INTERNATIONAL EQUITY FLOWS: DIVERSIFICATION DOES MATTER

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Abstract

This paper examines whether diversification opportunities, measured as differences in the distributions of equity returns, play a significant role in the determination of international equity flows. Using the concept of Marginal Conditional Stochastic Dominance (MCSD) to estimate the diversification opportunities, it provides strong evidence that diversification opportunities are significant determinants of international equity flows and that these opportunities are concentrated on the dominant distributions, thereby implying a tendency towards MCSD efficiency. It also shows that the relationship between diversification opportunities and equity flows is much stronger for developed markets than for emerging markets. These results are robust with respect to a range of conventional control variables documented in the outstanding literature.

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1. Introduction

In this paper we examine whether diversification opportunities, measured as differences in the distributions of equity returns, play a significant role in the determination of international equity flows. The substantial increase in these flows since the mid-1990s, a key manifestation of the globalization of the world economy and the integration of its financial markets, has generated a substantial literature on the subject of the determinants of international trade in equities. The focus of these studies, reviewed in the following section, ranges from tests of market efficiency and "home bias" to the effects of domestic and global factors, such as equity returns, interest rates, industrial production, credit ratings, and P/E ratios. However, there are no studies that consider the direct role played by diversification opportunities arising from differences in the distributions of equity returns. This paper aims to help fill this gap.

There are strong reasons to believe that differences in return distributions across countries could be a significant determinant of international equity flows. The first is the importance of the second moment for quadratic utility maximizers or normally distributed returns in modern portfolio theory. The second is the well documented fact since Mandelbrot (1963) that asset distributions are not normally distributed and the third is that the third and the fourth moments of return distributions, skewness and kurtosis respectively, do seem to matter to investors, who show a preference for positive skewness and aversion to kurtosis (see, Kraus and Litzenberger (1976), Athayde and Flôres (1999), Fang and Lai (1997), Dittmar (2002), Post et. al. (2008)).

The innovation of this paper is that we consider diversification opportunities directly to investigate their importance in the determination of international equity flows. To this end we use the concept of Marginal Conditional Stochastic Dominance (MCSD) developed by Shalit and Yitzhaki (1994) to estimate the diversification opportunities afforded by different return distributions across countries. Under the plausible assumption that investors are risk averse, MCSD provides the probabilistic conditions under which all risk-averse investors prefer one risky asset over another. In the terminology of stochastic dominance, MCSD provides the tools to assess the "dominance" or superiority of one asset over another. We make no assumptions regarding the efficiency of the global market portfolio or the distributions of equity returns. The only assumption is that investors are risk averse and that part of their investment decision process is to improve the return distribution of their portfolios, i.e. they diversify but do not necessarily aim to create efficient portfolios in the sense of Markowitz portfolio optimization.

The major contribution of this study is direct evidence that diversification opportunities are significant determinants of international equity flows. Our results also provide evidence of a tendency towards efficiency in that MCSD dominant markets attract flows while MCSD dominated markets lose them. These results are robust with respect to a range of conventional control variables, although there are differences between developed and emerging markets. The relationship between diversification opportunities, efficiency and equity flows is much stronger for developed markets than it is for emerging markets.

The remainder of the paper is organized as follows: the next section discusses the existing literature. Section three briefly presents the concept of MCSD, its implications for asset allocation and formalizes our testing hypotheses. Section four presents the data we use and section five our methodology. In section six we report our results and section seven concludes.

2. Literature Review

With respect to the determinants of international equity flows, one strand of the literature considers the effect of domestic and global factors; i.e. 'pull' and 'push' factors [e.g. Calvo et. al., 1993, Chuhan et. al., 1998, Fernandez-Arias, 1996]. Chuhan et. al. (1998) find that U.S. interest rates, the U.S. industrial production, local equity returns, the local market P/E ratio and the Institutional Investor credit rating are important in explaining equity flows into a sample of Latin American and Asian countries. Similar evidence is presented by Edison and Warnock (2008) who find that an increase in US interest rates reduces flows to emerging markets.[1] The role of domestic and global factors in these studies is to capture the expected risk and return of investing in these countries. Fernandez-Arias (1996) presents a model where equity flows to middle-income countries depend on three variables: expected domestic return, country creditworthiness and expected developed country return (i.e. opportunity cost) and finds that it is mostly 'push' factors that affect equity inflows.

Another strand of the literature takes its perspective from modern portfolio theory. Grubel (1968), Levy and Sarnat (1970), Solnik (1974) and Grauer and Hakansson (1987), for example, have demonstrated the benefits of international diversification for the performance of equity portfolios. These models imply that differences in expected asset returns and risk across countries generate international equity flows as investors exploit these opportunities. Other studies, such as Frankel and Engel (1984), Engel and Rodriguez (1989), Tesar and Werner (1994), and Bohn and Tesar, (1996), use first-order conditions for optimal portfolio allocation to test the consistency of particular models with actual investment positions.

Although the foregoing asset pricing models allow tests using at least the first two moments of return distributions, empirical research is often limited to the first moment reflected in differences in the rates of return.[2] For example, Froot et.al. (2001) examine the behavior of equity flows into and out of 44 countries and find a strong relationship between inflows and past equity returns, results that are similar to Tesar and Werner (1995), Bohn and Tesar (1996), Brennan and Cao (1997), and Griffin et al. (2004).[3]

Studies that do include higher moments usually consider only the second moments and examine the efficiency of international equity investment rather than the direct effect on equity flows. A finding for efficiency or increased efficiency implies that international diversification drives international equity flows through its effect on

[1] Although most studies find a statistically significant relationship between interest rates and flows, Bekaert, Harvey and Lumsdaine (2002) do not find such a relationship when they take into account regime changes brought about by capital flow liberalizations.

[2] Fernandez-Arias (1996) argues that the effect of equity returns' second moments on equity flows may be of less significance when a country's default risk is high.

[3] Clark and Berko (1996) find the opposite relationship for Mexico, i.e. unexpected inflows drive equity prices.

portfolio composition. For example, using data from ten developed equity markets, Engel and Rodrigues (1993) examine the efficiency of the world equity market, which they empirically reject.[4] De Santis (1993) and Harvey (1995) find that adding foreign securities to a set of domestic securities does not shift the mean-variance efficient frontier significantly. The implication of these studies is that international diversification is not a significant determinant of international equity flows[5]. Studies such as these, however, are plagued by serious shortcomings. The results of analyses that use a market portfolio to test for efficiency are valid only if the chosen market portfolio is efficient while, as Tesar and Werner (1995) have argued, results of tests that use market capitalization weighted portfolios to estimate the efficient frontier could be biased by the fact that market-capitalization weighted portfolios are often located in the interior of the mean variance frontier.

Another major problem with this type of analysis is that the inefficiency of a portfolio does not mean that higher moments of equity return distributions are not factors affecting equity flows. Even if international investors do not optimize their portfolios, there is no reason to assume they do not take advantage of the diversification benefits offered by foreign equity markets at least to some extent. For example, it is well documented in the literature that investors prefer to invest in domestic rather than foreign securities; i.e. they exhibit home bias (e.g. French and Poterba, 1991, Tesar and Werner, 1995, Graham et. al, 2005). Much of the literature on this "domestic bias" concentrates on consumption patterns weighted towards domestic production. Sercu (1980), Krugman (1981), Adler and Dumas (1983), and Branson and Henderson (1985), among others, suggest that hedging against domestic inflation to protect consumption levels of domestic goods accounts for the bias. Cooper and Kaplanis (1994) and Uppal (1993), however, present convincing evidence that this is not the case. This branch of the literature focuses on political risk. Black (1974) and Stultz (1981) show that taxes on foreign assets may be responsible for the domestic bias whereas Cooper and Kaplanis (1994) assign the cause to costs associated with political risk in general.

[4] This type of analysis, however, is plagued by the problem that the results are valid only if the chosen market portfolio is efficient.

[5] An exception is Portes and Rey (2005) who find that there is a statistically significant diversification effect in equity flows but it is weak and unstable.

More recent studies have focused on the effect of regulation and the availability of information on foreign investment. For example, Aggarwal et. al. (2005) find that U.S. fund managers show preference for open markets with strong shareholder rights, legal framework and accounting standards and Leuz et. al (2009) find that U.S. investors avoid investing in poorly governed firms abroad. Coval and Moskowitz (1999) and Portes and Rey (2005) underline the role of distance as an informational proxy to explain local equity bias. Chan et. al. (2005) examine the role of familiarity in equity flows in the sense that less familiarity implies more information costs. They find that familiarity is a cause of the home bias effect. Van Nieuwerburgh and Veldkamp (2008) argue that even if foreign investors could acquire the same information as domestic investors, a home bias would still exist because investors choose to acquire different information from other investors. Acquiring the same information does not have any value for them. The effect of choosing which information to acquire leads to under-diversification, as Van Nieuwerburgh and Veldkamp (2009) show in their model. The empirical findings of Didier et. al. (2008) confirm that fund managers under-diversify internationally.

Thus, although the foregoing empirical literature does not address the role of return distributions and diversification directly, its overall thrust is that diversification and portfolio efficiency are at best weak determinants of international equity flows.

3. Marginal Conditional Stochastic dominance and asset selection

Marginal Conditional Stochastic Dominance (MCSD) developed by Shalit and Yitzhaki (1994) gives the conditions under which all risk-averse individuals will prefer to increase the share of one risky asset over another when presented with a given portfolio.

Let R be the rate of return of a given portfolio $P = \sum_{i=1}^{n} \alpha_i A_i$ such that $R = \sum_{i=1}^{n} \alpha_i X_i$ with weights given by $\alpha_1, \alpha_2, ..., \alpha_n$ where $\sum_{i=1}^{n} \alpha_i = 1$ and X_i represents the return on asset A_i. Consider the joint distribution $(X_1, X_2, ... X_n)$ given by their joint probability distribution $f(x_1, x_2, ... x_n)$. Their cumulative density functions are $F_{X_1}, F_{X_2}, ...F_{X_n}$ respectively. The program to solve is: $\underset{\alpha_1, \alpha_2, ...\alpha_n}{Max} \; Eu(R)$ where u is the utility function and E stands for the expectation operator.

The first order condition is given by:

$$E\left[X_i \, u'(R)\right] = 0 \;\; \forall i = 1,...,n \qquad (1)$$

Following Shalit and Yitzhaki (1994), let $d\alpha_k$ and $d\alpha_j$ be the marginal changes in holding asset A_k and asset A_j such that $d\alpha_k + d\alpha_j = 0$. The marginal change in expected utility will be:

$$dEu(R) = E\left[(X_k d\alpha_k + X_j d\alpha_j) u'(R)\right] \qquad (2)$$

It will be optimal to increase the weight of asset A_k at the expense of asset A_j if and only if this expression is non-negative, or, equivalently if and only if:

$$\frac{dEu(R)}{d\alpha_k} = E\left[(X_k - X_j) u'(R)\right] \geq 0 \qquad (3)$$

According to the Marginal Conditional Stochastic Dominance (MCSD), asset A_k dominates asset A_j if and only if the expression in equation (3) is non-negative for all risk-averse individuals.

For MCSD Shalit and Yitzhaki (1994) introduce the notion of Absolute Concentration Curves (ACC), a concept widely used in the income area. Define the unconditional and the conditional expectation of each asset, namely $\mu_i = E(X_i)$ and $\mu_i(r) = E(X_i / R = r)$ where r represents the return on portfolio $P = \sum_{i=1}^{n} \alpha_i A_i$ and X_i stands for the return on asset A_i. The Absolute Concentration Curve (ACC) associated with asset A_i with respect to portfolio P is defined as follows:

$$ACC_{X_i/R}(\xi) = \int_{-\infty}^{r} \mu_i(t) f_R(t) dt \;\; \forall r \qquad (4)$$

where R represents the return of the given portfolio P and r is implicitly defined by the cumulative distribution of the given portfolio:

$$\xi = \int_{-\infty}^{r} f_R(t) dt = F_R(r) \qquad (5)$$

According to Shalit and Yitzhaki (1994) "For a given probability ξ, ACC is the cumulative return on asset A_i , given that the portfolio's return is less than *r*. ACC curves give the expected return on each asset conditional on the given portfolio $P = \sum_{i=1}^{n} \alpha_i A_i$ with respect to the cumulative probability of the given portfolio". They give three basic properties of the ACC:

a: $ACC_{X_i/R}(0) = 0$

b: $ACC_{X_i/R}(1) = \mu_i$

c: $\dfrac{\partial ACC_{X_i/R}(\xi)}{\partial \xi} = \mu_i(r)$

The theorem for Marginal Conditional Stochastic Dominance can be stated as follows: Given portfolio $P = \sum_{i=1}^{n} \alpha_i A_i$, asset A_k dominates asset A_j for all concave utility function *u* if and only if $ACC_{X_k/R}(\xi) \geq ACC_{X_j/R}(\xi)$ for $0 \leq \xi \leq 1$ with at least one strong inequality. The theorem states that for a given portfolio, all risk-averse individuals will prefer to increase the weight of asset A_k with the ACC above the ACC of asset A_j .

Thus, a test of MCSD is the test of the complete distribution of one asset compared to another. A market to market application of this rule is difficult in practice because it requires infinite pair-wise comparisons of alternative probability distributions[6]. An alternative application, however, suggested by Shalit and Yitzhaki, (1994), compares individual markets to the global market portfolio. They state (p.681): "if the market portfolio dominates one security, increasing the share of all securities in the portfolio and reducing the proportion of the dominated security improves the portfolio for all risk-averse investors". The opposite also applies: if a security dominates the market portfolio, increasing its proportion in the market portfolio and reducing the proportion of all other securities, improves the portfolio for all risk-averse investors. Thus, we can test if a market dominates (is dominated by) the global market portfolio and examine the reaction of the flow of funds in that market[7].

Chow (2001) proposes the following test for MCSD:

$$Z^{k-j}(\tau_i) = \frac{\overline{\Phi}^k(\tau_i) - \overline{\Phi}^j(\tau_i)}{\hat{S}^{k-j}(\tau_i)}, \text{ for i = 1, ..., m.} \quad (6)$$

where

$$\overline{\Phi}^k(\tau_i) = \overline{r_{pk} I(\tau_i)} - \overline{r_M I(\tau_i)}, \text{ i = 1,2,...,m and k=1,2,...,K,} \quad (7)$$

τ is the inverse cumulative distribution function of the market returns (r_M), and $\overline{\Phi}^k(\tau_i)$ is the mean excess conditional mean return of portfolio k relative to the market portfolio below a target rate of return τ. $\hat{S}^{k-j}(\tau_i)$ is the standard error of $\overline{\Phi}^k(\tau_i) - \overline{\Phi}^j(\tau_i)$ and $I(\tau_i)$ is an indicator variable such that $I(\tau_i)=1$ if $r_M < \tau$ and 0

6 This is the basic problem with applying second degree stochastic dominance to create efficient portfolios.

7 It should be noted that if market A dominates market B which in turn dominates market C, then A also dominates market C; in other words for MCSD binary relations, the transitivity property applies.

otherwise[8]. The Chow test follows a studentized maximum modulus distribution and the critical values are available in Stoline and Ury (1979).

As a test for MCSD, the Chow statistic tells us if the return distribution of market *k* is "superior" or "inferior" compared to the return distribution of the global market portfolio. The test "slices" the return distribution of each asset with respect to the return of the market portfolio and compares pairs of "slices". If the test is positive for all pairs of "slices" (i.e. if $\overline{\Phi}^{k}(\tau_i)$ - $\overline{\Phi}^{M}(\tau_i) > 0$ for all pairs of "slices") and at least one is statistically significant, then asset *k* dominates the market; if they are all negative and at least one is statistically significant, the market dominates asset *k*. In all other cases, there is no dominance. In the present study, we use deciles for each pair, which gives 10 statistics[9]. If all ten statistics of the Chow test are positive (negative) and at least one is statistically significant, then that asset dominates (is dominated by) the global market portfolio. The test in every case involves the returns of a country's stock market returns against the returns of the market portfolio.

3.1. First testing hypothesis

Our first hypothesis is that capital flows are sensitive to diversification benefits. As a comparison of the distribution of one asset with another, the Chow statistic is a measure of the diversification benefit between the two assets. Thus, if the average value of the ten statistics of the Chow test between an individual equity market and the world market portfolio is positive, it indicates that the distribution of the particular market is on average better than the distribution of the market portfolio.[10] In other words, the sign of the Chow statistic is a measure of whether an asset performed on average better or worse than the market portfolio during a given period and the magnitude of the statistic measures by how much one outperformed the other. Again, the term "perform" refers to the entire distribution of returns and not any

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[8] For detailed information on the Z test, see Chow (2001).

[9] According to Chow (2001), 10 deciles is a good partitioning for our sample size. If we 'slice' the distribution in too few segments, there will not be enough segments of the two distributions for a proper comparison. If we 'slice' the distribution in too many segments, there will not be enough observations in each segment to make inferences.

[10] It should be noted that this does not imply dominance. An average statistic which is positive suggests that the returns of a market were on average better than the returns of the market portfolio, but there is not necessarily dominance.

specific moment, such as the mean or the variance.[11] Therefore, if investors are sensitive to diversification benefits in the sense that they want to improve the return distribution of their portfolio, they may increase the proportion of an asset with positive and sizeable Chow statistics in their portfolio and reduce the proportion of other assets. Thus, if the Chow statistic is statistically significant in explaining equity flows and is positively correlated to these flows, this is evidence that diversification is a determinant of international equity flows.

3.2 Second testing hypothesis

Our second hypothesis refers to market efficiency. It is that investors prefer dominant markets to simple "superior" return distributions in general. Remember that in the terminology of MCSD, the absence of dominance implies efficiency.[12] Thus, if dominance is a significant determinant of equity flows, where dominant markets attract funds and dominated markets lose them, it is an indication of reduced inefficiencies in the global equity market. To examine this hypothesis, we create two dummy variables. One is equal to value of the average Chow statistic if all ten Chow statistics for that period are positive and at least one is statistically significant and 0 otherwise. The other is equal to value of the average Chow statistic if all ten Chow statistics for that period are negative and at least one is statistically significant and 0 otherwise. If dominance matters to investors, then the dummy variables should be significant in explaining net equity flows. The variable indicating positive dominance should have a positive sign and the one indicating negative dominance should have a negative sign (meaning that investors invest in a dominant market and leave a dominated market).

4. Data

The data set consists of all markets having the required information. Given the definition of MCSD and our testable hypotheses, we require data on net equity flows (i.e. the difference between inflows and outflows), which are reported in Datastream. They are quarterly and cover the period 1996 quarter 1 to 2008 quarter 1, giving us 49

[11] In other words, the comparison is between all the moments of the returns of a market and the market portfolio.
[12] Efficiency can exist at different combinations of asset proportions. Using a threshold of 50%, Clark and Jokung (1999) present the conditions for second order conditional stochastic dominance.

observations per country[13] for 16 developed countries and 10 emerging countries.[14] Equity flows are scaled by each market's capitalization.

Calculation of the Chow statistics (CS) requires only equity returns, including dividends. As in most tests of efficiency, we make the plausible assumption that there is a direct relation between expected returns and realized returns of the recent past.[15] Chow (2001) shows that the test requires 300 or more observations to have power. Thus, 300 observations is the shortest acceptable interval of the recent past to calculate the CS for each quarter end, measured prior to and including that date.[16]

To account for the well documented effect of past, mean equity returns on equity flows, we also use past returns of each market in two forms: the average daily return (R) and the average difference in daily returns (ΔR) between each market and the global market calculated over the same interval used for the calculation of CS.[17] If the diversification potential of these markets above and beyond the simple first moments of the distributions is a factor affecting equity flows, CS should be statistically significant even though the first moments of the return distributions are accounted for in the regressions by R (or ΔR).

Daily returns for each national equity market are calculated using the respective MSCI investable market index, including dividends. The investable market indices are more appropriate for this type of analysis because they cover a large proportion of each market's capitalization pertinent to the international investor, given

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[13] This period was chosen to balance the number of countries included in the study against the number of observations per country. A longer period would provide data for only a few developed countries. A shorter period would include a few more countries at the expense of available observations.

[14] To classify a country as developed or emerging, we use the classification of MSCI (as of February 2009). The developed markets are Australia, Austria, Canada, Finland, France, Germany, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, United Kingdom, United States. The emerging countries are: Argentina, Brazil, Chile, Czech Republic, Hungary, Korea, Peru, Philippines, Russia and Turkey.

[15] If this were not true, return maximizing investors would always invest in assets with lower expected returns.

[16] For example, the Chow statistics for 1996 quarter 1 are estimated from daily return data from the 6th of February 1995 to the 29th of March 1996, i.e. 300 daily returns. We use daily returns because a lower frequency would include data of several years prior to each date, which may be irrelevant. For example, if we used weekly returns to estimate the Chow statistics for 1996 quarter 1, we would have to include observations from 1991 to 1996.

[17] The same interval is necessary to make the data compatible. CS accounts for the entire distribution of equity returns while R (or ΔR) represents the first moment of the return distribution.

that the inclusion criteria emphasize investability and replicability.[18] The proxy for the global market portfolio is the MSCI world investable market index which includes data from 23 developed and 25 emerging countries. It is also important to underline the fact that for this type of analysis, the proxy for the market portfolio does not have to be efficient. All data are expressed in U.S. dollars so there is no currency effect.

We also include variables that other studies have shown affect equity flows and are related to equity returns[19]. More specifically, we follow Chuhan et. al. (1998) and include i) the first principal component comprised of 5 U.S. interest rates[20] (the 3 month Treasury bill rate, the 3 month Certificate of Deposit rate, the 3 month LIBOR rate, the 3 year Treasury rate and 10 year Treasury rate) and the U.S. industrial production index (PII) (this variable captures global factors affecting equity flows). We use the first principal component of the 6 variables to mitigate the effect of multicollinearity), ii) the Institutional Investor credit rating (CR) of each country[21] and, iii) the price-earnings ratio[22] (PE) of each market. Table 1 reports descriptive statistics of all the variables used in this study.

[INSERT TABLE 1 ABOUT HERE]

5. Methodology

As in most studies where a common set of variables affects different countries, we employ panel data estimation of the equation:

$$EF_{it}=c_i + \beta_1\, CS_{it} + \beta_2\, CSP_{it} + \beta_3\, CSN_{it} + \beta_4\, r_{it} +\beta_5\, CR_{it}+ \beta_6\, PE_{it} + \beta_7\, PII_t+e_{it} \quad (8)$$

[18] The MSCI investable market index is used for all markets except for the Czech Republic and Russia, where the respective indices are not available from 1995. For these two countries we use the Datastream market index including dividends.
[19] There are several factors which are identified in the literature to affect equity flows. We are only concerned with those that affect equity returns because CS could simply capture such factors at a domestic or global level.
[20] As in Chuhan et. al. (1998) we also use the first principal component of the real interest rates and U.S. industrial production and the results remain the same.
[21] Credit ratings are available semi-annually. For intermittent quarters, we use the ratings of the previous quarter. To make the series compatible with the linear regression model, we use the logistic transformation of the ranking (Cosset and Roy, 1991)
[22] Besides these three variables, Chuhan et. al. (1998) also use the secondary market debt prices as a variable capturing domestic economic conditions. This data is not available to us, however, Chuhan et. al. (1998) find that a principal component of secondary market debt prices and credit ratings is not significant in explaining equity flows to Latin American countries.

where EF_{it} is net equity flows in U.S. dollars for country i and period t, scaled by the market capitalization of country i equity market for period t, CS is the average Chow statistic, CSP is a positive dominance dummy variable equal to CS if country i significantly dominates the global market portfolio and zero otherwise, CSN is a negative dominance dummy variable equal to CS if the global market portfolio significantly dominates country i and zero otherwise, r is either the average daily return over the past 300 days (R), or the difference between R and the average daily return over the past 300 days for the global market portfolio, proxied by the MSCI global index including dividends (ΔR), PII is the first principal component of 5 U.S. interest rates and the U.S. industrial production index, CR is the Institutional Investor credit rating, PE is the price-earnings ratio and e is an error term. Equation 8 is estimated for all the markets in our sample and then separately for developed and emerging markets because if investors view these markets as different asset classes they may exhibit different characteristics.

One salient problem with the estimation of equation (8) is that some variables are likely to be endogenous. A Hausman endogeneity test suggests that this, in fact, is the case for stock returns. We address this issue by using the first lagged values for stock returns (R and ΔR), CS, CSP and CSN as instrumental variables. Endogeneity for the remaining variables is rejected at any conventional significance level.

Another issue is the use of fixed versus random effects. A Hausman test for random versus fixed effects for equation 8 rejects the random effects model in favor of the fixed effects model.[23] A subsequent comparison of the results between the simple fixed effects estimation and estimation by the seemingly unrelated regression (SUR) technique to address the issue of correlated equity flows across countries documented by Froot et al. (2001), shows that the SUR technique improves the adjusted R^2 of the regressions considerably. Thus, we estimate equation (8) using 3 stage least squares (3SLS)[24].

[23] As a robustness test, we also run equation 8 using the random effects estimator. In results not reported here but available upon request, the dominance variables remain statistically significant.
[24] SUR estimation uses the OLS residuals to obtain a consistent estimate of the system covariance matrix which however, is not efficient if any of the right hand side variables are endogenous. The use of the instrumental variables presented above sorts out this problem.

6. Results

As discussed above, a positive, significant relationship between the average Chow statistic and equity flows indicates that investors are exploiting the opportunities of international diversification, at least to some extent. If the dummy variables, CSP and CSN, indicating dominance are significant and have the right sign, this is evidence that investors are using diversification opportunities to improve the efficiency of their portfolios (in the MCSD sense), and, in the process, making the global equity markets more efficient. The positive dominance dummy variable (CSP) should have a positive sign and the negative dominance dummy variable (CSN) should have a negative sign indicating increased inflows in cases of positive dominance and increased outflows in cases of negative dominance. It should be noted that evidence of positive or negative dominance is evidence that the international equity markets are not fully integrated.

Estimation of the correlation coefficients among explanatory variables shows that the highest correlation coefficient is the one between ΔR_t and CS_t, as expected,[25] at 0.3 both for emerging and developed markets. The remaining correlations are (in absolute terms) between 0 and 0.3, which suggests that multicollinearity is not a problem.

6.1 Equity flows and the potential for international diversification

Table 2 reports the results for equation (8). Columns (1) and (2) report the results for the full model that include R or ΔR. Both CSP and CSN are significant and have the right sign. CS has the right sign but is not significant. This is evidence that diversification opportunities are concentrated on the dominant distributions. A positive and significant R in model 1 suggests that investors pay special attention to the first moment of return distributions. In models 3 and 5 that exclude CSP and CSN, CS is highly significant with a p-value of 0, which suggests that besides picking up the effect of dominance measured by CSP and CSN, CS has some explanatory value of its own. In this it is interesting that when CS is statistically significant in models 3

[25] CS measures the difference between the entire distribution of equity returns of a market and the market portfolio while ΔR measures the difference between the first moment of the distribution of a market and the market portfolio. Therefore, it is expected that these variables should be correlated.

and 5, R is not and vice-versa in model 1. We interpret this as evidence that diversification opportunities, measured as differences in the distributions of equity returns, generally play a significant role in the determination of international equity flows but are concentrated on the dominant distributions. When CS is significant, as the proxy for the difference in entire distributions, it picks up the effect of the first moment (R = past returns on equity flows) along with the other moments and R loses its statistical significance. This is evidence that in the relationship found in the literature between equity flows and past returns, past returns are acting as a proxy for the entire distribution.

[INSERT TABLE 2 ABOUT HERE]

Overall, CSP and CSN are statistically significant at high probability levels in all equations, which clearly indicates that diversification opportunities in equity returns are a significant determinant of equity flows and that these opportunities are concentrated on the dominant distributions. Past returns (R) are statistically significant in columns (1) and (4) suggesting a dominance effect combined with return chasing, which is consistent with the literature. The remaining variables except for ΔR are also statistically significant.[26] Our results are strong evidence that investors' asset allocation choices are much more nuanced than the simple analyses based on historical first moments[27] and that investors aim to improve the return distribution of their portfolios according to portfolio theory by exploiting the opportunities of international diversification.

6.2 Differences between developed and emerging markets

Tables 3 and 4 report the results for developed and emerging markets respectively. The results for developed markets are similar to those of the overall sample. Diversification opportunities are significant determinants of equity flows and

[26] In all regressions reported in Table 2 we used both R and ΔR as a proxy for past equity performance and ΔR is always statistically insignificant and does not affect the results so, we report only the regressions which include R. Those with ΔR are available upon request.

[27] For example, Bohn and Tesar (1996) and Froot et. al. (2001) find evidence that investors chase returns, while Brennan and Cao (1997) present a model where due to the information disadvantage that foreign investors have compared to local investors, they tend to buy foreign securities when returns are high and sell when returns are low.

are concentrated on the dominant distributions. In the absence of dominance, CS, the proxy for the difference for the overall distributions, is significant.

Emerging markets differ in three major respects. The first difference is in the effect of dominance on equity flows. There is a significant relationship between CSP and equity flows in emerging markets but not with CSN. In other words, investors seem to prefer dominant emerging markets while they don't seem to avoid those that are dominated. There is also an absence of a significant relationship between past returns and equity flows. This is further evidence that the effect of past returns on foreign equity investment and the return chasing reported in many academic papers may be very weak once the total distribution is accounted for. The second notable difference between developed and emerging markets is that the adjusted R^2 for developed markets is much higher than for emerging markets. The adjusted R^2s for all the regressions for emerging markets are quite low, which is the norm in studies on equity flows. Finally, the third difference is that while all the control variables (CR, PE and PII) are always statistically significant for developed markets, only CR is significant for emerging markets.

[INSERT TABLE 3 ABOUT HERE]

[INSERT TABLE 4 ABOUT HERE]

7. Conclusion

This paper is the first to directly examine the role of diversification opportunities in the determination of international equity flows. Using the concept of Marginal Conditional Stochastic Dominance to estimate the diversification opportunities afforded by different return distributions and the plausible assumption that investors are risk averse, it provides strong evidence that diversification opportunities are significant determinants of international equity flows and that these opportunities are concentrated on the dominant distributions. Concentration on the dominant distributions implies a tendency towards efficiency in that MCSD dominant markets attract flows while MCSD dominated markets lose them. We also show that there are differences between developed and emerging markets. Breaking down the sample into developed and emerging markets shows that the relationship between diversification opportunities and equity flows is much stronger for developed markets than for emerging markets.

These results are robust with respect to a range of conventional control variables documented in the outstanding literature. They also serve to confirm and clarify some of the more important findings of this literature. All the control variables except past returns, including the country credit rating, P/E ratio and principal component of US economic indicators, are highly significant for the overall sample, thereby confirming the importance of the push/ pull factors. Past returns, however, are not significant when CS, the proxy for the difference in total distributions, is significant. This is evidence that the "return chasing" documented in the literature is the reflection of the first moment of returns as the proxy for the overall distribution.

Our results are strong evidence that investors aim to improve the return distribution of their portfolios according to portfolio theory by exploiting the opportunities of international diversification.

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Table 1. Descriptive statistics for stacked data

	EF	CS	R	ΔR	CR	PE	PII
Mean	0.012	1.117	0.001	0.000	1.251	17.834	0.000
Median	0.009	1.005	0.001	0.000	1.483	16.500	0.222
Maximum	0.698	9.660	0.005	0.005	3.178	84.900	1.458
Minimum	-0.594	-4.444	-0.006	-0.006	-1.774	-0.093	-1.888
Std. Dev.	0.038	2.211	0.001	0.001	1.157	9.236	1.000
Skewness	2.853	0.643	-0.527	-0.628	-0.413	3.077	-0.411
Kurtosis	15.960	4.004	5.806	8.715	2.078	18.316	1.897

EF is net equity flows of developed and emerging markets, scaled by market capitalization. CS is the average Chow test statistic for MCSD between each country and the global market portfolio, proxied by the MSCI global index including dividends, using the past 300 daily return observations. R is the average daily return over the past 300 days for each country. ΔR is the difference between R and the average daily return over the past 300 days for the global market portfolio, proxied by the MSCI global index including dividends. CR_i is the Institutional Investor credit rating for country i, PE_i is the price-earning ratio for country i and PII is the first principal component of 5 U.S. interest rates (the 3 month Treasury bill rate, the 3 month Certificate of Deposit rate, the 3 month LIBOR rate, the 3 year Treasury rate and 10 year Treasury rate) and the U.S. industrial production index.

Table 2. Panel data estimation for net equity flows

	(1)	(2)	(3)	(4)	(5)	(6)
CS	0.0002	0.0003	0.0004***		0.0003***	
	(0.64)	(0.38)	(0.00)		(0.00)	
CSP	0.0011***	0.0011***		0.0012***		0.0009***
	(0.01)	(0.01)		(0.00)		(0.00)
CSN	-0.0034***	-0.0032***		-0.0035***		-0.0030***
	(0.00)	(0.00)		(0.00)		(0.00)
R	0.7911**		0.3142	0.6970**	-0.1075	0.4613
	(0.02)		(0.27)	(0.03)	(0.66)	(0.13)
ΔR		0.0006				
		(0.99)				
CR	-0.0065***	-0.0069***	-0.0064***	-0.0063***		
	(0.00)	(0.00)	(0.00)	(0.00)		
PE	-0.0003***	-0.0002***	-0.0002***	-0.0003***		
	(0.00)	(0.00)	(0.00)	(0.00)		
PII	0.0016***	0.0018***	0.0008***	0.0016***		
	(0.00)	(0.00)	(0.00)	(0.00)		
Adjusted R^2	0.27	0.26	0.34	0.27	0.34	0.29
N	1248	1248	1248	1248	1248	1248

The dependent variable is net equity flows of developed and emerging markets, scaled by market capitalization. R is the average daily return over the past 300 days for each country. CS is the average Chow test statistic for MCSD between each country and the global market portfolio, proxied by the MSCI global index including dividends, using the past 300 daily return observations. CSP is a dummy variable taking the value of CS if CS is positive and statistically significant and 0 otherwise, while CSN is a dummy variable taking the value of CS if CS is negative and statistically significant and 0 otherwise. CR_i is the Institutional Investor credit rating for country i, PE_i is the price-earning ratio for country i and PII is the first principal component of 5 U.S. interest rates (the 3 month Treasury bill rate, the 3 month Certificate of Deposit rate, the 3 month LIBOR rate, the 3 year Treasury rate and 10 year Treasury rate) and the U.S. industrial production index. Figures in parentheses are probabilities of significance estimated using White standard errors. ***, ** and *, denote significance at the 1%, 5% and 10% level of significance respectively. N is the number of observations. All regressions include a time trend. Intercepts and coefficients of the time trend are not reported. The estimation method is 3 stages least squares, with fixed effects.

Table 3. Panel data estimation for net equity flows for developed markets

	(1)	(2)	(3)	(4)	(5)	(6)
CS	0.0010	0.0010	0.0003**		0.0002**	
	(0.14)	(0.13)	(0.04)		(0.05)	
CSP	0.0004	0.0003		0.0012***		0.0006*
	(0.64)	(0.70)		(0.00)		(0.09)
CSN	-0.0042***	-0.0040**		-0.0028***		-0.0020**
	(0.01)	(0.02)		(0.01)		(0.02)
R	1.5690*		0.0860	1.1842	-0.4207	1.3970*
	(0.07)		(0.89)	(0.16)	(0.43)	(0.08)
ΔR		1.6979				
		(0.21)				
CR	-0.0038**	-0.0037**	-0.0051***	-0.0046***		
	(0.03)	(0.04)	(0.00)	(0.00)		
PE	-0.0004***	-0.0004***	-0.0003***	-0.0004***		
	(0.00)	(0.00)	(0.00)	(0.00)		
PII	0.0025***	0.0028***	0.0012***	0.0025***		
	(0.00)	(0.00)	(0.00)	(0.00)		
Adjusted R^2	0.19	0.19	0.30	0.20	0.35	0.22
N	768	768	768	768	768	768

The dependent variable is net equity flows of developed and emerging markets, scaled by market capitalization. R is the average daily return over the past 300 days for each country. CS is the average Chow test statistic for MCSD between each country and the global market portfolio, proxied by the MSCI global index including dividends, using the past 300 daily return observations. CSP is a dummy variable taking the value of CS if CS is positive and statistically significant and 0 otherwise, while CSN is a dummy variable taking the value of CS if CS is negative and statistically significant and 0 otherwise. CR_i is the Institutional Investor credit rating for country i, PE_i is the price-earning ratio for country i and PII is the first principal component of 5 U.S. interest rates (the 3 month Treasury bill rate, the 3 month Certificate of Deposit rate, the 3 month LIBOR rate, the 3 year Treasury rate and 10 year Treasury rate) and the U.S. industrial production index. Figures in parentheses are probabilities of significance estimated using White standard errors. ***, ** and *, denote significance at the 1%, 5% and 10% level of significance respectively. N is the number of observations. All regressions include a time trend. Intercepts and coefficients of the time trend are not reported. The estimation method is 3 stages least squares, with fixed effects.

Table 4. Panel data estimation for net equity flows for emerging markets

	(1)	(2)	(3)	(4)	(5)	(6)
CS	-0.0012	-00009	0.0004		0.0009**	
	(0.14)	(0.24)	(0.29)		(0.02)	
CSP	0.0026**	0.0027**		0.0017***		0.0018***
	(0.02)	(0.02)		(0.01)		(0.00)
CSN	0.0020	0.0026		0.0013		0.0009
	(0.37)	(0.30)		(0.52)		(0.56)
R	0.3353		0.1233	-0.1531	-0.2179	-0.2036
	(0.58)		(0.81)	(0.79)	(0.61)	(0.70)
ΔR		-0.3850				
		(0.66)				
CR	-0.0075***	-0.0082***	-0.0079***	-0.0081***		
	(0.00)	(0.00)	(0.00)	(0.00)		
PE	-0.0001	0.0001	-0.0001	-0.0001		
	(0.73	(0.88)	(0.71)	(0.88)		
PII	0.0002	0.0005	-0.0004	0.0006		
	(0.82)	(0.63)	(0.71)	(0.51)		
Adjusted R^2	0.06	0.04	0.09	0.008	0.06	0.05
N	480	480	480	480	480	480

The dependent variable is net equity flows of developed and emerging markets, scaled by market capitalization. R is the average daily return over the past 300 days for each country. CS is the average Chow test statistic for MCSD between each country and the global market portfolio, proxied by the MSCI global index including dividends, using the past 300 daily return observations. CSP is a dummy variable taking the value of CS if CS is positive and statistically significant and 0 otherwise, while CSN is a dummy variable taking the value of CS if CS is negative and statistically significant and 0 otherwise. CR_i is the Institutional Investor credit rating for country i, PE_i is the price-earning ratio for country i and PII is the first principal component of 5 U.S. interest rates (the 3 month Treasury bill rate, the 3 month Certificate of Deposit rate, the 3 month LIBOR rate, the 3 year Treasury rate and 10 year Treasury rate) and the U.S. industrial production index. Figures in parentheses are probabilities of significance estimated using White standard errors. ***, ** and *, denote significance at the 1%, 5% and 10% level of significance respectively. N is the number of observations. All regressions include a time trend. Intercepts and coefficients of the time trend are not reported. The estimation method is 3 stages least squares, with fixed effects.