Unexploited Gains from International Diversification: Patterns of Portfolio Holdings around the World

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Abstract

This paper studies how portfolios meant to be invested globally are actually allocated internationally using unique micro data on U.S. mutual funds. While investors have shifted toward funds with more flexibility to invest globally, mutual funds invest in a finite, rather small number of stocks, almost independently of their investment scope. In fact, the number of holdings in stocks and countries from a given region declines as the investment scope broadens. This restricted investment practice has a cost: there are unexploited gains from international diversification. Mutual funds investing globally could achieve better risk-adjusted returns by broadening their asset allocation, including stocks held by more specialized funds within the same mutual fund family (company). This investment pattern is not explained by the lack of instruments or information, a better ability of global funds to minimize negative outcomes, or transaction costs. Instead, mutual fund families play an important role, questioning existing theories.

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1. Introduction

Financial globalization has advanced substantially since the early 1990s. In fact, the degree of financial globalization achieved in the last fifteen years has been unprecedented, in part driven by institutional investors purchasing foreign assets.[1] Among the key motivations for the increased globalization are the potential gains from international diversification. On the supply side of funds, investors can reduce risk for a given level of expected returns (or increase returns for a given level of risk) by investing internationally.[2] On the demand side, firms and governments can reduce the cost of capital, finance new projects, and decrease the exposure of their balance sheets to some domestic macroeconomic shocks by tapping international investors.[3] However, despite the potential benefits from globalization and the increased international financial integration, evidence on how investors allocate their portfolios globally is still scarce.

In this paper, we construct a unique micro dataset of actual asset-level portfolios for a group of important institutional investors (U.S. mutual funds) to study in detail the behavior of international investment and the extent of international diversification. We find that although there is increasing flexibility to invest across countries and regions (through the expansion of global funds that invest around the world), mutual funds invest in a very restrictive manner, holding few stocks and forgoing gains from international diversification. This investment practice is not explained by the lack of available instruments or information, a better ability of global funds to minimize tail risk, or transaction costs. Instead, it is largely driven by mutual fund family (company) effects.

Mutual funds are particularly interesting to study international diversification. Mutual fund data allow us to analyze portfolios and the extent of international diversification for different types of funds (with different mandates to invest around the world) within the same mutual fund family. We analyze both funds specialized in some countries or regions (*specialized funds*) and those with a wider, unrestricted investment scope (*global funds*). The latter can invest anywhere in the world and thus have access to

[1] See, for example, Obstfeld and Taylor (2002), Stulz (2005), and Kose et al. (2006).
[2] A number of studies provide some evidence on the gains from international diversification. See, for example, Grubel (1968), Harvey (1995), De Santis and Gerard (1997), Errunza, Hogan, and Hung (1999), De Roon, Nijman, and Werker (2001), Goetzmann, Li, and Rouwenhorst (2005), and Driessen and Laeven (2007).
[3] See, for example, Rajan and Zingales (1998), Stulz (1999), Van Wincoop (1999), Bekaert and Harvey (2000), and Gozzi, Levine, and Schmukler (2008).

a larger set of instruments (more firms from more countries). The within-family comparison is important because knowing that a fund within a mutual fund family holds some stocks is an indication that those stocks are available for trading and are indeed desirable, at least by other fund managers within the same family. Moreover, information about those stocks has already been collected at the mutual fund company level and, in principle, is available to all managers of the same mutual fund family. Therefore, the relevance of asymmetric information, transaction costs, and industrial organization aspects discussed by the literature can be analyzed by comparing portfolios across different funds within the same mutual fund family and across families.

To conduct the research we collect holding and return data for the universe of actively managed open-ended U.S. mutual funds established to purchase assets around the world. Given the regular reporting requirements for mutual funds, asset-level portfolios can be constructed and traced over time since their inception period. This characteristic of the mutual fund industry is unique and contrasts with other types of investors such as hedge funds, pension funds, and individual international investors, for which portfolio information is not publicly available. The data on holdings contain asset-level annual portfolios between 1991 and 2005. We work with a total of 499 fund families and 1,904 funds. The total number of fund-year observations is 8,420 and the total number of asset-level holdings for all funds in all years is 1,359,750. The portfolio holdings have been matched to identify the country to which each stock belongs, tracking holdings over time. We use returns at the fund level on a daily basis between September 1989 and June 2006 for 36 fund families that have a variety of mutual funds for which useful comparisons can be made.[4] We work with a total of 722,885 daily observations, comprising returns for all funds from these families.

The first part of the paper documents three main stylized facts associated with how different types of mutual funds invest internationally. The second part of the paper focuses on the factors behind the global portfolio allocations of mutual funds. In particular, it studies the role of instrument availability, information asymmetries, family and fund effects, and transaction costs. Furthermore, it investigates whether there are

[4] For the return data, we focus on the largest mutual fund families in terms of assets under management and/or number of individual mutual funds. We are constrained by the need to concentrate on families with both global and specialized funds to make useful comparisons.

potential gains from further international diversification and whether the investment strategies of different types of funds explain some of the findings.

The first stylized fact the paper documents is that individual mutual funds hold a relatively small number of assets in their portfolios. Importantly, the number of assets in a mutual fund portfolio seems to be independent of the investment scope of the mutual fund. Namely, the number of asset holdings in mutual fund portfolios does not tend to increase for global funds compared to specialized funds within the same mutual fund family, even though the number of investable assets increases significantly. For example, global funds from Vanguard Group held on average 426 stocks in 2004, whereas specialized funds within this family of funds held 576 stocks. These numbers are small because there were over 39,000 stocks available worldwide in 2004. As a second stylized fact, global funds hold fewer assets in fewer countries compared to specialized funds within each region of exposure, especially in developing countries. For instance, if holdings in Latin America are considered, the median specialized fund holds 41 stocks, whereas global funds hold around 94% fewer stocks than specialized funds within their mutual fund families. Furthermore, global funds also invest in 75% fewer countries in Latin America than their specialized counterparts. Third, the above pattern of investment is particularly relevant because investors have shifted from specialized funds toward global ones. Although both global and specialized funds have expanded sharply since the early 1990s, global funds have become significantly larger than specialized funds in terms of assets under management. For example, global funds had 38 billion U.S. dollars of assets under management in 1992, being about three times as large as specialized funds. In 2004, global funds were six times as large as specialized funds with 530 versus 89 billion U.S. dollars of assets under management. Namely, global funds are investing an increasing amount of funds in a limited number of assets.

The paper then explores the possible reasons behind the restrictive international investment practices of mutual funds documented by the stylized facts. First, the patterns we document regarding mutual fund allocations do not seem to be driven by the inability of funds to hold more stocks around the world. For example, we show that, on average, mutual funds hold a very small fraction of market capitalization: global fund and specialized fund investments account (separately) for just 0.12% of firms' market

capitalization. This suggests that mutual funds might be able to increase their exposures without incurring major costs. Second, we study the possible role of information asymmetries. If global and specialized funds within mutual fund companies shared information and made similar decisions, one should observe similar portfolios across them. However, we show that this is not the case. Different types of mutual funds within families hold portfolios that are not very similar. For example, global and specialized funds share only 16% of their holdings (or, on average, 36% of net asset value of investments). In other words, we do not find evidence that managers are using information already gathered by other managers within the same mutual fund firm. Furthermore, we also find that measures that capture the ability of funds to gather and process information explain only a small proportion of the variance of the number of stocks held by each fund. In sum, informational asymmetries alone do not seem to explain the apparent lack of international diversification. Next, we show that the limited number of stocks in mutual fund portfolios is explained by strong family effects (i.e., by the company to which a fund belongs). For example, funds in the Templeton Group held on average 129 stocks in 2005, significantly fewer than the 517 stocks held on average by funds in the Vanguard Group. In fact, family effects explain almost 50% of the cross-sectional variation in the number of portfolio holdings.

Does the fact that global funds do not tend to hold more stocks than specialized funds imply a diversification loss? If assets within and across countries were correlated, it would be possible for global funds to obtain the same degree of diversification benefits as specialized funds by simply holding fewer stocks, possibly in fewer countries. Then, return correlations could account for the patterns observed in the data implying no return losses or excessive variance for investors. To address this issue, we estimate if global funds can improve their performance by just investing in specialized funds within the same mutual fund family.[5] In other words, we compare the performance of global funds to that of simulated global funds, each consisting of a portfolio of specialized and global funds. By definition this is a very restrictive exercise, since simulated global funds cannot invest in any possible stock available to specialized funds, they must invest in a portfolio

[5] The nature of this exercise is different from the one performed by Evans and Archer (1968), which studies how the variation of returns for randomly selected portfolios changes as a function of the number of securities in the portfolio.

already held by another fund within the same company. This guarantees that the stocks are available for investment (that we are considering a feasible set), that they are at least attractive to another manager in the same firm, and that information about the stocks was already collected and analyzed by someone relatively close to the global fund manager. Our results suggest that there are potential gains from further diversification. Global funds could obtain better returns for a given level of risk if they invested in portfolios that include holdings similar to those of specialized funds, even within the same mutual fund family. In other words, by not increasing the number of stocks as funds expand their investment scope, global funds forgo the benefits that broader international diversification entails. For example, we find that the average return of global funds could increase between 1.8% and 5.5% per year (p.y.) if they maximized daily or weekly returns following a mean-variance framework. The results are robust to many types of estimations that take into account expected returns, variances, and several benchmarks to which a fund is compared. We obtain similar results for exchange-traded funds (ETFs), so the findings do not seem to be driven by transaction costs on the investor side, which might prevent them from performing arbitrage.

Since global funds have the ability to shift their asset holdings across countries and regions (an option not available to specialized funds), we estimate if there is an insurance premium in the returns to global funds. The extra flexibility of global funds to move away from trouble countries might yield gains during crisis times, so investors might be willing to pay for this benefit by accepting lower expected returns. Our results indicate that global funds do not seem to better shield investors from tail risk. We find that the skewness and kurtosis of global fund returns are similar to those of the simulated global funds (holding specialized funds). These higher moments of the distribution of returns are important if global funds were to minimize losses during bad times instead of following standard mean-variance models. Moreover, conditional on large negative returns on either specialized funds or the MSCI Emerging Market Index, we find that returns on the simulated global funds are broadly similar to those on global funds.

Our findings contribute to several strands of the literature. First, our paper relates to a large literature on the extent of investor international diversification. This literature has focused mostly on the home bias puzzle, starting with the seminal work by French

and Poterba (1991). Most of this literature has concentrated on aggregate measures to shed light on the determinants of international investments and on country portfolios to study the degree to which countries hold assets abroad.[6] More recently, this literature has begun to exploit asset-level data based on institutional investor portfolios, although the evidence is still scarce.[7] Our findings reinforce the existing evidence of limited international diversification. Mutual funds meant to invest around the world are not diversified enough, even when there are potential diversification gains. Furthermore, the literature has mentioned some factors that can explain the patterns of international cross-country investments: the existence of explicit costs to international investment and the presence of implicit ones, like political or country risks and informational asymmetries.[8] However, our results cast doubts on some of these explanations. Asymmetric information does not seem to be a driver of the lack of international diversification, at least not in the dimensions studied here. Moreover, the fact that each individual fund is small relative to the market size suggests that the lack of diversification is not driven by the inability of global funds to purchase the securities that specialized funds hold; that is, the results are not driven by transaction costs. In sum, we provide evidence that some of the usual theories are not sufficient to fully address the findings of this paper.

Second, we contribute to the literature on how financial markets work, and in particular, to the literature on the importance of incentives and organizational aspects in explaining the behavior of investors and how that affects their portfolio choice. This literature highlights a misalignment in the incentives of managers of financial intermediaries (e.g. banks, hedge funds, and mutual funds) and underlying investors. This agency conflict might distort incentives in such a way that long-lasting mispricings arise and that managers hold suboptimal portfolios from the investors' perspective.[9] This paper finds evidence consistent with the view that fund managers do not hold optimal international portfolios. Also, our finding that the number of stocks held across mutual

[6] See Tesar and Werner (1995), Brenan and Cao (1997), Kraay et al. (2005), Portes and Rey (2005), Aviat and Coeurdacier (2007), Lane and Millesi-Ferretti (2008), among many others.
[7] See, for example, Strong and Xu (2003), Cai and Warnock (2006), Hau and Rey (2008), and Eun, Huang, and Lai (2008).
[8] See, for example, Kang and Stulz (1997), Dahlquist and Robertsson (2001), Grinblatt and Keloharju (2001), and Daude and Fratzscher (2008).
[9] Some papers argue that perverse incentives might lead to excessive manager risk taking, whereas others suggest the opposite effect See Shleifer and Vishny (1990), Bebchuk and Stole (1993), Brown, Harlow, and Starks (1996), Chevalier and Ellison (1997), Bolton, Freixas, and Shapiro (2004), Rajan (2005), and Stein (2005), among others.

funds is significantly explained by family effects, with limited role for investment mandates, suggests that the way the financial industry is organized might be an important factor in determining the degree of international diversification.[10] Furthermore, the existence of within mutual fund family competition might explain a lack of information sharing across mutual funds within a given family.[11] However, to our knowledge, there is no evidence on the effects of mutual fund families on the number of asset holdings by individual funds.[12]

Lastly, we contribute to the literature on the investment patterns of institutional investors, and mutual funds in particular. Part of this literature has focused on U.S. mutual fund domestic investments.[13] Another strand has studied the patterns of investment by institutional investors in emerging markets.[14] By focusing on mutual funds with different investment scopes as well as their portfolio choice over a relatively long time series, we present new evidence on mutual fund investment behavior, in particular, on the importance of family effects on the cross-country resource allocation. To the extent that global funds continue growing relative to specialized funds, the findings in this paper suggest that the foregone diversification gains can be large. Also, many countries and firms will not benefit from tapping international investors, with the associated effects on financing cost.

The rest of the paper is organized as follows. Section 2 describes the data. Section 3 studies how U.S. mutual funds allocate their portfolios internationally. Section 4 analyzes the factors behind the degree of international diversification. Section 5 studies whether there are potential gains from further international diversification, whether investment strategies can account for part of the results, and the role of transaction costs on the investor side. Section 6 concludes.

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[10] Pollet and Wilson (2008) analyze U.S. domestic mutual funds and find that funds respond to asset growth by increasing their ownership shares rather than the number of investments in their portfolio (which implies higher diversification). Moreover, funds with many siblings diversify less rapidly as they grow, suggesting that the fund family may influence a fund's portfolio strategy.

[11] See Kempf and Ruenzi (2008).

[12] Part of the literature has addressed issues related to mutual fund families; however the focus is on the decisions of the top management of a family and the existence of cross-fund subsidization to promote "high value" funds. See, for example, Nanda, Wang, and Zheng (2004) and Gaspar, Massa, and Matos (2006).

[13] See, for example, Grinblatt and Titman (1992), Jegadeesh and Titman (1993), Grinblatt, Titman, and Wermers (1995), Carhart (1997), Wermers (1999).

[14] See, Kang and Stulz (1997), Choe, Kho, and Stulz (1999), Kaminsky, Lyons, and Schmukler (2004), Dahlquist and Robertsson (2001), Kim and Wei (2002), Edison and Warnock (2004), Chan, Covrig, and Ng (2005), Gelos and Wei (2005), Broner, Gelos, and Reinhart (2006), among many others.

2. Data

To conduct the analysis, we use data on an important industry: U.S. equity mutual funds established to purchase assets around the world.[15] The U.S. mutual fund industry is very large (in 2005 there were 8,044 mutual funds with a market capitalization of eight trillion U.S. dollars or 69% of U.S. GDP), has a strong international presence (U.S. mutual funds represent more than 70% of the assets held worldwide by all mutual funds), channels a significant share of retirement savings (mutual funds captured 24% of retirement savings in the U.S. in 2004), and is a relatively mature and sophisticated industry. We use two types of data: mutual fund holdings and mutual fund prices.

Mutual fund holdings are available from Morningstar, a company that collects mutual fund data. We analyze monthly reports from March 1992 (when they became available) until June 2006. However, mutual funds do not tend to disclose their holdings as frequently. They do so on a quarterly basis or bi-annually (depending on the reporting SEC rules at the time). Given this heterogeneity in the release of new information, we construct our database with the last reported portfolio information for each fund on any given year. For example, our sample of mutual fund holdings for 2005 contains portfolio data for the Fidelity Worldwide Fund as of October 2005 and portfolio data for the Scudder Global Fund as of December 2005. In sum, we collect end-of-year detailed information on portfolio holdings between 1991 and 2005. We collect stock names, amount invested in each stock by each fund, and country of origin of these stocks.

A difficulty in constructing the holdings database is that mutual funds report their asset allocation separately over time, that is, their holdings are not linked and do not tend to have identifiers across reports. Therefore, each security needs to be identified at each point in time. This is not a simple task because stock identifiers are rarely available and, if so, are not always unique. We match these holdings across mutual funds over time based on the country of origin (when available) and the stock name for each security holding. We can then determine whether the same stocks appear in different mutual fund portfolios, across and within fund families.

[15] Funds that focus on both debt and equity are excluded from the analysis, even though they do invest a significant share of their portfolios in foreign stocks.

Table 1 describes the data. We collect data on 8,420 fund-year portfolio holdings over the period 1991 to 2005, covering 499 mutual fund families (companies) and a total of 1,904 funds. Each mutual fund family has on average six different mutual funds. Some families sell the same portfolio to investors under different names depending on their fee structure and minimum investment requirements. In this paper, we consider these different funds (with identical portfolios) only once; i.e., we do not treat them as separate funds as Morningstar does.[16] The total number of asset-level observations in our dataset is 1,359,750, counting each stock-level allocation across all funds over time.

The U.S. mutual fund industry is organized by splitting funds according to their investment scope. In particular, funds are classified into five distinct categories: world funds, foreign funds, emerging market funds, regional funds, and country funds. Regional funds are divided into: Asia (and Pacific) funds, Europe funds, Latin America (and the Caribbean) funds, and Middle East and Africa funds.[17] World funds invest all over the world including the U.S., while foreign funds invest around the world excluding the U.S. Emerging market funds invest only in emerging market assets.[18] Regional and country funds invest only in a particular region or country, respectively. For ease of exposition, we group funds into two categories: global funds and specialized funds. Global funds encompass world funds and foreign funds. All other fund types are called specialized funds, investing in a subset of assets. This organization of the mutual fund industry is displayed in Figure 1. Naturally, funds with a wider investment scope (global funds) are always able to invest in the stocks held by specialized funds, but not vice versa.

We also collect data on the time series of return/price data on mutual funds. Since these are open-ended funds, the value of each fund each day reflects the value of the underlying holdings or the net asset value (NAV). We thus use returns at the fund level on a daily basis between September 1989 and June 2006 for 36 mutual fund families, as reported in Table 1. We work with a total of 722,885 daily observations, encompassing all returns for all funds. We include all funds within a given family of funds. On average,

[16] For example, Fidelity Advisors Funds contain the following Latin America funds with the same portfolio: Fidelity Advisors Latin America A, Fidelity Advisors Latin America B, and Fidelity Latin America T.
[17] Asia funds can actually invest in countries located in both Asia and Pacific regions. Latin America funds can also invest in countries in the Caribbean. Some Europe funds also tend to invest in countries in Africa, such as South Africa.
[18] Emerging markets are typically middle-income countries. However, these funds might also invest a small proportion of their portfolios in low-income countries.

each family has ten different mutual funds.[19] To be able to compare returns, we work with a restricted number of mutual fund families, focusing on large families with several types of funds. This allows us to assess issues related to the gains from international diversification by holding different mutual funds within a family.

3. How Do Mutual Funds Allocate Their Portfolios Globally?

The U.S. mutual fund industry investing internationally has expanded sharply since the early 1990s. For example, in 1991 there were fewer than 170 mutual funds established to invest in international equity, while in 2005 there were almost 700 funds. This marked increase is not restricted to a specific mutual fund type. Figure 2 shows the number of funds between 1991 and 2005, when the number of both global and specialized funds increased significantly. However, while the number of global funds has increased steadily until the early 2000s, that of specialized funds increased until 1998 and then declined. This was likely driven by the Asian and Russian crises that might have generated a desire to hold funds that can invest more freely around the world. At the end of 2005, there were 490 global funds and 186 specialized funds. In terms of assets under management, the differences are even starker. Global (specialized) funds managed 29 (7) billion U.S. dollars in 1991 and 781 (160) billion U.S. dollars in 2005. This pattern holds across more specific fund types. Foreign funds are the ones with the most noticeable increase: assets under management increased from 10.3 billion to 540 billion U.S. dollars between 1991 and 2005. In sum, the data show a clear trend in the U.S. mutual fund industry toward funds with a wider investment scope over funds that invest in specific regions or countries.

Given the increasing importance of global funds, a natural question is to what extent their portfolios differ from the ones held by specialized funds and how widespread their investments are. We thus explore to what degree mutual fund holdings vary across different fund types within mutual fund families. In principle, as the investment scope increases, funds should be able to hold more assets across more countries and consequently diversify risk better.

[19] See Appendix Table 1 for a detailed description of the sample coverage of the price data for each mutual fund family.

Table 2 presents the average, median, and the standard deviation in the number of holdings across mutual fund types over the entire 1991-2005 period, pooling all the data. Moreover, Figure 3 shows the median number of holdings for different mutual fund types from 1991 to 2005. The top panel reports these medians for world funds (with and without U.S. holdings), foreign funds, emerging market funds, and regional funds. The bottom panel displays the number of stocks held by Asia funds, Europe funds, Latin America funds, and country funds. The median number of holdings is surprisingly stable over the 15-year sample period and similar across fund types.[20] The median number of holdings for world funds is 106 stocks (76 when excluding the U.S.), with no clear time trend. The median number of holdings for foreign funds is 105 stocks, while the median for emerging market funds is 121 stocks. The medians for Europe and Asia funds are 71 and 65 stocks, respectively, while Latin America and country funds hold 56 and 63 stocks, respectively. These median values are lower for more specialized funds. Across fund categories there is no clear time pattern. The only apparent exceptions are foreign funds, which have increased the number of holdings in the last few years. In sum, the evidence suggests that mutual fund managers tend to invest in a finite number of stocks that does not increase significantly as the scope of investment widens.[21]

Given that the number of stocks held by global funds does not increase significantly relative to specialized funds and global funds have a broader investment scope, a natural question is whether global funds hold fewer assets than specialized funds within each region of exposure. The evidence presented in Table 3 confirms that this is indeed the case. If holdings in Latin America are considered, the median for Latin America funds is 41 stocks. However, emerging market funds (with a greater investment scope) hold 34% fewer assets than the Latin America fund within its mutual fund family. The drop in the number of holdings is even more striking for global funds, it falls 94%

[20] Although not shown, the average number of holdings is also stable over time and similar across fund types.

[21] This pattern does not seem to be unique to mutual funds investing internationally. When repeating this exercise for U.S. mutual funds dedicated to domestic investments and for a popular and broad ETF family (Barclays' iShares), similar patterns arise. For example, the median number of holdings for funds investing in U.S. stocks in 2005 is 82. The median number of holdings for funds investing in large capitalization, mid capitalization, and small capitalization companies is 74, 77, and 141, respectively. When considering more specialized funds, with an industry specific focus, the median number of holdings is 77. Namely, the number of holdings does not increase substantially as funds have a wider investment scope; moreover, the number of holdings is relatively similar across fund types. In the case of iShares ETFs in 2005, the world fund held 113 stocks, the foreign fund held 827 stocks around the world, while specialized funds investing in specific world regions held on average 294 stocks. Furthermore, region-specific ETFs did not hold many more stocks than country-specific ETFs.

and 93% for world and foreign funds, respectively. Furthermore, world and foreign funds also invest, respectively, in 72% and 75% fewer countries than their specialized counterparts. For Asia, the numbers suggest a similar pattern. The median number of holdings for foreign and world funds is 35 and 19 assets, implying a drop of 42% and 69% relative to the Asian fund within the same mutual fund company. If the number of countries is considered, global funds also hold assets in significantly fewer countries than Asia funds in the same mutual fund family. Lastly, a similar trend is observed if holdings in developed Europe are considered: global funds hold fewer assets in fewer countries within Europe than specialized funds.

In sum, as their scope of investment becomes broader, mutual funds invest larger funds in fewer stocks and in fewer countries within each region of exposure, especially in developing countries. If asset returns were perfectly correlated this behavior would not be surprising, there would be no further gains from diversification. Several other reasons could also help explain this pattern. These reasons are studied in the rest of the paper.

4. What Factors Might Explain the Global Portfolio Allocations?

To analyze what might be behind the investment in a limited number of stocks, we first study to what extent mutual funds have the ability to invest in other assets and are constrained by transaction costs. Second, we study where the variation in the number of stocks held by mutual funds comes from; in particular, to what degree it is driven by information asymmetry and family effects.

A. Share of Total Assets

A first step to understanding the extent of international diversification by mutual funds is to analyze the universe of assets in which they can invest. Table 4 reports the size of the universe of stocks in 1997 and 2004.[22] It shows the total number of listed stocks across different regions for both developed and developing countries.[23] These potential holdings are larger in developing countries than in developed countries; however, the difference has fallen over time. The number of stocks has grown 40% during the period in

[22] Assets in the U.S. and Canada have been excluded from this table as we focus on the international holdings of mutual funds. Offshore centers have also been excluded as mutual fund companies usually only have offices in these centers but to invest elsewhere.

[23] Developed countries are high-income countries and developing countries (including emerging economies) are non-high-income countries according to the World Bank classification of countries.

developed countries, and 20% in developing countries, mostly concentrated in developing Europe.

Of the universe of potential holdings, mutual funds only invest in a fraction of the assets. Table 4 reports the actual number of mutual fund holdings and the fraction of holdings relative to the number of locally listed companies. It does so for all funds in our dataset and, separately, for global funds. In 1997, mutual funds invested in around 9,000 different firms. In developed countries, they held around 6,800 firms, an average of 50% of the available assets. However, in developing countries, these numbers are significantly smaller: they held 2,271 firms, or 13% of the available stocks. An even more pronounced pattern emerges when considering global funds only, the mutual fund type that has become very large over the sample period. In 1997, global funds held 4,953 different firms in developed countries, which constitute 38% of the number of potential stocks available. In developing economies, they held only 8% of the available shares.

Table 4 also shows that, although the universe of listed companies has increased between 1997 and 2004, there has been a considerable fall in the number of mutual fund holdings during this period. In 2004, mutual funds held 5,204 firms in developed countries and 1,085 in developing countries. This decline in holdings has not been concentrated in any particular region, but has been more accentuated in developing countries, where a fall of 52% is observed. In developed countries, the number of holdings declined 24%. When only global funds are considered, a similar investment pattern emerges. In 2004, their holdings have decreased to 4,799 firms in developed countries, or 26% of the available assets. In developing countries, the number of holdings fell approximately 46%, from 1,314 to 711 firms, or equivalently, from 8% to only 3% of the number of available stocks.

Although the number of mutual fund holdings has been falling between 1997 and 2004, the amount invested in these stocks has grown significantly, in both developed and developing countries. Investments in developed countries have increased from 204 billion U.S. dollars in 1997 to 446 billion U.S. dollars in 2004, a 119% increase. In developing countries, investments have also more than doubled, increasing from 30 to 62 billion U.S. dollars between 1997 and 2004. Thus, a growing amount of funds is being invested in fewer firms, and more significantly so in developing countries.

A concern about mutual fund investment across countries is that institutional investors tend to be large; therefore, the amount they invest in different assets might be determined by their ability to invest in them. For example, if specialized funds held a large fraction of the available shares, global funds would find it difficult to invest in them without affecting prices. To investigate whether there are restrictions coming from the supply side of instruments, Table 5 shows the size of individual mutual fund holdings relative to firms' market capitalization. The table shows that, on average, mutual funds hold a very small fraction of market capitalization. For example, both global funds and specialized funds account each for 0.12% of firms' market capitalization. Therefore, if funds wanted to increase their exposure, they could probably do so without generating a significant price impact. For example, if global funds invested all of their assets under management in specialized funds, each fund would still capture a small fraction of market capitalization, around 0.73%. Even if one aggregates all mutual fund holdings, the fraction of market capitalization remains small. The sum of all global fund holdings accounts on average for 2.8% of firms' market capitalization and that of specialized funds accounts for 1.3% of market capitalization. Therefore, the patterns observed regarding mutual fund holdings do not seem to be driven by the inability of funds to hold more companies across countries.

To complement the evidence that mutual fund investments are concentrated in few companies and not evenly distributed across regions, Figure 4 illustrates how mutual funds invest across countries. The figure plots the ratio of the number of companies held in mutual fund portfolios to the total number of listed companies. These ratios are computed on a yearly basis and reported according to their averages over the 1997-2004 period. Countries are sorted by the extent of mutual fund investment and divided in five equally-sized groups (quintiles). Reinforcing the previous evidence, this figure shows that mutual fund holdings are not evenly spread across countries. For around half of the countries in the sample, mutual funds invest in at most 20% of the listed companies. In no country do mutual funds exhaust the available stocks. Moreover, only developed countries appear in the highest quintile. Among developing countries, Mexico is the one with the largest ratio (44%), whereas among developed countries, Netherlands has the largest ratio (77%). In the bottom two percentiles, there are 24 developing countries but

only four developed countries. In other words, mutual funds tend to hold a larger fraction of listed firms from developed countries than from developing countries.

B. Informational Costs

In the second part of this section, we analyze the degree to which information asymmetries can explain the patterns of international investments by different types of mutual funds. We focus on costly information gathering and processing. To the extent that information is costly to obtain and process and that the managers of specialized funds have already decided on an asset allocation, global fund managers within the same mutual fund company could potentially benefit from this information and choose among the stocks selected by their peers (or at least they could use the same information gathered by the analysts). In other words, if global and specialized funds within mutual fund companies shared information and made similar decisions, one should observe similar portfolios across them. We also analyze the extent to which the number of managers and other measures related to the ability of funds to obtain and manage information might explain the number of asset holdings in mutual fund portfolios.

To assess the portfolio similarity we ask: what is the likelihood that a stock held by a specialized fund also belongs to the portfolio of global funds, within the same family of funds? The within family comparison is important given a large heterogeneity in holdings across mutual fund families and the hypothesis of interest, that is, whether fund managers in the same company make similar decisions (a sign of information sharing). To answer this question, we compute frequency counts. We consider global and specialized funds within a mutual fund family and count the number of observations for which a stock is held by one of these two fund types, with each of the close to 400,000 observations being a family-year-stock observation. Then we compute the fraction of the observations in which a stock is held by a certain fund type but not held by the other, a stock is held by both the fund types, and a stock is held by the global fund but there is no specialized fund within the same family that could hold that stock.[24] We make these comparisons on a yearly basis; for example, we compare a stock held by a specialized fund at time *t* with the stocks held by the corresponding global fund also at time *t*. By construction, no observation falls into the case where there is no global fund that could

[24] U.S. assets are excluded from the analysis here.

not hold a stock held by a specialized fund; that is, for every specialized fund there is always a global fund within the mutual fund family.[25] Moreover, also by construction, there are no observations for which a stock is held by neither the global fund nor the specialized fund. We repeat this exercise just for holdings in developing countries and by breaking global funds into world funds and foreign funds.

The basic results are shown in Table 6 for total holdings and those in developing countries only. Each cell represents the relative frequency of the observations, that is, the joint probability that the global and specialized funds hold/do not hold a particular stock. Conditional probabilities can be obtained by looking at a particular row or column. The evidence from Table 6 suggests that global funds and specialized funds do not hold many stocks in common. When considering all holdings, only 16% of actual holdings are shared by both fund types; in developing countries, that fraction is 13%. Moreover, only 23% of the global fund holdings are shared by specialized funds, and 32% of the stocks are held by specialized funds alone but not by global funds.

The results from Table 6 also suggest that the vast majority of mutual fund holdings in developing countries are concentrated on specialized funds, not on global funds. For example, 75% of the stocks are held by specialized funds but not by global funds. In other words, a mere 25% of stocks in developing countries in our sample is held by global funds. Furthermore, conditional on being held by a specialized fund, there is only a 15% probability that a stock from a developing country is held by a global fund. However, as opposed to patterns observed if all holdings are considered, global funds tend to hold a larger subset of what specialized funds hold in developing countries. Around half of global fund holdings are shared by their specialized counterparts in developing countries. This evidence also implies that the results on all holdings are being driven mostly by holdings in developed countries. In other words, global funds seem to be holding a different set of firms in developed countries than specialized funds do.

Appendix Table 2 splits global funds into world funds and foreign funds and compares them with specialized funds. The results suggest that there is no significant difference in portfolio holdings across global funds: specialized funds invest in a wider

[25] We exclude all family-year-stock observations for which mutual fund families do not have one of the fund types considered in that given year.

set of assets than both world funds and foreign funds (when specialized funds are available). World funds and specialized funds share only 10% of their holdings. This percentage increases to 15% if foreign funds are considered. In other words, the intersection of portfolio holdings between specialized funds and foreign funds is larger than between specialized funds and world funds. In sum, the results presented so far suggest that global funds actually hold a different set of assets than specialized funds, although the similarity in portfolios increases if holdings in developing countries are considered.

The frequency counts shown in Table 6 and Appendix Table 2 measure to what degree mutual funds with different investment scopes invest in the same stocks. However, that evidence does not take into account the size of the mutual fund investments in each stock. It might be possible that though the range of stocks in which mutual funds invest differs, global and specialized mutual fund portfolios have a large loading on stocks that are common to their portfolios. Therefore, mutual fund portfolios could actually be more similar than they appear with the evidence presented above. The reverse could also be true.

To account for the size of mutual fund investment in each stock, we study entropy or similarity measures that analyze how alike mutual fund investments (measured by the NAV) actually are. The entropy measure is constructed as follows:

$$Entropy_{f,t}^{i,j} = \frac{\sum_{s,i} NAV_{s,f,t}^{i} + \sum_{s,j} NAV_{s,f,t}^{j}}{\sum_{i} NAV_{f,t}^{i} + \sum_{j} NAV_{f,t}^{j}}, \qquad (1)$$

where $Entropy_{f,t}^{i,j}$ is measured for all funds within types *i* and *j* for each family *f* at time *t*. $i, j \in \{\text{global fund}, \text{specialized fund}\}$; *s* are stocks common to the portfolio of both funds *i* and *j* from family *f* at time *t*. As above, global funds are then split into world funds and foreign funds. Namely, for a given pair of different fund types within the same mutual fund family, the entropy measure is the ratio of the sum of the dollar investment in stocks common to the portfolio of these two fund types over the total net assets of the same funds. This entropy measure is an upper bound of commonality since it aggregates all specialized and global funds within a family instead of comparing separately each specialized fund with a global fund. The measure is calculated for every year. Moreover,

this measure is constructed within families, given our focus on information sharing within mutual fund companies.

The entropy measures indicate that mutual funds do indeed hold a more similar portfolio than what frequency counts suggest, however, mutual funds still invest in quite different portfolios. For example, when comparing global and specialized funds, the entropy measure shows that, on average, 36% of the value of their holdings is in common assets. In contrast, as mentioned for the case of Table 6, 16% of the number of their holdings is in the same stocks. The entropy measure is slightly higher in the case of developing countries, reaching on average 42%, compared to the 13% obtained for the frequency count of Table 6. As shown in Figure 5, the entropy measure is stable over the sample period, and if anything it decreases since 2001 (and since 1999 for the case of developing countries), suggesting that there is no rise in commonality over time. Similar patterns are obtained (in unreported results) when splitting global funds by type. On average, the entropy measure is 26% when comparing the holdings of world funds and specialized funds and 28% when comparing those of foreign funds and specialized funds.

To the extent that funds tend to hold portfolios that are not very similar, we do not find evidence of information sharing within mutual fund companies. Managers do not seem to be using information already gathered by other managers within the same mutual fund firm. We now analyze the degree to which the number of managers and other measures related to the ability of funds to obtain and process information (manager tenure, fund age, fund expenses, and fund size) might influence the number of stocks mutual funds hold. The results are shown in Table 7.[26] Column 1 shows that the number of stocks is positively associated with the number of managers; however, the marginal effect is low. For example, funds with one manager hold on average 133 stocks, while funds with two managers hold 135 stocks, and funds with six managers hold 197 stocks. In all other specifications, we consider the number of managers as a single count variable to summarize its results. Columns 2 and 3 add manager tenure and fund age to the regressions. The effects of these variables are also positive though statistically insignificant. The number of managers has a significant positive effect on the number of

[26] Appendix Table 3 reports regressions with the percentage of net assets in the top ten holdings as dependent variable. The results are qualitatively similar to the ones presented here.

fund holdings. Nevertheless, the proportion of the total variance explained by these variables is small, between 3% and 5%. We repeat these regressions in columns 4 and 5 but adding mutual fund expenses instead of the variable for the number of managers. While the variable fund expenses is positively associated with the number of holdings, the effect reverses when we control for fund size. Lastly, we report one specification including the variable for the number of managers and the variables for fund expenses together. The results are similar to the ones obtained with the other specifications. Additionally, less than 7% of the total variance is explained by all these variables together. In summary, although the variables related to the ability of funds to collect and manage information are positively associated with the number of holdings, their explanatory power is small.

In sum, we do not find much evidence that managers are using information already gathered by other managers within the same mutual fund firm.[27] In fact, managers within families might be competing with each other, picking stocks independently. Furthermore, we also find that measures that capture the ability of funds to gather and process information explain only a small proportion of the variance of the number of stocks held by each fund. Thus, informational asymmetries alone do not seem to explain the apparent lack of international diversification.

C. Family versus Fund Effects

We now study the role of families on the number of mutual fund holdings, given that Figure 3 already shows that the latter is relatively constant over time and does not vary significantly by fund type. Figure 6 (top panel) shows the distribution of the number of holdings for all fund-year observations. The median number of holdings is 95, while 95% of the observations are below 450. Although there is some dispersion, with some funds holding many stocks in some years, 73% of the observations imply holdings below 150 stocks and 86% holdings below 250 stocks. The bottom part of Figure 6 shows the median number of stocks per family, sorted from the lowest to the highest number of holdings. This panel suggests that the dispersion in the number of stocks found in the fund-year observations is linked to the dispersion in the number of stocks held across

[27] This finding is consistent with the evidence shown by Kempf and Ruenzi (2008) on the existence of a family tournament, i.e. competition among managers within mutual fund families.

mutual fund families. Mutual fund families differ substantially in the number of stocks they hold. For example, GAM Funds and Oppenheimer Funds hold on average substantially fewer than 200 stocks, while others (such as Dreyfus Founders and Vanguard Group) hold at least two times more. The mean of the fist quintile of the distribution is 39 stocks, whereas the mean of the fifth quintile is 335. While there are extreme cases, with the median fund in one family holding 1,094 stocks, most families hold a limited number of stocks, with the mean of the fourth quintile being 122 stocks.

How important are family effects versus time and fund type effects to explain the number of holdings across mutual funds over time? The top panel of Table 8 reports regressions of the number of holdings, as the dependent variable, on year, fund type, and family dummies.[28] The dummy coefficients are not reported, although they are usually significant at a 1% confidence level. Seven different specifications are reported. In the first specification, only year dummies are considered. In this case, less than 1% of the variance in mutual fund holdings can be explained. Column 2 reports a regression with fund type dummies alone. Again, a small percentage (only 2%) of the variance of the dependent variable is explained by these dummies. The specification in column 3 includes family dummies. In this case, 39% of the variance in the number of holdings across funds over time is explained, a much greater percentage than that explained by fund type and year effects alone. The next three reported regressions include a combination of these three types of dummies: family dummies, fund type dummies, and year dummies. In all these cases, the R-squared is relatively high only when family dummies are included. Lastly, we report a specification with all dummies together (column 7). We observe only a slight increase in the R-squared in comparison to the other regressions with family dummies. Therefore, family effects indeed seem to be important to explain mutual fund holdings.

Given the relevance of family effects, we revisit the hypothesis that informational asymmetries can explain the apparent lack of international diversification. It might be that the key variables for the ability of funds to gather and process information are family-level expenses, not fund-level ones. In this case, family expenses (and family size)

[28] Appendix Table 4 reports regressions with the percentage of net assets in the top ten holdings as our dependent variable. The results are qualitatively similar to the ones presented here.

should explain a significantly higher proportion of the variance of the number of stocks held by each mutual fund than the fund-level expenses included in the regressions reported in Table 7. The results are shown in the bottom panel of Table 8. In the first three columns, the regressions do not include family dummies, but incorporate fund-level variables (the count variable on the number of managers, manager tenure, and fund age) and family-level ones (family expenses and family size). The results are similar to the ones reported in Table 7. Expenses at the mutual fund family level are positively associated with the number of holdings. Nevertheless, they explain only a small proportion of the variance of the number of stocks held by mutual funds, between 1% and 7% versus 39% explained by family dummies alone. In other words, family-level expenses do not seem to explain what family dummies capture. Moreover, if we include family dummies in these regressions (reported in columns 4 to 7 in the bottom of Table 8), both fund-level and family-level variables become statistically insignificant.

In sum, the results presented in this section suggest that the apparent lack of international diversification in mutual fund portfolios cannot be explained by the lack of available instruments or by informational asymmetries alone. Instead, family effects unrelated to these two factors seem to be very relevant.

5. Do Returns and Investment Strategies Explain Portfolio Allocations?

This section analyzes mutual fund returns to shed light on whether they can help explain why global funds do not have a substantially larger number of holdings relative to specialized funds. The fact that global funds tend to hold a smaller number of stocks in fewer countries within regions of exposure (compared to specialized funds in the same mutual fund family) might be explained by the lack of extra diversification gains (due to correlated returns) and/or by the desire of investors to minimize risk or transaction costs. We then study if there are potential gains from further international diversification by global funds. We also test whether benchmark effects can justify the portfolio choice of global funds, since managers are generally evaluated on their performance relative to benchmark indexes. In addition, we investigate the existence of an insurance premium in the returns of global funds. Lastly, we analyze the performance of ETFs to shed light on

whether potential transaction costs on the investor side, which might inhibit arbitrage, could explain part of the results.

A. Standard Portfolio Model: Mean-Variance Analysis

To evaluate the potential cost of the apparent lack of diversification by global funds, we compare the returns of global funds to those of "simulated global funds." We construct one simulated global fund for each global fund, consisting of a portfolio of specialized funds (that belong to the same mutual fund family as the global fund) and the global fund itself. This is analogous to letting a global fund invest in a portfolio that replicates specialized fund holdings at any point in time. The portfolio weights on the specialized funds are obtained through mean-variance optimizations. The returns on the simulated global funds are compared to the returns on the actual global funds over the same period. This is a conservative exercise to evaluate the gains from international diversification since it does not use all stocks in the investment universe of global funds to construct alternative portfolios (which might include assets that are hard to reach, but could apparently yield substantially higher returns); it only uses the stocks already chosen by specialized funds within the same family.

There is an important advantage in constructing these simulated global funds at the family level. The fact that a specialized fund within the mutual fund family is already holding the asset is an indication that the mutual fund company has already paid for the potential costs of collecting and processing information about a particular stock or country. Moreover, the fact that at least one specialized fund is investing in those stocks is a clear indication that they are within the subset of investable assets. From the manager's perspective there are no restrictions to investing in those assets, so transaction costs should not be very high.

To perform the mean-variance analysis, consider that there is a global fund with an observed return history *G*, and there are also several specialized funds within the mutual fund family of the global fund with observed returns S_i. The global fund can invest anywhere in the world including the assets held by specialized funds (with the exception of the U.S. if it is a foreign fund), whereas specialized funds invest in specific

regions.[29] The simulated global fund is constructed as a portfolio *P* that assigns non-negative weights to all specialized funds and to the global fund itself. This within mutual fund family exercise is isomorphic to allowing a global fund to invest in specialized funds within its mutual fund family. This portfolio *P* is constructed such that it optimally minimizes its own variance and achieves at least the same expected return (net of administrative fees) as the global fund itself.

We impose the following restrictions to construct the simulated global funds: (i) portfolios are constructed for each global fund using a combination of the fund itself and specialized funds within the same mutual fund family; (ii) only buy and hold strategies are considered; (iii) funds cannot be shorted; (iv) the performance evaluation is always conducted out-of-sample; (v) the portfolio is optimized on a daily or weekly basis; and (vi) a mean-variance framework is used.

The optimization problem is set to minimize the variance of the returns on the simulated global fund, keeping returns on the simulated global fund at least as large as those on the global fund (i.e., with the same objective as the global fund). The exercise can be described as follows:

$$\underset{x}{Min}\ \text{var}(P) = x'\Sigma x\ , \tag{2}$$

$$\begin{aligned} &\text{such that}: E(P) \geq E(G), \\ &0 \leq x_i \leq 1, \\ &\sum_i x_i \leq 1, \\ &P = \left(1 - \sum_i x_i\right) * G + \sum_i x_i * S_i, \end{aligned} \tag{3}$$

where x_i is the portfolio weight on fund *i* within a mutual fund family (either a specialized fund or the global fund itself) and Σ is the covariance matrix of all mutual fund returns. Since the simulated global fund *P* is evaluated out-of-sample, the portfolio shares are computed at time *t* using all available information up to that time, and held for the next period, when the return on *P* is computed. We are then able to compare the return on the simulated global fund *P* with the return on the global fund *G* over the same time period. Portfolio weights are actively re-optimized every period.

[29] In the families analyzed here, there are no specialized funds with holdings exclusively in the U.S.

As an alternative exercise, we maximize expected returns, keeping the variance of the simulated global fund at most as small as that of the global fund itself. This strategy can be described as follows:

$$\underset{x}{Max}\ \mathrm{E}(P), \tag{4}$$

$$\begin{aligned} &\text{such that}: \mathrm{var}(P) \le \mathrm{var}(G) \\ &0 \le x_i \le 1 \\ &\sum_i x_i \le 1 \\ &P = \left(1 - \sum_i x_i\right) * G + \sum_i x_i * S_i . \end{aligned} \tag{5}$$

We perform these two types of exercises for several types of global funds: world funds, foreign funds, or a pool of world or foreign funds. Pools of world (or foreign) funds exist when more than one fund in a mutual fund family is classified as a world (or foreign) fund and these funds have different objectives such as value, growth, or blend strategies. An important benefit of the exercises performed here is that they do not need to identify the exact stocks held by different mutual funds within a mutual fund family at every point in time. The only information needed is mutual fund returns over time and the investment scope. This allows us to extend the time horizon of the data to start in the late 1980s.

The summary statistics of the simulated global and actual global funds are shown in two tables. Table 9 reports the results for simulated global funds constructed with the largest number of available specialized funds, called the "largest number of funds" (the largest cross-section) simulation. This simulation includes all possible specialized funds for each family and adjusts the time series accordingly to use the sample available for all funds included in the simulation; however, it does not necessarily entail a very long time span due to data availability on mutual fund returns. Table 10 reports results that use instead only specialized funds that allow for an estimation of a simulated global fund with a relatively long time series. More specifically, specialized funds are excluded from the simulations if they reduce the sample size by at least six months. On average three specialized funds are excluded from these simulations, which leads to an average increase of 44 months in the time span of the simulations. This is the longest possible simulation for each global fund, dubbed the "longest available sample" (the longest time series)

simulation. This longer time series come at a cost since fewer specialized funds are typically available for comparison. The tables present the following statistics: the average annualized returns for the global funds and the simulated global funds, the average annualized difference in accumulated returns between each simulated global fund and the corresponding global fund, daily standard deviation of returns, and the number of comparisons.[30] Annualized differences in accumulated returns are calculated over the entire sample for each simulation performed. Averages across simulations are then computed.[31] For global funds, the tables report separately world funds, foreign funds, and a pool of world or foreign funds. Results are presented using daily and weekly (Wednesday) returns.

The top panels of Tables 9 and 10 report results based on minimizing variances, using equations (2) and (3). Table 9 shows that simulated global funds yield on average annualized excess returns of 483 basis points per year relative to world funds, 398 basis points relative to foreign funds, and 455 basis points relative to the pool of world or foreign funds. These increases in risk-adjusted expected returns suggest that there are potential gains from further international diversification, even if investing only in stocks held by other funds within the same mutual fund family. Moreover, the daily standard deviation of the returns on the simulated global fund is also smaller than that of the global fund. For example, Table 9 shows that the standard deviation falls by nine basis points for world funds, eight basis points for foreign funds, and six basis points for the pool of world or foreign funds. The numbers might seem small, but they are reductions in the daily standard deviation of returns. The results hold when using weekly returns. For example, Table 9 shows that the simulated global funds yield on average 437 basis points more per year than global funds when considering all types of global funds.

Table 10 shows that the results are similar when using the simulations with the longest time span. For example, the average improvement in returns is 301 basis points per year and the improvement in the daily standard deviation of returns is six basis points. The results are more modest though than the ones reported on Table 9. The reason is that

[30] We also compute these tables at the family levell to show the heterogeneity across mutual fund families. The results are shown in Appendix Table 5A and 5B for the largest number of funds simulations, and in Appendix Table 6A and 6B for the longest available sample simulation for each global fund.

[31] Although not reported, for robustness purposes, we also calculated these return differences at every point in time and then computed the averages within and across simulations. The results are qualitatively similar to those reported here.

fewer specialized funds are available when the longest available sample simulations are considered. In other words, there is less scope for improvement than in the previous case. Similar patterns arise for simulations based on weekly returns.

The bottom panels of Tables 9 and 10 report summary statistics of portfolios constructed based on maximizing expected returns while holding the variance constant, using equations (4) and (5). Considering the simulations with the greater number of specialized funds (Table 9), the improvement in annualized returns is 176 basis points for all types of global funds, whereas the daily standard deviation is identical. If the longest available sample simulations are considered, Table 10 shows that the improvement in returns is 85 basis points and the daily standard deviation is again identical. When using weekly returns, larger differences are obtained; the improvement in returns are 550 and 354 basis points for the largest number of funds and the longest available sample simulations, respectively.

In sum, the results from these simulations allow us to reject the hypothesis that there are no gains from further international diversification by holding more stocks within and across countries. In other words, the investment practices documented in the first part of the paper seem to be very restrictive. Although there is some heterogeneity in the results depending on the strategy used, the simulated global funds consistently yield higher returns and no greater volatility than the global funds, even when comparing funds within the same families.[32]

B. Benchmarking

The optimization strategies described above are perhaps somewhat unrestricted because the objective of most mutual funds is not necessarily to minimize the variance given some expected return, or to maximize returns given some variance. The performance of mutual funds might actually be evaluated in comparison to benchmark indexes. Moreover, managers might be compensated according to this relative performance. Thus, portfolio decisions should incorporate these managerial incentives. Furthermore, different mutual funds might follow different investment goals. It is possible that some mutual funds follow passively a benchmark index while others are more active in seeking

[32] For robustness, we also perform these simulations with a more restricted sample. We use rolling windows of 240 business days. The results are robust to this change and are reported in Appendix Tables 7A and 7B.

returns. Therefore, the difference in returns between global funds and the simulated global funds could, in principle, be explained by different investment practices by global and specialized funds. We address these two related issues in this sub-section.

We first test whether benchmark effects are important in explaining the gains from further international diversification found in the previous exercise. For the case of the variance minimization, we modify the objective function to take into consideration a benchmark index. The benchmark is the appropriate MSCI index (*B*), specific for each global fund as described in the Morningstar database or in the fund's website. Instead of minimizing the variance of the portfolio, we minimize the variance of the difference between the portfolio and the benchmark index. Thus, while the constraints remain as stated in equation (3), the following equation (6) replaces equation (2) for this strategy:

$$\underset{x}{Min}\ \text{var}(P-B) \qquad (6)$$

For the maximization of expected returns, we impose an additional restriction: the variance of the difference between the simulated global fund and the benchmark index has to be at most the same as the variance of the difference between the global fund and the benchmark index. Equation (7) states this additional restriction:

$$\text{var}(P-B) \leq \text{var}(G-B) \qquad (7)$$

The results of these new simulations are reported in Table 11 for the largest number of funds simulations for each global fund, and in Table 12 for the longest sample available simulations for each global. For simulations that minimize the variance of the portfolio, the results are similar to the ones reported in the previous section. For the largest number of funds simulations reported on the top panel of Table 11, the simulated global funds generate excess annualized returns of 341, 361, and 420 basis points when compared to world funds, foreign funds, and the pool of world or foreign funds, respectively. Improvements in the standard deviation are also observed. On average, the daily standard deviation falls five basis points. When the longest available sample simulations are considered, as reported in the top panel of Table 12, the results hold. Simulated global funds yield, on average, an excess annualized expected return of 277 basis points across the different simulations, and a daily standard deviation 13 basis points lower than global funds. When maximizing expected returns, the results are even stronger. Table 11 shows an improvement in annualized returns of 395 basis points on

average across mutual fund families and an improvement in daily standard deviations of eight basis points. In Table 12, where fewer specialized funds are included in portfolio simulations, the improvement in returns is 316 basis points, but reaches 503 basis points for the pool of world or foreign funds. The improvement in daily standard deviations is also considerable: six basis points on average across mutual fund families. In sum, our results suggest that benchmark effects cannot explain the empirical evidence described above regarding investment patterns. We find that, even within the same mutual fund family and accounting for benchmarking, global funds could obtain improvements in both risk and returns by diversifying more through investing in more stocks.

To study whether global and specialized funds follow different types of investment strategies (some being passive while others being active), we compute entropy measures over time. That is, we calculate the similarity of mutual fund portfolios between any two consecutive years of mutual fund holdings. Importantly, we compute separate measures for each individual fund and then obtain averages for world funds, foreign funds, and specialized funds. The average entropy over time is 0.64, 0.65, and 0.66 for world funds, foreign funds, and specialized funds, respectively. These measures are very stable over time and are not statistically different from each other, suggesting that stock turnover is not different across funds with different investment scopes. Similar results are obtained when considering only holdings in developing economies. These results suggest that different types of funds do not have significantly different trading strategies since their portfolios behave similarly over time.

C. Insurance Premium in the Global Fund Returns

Another possible explanation for our results is the existence of an insurance premium in the returns of global funds. Global funds have the ability to shift their stock holdings across countries and regions, which is not an option to specialized funds. Thus, investors might be willing to pay for this extra flexibility, by requiring lower returns from global funds, since it might yield gains during turbulent times. In other words, global funds might be better suited than specialized funds to avoid large losses due to their ability to move away from trouble countries. Therefore, we evaluate whether global funds have indeed a better ability to minimize losses compared to specialized funds.

We first compare the skewness and kurtosis of the global fund returns to those of the simulated global fund returns obtained from the mean-variance framework. Higher moments of the distribution of returns are important if global funds were to minimize losses during bad times instead of following a standard mean-variance approach. The results are reported on Table 13 for our largest number of funds simulations and Table 14 for our longest available sample simulations. We find that skewness and kurtosis of returns are similar, and not statistically different, between global and simulated global funds. For example, if the largest number of funds (longest time series) simulations are considered, the skewness of global fund returns is -0.66 (-0.43) on average, whereas that of the returns on the simulated global funds is -0.82 (-0.30) if based on simulations of variance minimization or -0.71 (-0.44) if based on simulations of maximization of expected returns. If the kurtosis is analyzed, the returns on global funds exhibit kurtosis of 10.03 and 34.16 for largest number of funds and longest available sample simulations, respectively. Similarly, the kurtosis on the returns on our constructed portfolio is 9.72 (46.63) if based on simulations of variance minimization or 10.41 (34.08) if based on simulations of maximization of expected returns for the largest number of funds (longest available sample) simulations. Overall, the evidence suggests that, despite the differences in the mean and the variances reported above, higher moments of the distribution of returns are not considerably different across global funds and simulated global funds.

We now consider the ability of global funds to move away from crisis-hit countries or regions, and thus actually avoid realized risks. Given the limited information on portfolio holdings, we focus the analysis on the incidence of negative returns during turbulent times. For instance, conditional on large negative returns on the MSCI Emerging Market Index (our proxy for crises periods), we compare the realized returns of both global funds and simulated global funds.[33] The results reported in Table 15 show that their performances are not statistically different. For example, the average global fund return is -3.43% per week (p.w.) when the MSCI Emerging Market Index falls more than 10% in one week, while the returns on our portfolios of specialized funds are on average -3.47% (-3.62%) p.w. if the largest number of funds simulations for variance

[33] The evidence reported here considers only weekly returns. The results are similar if monthly returns are analyzed. Results are available upon request.

minimization (maximization of expected return) are considered. Therefore, global funds do not seem to avoid large losses if compared to specialized funds.

As an alternative, Table 16 shows the return differentials conditional on periods in which the simulated global funds perform badly. In these situations, global funds obtain slightly higher weekly return, with differentials between 0.04% and 0.87% p.w., although these return differentials are not always statistically different from zero. Table 17 performs a similar exercise but when global funds do not perform well. In this case, simulated global funds perform slightly better than global funds. For example, when the return on global funds is less than 10% in one week, the simulated global funds yield an extra 2.18% p.w. when minimizing the variance with the largest number of funds. However, if the longest available sample simulations for return maximization are considered, the difference in returns falls to 0.23% p.w. on average, being no longer significantly different from zero.

D. Transaction Costs on the Investor Side

One natural question that arises from the mean-variance analysis is why investors are not arbitraging away the potential diversification gains. It could be that different funds have different transaction costs (such as front and end loads) that make arbitrage expensive. It is difficult to address this issue given the large number of funds considered in the estimations and the different policies and costs that funds impose to purchase and sell their shares. Although our sample contains no-load funds, knowing all the restrictions to investors is not straightforward.

Exchange-traded funds provide a good opportunity to explore whether the potential transaction costs to trade mutual funds are driving the results. Since ETFs are stocks traded in a stock exchange, they do not entail any additional entry or exit cost beyond brokerage fees. We therefore perform a similar mean-variance analysis with Barclays' iShares ETFs, encompassing both global and specialized ETFs. The results, presented in Table 18, are similar to the ones reported for mutual funds; that is, holding a portfolio of specialized ETFs yields higher returns than holding global ETFs. When minimizing the variance (maximizing returns), a portfolio of specialized ETFs yields on average 443 (509) basis points higher per year than the corresponding global ETF. In

other words, this evidence suggests that the differences found for mutual funds might be difficult to be driven by transaction costs on the investor side.

6. Conclusions

Using a novel dataset of portfolio holdings of U.S. institutional investors, this paper has studied whether there are unexploited gains from international diversification and, more generally, how investors allocate portfolios internationally. This dataset allows us to analyze important aspects of internationalization and shed light on existing theories. We take advantage of the fact that mutual funds belong to families, each having several funds with different scopes for international investment. As the investment scope broadens, one would expect risk to be better diversified internationally and funds to hold more securities, to the extent that asset returns are not perfectly correlated.

We find that mutual funds invest in few countries and firms and could benefit from more international diversification. As their investment scope widens, mutual funds invest in fewer stocks and fewer countries within each region of exposure. Furthermore, there are strong family effects behind these restrictive investment practices. That is, the number of stocks held across fund types is similar within mutual fund companies but different across them. Importantly, holding few stocks entails a cost. Global funds could gain substantially from further international diversification by simply replicating portfolios that are already held by other funds within the same company.

Several conclusions can be drawn from the results in this paper, which question existing explanations of international portfolio allocations. First, the evidence in this paper does not seem consistent with the idea that asset allocation is driven by asymmetric information. Since we compare the potential diversification gains within mutual fund companies, one can argue that the cost of gathering and processing information has already been paid and that mutual fund managers could freely obtain that information. Moreover, we also evaluate whether the number of managers working in the fund, fund and family expenses, fund or family size, and other proxies for information asymmetry could explain these differences, in line with theories based on limited capacity to acquire and process information. We find that while more managers tend to increase the number of stocks held by a fund, this effect is very small and not statistically significant once

family effects are considered. Second, the results also allow us to conclude that the lack of diversification is not driven by transaction costs, broadly understood as barriers to purchase securities. Specialized funds have already purchased those assets, so they are available to global funds too. Furthermore, each fund is not very large relative to market capitalization; therefore the pattern of investment in few firms does not seem to be driven by the size of global funds. Moreover, transaction costs on the investor side are unlikely to be driving the results as mean-variance analysis with ETFs (which entail no transaction costs to purchase fund shares) yields similar results. Lastly, our results indicate that global funds are not better suited to avoid large losses due to their ability to shift their stock holdings across countries and regions. For example, the skewness and kurtosis of global funds are similar to those of portfolios of specialized funds. In other words, it is not the case that global funds yield lower returns in exchange for lower tail risk. Thus, the existence of an insurance premium in the returns of global funds also does not seem to be enough to explain the existence of potential large gains from further international diversification.

Several puzzling aspects remain for future research. Given the potential gains, why are global funds not more internationally diversified? Perhaps the remuneration scheme gives no incentives for the information gathered by specialized funds to be freely shared within each mutual fund company, with each fund manager collecting her own information and competing with other managers. Or global fund managers might not have incentives to use the information freely available at the mutual fund family. Moreover, given the differences in the performance of specialized funds relative to global funds, it is important to also understand why investors do not arbitrage these differences and favor specialized funds over global ones. Furthermore, why are family effects so important? Organizational aspects of mutual fund companies seem to be behind these effects. But what specific factors make funds within families hold similar number of stocks remains to be understood. While more research needs to continue this work, this paper has documented some new stylized facts and cast doubts over some standard explanations of important puzzles in international portfolio allocations.

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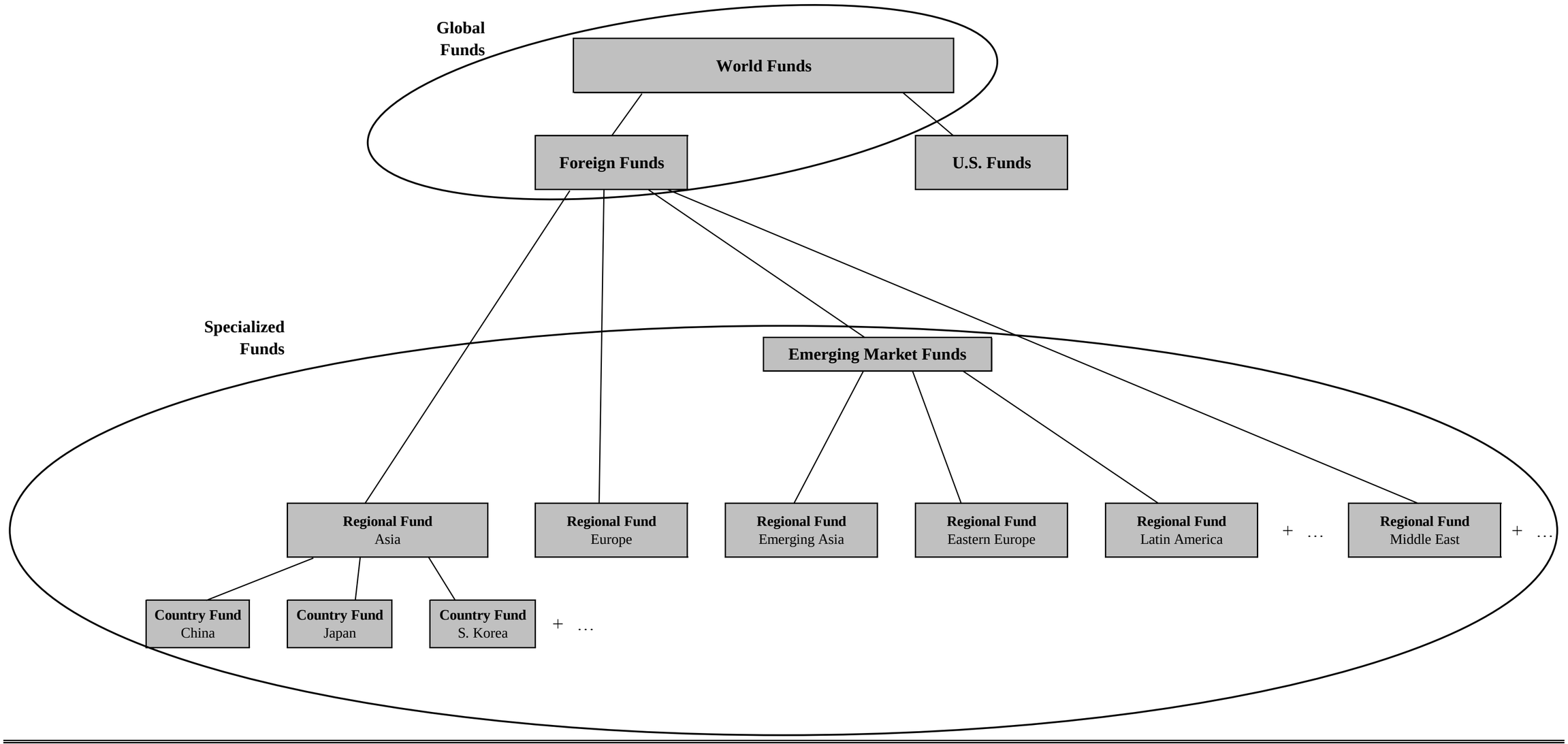
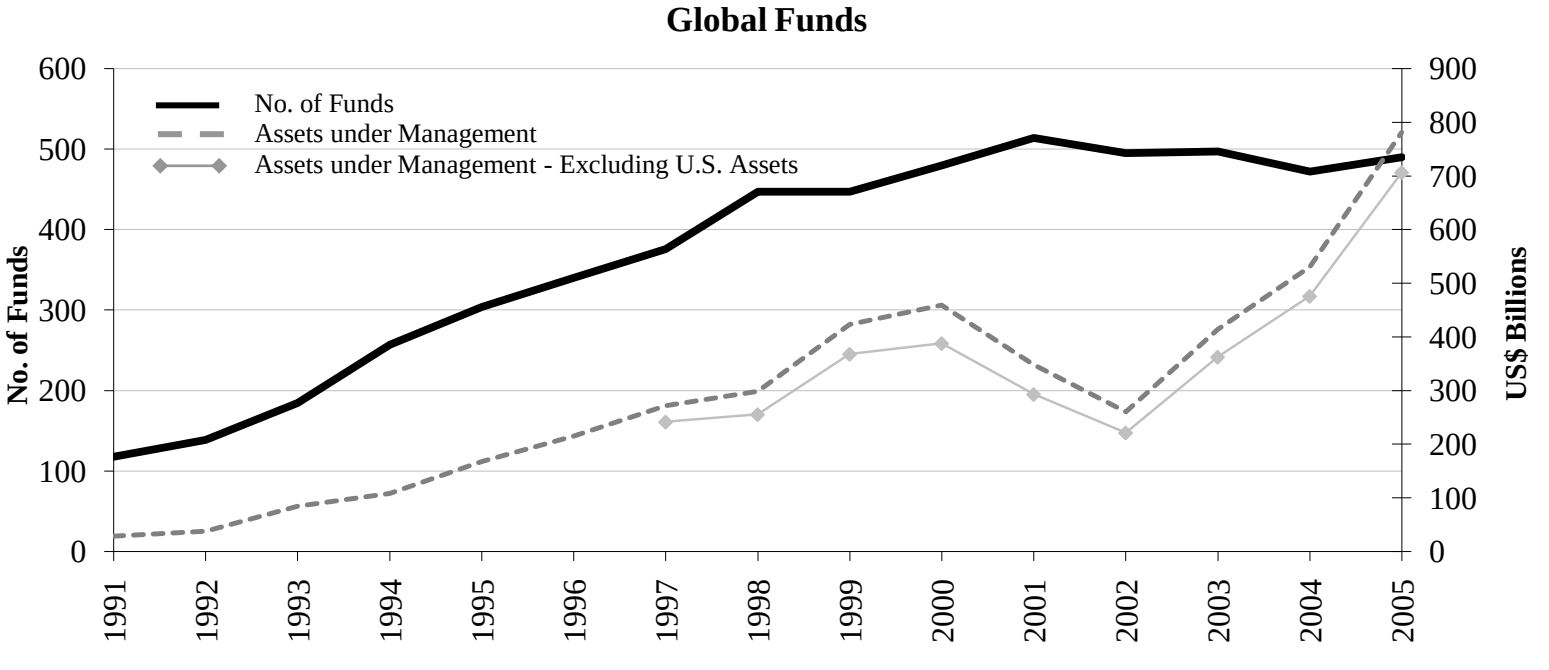
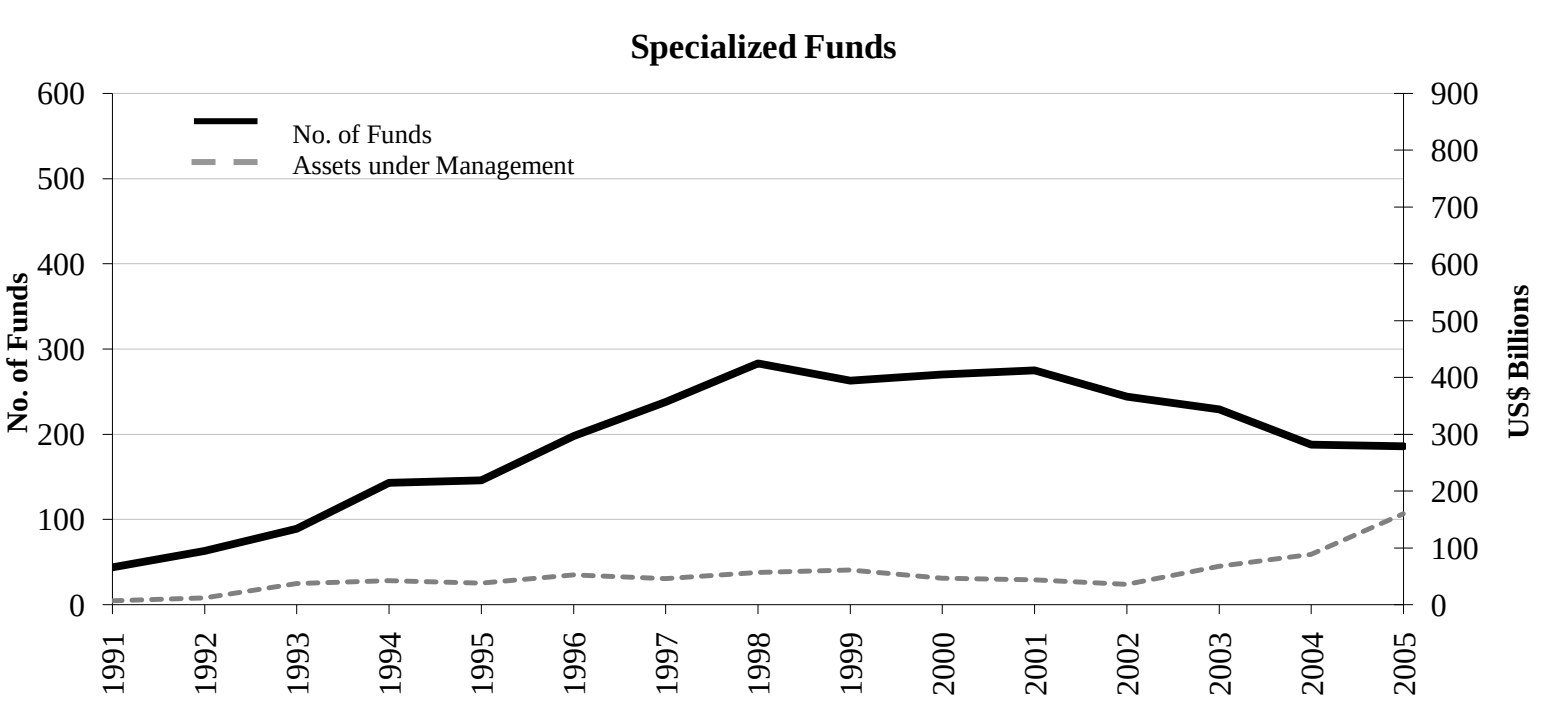
Figure 1. Structure of the U.S. Mutual Fund Industry



This figure characterizes the organization of U.S. mutual fund families that invest in foreign assets. The figure also shows our classification of global and specialized funds. Global funds include both world and foreign funds. Specialized funds include: emerging market funds, regional funds, and country funds.

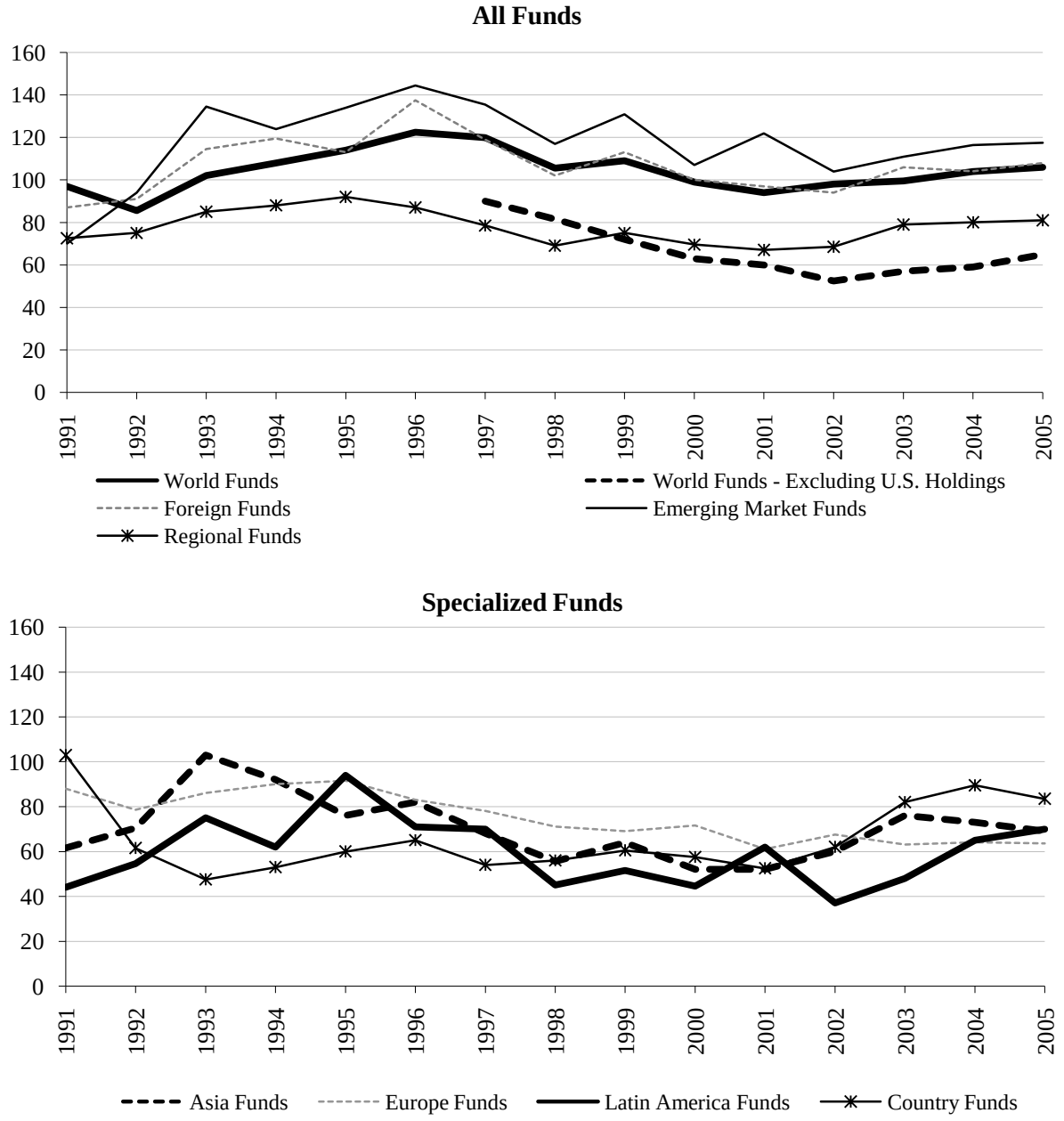
Figure 2. Total Number of Funds and Total Assets under Management by Fund Type





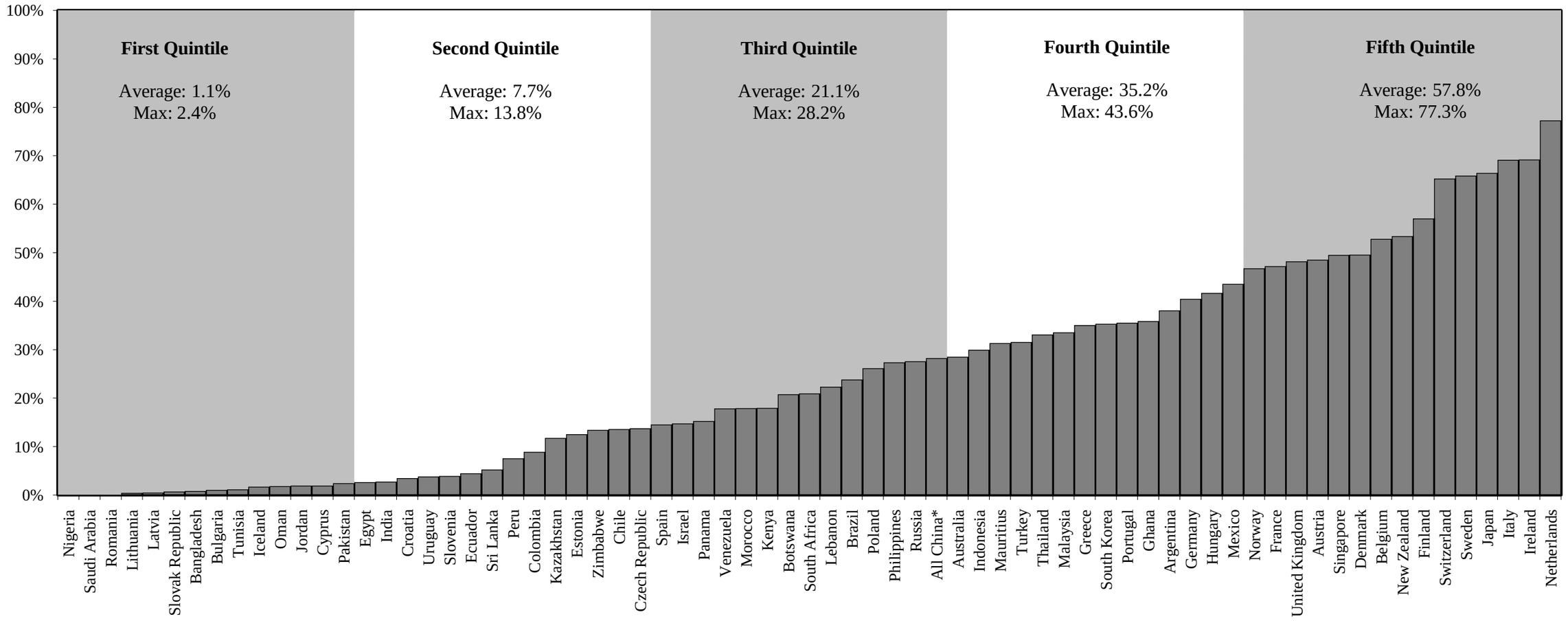
This figure shows the total number of mutual funds in our holdings database and their total assets under management by fund type. For global funds, the value of assets under management invested in non-U.S. assets is also shown (data available only after 1997). Data on assets under management are in billions of U.S. dollars (US$).

Figure 3. Median Number of Holdings by Fund Type



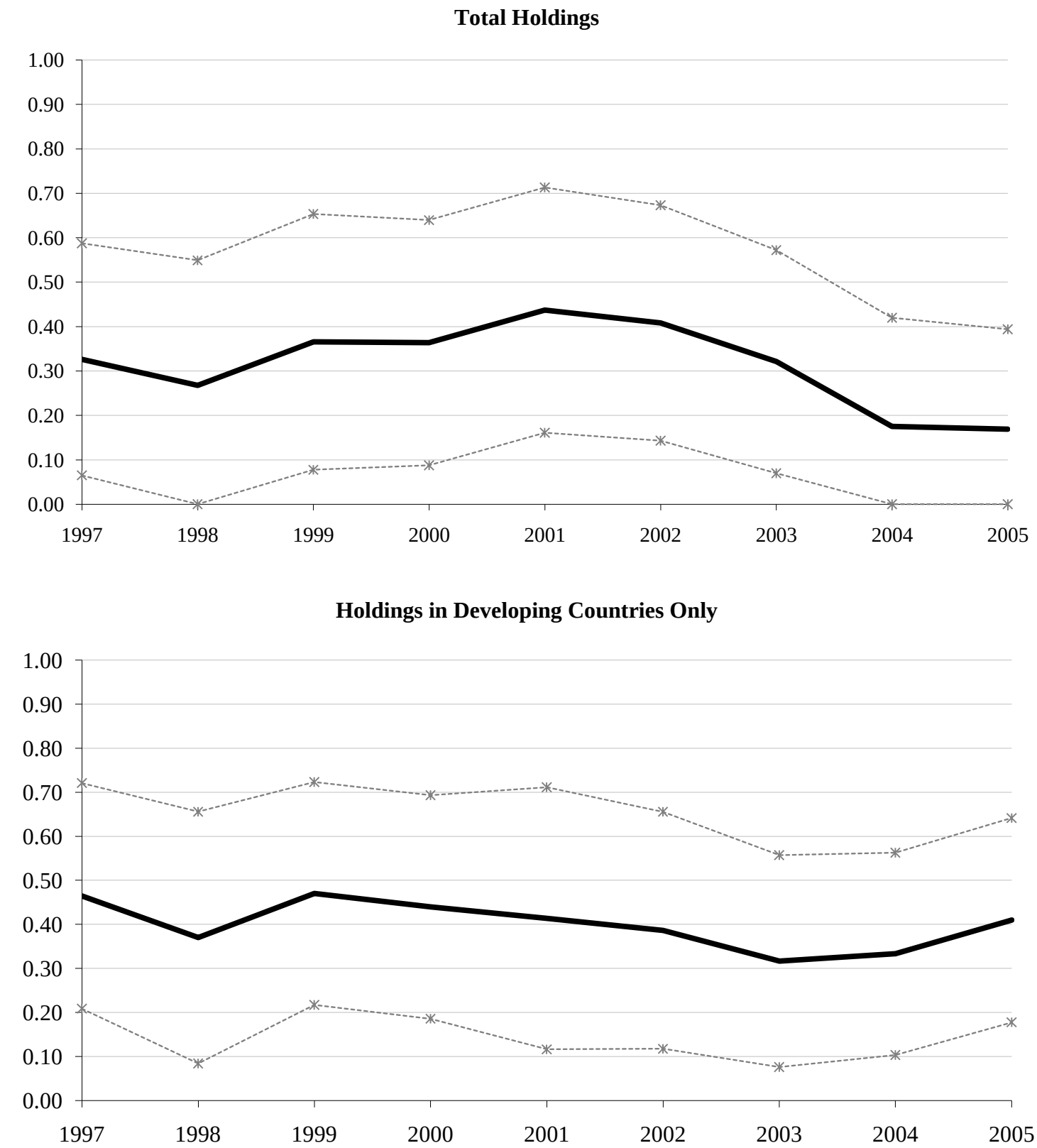
This figure shows the median number of stock holdings by mutual fund type. The following mutual fund types are shown in the top panel: world, foreign, emerging market, and regional funds. The median number of foreign holdings of world funds is also shown. In the bottom panel, regional funds are divided into three different categories: Asia, Europe, and Latin America funds. The median number of holdings for country funds is also reported.

Figure 4. Mutual Fund Holdings as a Proportion of the Total No. of Listed Stocks by Country



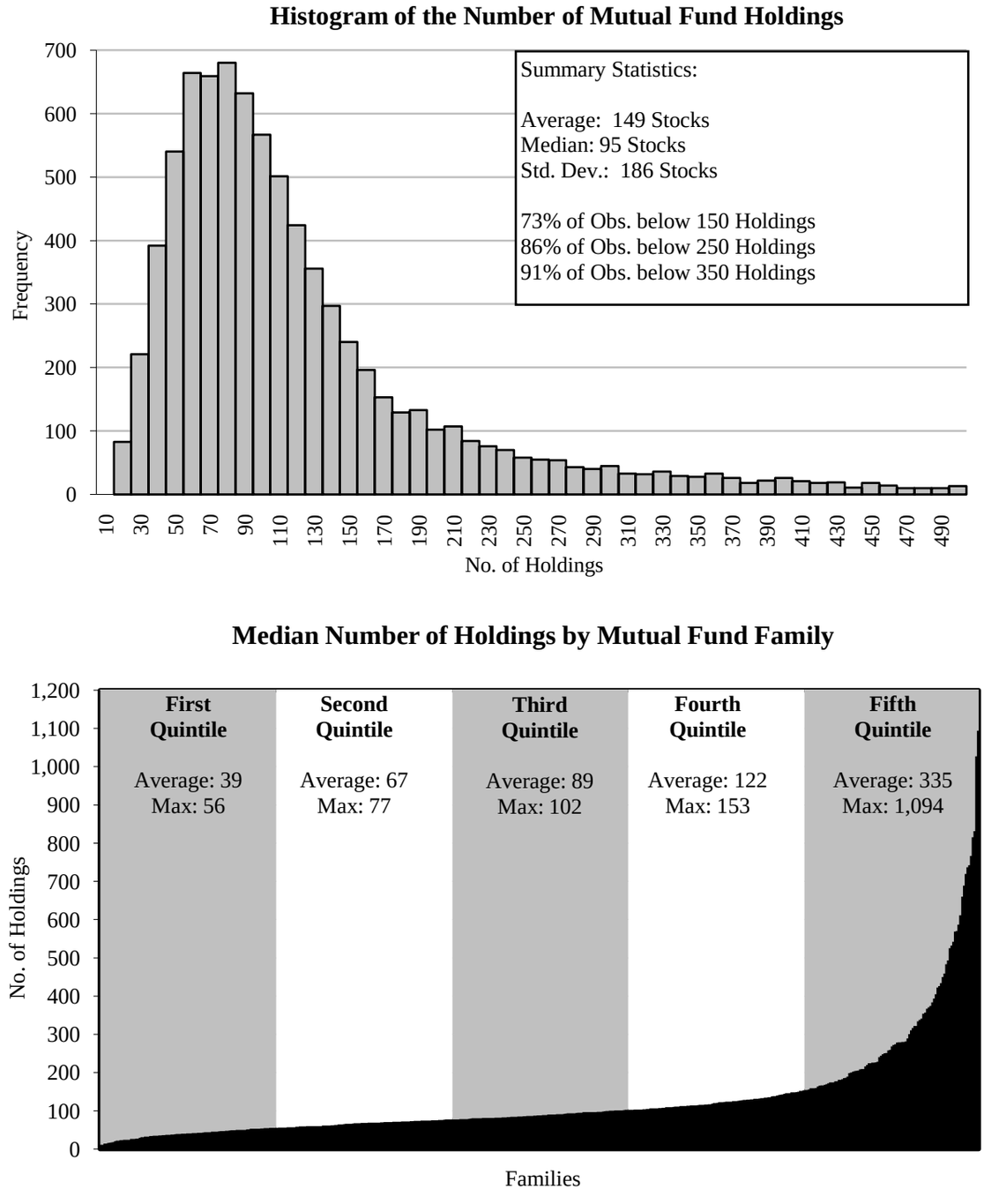
This figure shows the total number of all mutual fund stock holdings in our sample as a percentage of the total number of listed stocks by country. Countries are sorted according to their average ratio in the 1997-2004 period. Countries are divided into five equally-sized groups (quintiles); the average and maximum values for each quintile are reported. The United States and Canada are excluded from the figure. The data for the total number of listed stocks come from the Global Financial Database. * "All China" includes the following economies: Mainland China, Hong Kong, and Taiwan.

Figure 5. Evolution of Entropy Measures



This figure shows the evolution of the entropy measure that captures the commonality of stock holdings by global and specialized funds. See main text for the definition of the entropy measure. In the top panel, holdings in assets from all countries except the U.S. are considered; in the bottom panel, only asset holdings in emerging countries are shown. The thick line represents the median value across families in a given year. The figure also shows +/- one standard deviation (dotted grey lines) from the median.

Figure 6. Number of Holdings: Dispersion and Family Effects



This figure shows two characteristics of mutual fund holdings. The top panel shows the distribution of the number of stock holdings during the 1991-2005 period by all mutual funds in the sample. The bottom panel reports the median number of holdings by mutual fund family. All funds in any given family are considered. Families are sorted according to their median number of holdings during the 1991-2005 period. Families are divided into five equally-sized groups (quintiles); the average and maximum values for each quintile are reported.

Table 1. Data Coverage

Holdings Data	
Sample	1991-2005
Frequency	Annual
No. of Families	499
Total Number of Funds	1,904
Price Data	
Sample	September 1989 - June 2006
Frequency	Daily
No. of Families	36
Total Number of Funds	371

This table describes the two datasets analyzed in this paper. The source of the data on mutual fund holdings is Morningstar International Equity Mutual Funds. The source of the mutual fund price/return dataset is Bloomberg.

Table 2. Number of Mutual Fund Holdings

	Average	Median	Std. Dev.
Fund Type			
Global Funds	155	96	196
World Funds	136	106	132
Excluding U.S. Holdings	101	76	100
Foreign Funds	175	105	219
Specialized Funds	117	79	136
Emerging Market Funds	161	121	138
Asia Funds	89	65	110
Europe Funds	111	71	158
Latin America Funds	58	56	24
Country Funds	126	63	178
Total	150	95	186

This table shows the average, the median, and the standard deviation of the number of stock holdings by mutual fund type over the period 1991-2005.

Table 3. Differences in Holdings within Regions across Fund Types

Number of Holdings (Stocks)

Fund Type	Latin America	Asia	Developed Europe
Regional Funds			
Median No. of Holdings	41	60	62
Changes Relative to			
Emerging Market Funds	-34%	-33%	-
Foreign Funds	-93%	-42%	-5%
World Funds	-94%	-69%	-49%

Number of Countries

Fund Type	Latin America	Asia	Developed Europe
Regional Funds			
Median No. of Countries	6	8	12
Changes Relative to			
Emerging Market Funds	-17%	-10%	-
Foreign Funds	-72%	-30%	0%
World Funds	-75%	-36%	-14%

This table reports differences in stock and country holdings across fund types within regions of exposure. These differences are expressed as a percentage change relative to the holdings of the corresponding regional fund. Median values for regional funds are reported. The top panel shows the differences in the number of stock holdings across fund types. The bottom panel shows the differences in the number of countries receiving investments from different fund types. The first row in each panel reports the median number of stock holdings or countries in a given region for the corresponding regional funds. The comparisons are made within mutual fund families. Families without the corresponding regional fund are excluded from the analysis. The sample period is 1997-2005. Instead of reporting global funds, the table displays differences with respect to foreign and world funds.

Table 4. Mutual Fund Holdings

	Number of Listed Companies	All Fund Holdings		Global Fund Holdings	
		Number of Holdings	As a Percentage of All Listed Stocks	Number of Holdings	As a Percentage of All Listed Stocks
			1997		
Total	30,319	9,086	30%	6,267	21%
Developed Countries	12,987	6,815	52%	4,953	38%
Asia	5,760	3,249	56%	2,246	39%
Europe	6,392	3,459	54%	2,635	41%
Middle East	802	87	11%	54	7%
Developing Countries	17,332	2,271	13%	1,314	8%
Asia	10,089	1,304	13%	693	7%
Europe	2,697	319	12%	167	6%
Latin America	2,196	399	18%	297	14%
Middle East & Africa	2,350	249	11%	157	7%
			2004		
Total	39,061	6,289	16%	5,510	14%
Developed Countries	18,282	5,204	28%	4,799	26%
Asia	7,758	2,748	35%	2,429	31%
Europe	9,817	2,392	24%	2,315	24%
Middle East	686	45	7%	37	5%
Developing Countries	20,779	1,085	5%	711	3%
Asia	10,444	566	5%	394	4%
Europe	6,279	184	3%	114	2%
Latin America	1,525	195	13%	141	9%
Middle East & Africa	2,531	140	6%	62	2%

This table shows the number of stocks available for investment and the number of holdings in 1997 (top panel) and 2004 (bottom panel). The first column shows the total number of listed stocks in the main stock exchange in each country within each region. The data are from the Global Financial Database. This is considered the universe of stocks that can be held by mutual funds. The second and third columns show the number of stocks actually held by all U.S. mutual funds in these regions, in absolute terms and as a percentage of the universe of stocks available. The fourth and fifth columns report the same numbers for global funds only. The United States, Canada, and offshore centers are excluded from the table.

Table 5. Size of Mutual Fund Holdings

	Holding Amount as Percentage of Firms' Market Capitalization			Average Mutual Fund Size (US$ Million)
	Average	Median	Std. Dev.	
Fund Type				
Global Funds	0.12%	0.01%	0.75%	899
World Funds	0.18%	0.01%	0.86%	1,320
Foreign Funds	0.11%	0.01%	0.72%	758
Specialized Funds	0.12%	0.02%	0.59%	277
Emerging Market Funds	0.15%	0.02%	0.70%	369
Asia Funds	0.12%	0.01%	0.53%	132
Europe Funds	0.08%	0.01%	0.35%	346
Latin America Funds	0.10%	0.02%	0.47%	144

This table shows the average, median, and standard deviation of the amount of mutual fund foreign holdings as a percentage of firms' market capitalization by fund type. The average size of mutual funds is also reported. The data are in millions of U.S. dollars (US$). The sample period is 1997-2005.

Table 6. Probabilities of Being Held by a Mutual Fund

Total Holdings

		Global Funds Probability of:		Total
		Not Being Held	Being Held	
Specialized Funds Probability of:	Not Being Held	0%	25%	25%
	Being Held	32%	16%	48%
No Specialized Fund		0%	27%	27%
Total [No. of Observations]		32%	68%	100% [396,388]

Holdings in Developing Countries Only

		Global Funds Probability of:		Total
		Not Being Held	Being Held	
Specialized Funds Probability of:	Not Being Held	0%	10%	10%
	Being Held	75%	13%	89%
No Specialized Fund		0%	2%	2%
Total [No. of Observations]		75%	25%	100% [92,175]

This table shows frequency counts for mutual fund holdings from 1997 to 2005. It reports the probability of being held (or not) by certain types of mutual funds, given that a mutual fund family has both fund types. The top panel uses stock holdings in all countries except the U.S., whereas the bottom panel includes stock holdings in developing countries only. Each observation is a family-year-stock observation. The total number of observations is reported in brackets in the "Total" column of each table. If in a given family-year, a global fund holds a stock in a country not covered by the specialized funds within that family in that year, then this observation is counted in the "No Specialized Fund" line.

Table 7. Number of Holdings: Importance of Number of Managers and Fees

	Dependent Variable: Number of Holdings					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Independent Variables						
Number of Managers		17.430 ***	16.184 ***			16.441 ***
		[4.576]	[4.655]			[4.859]
1	132.557 ***					
	[10.796]					
2	135.178 ***					
	[8.694]					
3	153.644 ***					
	[19.300]					
4	166.163 ***					
	[20.096]					
5	152.236 ***					
	[16.559]					
6	196.882 ***					
	[31.306]					
7 or More	221.734 ***					
	[28.132]					
Manager Tenure		2.512	2.964	-1.372	-2.210	1.268
		[2.488]	[2.488]	[2.703]	[2.537]	[2.250]
Fund Age		0.893	0.211	0.372	0.778	0.173
		[0.790]	[0.775]	[0.885]	[0.912]	[0.849]
Fund Expenses				0.654 ***	-2.162 *	-2.211 *
				[0.117]	[1.227]	[1.269]
Fund Size					0.027 **	0.026 **
					[0.013]	[0.013]
Year Dummies	No	No	Yes	No	No	Yes
Fund Type Dummies	No	No	Yes	No	No	Yes
No. of Observations	6,321	6,093	6,093	5,668	5,668	5,662
R-squared	0.02	0.03	0.05	0.01	0.02	0.07

This table reports regressions of the number of mutual fund stock holdings on the number of managers, manager tenure, fund age (in years), fund expenses, and fund size. Year and fund type dummies are included in some of the regressions. The sample period is 1997-2005. Fund expenses and fund size are in millions of U.S. dollars (US$). R-squared and total number of observations are reported at the bottom of the table. Standard errors are clustered at the family level. Standard deviations are shown in brackets. ***, **, and * indicate significance at one, five, or ten percent, respectively.

Table 8. Number of Mutual Fund Holdings

Importance of Year, Fund Type, and Family Effects

Dependent Variable: Number of Holdings

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
R-squared	0.00	0.02	0.39	0.02	0.40	0.41	0.41
Independent Variables							
Year Dummies	Yes	No	No	Yes	Yes	No	Yes
Fund Type Dummies	No	Yes	No	Yes	No	Yes	Yes
Family Dummies	No	No	Yes	No	Yes	Yes	Yes
No. of Observations	8,420	8,420	8,420	8,420	8,420	8,420	8,420

Importance of Family Expenses and Family Size

Dependent Variable: Number of Holdings

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Independent Variables							
Number of Managers			14.762 ***	4.693			4.601
			[4.569]	[3.702]			[3.703]
Manager Tenure	-0.524	-1.654	1.468	2.260 *	1.640	1.652	2.243 *
	[2.680]	[2.467]	[2.255]	[1.208]	[1.216]	[1.217]	[1.203]
Fund Age	0.739	1.152	0.316	-1.027	-0.961	-0.964	-1.013
	[0.884]	[0.925]	[0.845]	[0.863]	[0.866]	[0.870]	[0.863]
Family Expenses	0.094 **	-0.747 ***	-0.650 **		0.050	-0.017	-0.014
	[0.047]	[0.233]	[0.252]		[0.036]	[0.158]	[0.160]
Family Size		0.009 ***	0.008 ***			0.001	0.001
		[0.003]	[0.003]			[0.002]	[0.002]
Year Dummies	No	No	Yes	Yes	Yes	Yes	Yes
Fund Type Dummies	No	No	Yes	Yes	Yes	Yes	Yes
Family Dummies	No	No	No	Yes	Yes	Yes	Yes
No. of Observations	6,100	6,100	6,093	6,093	6,100	6,100	6,093
R-squared	0.01	0.03	0.07	0.49	0.49	0.49	0.49

The top table shows the R-squared of the regressions of the number of mutual fund stock holdings on year dummies, fund type dummies, and family dummies. Seven different specifications are shown. See the main text for a detailed description. The sample period is 1991-2005. The bottom table reports regressions of the number of mutual fund holdings on the number of managers, manager tenure, fund age (in years), mutual fund family expenses, and mutual fund family size. Year, fund type, family dummies are included in some of the regressions. The sample period is 1997-2005. Family expenses and family size are in millions of U.S. dollars (US$). R-squared and total number of observations are reported at the bottom of the table. Standard errors are clustered at the family level. Standard deviations are shown in brackets. ***, **, and * indicate significance at one, five, or ten percent, respectively.

Table 9. Simulations Using the Largest Number of Funds

Minimizing the Variance

Type of Global Fund	Average Return (Per Year)		Average Difference in Accumulated Returns	Standard Deviation of Returns		Number of Comparisons
	Global Fund	Simulated Global Fund		Global Fund	Simulated Global Fund	
Daily Data						
World Funds	6.36%	11.13%	4.83%	0.87%	0.78%	64
Foreign Funds	6.24%	10.12%	3.98%	0.97%	0.89%	76
Pool of World or Foreign Funds	10.53%	15.23%	4.55%	0.86%	0.80%	25
Total	6.93%	11.27%	4.39%	0.91%	0.83%	165
Weekly Data						
World Funds	6.42%	11.51%	5.10%	2.05%	1.92%	64
Foreign Funds	6.24%	9.88%	3.72%	2.25%	2.12%	76
Pool of World or Foreign Funds	10.54%	15.16%	4.44%	1.99%	1.90%	25
Total	6.95%	11.30%	4.37%	2.13%	2.01%	165

Maximizing Expected Return

Type of Global Fund	Average Return (Per Year)		Average Difference in Accumulated Returns	Standard Deviation of Returns		Number of Comparisons
	Global Fund	Simulated Global Fund		Global Fund	Simulated Global Fund	
Daily Data						
World Funds	6.36%	8.18%	1.84%	0.87%	0.87%	64
Foreign Funds	6.24%	7.15%	0.90%	0.97%	0.97%	76
Pool of World or Foreign Funds	10.53%	14.85%	4.19%	0.86%	0.86%	25
Total	6.93%	8.69%	1.76%	0.91%	0.91%	165
Weekly Data						
World Funds	6.42%	12.64%	6.09%	2.05%	2.12%	64
Foreign Funds	6.24%	11.29%	4.92%	2.25%	2.30%	76
Pool of World or Foreign Funds	10.54%	16.67%	5.74%	1.99%	2.10%	25
Total	6.95%	12.61%	5.50%	2.13%	2.20%	165

This table shows the results of the following simulations: minimization of the variance of returns subject to restrictions on expected returns (top panel) and maximization of expected returns subject to a restriction on the variance of returns (bottom panel). The simulations use portfolios that include the largest number of available specialized funds for each global fund in each family ("largest number of funds"). The global funds are world funds, foreign funds, and a pool of world or foreign funds. The pool of world or foreign funds are simulations that include several world (or foreign) funds within the same family but with different scopes, e.g. world (foreign) value funds and world (foreign) growth funds. Portfolio weights are updated every day or every week, depending on the data frequency considered. Realized returns of the simulated portfolio are calculated out-of-sample, as described in the main text. Annualized differences in accumulated returns are calculated over the entire sample for each simulation performed. Averages across simulations are then computed and reported.

Table 10. Simulations Using the Longest Available Sample

Minimizing the Variance

Type of Global Fund	Average Return (Per Year)		Average Difference in Accumulated Returns	Standard Deviation of Returns		Number of Comparisons
	Global Fund	Simulated Global Fund		Global Fund	Simulated Global Fund	
Daily Data						
World Funds	7.90%	10.63%	2.77%	1.14%	1.07%	63
Foreign Funds	5.10%	7.81%	2.82%	0.98%	0.92%	78
Pool of World or Foreign Funds	7.69%	11.91%	4.26%	0.93%	0.86%	24
Total	6.54%	9.47%	3.01%	1.03%	0.97%	165
Weekly Data						
World Funds	8.07%	9.78%	2.44%	2.66%	2.16%	63
Foreign Funds	5.13%	7.35%	2.33%	2.26%	2.16%	78
Pool of World or Foreign Funds	7.94%	12.20%	4.26%	2.20%	2.06%	24
Total	6.65%	8.97%	2.66%	2.40%	2.14%	165

Maximizing Expected Return

Type of Global Fund	Average Return (Per Year)		Average Difference in Accumulated Returns	Standard Deviation of Returns		Number of Comparisons
	Global Fund	Simulated Global Fund		Global Fund	Simulated Global Fund	
Daily Data						
World Funds	7.90%	7.98%	0.07%	1.14%	1.14%	63
Foreign Funds	5.10%	5.44%	0.33%	0.98%	0.98%	78
Pool of World or Foreign Funds	7.69%	12.25%	4.58%	0.93%	0.92%	24
Total	6.54%	7.38%	0.85%	1.03%	1.03%	165
Weekly Data						
World Funds	8.07%	10.87%	3.20%	2.66%	2.37%	63
Foreign Funds	5.13%	8.34%	3.18%	2.26%	2.27%	78
Pool of World or Foreign Funds	7.94%	13.69%	5.58%	2.20%	2.25%	24
Total	6.65%	10.07%	3.54%	2.40%	2.31%	165

This table shows the results of the following simulations: minimization of the variance of returns subject to restrictions on expected returns (top panel) and maximization of expected returns subject to a restriction on the variance of returns (bottom panel). The simulations use portfolios that include the longest time series for each global fund in each family ("longest available sample"). The global funds are world funds, foreign funds, and a pool of world or foreign funds. The pool of world or foreign funds are simulations that include several world (or foreign) funds within the same family but with different scopes, e.g. world (foreign) value funds and world (foreign) growth funds. Portfolio weights are updated every day or every week, depending on the data frequency considered. Realized returns of the simulated portfolio are calculated out-of-sample, as described in the main text. Annualized differences in accumulated returns are calculated over the entire sample for each simulation performed. Averages across simulations are then computed and reported.

Table 11. Benchmarking: Simulations Using the Largest Number of Funds

Minimizing the Variance

Type of Global Fund	Average Return (Per Year)		Average Difference in Accumulated Daily Returns	Standard Deviation of Daily Returns		Number of Comparisons
	Global Fund	Simulated Global Fund		Global Fund	Simulated Global Fund	
World Funds	8.86%	12.25%	3.41%	0.88%	0.81%	57
Foreign Funds	6.20%	9.73%	3.61%	0.96%	0.91%	76
Pool of World or Foreign Funds	10.60%	14.88%	4.20%	0.86%	0.85%	24
Total	7.82%	11.41%	3.63%	0.92%	0.87%	157

Maximizing Expected Return

Type of Global Fund	Average Return (Per Year)		Average Difference in Accumulated Daily Returns	Standard Deviation of Daily Returns		Number of Comparisons
	Global Fund	Simulated Global Fund		Global Fund	Simulated Global Fund	
World Funds	8.86%	12.13%	3.37%	0.88%	0.78%	57
Foreign Funds	6.20%	10.50%	4.36%	0.96%	0.90%	76
Pool of World or Foreign Funds	10.60%	14.69%	4.00%	0.86%	0.83%	24
Total	7.82%	11.72%	3.95%	0.92%	0.84%	157

This table shows the results of the following simulations: minimization of the variance of returns relative to a benchmark index subject to restrictions on expected returns (top panel) and maximization of expected returns subject to a restriction on the variance of returns relative to a benchmark index (bottom panel). The simulations use portfolios that include the largest number of available specialized funds for each global fund in each family ("largest number of funds"). An appropriate benchmark index is used for each simulation. The global funds are world funds, foreign funds, and a pool of world or foreign funds. The pool of world or foreign funds are simulations that include several world (or foreign) funds within the same family but with different scopes, e.g. world (foreign) value funds and world (foreign) growth funds. Portfolio weights are updated every day, depending on the data frequency considered. Realized returns of the simulated portfolio are calculated out-of-sample, as described in the main text. Annualized differences in accumulated returns are calculated over the entire sample for each simulation performed. Averages across simulations are then computed and reported.

Table 12. Benchmarking: Simulations Using the Longest Available Sample

Minimizing the Variance

Type of Global Fund	Average Return (Per Year)		Average Difference in Accumulated Daily Returns	Standard Deviation of Daily Returns		Number of Comparisons
	Global Fund	Simulated Global Fund		Global Fund	Simulated Global Fund	
World Funds	8.94%	10.28%	2.29%	1.14%	0.85%	63
Foreign Funds	5.07%	7.70%	2.70%	0.97%	0.94%	78
Pool of World or Foreign Funds	7.50%	11.71%	4.29%	0.94%	0.90%	23
Total	6.88%	9.24%	2.77%	1.03%	0.90%	164

Maximizing Expected Return

Type of Global Fund	Average Return (Per Year)		Average Difference in Accumulated Daily Returns	Standard Deviation of Daily Returns		Number of Comparisons
	Global Fund	Simulated Global Fund		Global Fund	Simulated Global Fund	
World Funds	8.94%	10.13%	2.22%	1.14%	0.82%	63
Foreign Funds	5.07%	8.34%	3.37%	0.97%	0.92%	78
Pool of World or Foreign Funds	7.50%	12.52%	5.03%	0.94%	0.88%	23
Total	6.88%	9.61%	3.16%	1.03%	0.87%	164

This table shows the results of the following simulations: minimization of the variance of returns relative to a benchmark index subject to restrictions on expected returns (top panel) and maximization of expected returns subject to a restriction on the variance of returns relative to a benchmark index (bottom panel). The simulations use portfolios that include the longest time series for each global fund in each family ("longest available sample"). An appropriate benchmark index is used for each simulation. The global funds are world funds, foreign funds, and a pool of world or foreign funds. The pool of world or foreign funds are simulations that include several world (or foreign) funds within the same family but with different scopes, e.g. world (foreign) value funds and world (foreign) growth funds. Portfolio weights are updated every day, depending on the data frequency considered. Realized returns of the simulated portfolio are calculated out-of-sample, as described in the main text. Annualized differences in accumulated returns are calculated over the entire sample for each simulation performed. Averages across simulations are then computed and reported.

Table 13. Skewness and Kurtosis Based on Simulations Using the Largest Number of Funds

Minimizing the Variance

	Daily Returns on Global Funds		Daily Returns on Simulated Global Funds		Number of Comparisons
	Skewness	**Kurtosis**	**Skewness**	**Kurtosis**	
Type of Global Fund					
World Funds	-0.63	10.10	-0.70	8.81	64
	[0.99]	[14.45]	[0.92]	[16.08]	
Foreign Funds	-0.76	11.11	-0.93	10.45	76
	[1.06]	[15.60]	[0.81]	[9.48]	
Pool of World or Foreign Funds	-0.42	6.57	-0.79	9.85	25
	[0.49]	[5.64]	[0.90]	[11.91]	
Total	-0.66	10.03	-0.82	9.72	165
	[0.97]	[14.09]	[0.87]	[12.72]	

Maximizing Expected Return

	Daily Returns on Global Funds		Daily Returns on Simulated Global Funds		Number of Comparisons
	Skewness	**Kurtosis**	**Skewness**	**Kurtosis**	
Type of Global Fund					
World Funds	-0.63	10.10	-0.63	9.91	64
	[0.99]	[14.45]	[0.96]	[14.085]	
Foreign Funds	-0.76	11.11	-0.76	10.86	76
	[1.06]	[15.60]	[1.05]	[15.00]	
Pool of World or Foreign Funds	-0.42	6.57	-0.72	10.30	25
	[0.49]	[5.64]	[1.01]	[13.12]	
Total	-0.66	10.03	-0.71	10.41	165
	[0.97]	[14.09]	[1.00]	[14.30]	

This table shows skewness and kurtosis for global funds and simulated global funds based on the following simulations: minimization of the variance of returns subject to restrictions on expected returns (top panel) and maximization of expected returns subject to a restriction on the variance of returns (bottom panel). The simulations use portfolios that include the largest number of available specialized funds for each global fund in each family ("largest number of funds"). The global funds are world funds, foreign funds, and a pool of world or foreign funds. The pool of world or foreign funds are simulations that include several world (or foreign) funds within the same family but with different scopes, e.g. world (foreign) value funds and world (foreign) growth funds. Portfolio weights are updated every day, depending on the data frequency considered. Realized returns of the simulated portfolio are calculated out-of-sample, as described in the main text. Standard deviations of both skewness and kurtosis are in brackets.

Table 14. Skewness and Kurtosis Based on Simulations Using the Longest Available Sample

Minimizing the Variance

	Daily Returns on Global Funds		Daily Returns on Simulated Global Funds		Number of Comparisons
	Skewness	**Kurtosis**	**Skewness**	**Kurtosis**	
Type of Global Fund					
World Funds	0.17	69.50	0.16	66.99	63
	[7.67]	[447.15]	[7.64]	[447.34]	
Foreign Funds	-0.92	14.07	-0.51	41.39	78
	[1.22]	[20.22]	[4.83]	[251.41]	
Pool of World or Foreign Funds	-0.44	6.68	-0.84	10.26	24
	[0.44]	[4.56]	[0.90]	[12.08]	
Total	-0.43	34.16	-0.30	46.63	165
	[4.82]	[276.70]	[5.77]	[325.16]	

Maximizing Expected Return

	Daily Returns on Global Funds		Daily Returns on Simulated Global Funds		Number of Comparisons
	Skewness	**Kurtosis**	**Skewness**	**Kurtosis**	
Type of Global Fund					
World Funds	0.17	69.50	0.17	69.47	63
	[7.67]	[447.15]	[7.67]	[447.16]	
Foreign Funds	-0.92	14.07	-0.85	12.61	78
	[1.22]	[20.22]	[1.06]	[16.13]	
Pool of World or Foreign Funds	-0.44	6.68	-0.73	10.95	24
	[0.44]	[4.56]	[1.05]	[13.40]	
Total	-0.43	34.16	-0.44	34.08	165
	[4.82]	[276.70]	[4.81]	[276.62]	

This table shows skewness and kurtosis for global funds and simulated global funds based on the following simulations: minimization of the variance of returns subject to restrictions on expected returns (top panel) and maximization of expected returns subject to a restriction on the variance of returns (bottom panel). The simulations use portfolios that include the longest time series for each global fund in each family ("longest available sample"). The global funds are world funds, foreign funds, and a pool of world or foreign funds. The pool of world or foreign funds are simulations that include several world (or foreign) funds within the same family but with different scopes, e.g. world (foreign) value funds and world (foreign) growth funds. Portfolio weights are updated every day, depending on the data frequency considered. Realized returns of the simulated portfolio are calculated out-of-sample, as described in the main text. Standard deviations of both skewness and kurtosis are in brackets.

Table 15. Average Returns Conditional on Returns on the MSCI Emerging Market Index

	Average Return (Per Week)			
	Global Fund (G)	**Simulated Global Fund (P)**	**T-test: (P)-(G) > 0**	**No. of Obs.**
Minimizing the Variance				
Largest Number of Funds Simulation				
MSCI Returns between 0% and -1%	-0.36%	-0.26%	3.29	4,865
MSCI Returns between -1% and -5%	-1.53%	-1.49%	1.68	10,140
MSCI Returns between -5% and -10%	-3.98%	-4.34%	-2.26	945
MSCI Returns less than -10%	-3.43%	-3.47%	-0.12	190
Longest Available Sample Simulation				
MSCI Returns between 0% and -1%	-0.30%	-0.23%	2.47	7,334
MSCI Returns between -1% and -5%	-1.50%	-1.48%	0.92	14,437
MSCI Returns between -5% and -10%	-4.07%	-4.35%	-2.04	1,309
MSCI Returns less than -10%	-3.66%	-3.73%	-0.35	290
Maximizing Expected Return				
Largest Number of Funds Simulation				
MSCI Returns between 0% and -1%	-0.36%	-0.35%	0.59	4,865
MSCI Returns between -1% and -5%	-1.53%	-1.53%	-0.23	10,140
MSCI Returns between -5% and -10%	-3.98%	-4.10%	-0.69	945
MSCI Returns less than -10%	-3.43%	-3.62%	-0.65	190
Longest Available Sample Simulation				
MSCI Returns between 0% and -1%	-0.30%	-0.30%	0.22	7,334
MSCI Returns between -1% and -5%	-1.50%	-1.51%	-0.21	14,437
MSCI Returns between -5% and -10%	-4.07%	-4.12%	-0.40	1,309
MSCI Returns less than -10%	-3.66%	-3.71%	-0.23	290

This table shows the average return for both global funds and simulated global funds conditional on negative returns on the MSCI Emerging Market Index. Weekly returns are reported. Results for the following simulations are shown: minimization of the variance of returns subject to restrictions on expected returns (top panel) and maximization of expected returns subject to a restriction on the variance of returns (bottom panel). Both simulations using portfolios that include the largest number of available specialized funds for each global fund in each family ("largest number of funds") and simulations using portfolios that include the longest time series for each global fund in each family ("longest available sample") are displayed. T-statistics for the test of equality of means are shown. A positive t-statistic means that the return on the simulated global fund is larger than that on the global fund.

Table 16. Average Returns Conditional on Simulated Global Fund Returns

	Average Return (Per Week)			
	Global Fund (G)	Simulated Global Fund (P)	T-test: (P)-(G) > 0	No. of Obs.
Minimizing the Variance				
Largest Number of Funds Simulation				
Simulated Global Fund Returns between 0% and -1%	-0.52%	-0.48%	4.08	6,357
Simulated Global Fund Returns between -1% and -5%	-2.21%	-2.17%	1.96	8,898
Simulated Global Fund Returns between -5% and -10%	-6.05%	-6.36%	-2.74	580
Simulated Global Fund Returns less than -10%	-11.53%	-12.40%	-1.77	97
Longest Available Sample Simulation				
Simulated Global Fund Returns between 0% and -1%	-0.50%	-0.47%	3.21	9,386
Simulated Global Fund Returns between -1% and -5%	-2.22%	-2.19%	2.05	12,618
Simulated Global Fund Returns between -5% and -10%	-6.23%	-6.37%	-1.77	914
Simulated Global Fund Returns less than -10%	-11.85%	-12.72%	-2.14	158
Maximizing Expected Return				
Largest Number of Funds Simulation				
Simulated Global Fund Returns between 0% and -1%	-0.47%	-0.47%	-0.42	6,247
Simulated Global Fund Returns between -1% and -5%	-2.20%	-2.23%	-2.32	9,233
Simulated Global Fund Returns between -5% and -10%	-6.27%	-6.33%	-0.98	748
Simulated Global Fund Returns less than -10%	-12.28%	-13.00%	-1.69	117
Longest Available Sample Simulation				
Simulated Global Fund Returns between 0% and -1%	-0.47%	-0.47%	-0.79	9,288
Simulated Global Fund Returns between -1% and -5%	-2.21%	-2.23%	-1.70	12,944
Simulated Global Fund Returns between -5% and -10%	-6.42%	-6.45%	-0.72	1,133
Simulated Global Fund Returns less than -10%	-12.92%	-13.18%	-0.74	165

This table shows the average return for both global funds and simulated global funds conditional on negative returns on the simulated global fund. Weekly returns are reported. Results for the following simulations are shown: minimization of the variance of returns subject to restrictions on expected returns (top panel) and maximization of expected returns subject to a restriction on the variance of returns (bottom panel). Both simulations using portfolios that include the largest number of available specialized funds for each global fund in each family ("largest number of funds") and simulations using portfolios that include the longest time series for each global fund in each family ("longest available sample") are displayed. T-statistics for the test of equality of means are shown. A positive t-statistic means that the return on the simulated global fund is larger than that on the global fund.

Table 17. Average Returns Conditional on Global Fund Returns

	Average Return (Per Week)			
	Global Fund (G)	**Simulated Global Fund (P)**	**T-test: (P)-(G) > 0**	**No. of Obs.**
Minimizing the Variance				
Largest Number of Funds Simulation				
Global Fund Returns between 0% and -1%	-0.47%	-0.34%	11.73	6,355
Global Fund Returns between -1% and -5%	-2.23%	-1.91%	19.76	9,222
Global Fund Returns between -5% and -10%	-6.36%	-5.25%	13.66	776
Global Fund Returns less than -10%	-12.89%	-10.71%	4.73	111
Longest Available Sample Simulation				
Global Fund Returns between 0% and -1%	-0.47%	-0.37%	12.05	9,334
Global Fund Returns between -1% and -5%	-2.23%	-1.98%	15.88	12,939
Global Fund Returns between -5% and -10%	-6.46%	-5.55%	13.61	1,153
Global Fund Returns less than -10%	-13.22%	-11.31%	4.97	165
Maximizing Expected Return				
Largest Number of Funds Simulation				
Global Fund Returns between 0% and -1%	-0.47%	-0.45%	2.45	6,355
Global Fund Returns between -1% and -5%	-2.23%	-2.19%	2.83	9,222
Global Fund Returns between -5% and -10%	-6.36%	-6.17%	2.85	776
Global Fund Returns less than -10%	-12.89%	-12.76%	0.32	111
Longest Available Sample Simulation				
Global Fund Returns between 0% and -1%	-0.47%	-0.46%	1.60	9,334
Global Fund Returns between -1% and -5%	-2.23%	-2.20%	2.53	12,939
Global Fund Returns between -5% and -10%	-6.46%	-6.32%	2.40	1,153
Global Fund Returns less than -10%	-13.22%	-12.98%	0.69	165

This table shows the average return for both global funds and simulated global funds conditional on negative returns on the global fund. Weekly returns are reported. Results for the following simulations are shown: minimization of the variance of returns subject to restrictions on expected returns (top panel) and maximization of expected returns subject to a restriction on the variance of returns (bottom panel). Both simulations using portfolios that include the largest number of available specialized funds for each global fund in each family ("largest number of funds") and simulations using portfolios that include the longest time series for each global fund in each family ("longest available sample") are displayed. T-statistics for the test of equality of means are shown. A positive t-statistic means that the return on the simulated global fund is larger than that on the global fund.

Table 18. ETF Simulations

Minimizing the Variance

	Type of Simulation	Average Return (Per Year)		Average Difference in Accumulated Daily Returns	Standard Deviation of Daily Returns		Number of Comparisons
		Global Fund	Simulated Global Fund		Global Fund	Simulated Global Fund	
iShares							
World Funds	Without Country Funds	4.12%	10.52%	6.26%	1.00%	0.97%	2
	With Country Funds	4.12%	10.78%	6.54%	1.00%	0.95%	2
Foreign Funds	Without Country Funds	9.41%	12.15%	2.56%	1.06%	1.05%	2
	With Country Funds	9.41%	11.88%	2.36%	1.06%	1.03%	2
Average		6.76%	11.33%	4.43%	1.03%	1.00%	

Maximizing Expected Return

	Type of Simulation	Average Return (Per Year)		Average Difference in Accumulated Daily Returns	Standard Deviation of Daily Returns		Number of Comparisons
		Global Fund	Simulated Global Fund		Global Fund	Simulated Global Fund	
iShares							
World Funds	Without Country Funds	4.12%	11.71%	7.17%	1.00%	1.05%	2
	With Country Funds	4.12%	11.77%	6.95%	1.00%	1.13%	2
Foreign Funds	Without Country Funds	9.41%	13.13%	3.26%	1.06%	1.11%	2
	With Country Funds	9.41%	12.96%	2.96%	1.06%	1.16%	2
Average		6.76%	12.39%	5.09%	1.03%	1.11%	

This table shows the results of the following simulations based on returns on exchange-traded funds (ETFs): minimization of the variance of returns subject to restrictions on expected returns (top panel) and maximization of expected returns subject to a restriction on the variance of returns (bottom panel). ETF family averages are reported. Only country funds from emerging countries are used. Portfolio weights are updated every day. Realized returns of the simulated portfolio are calculated out-of-sample, as described in the main text. Annualized differences in accumulated returns are calculated over the entire sample for each simulation performed. Averages across simulations are reported.

Appendix Table 1. Price Data on Mutual Funds

	Mutual Fund Family	No. of Funds	Sample	
			Beginning	End
1	AIM Family of Funds	17	Apr. 92	Jul. 05
2	Alliance Bernstein	10	Dec. 99	Jun. 06
3	Allianz Funds	4	Dec. 04	Jul. 05
4	American Funds Group	7	Mar. 02	Jun. 06
5	Columbia Funds	8	Oct. 00	Jun. 06
6	Credit Suisse	8	Dec. 01	Jun. 06
7	DFA Investment Dimensions Group	9	Mar. 93	Jul. 05
8	Dreyfus Founders	11	Jul. 96	Jun. 06
9	Eaton Vance Group	7	Sep. 99	Jul. 05
10	Evergreen Funds	5	Sep. 94	Jun. 06
11	Excelsior Funds	4	Sep. 93	Jul. 05
12	Fidelity Advisors Funds	14	Dec. 00	Jun. 06
13	Fidelity Group	18	Sep. 89	Jul. 05
14	GAM Funds	7	Jan. 90	Jul. 05
15	Gartmore	5	Jul. 04	Jun. 06
16	GMO LLC	17	Jan. 99	Jul. 05
17	Goldman Sachs Asset Management Group	11	Oct. 98	Jul. 05
18	Hartford Mutual Funds	10	May 01	Jun. 06
19	ING Funds Trust	12	Nov. 94	Jul. 05
20	Ivy Mackenzie Management	9	May 99	Jul. 05
21	J.P. Morgan Funds	10	Jul. 02	Jun. 06
22	Janus	12	Oct. 98	Jun. 06
23	Merrill Lynch Group	15	Nov. 94	Jul. 05
24	MFS Family of Funds	11	Jun. 96	Jun. 06
25	Morgan Stanley Funds	26	Oct. 94	Jul. 05
26	Oppenheimer Funds	9	Sep. 04	Jun. 06
27	Putnam Funds	6	Nov. 91	Jul. 05
28	RiverSource (former AXP)	9	Jul. 90	Jul. 05
29	Scudder Funds	18	Jun. 98	Jul. 05
30	Seligman Group	4	Jun. 03	Jun. 06
31	Smith Barney Group	6	Mar. 98	Jun. 06
32	T. Rowe Price Funds	14	Jun. 92	Jul. 05
33	Templeton Group	20	Nov. 92	Jul. 05
34	UBS Funds	6	Mar. 01	Jun. 06
35	Vanguard Group	11	Jul. 00	Jun. 06
36	Wells Fargo Advantage	5	Oct. 97	Jul. 05

This table describes mutual fund price data by mutual fund families. It shows the number of funds and the beginning and the end of the sample for each mutual fund family. The data source is Bloomberg.

Appendix Table 2. Probabilities of Being Held by a Mutual Fund (World Funds and Foreign Funds)

Total Holdings

		World Funds Probability of:		Total
		Not Being Held	Being Held	
Specialized Funds Probability of:	Not Being Held	0%	12%	12%
	Being Held	52%	10%	62%
No Specialized Fund		15%	11%	26%
Total [No. of Observations]		67%	33%	100% [180,744]

		Foreign Funds Probability of:		Total
		Not Being Held	Being Held	
Specialized Funds Probability of:	Not Being Held	0%	23%	23%
	Being Held	34%	15%	49%
No Specialized Fund		2%	26%	28%
Total [No. of Observations]		36%	64%	100% [379,913]

Holdings in Developing Countries Only

		World Funds Probability of:		Total
		Not Being Held	Being Held	
Specialized Funds Probability of:	Not Being Held	0%	5%	5%
	Being Held	83%	9%	92%
No Specialized Fund		1%	1%	3%
Total [No. of Observations]		85%	15%	100% [45,458]

		Foreign Funds Probability of:		Total
		Not Being Held	Being Held	
Specialized Funds Probability of:	Not Being Held	0%	8%	8%
	Being Held	79%	12%	90%
No Specialized Fund		0%	1%	2%
Total [No. of Observations]		79%	21%	100% [89,272]

This table shows frequency counts for mutual fund holdings from 1997 to 2005. It reports the probability of being held (or not) by certain types of mutual funds, given that a mutual fund family has both fund types. The top panel uses stock holdings in all countries except the U.S., whereas the bottom panel includes stock holdings in developing countries only. Each observation is a family-year-stock observation. The total number of observations is reported in brackets in the "Total" column of each table. If in a given family-year, a global fund holds a stock in a country not covered by the specialized funds within that family in that year, then this observation is counted in the "No Specialized Fund" line.

Appendix Table 3. Percentage of Net Assets in Top Ten Holdings: Importance of Number of Managers and Fees

Dependent Variable: Percentage of Net Assets in Top Ten Holdings

	(1)	(2)	(3)	(4)	(5)	(6)
Independent Variables						
Number of Managers		-0.670 ***	-0.554 ***			-0.626 ***
		[0.184]	[0.175]			[0.157]
1	29.068 ***					
	[0.545]					
2	27.582 ***					
	[0.664]					
3	25.590 ***					
	[1.012]					
4	24.656 ***					
	[2.284]					
5	24.302 ***					
	[1.100]					
6	22.751 ***					
	[2.323]					
7 or More	26.798 ***					
	[0.971]					
Manager Tenure		-0.042	-0.067	0.143	0.138	-0.020
		[0.119]	[0.118]	[0.113]	[0.114]	[0.122]
Fund Age		-0.164 ***	-0.129 **	-0.125 **	-0.123 **	-0.099 **
		[0.060]	[0.053]	[0.054]	[0.055]	[0.048]
Fund Expenses				-0.051 ***	-0.068	-0.035
				[0.009]	[0.043]	[0.049]
Fund Size					0.000	0.000
					[0.000]	[0.000]
Year Dummies	No	No	Yes	No	No	Yes
Fund Type Dummies	No	No	Yes	No	No	Yes
No. of Observations	6,308	6,080	6,080	5,655	5,655	5,649
R-squared	0.02	0.02	0.13	0.02	0.02	0.15

This table reports regressions of the percentage of net assets in the top ten holdings on the number of managers, manager tenure, fund age (in years), fund expenses, and fund size. Year and fund type dummies are included in some of the regressions. The sample period is 1997-2005. Fund expenses and fund size are in millions of U.S. dollars (US$). R-squared and total number of observations are reported at the bottom of the table. Standard errors are clustered at the family level. Standard deviations are shown in brackets. ***, **, and * indicate significance at one, five, or ten percent, respectively.

Appendix Table 4. Percentage of Net Assets in Top Ten Holdings

Dependent Variable: Percentage of Net Assets in Top Ten Holdings

Importance of Year, Fund Type, and Family Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
R-squared	0.05	0.10	0.29	0.15	0.33	0.37	0.40
Independent Variables							
Year Dummies	Yes	No	No	Yes	Yes	No	Yes
Fund Type Dummies	No	Yes	No	Yes	No	Yes	Yes
Family Dummies	No	No	Yes	No	Yes	Yes	Yes
No. of Observations	8,400	8,400	8,400	8,400	8,400	8,400	8,400

Dependent Variable: Percentage of Net Assets in Top Ten Holdings

Importance of Family Expenses and Family Size

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Independent Variables							
Number of Managers			-0.529 ***	-0.186			-0.179
			[0.178]	[0.188]			[0.187]
Manager Tenure	0.079	0.097	-0.033	-0.133	-0.107	-0.107	-0.129
	[0.111]	[0.110]	[0.115]	[0.084]	[0.082]	[0.082]	[0.084]
Fund Age	-0.145 **	-0.151 ***	-0.106 **	-0.126 **	-0.129 ***	-0.130 ***	-0.128 ***
	[0.058]	[0.057]	[0.052]	[0.049]	[0.049]	[0.049]	[0.049]
Family Expenses	-0.007 **	0.006	-0.001		-0.005 **	-0.010	-0.010
	[0.003]	[0.010]	[0.011]		[0.002]	[0.009]	[0.009]
Family Size		0.000	0.000			0.000	0.000
		[0.000]	[0.000]			[0.000]	[0.000]
Year Dummies	No	No	Yes	Yes	Yes	Yes	Yes
Fund Type Dummies	No	No	Yes	Yes	Yes	Yes	Yes
Family Dummies	No	No	No	Yes	Yes	Yes	Yes
No. of Observations	6,087	6,087	6,080	6,080	6,087	6,087	6,080
R-squared	0.01	0.01	0.13	0.45	0.45	0.45	0.45

The top table shows the R-squared of the regressions of the percentage of net assets in the top ten holdings on year dummies, fund type dummies, and family dummies. Seven different specifications are shown. See the main text for a detailed description. The sample period is 1991-2005. The bottom table reports the regressions of the percentage of net assets in the top ten holdings on the number of managers, manager tenure, fund age (in years), mutual fund family expenses, and mutual fund family size. Year, fund type, family dummies are included in some of the regressions. The sample period is 1997-2005. Family expenses and family size are in millions of U.S. dollars (US$). R-squared and total number of observations are reported at the bottom of the table. Standard errors are clustered at the family level. Standard deviations are shown in brackets. ***, **, and * indicate significance at one, five, or ten percent, respectively.

Appendix Table 5A. Family Simulations Using the Largest Number of Funds

Minimizing the Variance

	Family	Average Return (Per Year)		Average Difference in Accumulated Daily Returns	Standard Deviation of Daily Returns		Number of Comparisons
		Global Fund	Simulated Global Fund		Global Fund	Simulated Global Fund	
1	Allianz Funds	0.95%	-3.05%	-3.91%	0.66%	0.65%	2
2	Alliance Bernstein	11.01%	12.90%	1.77%	0.81%	0.79%	8
3	American Funds Group	10.57%	13.93%	3.33%	0.87%	0.74%	4
4	AIM Family of Funds	9.53%	22.55%	12.37%	0.90%	0.76%	10
5	Columbia Funds	17.58%	21.08%	3.28%	0.85%	0.77%	3
6	Credit Suisse	8.46%	12.15%	3.63%	0.95%	0.85%	2
7	DFA Investment Dimensions Group	2.97%	1.13%	-1.64%	0.91%	0.85%	4
8	Dreyfus Founders	8.94%	15.90%	6.66%	0.87%	0.80%	6
9	Evergreen Funds	3.25%	1.69%	-1.21%	1.12%	1.02%	2
10	Eaton Vance Group	5.63%	22.13%	16.40%	1.01%	0.71%	2
11	Excelsior Funds	3.95%	7.15%	3.13%	0.89%	0.87%	2
12	Fidelity Group	5.80%	9.46%	3.78%	1.03%	0.94%	6
13	Fidelity Advisors Funds	7.76%	11.71%	3.96%	0.87%	0.76%	6
14	GAM Funds	-7.63%	-3.88%	4.40%	1.08%	0.96%	2
15	Gartmore	22.30%	18.99%	-2.62%	0.81%	0.78%	3
16	GMO LLC	6.65%	8.05%	1.36%	0.76%	0.77%	8
17	Goldman Sachs Asset Management Group	1.63%	7.18%	5.84%	1.03%	0.91%	6
18	Hartford Mutual Funds	10.41%	13.49%	3.11%	0.98%	0.84%	2
19	ING Funds Trust	-5.75%	-1.34%	5.33%	1.12%	1.01%	6
20	Ivy Mackenzie Management	4.95%	7.25%	2.44%	0.77%	0.66%	3
21	Janus	-7.01%	0.08%	7.60%	0.67%	0.70%	5
22	J.P. Morgan Funds	22.11%	24.06%	1.68%	0.90%	0.87%	4
23	MFS Family of Funds	19.39%	33.85%	12.73%	0.85%	0.81%	4
24	Merrill Lynch Group	10.31%	12.78%	2.49%	1.01%	0.93%	9
25	Morgan Stanley Funds	1.23%	4.47%	3.61%	1.01%	0.88%	11
26	Oppenheimer Funds	9.04%	9.06%	-0.03%	0.80%	0.84%	4
27	Putnam Funds	4.86%	5.53%	0.74%	1.08%	1.05%	5
28	RiverSource (former AXP)	13.45%	22.06%	7.87%	0.84%	0.73%	2
29	Scudder Funds	8.56%	14.60%	5.85%	0.97%	0.86%	9
30	Smith Barney Group	8.79%	9.81%	0.90%	0.72%	0.74%	1
31	Seligman Group	14.45%	15.89%	1.26%	0.82%	0.82%	2
32	Templeton Group	-3.58%	-0.94%	3.04%	0.89%	0.77%	9
33	T. Rowe Price Funds	24.48%	38.61%	11.47%	0.82%	0.80%	6
34	UBS Funds	4.41%	7.30%	2.88%	0.89%	0.84%	1
35	Vanguard Group	7.77%	10.39%	2.54%	0.96%	0.92%	4
36	Wells Fargo Advantage	5.22%	11.69%	6.65%	0.98%	0.78%	2
	Total	6.93%	11.27%	4.39%	0.91%	0.83%	165

This table shows the results of the following simulation: minimization of the variance of returns subject to restrictions on expected returns. The results are reported by mutual fund family. The simulations use portfolios that include the largest number of available specialized funds for each global fund in each family ("largest number of funds"). The global funds are world funds, foreign funds, and a pool of world or foreign funds. The pool of world or foreign funds are simulations that include several world (or foreign) funds within the same family but with different scopes, e.g. world (foreign) value funds and world (foreign) growth funds. Portfolio weights are updated every day. Realized returns of the simulated portfolio are calculated out-of-sample, as described in the main text. Annualized differences in accumulated returns are calculated over the entire sample for each simulation performed. Averages across simulations are then computed and reported.

Appendix Table 5B. Family Simulations Using the Largest Number of Funds

Maximizing Expected Return

	Family	Average Return (Per Year)		Average Difference in Accumulated Daily Returns	Standard Deviation of Daily Returns		Number of Comparisons
		Global Fund	Simulated Global Fund		Global Fund	Simulated Global Fund	
1	Allianz Funds	0.95%	0.95%	0.00%	0.66%	0.66%	2
2	Alliance Bernstein	11.01%	11.32%	0.30%	0.81%	0.80%	8
3	American Funds Group	10.57%	10.78%	0.18%	0.87%	0.87%	4
4	AIM Family of Funds	9.53%	14.49%	4.76%	0.90%	0.90%	10
5	Columbia Funds	17.58%	16.06%	-1.26%	0.85%	0.84%	3
6	Credit Suisse	8.46%	8.39%	-0.06%	0.95%	0.95%	2
7	DFA Investment Dimensions Group	2.97%	3.74%	0.80%	0.91%	0.89%	4
8	Dreyfus Founders	8.94%	10.54%	1.56%	0.87%	0.86%	6
9	Evergreen Funds	3.25%	3.25%	0.00%	1.12%	1.12%	2
10	Eaton Vance Group	5.63%	8.58%	3.14%	1.01%	0.88%	2
11	Excelsior Funds	3.95%	3.95%	0.01%	0.89%	0.89%	2
12	Fidelity Group	5.80%	5.95%	0.13%	1.03%	1.04%	6
13	Fidelity Advisors Funds	7.76%	7.43%	-0.29%	0.87%	0.87%	6
14	GAM Funds	-7.63%	-7.90%	-0.30%	1.08%	1.09%	2
15	Gartmore	22.30%	22.30%	0.00%	0.81%	0.81%	3
16	GMO LLC	6.65%	7.50%	0.74%	0.76%	0.79%	8
17	Goldman Sachs Asset Management Group	1.63%	2.31%	0.69%	1.03%	1.03%	6
18	Hartford Mutual Funds	10.41%	10.41%	0.00%	0.98%	0.98%	2
19	ING Funds Trust	-5.75%	4.80%	11.95%	1.12%	1.09%	6
20	Ivy Mackenzie Management	4.95%	7.39%	2.52%	0.77%	0.71%	3
21	Janus	-7.01%	11.09%	19.43%	0.67%	0.74%	5
22	J.P. Morgan Funds	22.11%	21.52%	-0.48%	0.90%	0.90%	4
23	MFS Family of Funds	19.39%	19.16%	-0.19%	0.85%	0.85%	4
24	Merrill Lynch Group	10.31%	11.18%	0.73%	1.01%	1.04%	9
25	Morgan Stanley Funds	1.23%	1.67%	0.41%	1.01%	1.02%	11
26	Oppenheimer Funds	9.04%	8.48%	-0.51%	0.80%	0.81%	4
27	Putnam Funds	4.86%	4.96%	0.11%	1.08%	1.08%	5
28	RiverSource (former AXP)	13.45%	13.45%	0.00%	0.84%	0.84%	2
29	Scudder Funds	8.56%	12.33%	3.46%	0.97%	0.98%	9
30	Smith Barney Group	8.79%	8.79%	0.00%	0.72%	0.72%	1
31	Seligman Group	14.45%	14.44%	0.00%	0.82%	0.81%	2
32	Templeton Group	-3.58%	-3.42%	0.13%	0.89%	0.90%	9
33	T. Rowe Price Funds	24.48%	24.49%	0.00%	0.82%	0.82%	6
34	UBS Funds	4.41%	4.41%	0.00%	0.89%	0.89%	1
35	Vanguard Group	7.77%	7.50%	-0.24%	0.96%	0.96%	4
36	Wells Fargo Advantage	5.22%	6.03%	0.87%	0.98%	0.95%	2
	Total	6.93%	8.69%	1.76%	0.91%	0.91%	165

This table shows the results of the following simulation: maximization of expected returns subject to a restriction on the variance of returns. The results are reported by mutual fund family. The simulations use portfolios that include the largest number of available specialized funds for each global fund in each family ("largest number of funds"). The global funds are world funds, foreign funds, and a pool of world or foreign funds. The pool of world or foreign funds are simulations that include several world (or foreign) funds within the same family but with different scopes, e.g. world (foreign) value funds and world (foreign) growth funds. Portfolio weights are updated every day. Realized returns of the simulated portfolio are calculated out-of-sample, as described in the main text. Annualized differences in accumulated returns are calculated over the entire sample for each simulation performed. Averages across simulations are then computed and reported.

Appendix Table 6A. Family Simulations Using the Longest Available Sample

Minimizing the Variance

	Family	Average Return (Per Year)		Average Difference in Accumulated Daily Returns	Standard Deviation of Daily Returns		Number of Comparisons
		Global Fund	Simulated Global Fund		Global Fund	Simulated Global Fund	
1	Allianz Funds	0.95%	-3.05%	-3.91%	0.66%	0.65%	2
2	Alliance Bernstein	9.36%	13.06%	3.48%	0.89%	0.86%	8
3	American Funds Group	10.57%	13.93%	3.33%	0.87%	0.74%	4
4	AIM Family of Funds	7.34%	18.76%	11.17%	1.03%	0.89%	10
5	Columbia Funds	14.17%	17.04%	2.99%	0.92%	0.76%	3
6	Credit Suisse	8.46%	12.15%	3.63%	0.95%	0.85%	2
7	DFA Investment Dimensions Group	3.15%	1.22%	-1.70%	0.91%	0.84%	4
8	Dreyfus Founders	4.71%	7.83%	3.33%	1.02%	0.92%	6
9	Evergreen Funds	5.76%	5.56%	-0.21%	1.07%	1.08%	2
10	Eaton Vance Group	-4.98%	8.94%	15.46%	1.13%	0.87%	2
11	Excelsior Funds	1.58%	1.67%	0.10%	0.99%	0.99%	2
12	Fidelity Group	6.89%	8.09%	1.36%	0.95%	0.86%	7
13	Fidelity Advisors Funds	7.40%	9.99%	2.72%	0.93%	0.82%	6
14	GAM Funds	41.57%	45.05%	1.43%	8.19%	8.66%	2
15	Gartmore	22.30%	18.99%	-2.62%	0.81%	0.78%	3
16	GMO LLC	6.65%	8.05%	1.36%	0.76%	0.77%	8
17	Goldman Sachs Asset Management Group	1.63%	7.18%	5.84%	1.03%	0.91%	6
18	Hartford Mutual Funds	6.10%	8.06%	2.17%	1.04%	0.91%	2
19	ING Funds Trust	0.96%	4.03%	3.53%	1.04%	0.93%	6
20	Ivy Mackenzie Management	0.89%	5.81%	5.25%	0.99%	0.86%	3
21	Janus	4.97%	7.82%	2.75%	0.88%	0.87%	5
22	J.P. Morgan Funds	22.11%	24.06%	1.68%	0.90%	0.87%	4
23	MFS Family of Funds	12.47%	16.07%	3.19%	0.80%	0.82%	3
24	Merrill Lynch Group	5.09%	6.49%	1.57%	1.03%	0.96%	9
25	Morgan Stanley Funds	2.47%	6.23%	4.00%	0.97%	0.87%	11
26	Oppenheimer Funds	12.15%	11.35%	-0.77%	0.77%	0.80%	4
27	Putnam Funds	4.86%	5.53%	0.74%	1.08%	1.05%	5
28	RiverSource (former AXP)	3.46%	3.15%	-0.28%	1.14%	1.13%	2
29	Scudder Funds	5.44%	10.47%	4.99%	0.99%	0.91%	9
30	Smith Barney Group	2.03%	2.35%	0.30%	0.94%	0.94%	1
31	Seligman Group	14.45%	15.89%	1.26%	0.82%	0.82%	2
32	Templeton Group	3.15%	3.41%	0.41%	0.80%	0.73%	9
33	T. Rowe Price Funds	5.04%	10.10%	5.07%	0.98%	0.92%	6
34	UBS Funds	4.41%	7.30%	2.88%	0.89%	0.84%	1
35	Vanguard Group	5.40%	7.05%	1.68%	0.99%	0.95%	4
36	Wells Fargo Advantage	6.44%	8.39%	2.18%	1.01%	0.88%	2
	Total	6.54%	9.47%	3.01%	1.03%	0.97%	165

This table shows the results of the following simulation: minimization of the variance of returns subject to restrictions on expected returns. The results are reported by mutual fund family. The simulations use portfolios that include the longest time series for each global fund in each family ("longest available sample"). The global funds are world funds, foreign funds, and a pool of world or foreign funds. The pool of world or foreign funds are simulations that include several world (or foreign) funds within the same family but with different scopes, e.g. world (foreign) value funds and world (foreign) growth funds. Portfolio weights are updated every day. Realized returns of the simulated portfolio are calculated out-of-sample, as described in the main text. Annualized differences in accumulated returns are calculated over the entire sample for each simulation performed. Averages across simulations are then computed and reported.

Appendix Table 6B. Family Simulations Using the Longest Available Sample

Maximizing Expected Return

	Family	Average Return (Per Year)		Average Difference in Accumulated Daily Returns	Standard Deviation of Daily Returns		Number of Comparisons
		Global Fund	Simulated Global Fund		Global Fund	Simulated Global Fund	
1	Allianz Funds	0.95%	0.95%	0.00%	0.66%	0.66%	2
2	Alliance Bernstein	9.36%	9.43%	0.06%	0.89%	0.89%	8
3	American Funds Group	10.57%	10.78%	0.18%	0.87%	0.87%	4
4	AIM Family of Funds	7.34%	13.21%	5.80%	1.03%	1.03%	10
5	Columbia Funds	14.17%	12.69%	-1.27%	0.92%	0.91%	3
6	Credit Suisse	8.46%	8.39%	-0.06%	0.95%	0.95%	2
7	DFA Investment Dimensions Group	3.15%	3.85%	0.73%	0.91%	0.88%	4
8	Dreyfus Founders	4.71%	4.84%	0.13%	1.02%	1.02%	6
9	Evergreen Funds	5.76%	5.76%	0.00%	1.07%	1.07%	2
10	Eaton Vance Group	-4.98%	-4.41%	0.59%	1.13%	1.13%	2
11	Excelsior Funds	1.58%	1.54%	-0.05%	0.99%	0.99%	2
12	Fidelity Group	6.89%	6.85%	-0.04%	0.95%	0.95%	7
13	Fidelity Advisors Funds	7.40%	6.79%	-0.56%	0.93%	0.93%	6
14	GAM Funds	41.57%	40.49%	-0.72%	8.19%	8.17%	2
15	Gartmore	22.30%	22.30%	0.00%	0.81%	0.81%	3
16	GMO LLC	6.65%	7.50%	0.74%	0.76%	0.79%	8
17	Goldman Sachs Asset Management Group	1.63%	2.31%	0.69%	1.03%	1.03%	6
18	Hartford Mutual Funds	6.10%	6.10%	0.00%	1.04%	1.04%	2
19	ING Funds Trust	0.96%	5.73%	5.38%	1.04%	1.02%	6
20	Ivy Mackenzie Management	0.89%	5.14%	4.53%	0.99%	0.88%	3
21	Janus	4.97%	4.94%	-0.05%	0.88%	0.88%	5
22	J.P. Morgan Funds	22.11%	21.52%	-0.48%	0.90%	0.90%	4
23	MFS Family of Funds	12.47%	12.18%	-0.26%	0.80%	0.80%	3
24	Merrill Lynch Group	5.09%	6.11%	0.98%	1.03%	1.04%	9
25	Morgan Stanley Funds	2.47%	3.35%	0.83%	0.97%	0.99%	11
26	Oppenheimer Funds	12.15%	11.59%	-0.51%	0.77%	0.77%	4
27	Putnam Funds	4.86%	4.96%	0.11%	1.08%	1.08%	5
28	RiverSource (former AXP)	3.46%	3.46%	0.00%	1.14%	1.14%	2
29	Scudder Funds	5.44%	7.26%	1.71%	0.99%	1.00%	9
30	Smith Barney Group	2.03%	2.41%	0.37%	0.94%	0.94%	1
31	Seligman Group	14.45%	14.44%	0.00%	0.82%	0.81%	2
32	Templeton Group	3.15%	3.22%	0.07%	0.80%	0.80%	9
33	T. Rowe Price Funds	5.04%	5.20%	0.15%	0.98%	0.98%	6
34	UBS Funds	4.41%	4.41%	0.00%	0.89%	0.89%	1
35	Vanguard Group	5.40%	5.13%	-0.24%	0.99%	0.99%	4
36	Wells Fargo Advantage	6.44%	6.11%	-0.27%	1.01%	1.00%	2
	Total	6.54%	7.38%	0.85%	1.03%	1.03%	165

This table shows the results of the following simulation: maximization of expected returns subject to a restriction on the variance of returns. The results are reported by mutual fund family. The simulations use portfolios that include the longest time series for each global fund in each family ("longest available sample"). The global funds are world funds, foreign funds, and a pool of world or foreign funds. The pool of world or foreign funds are simulations that include several world (or foreign) funds within the same family but with different scopes, e.g. world (foreign) value funds and world (foreign) growth funds. Portfolio weights are updated every day. Realized returns of the simulated portfolio are calculated out-of-sample, as described in the main text. Annualized differences in accumulated returns are calculated over the entire sample for each simulation performed. Averages across simulations are then computed and reported.

Appendix Table 7A. Simulations Using the Largest Number of Funds

Minimizing the Variance (Rolling Windows: 240 Business Days)

Type of Global Fund	Average Return (Per Year)		Average Difference in Accumulated Daily Returns	Standard Deviation of Daily Returns		Number of Comparisons
	Global Fund	Simulated Global Fund		Global Fund	Simulated Global Fund	
World Stock	9.21%	13.91%	4.51%	0.86%	0.77%	56
Foreign Stock	6.46%	10.36%	4.01%	0.97%	0.87%	74
Pool of World or Foreign Funds	11.81%	13.78%	1.64%	0.81%	0.75%	22
Total	8.23%	12.15%	3.85%	0.91%	0.81%	152

Maximizing Expected Return (Rolling Windows: 240 Business Days)

Type of Global Fund	Average Return (Per Year)		Average Difference in Accumulated Daily Returns	Standard Deviation of Daily Returns		Number of Comparisons
	Global Fund	Simulated Global Fund		Global Fund	Simulated Global Fund	
World Stock	9.21%	9.99%	0.54%	0.86%	0.86%	56
Foreign Stock	6.46%	7.90%	1.41%	0.97%	0.97%	74
Pool of World or Foreign Funds	11.81%	13.13%	1.15%	0.81%	0.83%	22
Total	8.23%	9.41%	1.05%	0.91%	0.91%	152

This table shows the results of the following simulations: minimization of the variance of returns subject to restrictions on expected returns (top panel) and maximization of expected returns subject to a restriction on the variance of returns (bottom panel). The simulations use portfolios that include the largest number of available specialized funds for each global fund in each family ("largest number of funds"). The global funds are world funds, foreign funds, and a pool of world or foreign funds. The pool of world or foreign funds are simulations that include several world (or foreign) funds within the same family but with different scopes, e.g. world (foreign) value funds and world (foreign) growth funds. Portfolio weights are updated every day. Realized returns of the simulated portfolio are calculated out-of-sample, as described in the main text. Simulations use information based on the previous 240 business days only at each point in time. Annualized differences in accumulated returns are calculated over the entire sample for each simulation performed. Averages across simulations are then computed and reported.

Appendix Table 7B. Simulations Using the Longest Available Sample

Minimizing the Variance (Rolling Windows: 240 Business Days)

Type of Global Fund	Average Return (Per Year)		Average Difference in Accumulated Daily Returns	Standard Deviation of Daily Returns		Number of Comparisons
	Global Fund	Simulated Global Fund		Global Fund	Simulated Global Fund	
World Stock	8.03%	10.46%	2.53%	0.90%	0.82%	62
Foreign Stock	5.37%	8.33%	3.09%	0.98%	0.91%	76
Pool of World or Foreign Funds	10.55%	13.25%	2.59%	0.89%	0.80%	22
Total	7.10%	9.82%	2.80%	0.94%	0.86%	160

Maximizing Expected Return (Rolling Windows: 240 Business Days)

Type of Global Fund	Average Return (Per Year)		Average Difference in Accumulated Daily Returns	Standard Deviation of Daily Returns		Number of Comparisons
	Global Fund	Simulated Global Fund		Global Fund	Simulated Global Fund	
World Stock	8.03%	8.05%	-0.04%	0.90%	0.90%	62
Foreign Stock	5.37%	5.80%	0.42%	0.98%	0.99%	76
Pool of World or Foreign Funds	10.55%	11.57%	0.83%	0.89%	0.89%	22
Total	7.10%	7.45%	0.30%	0.94%	0.94%	160

This table shows the results of the following simulations: minimization of the variance of returns subject to restrictions on expected returns (top panel) and maximization of expected returns subject to a restriction on the variance of returns (bottom panel). The simulations use portfolios that include the longest time series for each global fund in each family ("longest available sample"). The global funds are world funds, foreign funds, and a pool of world or foreign funds. The pool of world or foreign funds are simulations that include several world (or foreign) funds within the same family but with different scopes, e.g. world (foreign) value funds and world (foreign) growth funds. Portfolio weights are updated every day. Realized returns of the simulated portfolio are calculated out-of-sample, as described in the main text. Simulations use information based on the previous 240 business days only at each point in time. Annualized differences in accumulated returns are calculated over the entire sample for each simulation performed. Averages across simulations are then computed and reported.