 | -0.46 | 4.71 | 1.60 | 6.19 |
| **Indonesia** | 5.62 | 44.41 | -1.25 | 9.80 | 2.60 | 9.54 |
| **India** | 1.92 | 10.36 | -1.70 | 2.99 | 0.87 | 3.20 |
| **South Korea** | 2.06 | 7.40 | -0.24 | 1.84 | 1.23 | 3.75 |
| **Philippines** | 9.90 | 36.79 | -1.45 | 6.93 | 1.19 | 5.60 |
| **Romania** | 8.80 | 45.85 | -1.42 | 10.47 | 1.61 | 5.61 |
| **Turkey** | 3.63 | 14.04 | -0.30 | 3.17 | 1.00 | 3.57 |
| **Taiwan** | 2.57 | 10.01 | -0.18 | 2.16 | 1.04 | 4.00 |
| **South Africa** | 2.97 | 13.99 | -0.61 | 2.99 | 1.02 | 4.17 |
| **All** | 4.76 | 45.85 | -1.70 | 6.47 | 2.92 | 14.85 |
| **PANEL B - Simulated Distribution** | | | | | | |
| **Brazil** | -0,01 | 2,19 | -0,61 | 0,43 | 1,05 | 4,14 |
| **Indonesia** | 0,00 | 4,19 | -1,26 | 0,94 | 0,97 | 3,71 |
| **India** | 0,00 | 6,74 | -1,79 | 1,28 | 0,96 | 3,84 |
| **South Korea** | 0,00 | 1,40 | -0,37 | 0,25 | 1,00 | 4,05 |
| **Philippines** | 0,02 | 5,97 | -1,62 | 1,22 | 0,97 | 3,85 |
| **Romania** | 0,00 | 5,52 | -2,05 | 1,23 | 0,97 | 3,76 |
| **Turkey** | 0,01 | 2,53 | -0,63 | 0,48 | 0,95 | 3,62 |
| **Taiwan** | 0,00 | 1,44 | -0,40 | 0,30 | 1,00 | 3,81 |
| **South Africa** | 0,01 | 2,40 | -0,63 | 0,48 | 1,01 | 3,87 |
| **All** | 0,00 | 6,74 | -2,05 | 0,84 | 1,27 | 6,96 |

| PANEL C - Kolmogorov and Kuiper Tests | | | | |
|---|---|---|---|---|
| **Market** | **Kolmogorov** | | **Kuiper** | |
| | **Distance** | **p-value** | **Distance** | **p-value** |
| **Brazil** | 0,8257 | 0,0000 | 0,8257 | 0,0000 |
| **Indonesia** | 0,5382 | 0,0000 | 0,5382 | 0,0000 |
| **India** | 0,3917 | 0,0000 | 0,4094 | 0,0000 |
| **South Korea** | 0,8174 | 0,0000 | 0,8174 | 0,0000 |
| **Philippines** | 0,8208 | 0,0000 | 0,8208 | 0,0000 |
| **Romania** | 0,6075 | 0,0000 | 0,6126 | 0,0000 |
| **Turkey** | 0,7421 | 0,0000 | 0,7421 | 0,0000 |
| **Taiwan** | 0,7590 | 0,0000 | 0,7590 | 0,0000 |
| **South Africa** | 0,6296 | 0,0000 | 0,6296 | 0,0000 |
| **All** | 0.6429 | 0,0000 | 0.6438 | 0,0000 |

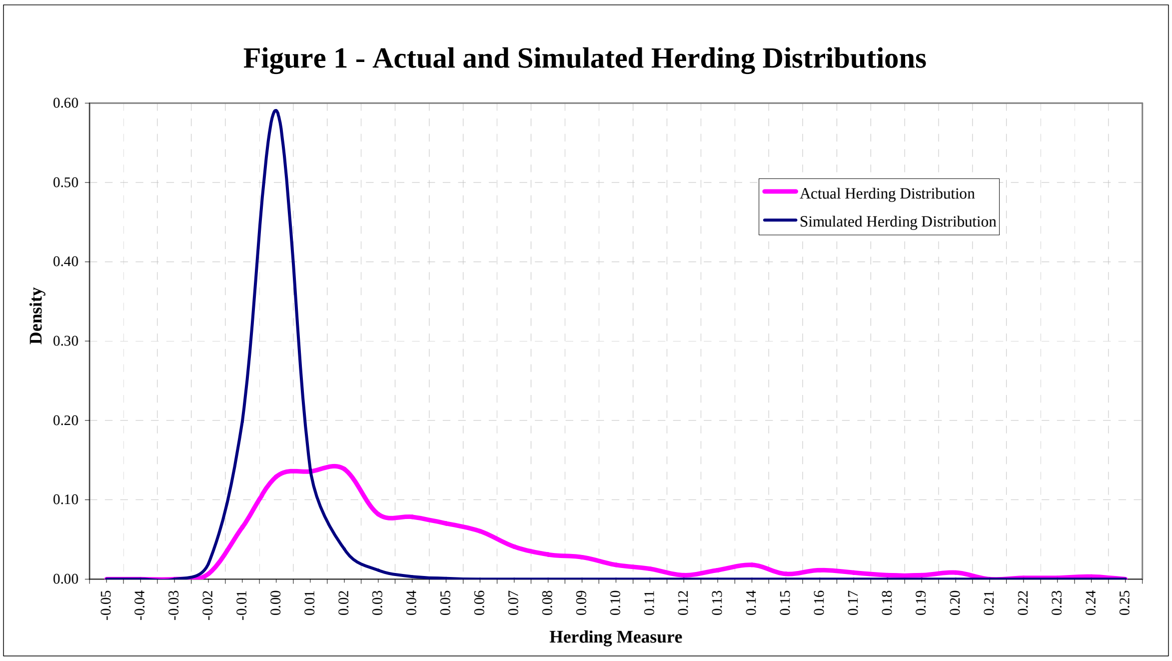


**TABLE 4 – LSV Herding Measure Autocorrelation**

| Market | Autocorrelation Coefficients | | | p-values | | |
|---|---|---|---|---|---|---|
| | 1 Lag | 2 Lags | 3 Lags | 1 Lag | 2 Lags | 3 Lags |
| **Brazil** | 0,149 | 0,103 | 0,033 | 21,0% | 31,1% | 49,1% |
| **Indonesia** | 0.363 | 0.291 | 0.323 | 0.2% | 0.0% | 37.8% |
| **India** | -0.017 | -0.053 | 0.022 | 88.9% | 89.6% | 96.8% |
| **South Korea** | 0.192 | -0.073 | -0.077 | 10.6% | 22.4% | 33.0% |
| **Philippines** | 0.366 | 0.225 | 0.276 | 0.2% | 0.1% | 0.0% |
| **Romania** | -0.048 | 0.045 | 0.076 | 68.6% | 85.5% | 86.4% |
| **Turkey** | 0.264 | 0.174 | 0.037 | 2.6% | 2.8% | 6.5% |
| **Taiwan** | -0.071 | -0.178 | 0.104 | 55.2% | 26.6% | 32.8% |
| **South Africa** | 0.076 | 0.120 | -0.057 | 52.2% | 48.5% | 64.0% |
| **All Sample** | -0.012 | 0.037 | 0.199 | 91.8% | 94.6% | 39.2% |

This table shows Autocorrelation Coefficients up to 1, 2 and 3 lags and p-value for the null hypothesis of no autocorrelation for up to 1, 2 and 3 lags.

## 6) Herding Measure and Kurtosis of Returns

One interesting analysis that can be done with the LSV herding measure is to compare it with the kurtosis of return's distribution on each month, in order to evaluate whether the positive association between excess kurtosis and herding proposed by Cont and Bouchaud (2000) and Bak et al (1997) exists and if it is relevant or not. As seen before on section 2, they support this association using theoretical models, and not empirical data. On this section, we aim to test this relationship using empirical data on emerging markets. We are considering that foreign investors are noise traders that use to herd, and this behavior would exacerbate the kurtosis of the equity return's distribution.

We use a regression with the lagged values of Local Return's Kurtosis and the LSV Herding measure as independent variables. We could include the foreign turnover as control variables, but as seen on Ornelas (2006), no effect of the foreign turnover on the Kurtosis of returns (both local currency and USD) is found. Therefore, we run the following pooled regression:

$$SK_{k,t} = c_k + \sum_{i=1}^{n} \alpha_i SK_{k,t-i} + \beta\, LSV_{k,t} + \varepsilon_{k,t} \qquad (3)$$

Where $LSV_{k,t}$ is the LSV Herding measure of market $k$ at time $t$, $SK_{k,t}$ is the excess kurtosis of the daily equity returns in local currency of country $k$ at time $t$.

Results are on Table 5. The lagged coefficients of the kurtosis are not significant. But the LSV Herding measure coefficient is positive and significant, which corroborates empirically the models of Cont and Bouchaud (2000) and Bak et al (1997). Although this coefficient is significant, the $R^2$ of the regression is low, so that the Herding measure explains only a small variation of the Kurtosis.

Some caution should be used to interpret the results of this section due to omitted variables bias. For example, other groups of investors may engage in herding behavior and also affect the kurtosis. But also in this case the above mentioned models would be supported.

**TABLE 5 – Panel Data: Kurtosis x Herding**

**Equation (3)**

| | Kurtosis | | LSV Herding | Constant | Adj $R^2$ |
|---|---|---|---|---|---|
| | Lag: 1M | Lag: 2M | | | |
| **Kurtosis** | 0.0251 | 0.0505 | 1.966[b] | 0.165[a] | -0.32% |

Estimation Method: Seemingly Unrelated Regression, common Effects.

a) Coefficient significant at 1%
b) Coefficient significant at 5%
c) Coefficient significant at 10%

## 7) Herding Measure and Volatility of Returns

The degree of herding behavior may also impact the volatility of returns (or vice-versa). If the degree of herding that we detected among foreign investors had important effects on emerging equity markets, we would expect to observe a positive correlation between the degree of herding and the volatility of stock returns. This issue was studied by Borensztein and Gelos (2003) and they obtained mixed evidence on the relationship between herding and volatility. Using a bivariate regression with only the variance of stock returns and the mean of herding measure, they found statistically significant relationship for 40 countries, with the coefficient on the herding variable reaching 0.47. They also estimated a GARCH (1,1) model in which the herding measure entered the variance equation for each country individually. Among 39 countries, the herding variable was significantly positive in 15 cases, and significantly negative in 5.

On this section, we use a pooled regression to investigate the effects of herding on volatility of stock's returns. To account for the volatility persistence, we use two lagged terms together with the contemporaneous herding coefficients, and the foreign flow turnover as the control variable (see equation (4)). Therefore the regression used here is the same of Ornelas (2006), but with the inclusion of the Herding measure. The regression is then performed with pooled data of the 9 countries of our sample.

$$SV_{k,t} = c_k + \sum_{i=1}^{n} \alpha_i SV_{k,t-i} + \beta\, LSV_{k,t} + \sum_{i=1}^{n} \gamma_i FT_{k,t-i} + \varepsilon_{k,t} \qquad (4)$$

Where $LSV_{k,t}$ is the LSV Herding measure of market $k$ at time $t$; $SV_{k,t}$ is the volatility of the daily equity returns in local currency of country $k$ at time $t$; $FT_{k,t}$ is the Turnover[1] of Equity Foreign Portfolio Investors of country $k$ at time $t$ as a percentage of the total turnover.

The results are on Table 6, and show no evidence that Herding affects the volatility. The lagged volatilities and Foreign Turnover were significant. Overall, the inclusion of the herding measure did not help at all in explaining the volatility movements.

[1] The total turnover of foreign equity investors is the sum of purchases and sales.

| TABLE 6 – Panel Data - Volatility Effects of Foreign trading | | | | | |
|---|---|---|---|---|---|
| **Equation (4)** | | | | | |
| **Dependent Variable** | **Volatility** | | **Foreign Turnover** | **LSV Herding Measure** | **Adj $R^2$** |
| | **Lag: 1M** | **Lag: 2M** | | | |
| **Local Equity Returns' Volatility** | 0.3250[a] | 0.1459[a] | -0.0715[b] | 0.0406 | 42.4% |

Estimation Method: Seemingly Unrelated Regression, Fixed Effects.
a) Coefficient significant at 1%
b) Coefficient significant at 5%
c) Coefficient significant at 10%

## 8) Conclusion

This paper addressed the issue of Herding behavior by foreign investors on emerging markets. We used an adaptation of the LSV Herding measure and calculated this measure for a sample of 9 emerging markets over the period 2000-2005. Our overall mean, 4.75, although is lower than previous studies with emerging equity markets, still indicates the presence of herding behavior. Therefore we have evidence to support the hypothesis of herding decreasing from the period 1995-2000 to 2000-2005. However, the difference of the sample characteristics between our study and the previous ones may be the responsible for these results. The two main differences on our sample is that we use country allocation, instead of stocks and the all universe of foreign investors, instead of only funds as in Borensztein and Gelos (2003). In this way an alternative hypothesis would be that funds herd in a higher intensity than the other types of investors.

Regarding the effects of Herding on the risk measures, our results are mixed. Our regression analysis showed no effects of the Herding on the volatility, which is one of the main risk measures used by investors. However, the fat tails of equity return's distribution may be caused by this herding behavior of foreigners. Further studies should address this issue in more in depth since the fat tails may be due to herding of other types of investors also.

## 9) Appendix

### 9.1) Monte Carlo Simulation of the Herding Measure Distribution

This appendix describes the Monte Carlo Simulation used on section 5 to generate the Herding Measure Distribution, considering independent trading decisions by investors. It follows the methodology of Wermers (1999) and Borensztein and Gelos (2003).

For each month $t$ and country $i$, we produce $N_{it}$ random draws from a Uniform (0,1) distribution, where Nit is the number of investors trading. The outcomes that are greater than (1–E[$p_{i,t}$]) are summed up, yielding a draw from a binomial distribution with parameters ($N_{it}$, E[$p_{i,t}$]). As explained in section 3, E[$p_{i,t}$] is the actual proportion of investors buying at month $t$. We then use the draw of this binomial distribution as the number of investors buying for each country and month in order to calculate the herding measure using formula (2). This procedure is repeated 100 times for each country-month, yielding a simulated distribution with 61,200 observations.

### 9.2) Kolmogorov and Kuiper Distances

The Kolmogorov-Smirnov and Kuiper tests have the null hypothesis that an empirical distribution is equal to a theoretical cumulative distribution function.

The Kolmogorov distance (see, for example, Massey[1951]) is defined as the greatest distance between the empirical and the theoretical cumulative distribution, for all possible values:

$$D_{Kol} = \max_{x \in \Re} \left| f_{Emp}(x) - f_{Theo}(x) \right| \qquad (5)$$

where $f_{\text{Emp}}$ is an empirical cumulative density function and $f_{\text{Theo}}$ is a continuous and completely specified theoretical cumulative density function.

The Kuiper distance (see Kuiper[1962]) is similar to the Kolmogorov distance, but it considers the direction of the deviation, adding the greatest distances upwards and downwards:

$$D_{Kui} = \max_{x \in \Re} \left\{ f_{Emp}(x) - f_{Theo}(x) \right\} + \max_{x \in \Re} \left\{ f_{Theo}(x) - f_{Emp}(x) \right\} \qquad (6)$$

On our tests, we substitute the theoretical distribution by the simulated distribution, using numerical methods to calculate the distance of the simulated and empirical distributions.

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