

Are mutual fund fees too high?

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Abstract

We study the tradeoff between direct and indirect stock investments through equity mutual funds for a utility-maximizing investor. Whereas direct investments impose higher transaction costs on forming a well-diversified portfolio, mutual funds charge fees for their services. Our results show that the fee levels that make private investors indifferent between direct and indirect stock investments vary heavily according to risk aversion, the amounts invested, correlations between assets, transaction costs and the length of investment horizon. In particular, our results suggest that for a wide range of actively managed mutual funds, the fees charged are too high for these mutual funds to appeal to a wide range of informed investors.

JEL Classification Codes: G11, D14, G25

Key Words: portfolio choice, mutual funds, management fees, transaction costs, diversification

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1 Introduction

The mutual fund industry has recently experienced abundant growth throughout the developed countries. By the end of 2010, the mutual fund industry had grown to 24.7 trillion dollars under management worldwide, corresponding to an increase of 38.98% over the last 5 years. Investors could choose among 69,519 different funds in 2010, an increase of 31.8% compared to the pool of funds in 1999. Although the largest markets are still located in the USA and Europe, with global market shares of 47.9% and 32.0%, respectively, the Asian and Pacific (12.4%) and African (0.6%) countries are steadily bridging the gap with an average annual growth rate of 9.6% and 16.6% over the last 5 years.¹

Mutual funds provide investors with management services and the desirable option of gaining access to a well-diversified portfolio, even when they only invest a smaller amount. Furthermore, these investment vehicles can restructure their portfolios at substantially lower transaction costs than would be the case for private investors. However, for their services, mutual funds charge management and administration fees, which are usually expressed as a proportion of the funds under management, which reduces the portfolio return. The fees thus entail a tradeoff between direct and indirect equity investments, the latter being through mutual funds. Research on this tradeoff ranges back to Smith and Schreiner (1970), Fielitz (1974), and Jacob (1974). Other work includes Sankaran and Patil (1999), Kellerer, Mansini, and Speranza (2000), and Baule (2010). However, none of these studies take into account the fact that the tradeoff between direct and indirect equity investments depends substantially on investor preferences.

We contribute to the existing literature by studying this tradeoff for a utility-maximizing investor. This tradeoff can vary considerably between individual investors. More specifically, we show that the fee level that makes private investors indifferent between direct and indirect stock investments, varies heavily according to risk aversion, the amount invested, transaction costs, correlations between asset returns, and the length of investment

¹Source: European Fund and Asset Management Association, International Statistical Release 2010, Supplementary Tables.

horizon. In particular, our results suggest that for a wide range of mutual funds, the fees charged are too high to make those funds appealing.

Our research draws on two major groups of previous studies on mutual funds and the cost of investing. First, mutual fund performance and diversification are discussed comprehensively in the finance literature. For example, Hendricks, Patel, and Zeckhauser (1993), Goetzmann and Ibbotson (1994), and Brown and Goetzmann (1995) explain the mutual fund performance by "hot hands" or general investment strategies. However, their results seem to be driven partly by the one- to three-years momentum effect documented by Jegadeesh and Titman (1993). Carhart (1997) shows that general factors in equity returns and fund expenses explain almost all the persistence in equity mutual fund mean and risk-adjusted returns. His results do not confirm the existence of differential manager information or stock-picking skills. These results are confirmed, among others, by Busse, Goyal, and Wahlal (2010) and Blitz, Huij, and Swinkels (2010). Similarly, Fama and French (2010) find that the majority of funds do not generate α s that are statistically different from zero. As a consequence, investors should generally prefer funds with lower fees, as lower fees *ceteris paribus* have a direct positive impact on performance.

In addition, a number of studies pioneered by Jorion (1985) show that the out-of-sample performance of the ex-ante optimal determined portfolios within a sample-based mean-variance model may underperform, in comparison to naïve strategies such as an equally weighted portfolio. Recently, DeMiguel, Garlappi, and Uppal (2009) extended the sample-based mean-variance model by approaches designed to reduce estimation error, relative to the naïve $1/N$ portfolio. Of the 14 models which they analyze on the basis of parameters calibrated to the U.S. equity market, none consistently outperform the $1/N$ rule in terms of Sharpe ratio, certainty-equivalent return or turnover. The analytical results and simulations in DeMiguel, Garlappi, and Uppal (2009) document that the estimation window needed for the sample-based mean-variance strategy and its extensions to dominate the $1/N$ benchmark is around 3,000 months for a portfolio with 25 assets.

Our research further draws on papers that address the cost of investing and different fee structures. For investors, fees are the price paid for professional investment manage-

ment, distribution, and other services. On the one hand, higher fees reduce fund performance. Alternatively, they might increase investment company profitability through their ability to attract skilled managers. However, empirical results by Carhart (1997), Bogle (2005), Fama and French (2010) or Blitz, Huij, and Swinkels (2010) among others, suggest that the former effect generally outweighs the latter. From a theoretical perspective, Pástor and Stambaugh (2010) argue that a growing mutual fund industry reduces actively managed fund's ability to outperform a passive benchmark. Evans (2008) indeed documents that mutual funds with managerial investments perform slightly better than other mutual funds.

Khorana, Servaes, and Tufano (2009) study the fee structure charged by 46,580 mutual funds in 18 countries, representing approximately 86% of the world fund industry in 2002. They analyze the management fees, total expense ratios, and total shareholder costs including load charges. Fund expenses differ substantially by size, investment objectives and countries. Larger funds and fund complexes charge lower fees, whereas fees are higher for funds offered in different countries and those domiciled in certain tax havens. Significant differences among countries persist even after adjusting for these variables. The most robust explanatory factor for the remaining differences is that fund fees are higher in countries with weaker investor protection. The asset-weighted average total shareholder costs for equity funds worldwide were 1.80% in 2002. The cost-range varies from 0.82% in the Netherlands to 3.00% in Canada. In the United States, legal settlements and lawsuits accusing fund managers of illegal kickback commissions have led to cost reductions to 1.53 percentage points. In a recent study, Cremers, Ferreira, Matos, and Starks (2011) report average total shareholder costs of 1.38% for actively managed mutual funds, 0.3% for exchange traded funds, and 0.26% for passively managed mutual funds.

French (2008) compares the actual cost of investing – the transaction costs, fees and expenses paid for equity mutual funds in the U.S. stock market with the modeled cost of investing, if everybody invested passively from 1980-2006. He calculates average total costs per year of 0.82% of the total value of domestic equities in 1980 and 0.75% of that in 2006. With a purely passive investment in the market portfolio, however, the cost of

investing would have been 0.18% of the total value of domestic equities in 1980 and 0.09% in 2006 only. The difference between the active and passive strategy can be regarded as the cost of active investing. Consequently, the average annual cost of active investing is 0.66% in terms of total 2006 domestic equities. From an investment company perspective, this percentage expresses the cost of price discovery, based on the value of all stocks. From a private investor perspective, the interpretation is more challenging. Without net transfer between a passive market portfolio and other investors, the application of a passive strategy increases the average annual return by 66 basis points. In addition, mutual funds have front-load fees that typically vary between 1 and 8.5% (Livingston and O'Neal (1998)) and tend to have an even lower performance, following significant mutual fund outflows (Clarke, Cullen, and Gasbarro (2007)). Therefore, it may seem incomprehensible that active traders continue to play a negative sum game. According to French (2008), there are three main reasons. First, investors fail to understand the potential to increase returns by applying a passive strategy. Second, investment company promotion suggest that active trading is effortless and profitable. This impression a private investor might gain is supported by the financial press, which reports stories of undervalued stocks and prosperous deals. Third, Odean (1998), Barber and Odean (2001), and Statman, Thorley, and Vorkink (2006) report that investor overconfidence about their ability to gain superior returns overrides the knowledge that active trading may be costly.

To the best of our knowledge, we are the first to show how key parameters like risk aversion, an investor's wealth level, transaction costs, correlation, and the length of the investment horizon affect the tradeoff between direct and indirect stock investments for a utility-maximizing investor. Our results suggest that fees charged by many mutual funds are too high for them to be attractive for a wide range of private investors.

The paper proceeds as follows. Section 2 introduces our model. In section 3, we present our results and section 4 concludes.

2 The model

Throughout our manuscript, we consider an investor who can either invest directly in up to N different stocks or indirectly via an equity mutual fund. Indirect investments via equity mutual funds provide two key advantages. First, equity mutual funds give private investors with low wealth levels access to diversified portfolios. Second, transaction costs for rebalancing portfolio weights are substantially lower for institutional investors than for individual investors.

On the other hand, mutual funds charge an annual fee, which is usually a constant percentage of the fund being managed. Depending on the type of fund, the annual total shareholder costs including load charges typically vary between 0.26% for passively managed equity mutual funds and 1.6% for actively managed equity mutual funds.² We refer to these expenses and costs as fees in the following analysis and assume that the mutual fund's transaction costs are already included in the annual fee. We further assume that the mutual fund invests in such a way that the investor's utility is maximized. Specifically, we consider an investor with constant relative risk aversion, whose utility from total final wealth is given by

$$U(W) = \begin{cases} \frac{W^{1-\gamma}}{1-\gamma} & \text{for } \gamma \neq 1 \\ \ln(W) & \text{for } \gamma = 1 \end{cases} \quad (1)$$

where $\gamma \geq 0$ denotes the investor's degree of risk aversion.

Both investors holding mutual funds and those investing directly are subject to fees or transaction costs. By τ_f , we denote a fixed transaction-cost rate that the investor has to pay each time he buys and sells a fund holding. We assume that investors are not subject to variable transaction costs.³ Initially, our investor is endowed with an amount of W_{0-} in cash which he seeks to invest. In our base-case parameter setting, we consider

²Cremers, Ferreira, Matos, and Starks (2011) report average total shareholder costs of 0.26% for passively managed mutual funds for the time period 2002-2007. Ramos (2009) computes an average total shareholder costs of 1.6% for actively managed mutual funds in 2005.

³We also computed results for settings with variable transaction costs. However, given that variable transaction costs affect direct and indirect stock investments in a very similar manner, our results are not affected much by introducing variable transaction costs.

an investor who invests over a one-year investment horizon. First, restricting ourselves to a one-period investment horizon avoids unnecessary complications in notation. Second, the average holding period for both equity mutual funds and individual stocks listed at NYSE is only about one year (Bogle (2005) and Montier (2007)).⁴

2.1 Diversification

Since the pioneering work of Markowitz (1952), it is known that diversification is the key driving force for portfolio formation. For a portfolio with n assets, the portfolio's variance σ_n^2 is given by

$$\sigma_n^2 = \sum_{i=1}^n \sum_{j=1}^n w_i w_j \sigma_i \sigma_j \rho_{i,j} \quad (2)$$

where σ_i denotes the standard deviation of asset i , $\rho_{i,j}$ the correlation between the return on asset i and asset j , and w_i is the portfolio weight of asset i . In order to compare the performance of a mutual fund with that of direct investments, we must take into account that the latter might optimally not invest in all assets, in an attempt to limit the transaction cost burden. In general, the submenu of assets chosen will depend on the individual characteristics of the assets considered, as well as the level of the transaction cost for trading these assets.

One of the key advantages from direct investment in stocks is that the investor can avoid paying management fees. However, for direct investments, transaction costs can be substantial. In the presence of transaction costs, investors face a tradeoff between the benefits and costs of diversifying their portfolios. This tradeoff can lead them to hold portfolios that differ from those they would have chosen in the absence of transaction costs. In particular, in the presence of fixed transaction costs, investors might choose to hold a smaller number of different assets (see e.g. Mayshar (1979), Campanale (2009)). The impact of variable transaction costs is, among others, studied in Constantinides (1986), Davis and Norman (1990), or Dumas and Luciano (1991). Liu (2004) and Lynch

⁴We consider the impact of longer investment horizons in section 3.5.

and Tan (2010) analyze the joint impact of both forms of transaction costs and Baule (2010) studies a portfolio choice problem with variable transaction costs and minimum fees.

The dynamic nature of the portfolio problem caused by introducing transaction costs into optimal multi-period portfolio problems makes the portfolio optimization computationally challenging. Research in this field has therefore focused on studying settings with up to two risky assets only. Given that two assets rarely constitute a well-diversified portfolio and diversification is a key factor driving the tradeoff between direct and indirect equity investments, we have to allow for more than two risky assets. As proved by Kellerer, Mansini, and Speranza (2000), finding a portfolio with the optimal number of stocks is in general an NP-hard problem.⁵ To keep the optimization problem numerically tractable, we therefore restrict our analysis to a menu of N stocks that all yield the same expected return μ , the same standard deviation σ and the same pairwise correlation ρ . This assumption potentially overestimates the desirability of mutual fund investments, in that it potentially underestimates the diversification benefits of direct stock investments. In particular, it rules out the fact that in directly invested portfolios, investors achieve substantial diversification benefits by holding those assets that correlate least.

Our assumptions imply that mutual funds are not able to generate higher expected returns by for instance, stock-picking. This corresponds with overwhelming empirical evidence that mutual funds on average do not outperform their corresponding benchmarks.⁶ Therefore, investors should *ceteris paribus*, prefer mutual funds with lower fees. In particular, investors should generally prefer exchange traded funds (ETFs) to actively managed equity mutual funds and to the so-called enhanced ETFs (Chang and Krueger (2010)) that tend to charge higher fees. Exchange traded funds are traded on stock markets essentially like individual stocks. We therefore assume that the same transaction

⁵For an investor having access to N risky assets, there are $\frac{N!}{K!(N-K)!}$ portfolios with K different assets. Thus, finding the optimal portfolio with the optimal number of risky assets generally requires solving $\sum_{K=1}^N \frac{N!}{K!(N-K)!}$ optimization problems. Already for an N as small as 30, this results in more than 1,000,000,000 optimization problems.

⁶See, Jensen (1968), Malkiel (1995), Carhart (1997), Bogle (2005), Busse, Goyal, and Wahlal (2010), Fama and French (2010), and Blitz, Huij, and Swinkels (2010).

costs apply to trading individual stocks and to mutual funds.

For the portfolio problem that we study, an investor holding n stocks optimally holds an equal fraction $\frac{1}{n}$ of his wealth in each and every asset. Empirically, such an investment strategy seems to have desirable out-of-sample properties. For instance, DeMiguel, Garlappi, and Uppal (2009) report that, due to estimation risk in other portfolio choice models, they are unable to find a portfolio choice strategy that systematically outperforms the naïve equally-weighted portfolio strategy. With an equal fraction of wealth invested in each and every asset, equation (2) can be rewritten as

$$\begin{aligned}
\sigma_n^2 &= \frac{1}{n^2} \sum_{i=1}^n \sigma^2 + \frac{1}{n^2} \sum_{i=1}^n \sum_{\substack{j=1 \\ j \neq i}}^n \sigma^2 \rho \\
&= \frac{1}{n} \sigma^2 + \frac{1}{n} (n-1) \sigma^2 \rho \\
&= \sigma^2 \rho + \frac{1}{n} \sigma^2 (1 - \rho)
\end{aligned} \tag{3}$$

Equation (3) indicates that the portfolio's variance consists of two summands. The first summand $\sigma^2 \rho$ describes the portfolio's systematic risk that cannot be diversified. The second summand $\frac{1}{n} \sigma^2 (1 - \rho)$ is the idiosyncratic risk that can be eliminated by holding a large number of different assets. If the number n of different stocks goes to infinity, the second term vanishes completely. Even for a reasonably large n , the systematic risk becomes negligible.

Please insert Figure 1 about here.

Figure 1 depicts the relationship between a portfolio's volatility σ_n and the number n of assets held in the portfolio when $\sigma = 29.02\%$ and $\rho = 0.2503$, corresponding to the average historical standard deviation and correlation for annual returns of assets contained in the Dow Jones Industrial Average between 1980 and 2010. This confirms the finding of Statman (1987) that a portfolio consisting of 30 stocks is well-diversified. We therefore restrict ourselves to a market in which $N = 30$ stocks are traded throughout. According to the 2007 Survey of Consumer Finances, 36.4% of all families with direct stock investments held only one stock, implying a portfolio's volatility of 0.2902% in our

model. 47.6% of all households hold between 2 and 9 stocks, implying portfolio volatilities between 0.2295% and 0.1676%. Only 16% of the households have more than 10 stocks and consequently, a volatility not exceeding 0.1676%. The evolution of wealth depends on whether the investor chooses a direct or an indirect stock investment.

2.2 Direct investment

An investor who invests directly in n stocks has to pay transaction costs for each unit of the stock he trades. That is, the amount W_{0+} invested after purchasing stocks is given by

$$W_{0+} = W_{0-} - n\tau_f \quad (4)$$

Equation (4) shows how the investor's wealth before trading W_{0-} is shrunk to wealth after trading of W_{0+} due to the associated transaction costs. The investor's wealth W_{1-} before trading at time $t = 1$ is given by

$$W_{1-} = W_{0+} \sum_{i=1}^n \frac{1}{n} R_i \quad (5)$$

where R_i denotes the gross return on asset i . At time $t = 1$, the investor liquidates his investments. Consequently,

$$W_{1+} = W_{1-} - n\tau_f \quad (6)$$

An investor holding stocks directly thus faces a tradeoff between increasing the number of stocks to improve the portfolio diversification and not increasing it to save the transaction costs. That is, the investor has to optimize the number of assets in his portfolio and solve the optimization problem

$$U^* = \max_n U(W_{1+}) \quad (7)$$

subject to equations (4) to (6).

2.3 Mutual fund investment

When investing in a mutual fund, the investor has to pay fees. We assume that the fund charges a fee $f \in (0, 1)$ at the end of each period, which is a constant multiple of the funds under management at that point in time. When the investor has to pay transaction costs to purchase the mutual fund at time 0, it holds that

$$W_{0+} = W_{0-} - \tau_f \quad (8)$$

Note that in contrast to a direct stock investment, the investor only has to pay the transaction cost τ_f once – for purchasing the mutual fund. One of the key advantages of an investment in a mutual fund is the fact that the mutual fund constantly rebalances portfolio weights to the equally weighted portfolio, thereby keeping the portfolio's standard deviation as small as possible. That is, the mutual fund's annual gross return R_M prior to charging fees is given by

$$R_M = \frac{1}{N} \sum_{i=1}^N R_i \quad (9)$$

The return on the portfolio after paying of the annual fee of f is given by $R_M(1 - f)$. The investor's wealth W_{1-} before selling the mutual fund at time $t = 1$ is then given by

$$\begin{aligned} W_{1-} &= W_{0+} R_M (1 - f) \\ &= (W_{0-} - \tau_f) R_M (1 - f) \end{aligned} \quad (10)$$

After paying the transaction costs, his wealth W_{1+} is given by

$$\begin{aligned} W_{1+} &= W_{1-} - \tau_f \\ &= (W_{0-} - \tau_f) R_M (1 - f) - \tau_f \end{aligned} \quad (11)$$

Compared to direct investments, mutual fund investments leave the investor with a lower fixed transaction costs burden, as he only has to pay the transaction cost for trading the mutual fund, even though the fund itself is a well-diversified portfolio that invests in all N assets. However, the fund's return is negatively affected by the fee.

2.4 Calibration

Throughout our numerical analysis, we consider an investor with degree of risk aversion of $\gamma = 5$, which is in the range of values considered reasonable by Mehra and Prescott (1985).⁷ The investor is initially endowed with $W_0 = 35,000$ dollars, roughly corresponding to the median wealth held in stocks directly or indirectly by stock owners, according to the 2007 Survey of Consumer Finances. Transaction costs are set to $\tau_f = 8$ dollars, corresponding to the flat-fee charged by in Fidelity Accounts, for example.

The risk-return characteristics of the individual assets are estimated from data from the stocks contained in the Dow Jones Industrial Average between 1980 and 2010. This leaves us with an expected return of $\mu = 8.39\%$, a standard deviation of $\sigma = 29.02\%$ and a pairwise correlation of $\rho = 0.2503$, an order of magnitude similar to that reported by Silvapulle and Granger (2001).⁸ This set of parameter values, which we refer to as our base case parameter choice throughout, is summarized in Table 1.

Please insert Table 1 about here.

To illustrate the quantitative impact of transaction costs and mutual fund fees, we determine the level of a mutual fund's fee that makes an investor indifferent between holding the mutual fund and a direct investment. The investor is indifferent between a mutual fund investment and a direct stock investment, if the utility U_M from investing in the mutual fund and the utility $U^* = \max_n U(W_{1+})$ from a direct investment with the optimal number of stocks is the same, i.e. if $U^* - U_M = 0$. We further assume the returns to be multivariate lognormally distributed. Since there is no known closed-form expression for

⁷In section 3.1 we demonstrate how other levels of risk aversion affect the tradeoff between direct and indirect stock investments.

⁸We also estimated the stocks' characteristics, using other lengths of estimation window. Since these changes did not have a significant impact on our results, we have not reported them here in greater detail.

sums of lognormals and due to the non-linearity of the utility function, we have to rely on numerical methods for finding the optimal investment strategy. Specifically, we use Monte Carlo simulation to approximate the distribution of total final wealth. The results reported throughout are each based on 50,000 simulated paths.⁹

3 Numerical results

For our base-case parameter setting, the fee f_i that makes the investor indifferent between investing in a mutual fund and a direct stock investment is $f_i = 0.6254\%$, indicating that our base case investor prefers investing in a mutual fund, if the fund's annual fee is below 0.6254% and he prefers a direct stock investment if mutual funds charge fees exceeding 0.6254%. This fee seems relatively small, compared those charged by many existing mutual funds. The fact that despite higher fees, there are still many investors holding these funds, can be attributed to various different reasons. First, private investors might be willing to pay an additional fee for a professional management of their money. This incentive should be particularly relevant for investors with minimal or no knowledge of the field of finance and investment. Also, given the financial innovations such as options, investment certificates or swaps, the fee such investors are willing to pay for professional management might even have increased over the last couple of decades. Second, the fee making the investor indifferent between a direct and an indirect stock investment might be heavily affected by some parameter assumptions we have made so far. In the following analysis, we seek to understand how key model parameters such as an investor's degree of risk aversion, correlations between assets' returns, the initial amount invested, the level of transaction costs, and the length of investment horizon affect the tradeoff between direct and indirect equity investments.

⁹Our results are robust to increasing the number of simulations.

3.1 Impact of risk aversion

An investor's risk aversion is a key parameter defining his optimal portfolio decision. In our setting, the investor faces a tradeoff between paying transaction costs and diversifying of idiosyncratic portfolio risk. As the investor's risk aversion increases, he should assign a higher weight to diversifying his portfolio, compared to saving transaction costs. We vary the investor's degree of risk aversion between 0 and 10, the range of values considered reasonable by Mehra and Prescott (1985).

Please insert Figure 2 about here.

Figure 2 depicts the relationship between the investor's risk aversion and the level of mutual fund's fee f_i that makes our investor indifferent between investing in the equity mutual fund and a direct stock investment. Figure 2 indicates that the fee the investor is willing to pay to the mutual fund for its services increases with an increasing level of risk aversion. A risk-neutral investor with degree of risk aversion of $\gamma = 0$ is not prepared to pay the mutual fund for its services as he is not concerned about diversification. As the investor's risk aversion increases, he place greater emphasis on diversifying his portfolio. This affects the fee he is willing to pay to the mutual fund through two channels. First, the improved diversification potential of the mutual fund, compared to the direct investment, is considered more desirable for a more risk-averse investor. Second, the number of assets a risk-averse investor wishes to hold when investing directly in stocks increases with his risk aversion, thereby causing transaction costs to increase. In order to avoid this transaction cost burden, the investor is willing to pay a higher fee to the mutual fund.

3.2 Impact of correlation

Correlation is one of the most important factors driving portfolio decisions. As is well-known, the level of correlation determines the relationship between idiosyncratic and systematic risk.

Please insert Figure 3 about here.

Figure 3 depicts the relationship between the pairwise correlation ρ of the assets and the fee f_i that makes the investor indifferent between mutual fund and direct stock investments. Figure 3 reveals a hump-shaped relationship between correlation and the fee f_i . This hump-shaped pattern is caused by the tradeoff between transaction costs and diversification concerns. Investors who invest in stocks directly face a tradeoff between the transaction cost and diversification. Whereas a portfolio consisting of only one asset is clearly most transaction-cost efficient, it entirely neglects diversification. A portfolio investing in all available assets, on the other hand, might leave the investor with excessive transaction costs. For levels of correlation close to zero, the investor can obtain a well-diversified portfolio with only a few different assets and therefore avoids further transaction costs from holding more assets. Given that transaction costs from direct investments are therefore small and so is the mutual fund's additional diversification potential, the investor is only prepared to pay a small fee to the mutual fund, so that f_i assumes a low value. As correlation increases, the number of assets required to diversify the portfolio increases. To achieve a reasonable level of diversification, the investor therefore has to pay higher transaction costs with the direct investment strategy. The mutual fund's greater diversification potential and lower transaction costs imply that the investor is prepared to accept a higher fee.

Studies of correlations between stock returns are at the heart of portfolio management and have recently received considerable attention in a wide variety of literature. Recent articles, including Solnik and Roulet (2000), Bekaert, Hodrick, and Zhang (2009), and Eun and Lee (2010) show that the risk-return characteristics and correlation of major stock market indices of developed and developing countries have increased significantly over the last few decades. By using a sample of 17 developed markets and weekly returns in three subperiods, 1974-1984, 1985-1995, and 1996-2007, Eun and Lee (2010) compute an average correlation of 0.297, 0.387, and 0.538, respectively. Our results in Figure 3 suggest that this increase in correlation should have increased investor willingness to hold internationally diversified portfolios.

For higher levels of correlation, the diversification potential diminishes. This implies a change in the tradeoff between diversification benefits and transaction costs from holding additional assets. The higher the correlation, the lower the diversification benefits, whereas transaction costs from trading another stock remain constant. As a consequence, the investor reduces the number of assets, as the correlation increases. Therefore, direct investment strategies again become more transaction cost efficient, which is why the investor is only prepared to pay a lower fee for a mutual fund. In the extreme case where correlation is perfect ($\rho = 1$), there is no diversification benefit from holding different assets. Consequently, the optimal direct investment strategy is to invest in one asset only. Furthermore, the mutual fund cannot provide a diversification benefit to the investor, who is therefore not prepared to pay a fee for the mutual fund.

3.3 Impact of transaction costs

The level of the fixed transaction cost an investor has to pay for trading an asset is a key factor driving the tradeoff between direct and indirect stock investments. An increased transaction cost affects the investor's total wealth for both direct and indirect stock investments. However, when purchasing an equity mutual fund, the investor only has to pay the transaction cost once, whereas to construct his own diversified portfolio, he has to pay fees for every asset he purchases. Consequently, direct stock investments are affected more by increased transaction costs than indirect ones.

Please insert Figure 4 about here.

In Figure 4, we allow the fixed transaction costs to be paid per trade to vary between 0 and 20 and depict its impact on the mutual fund's fee f_i that makes the investor indifferent between a direct and an indirect stock investment. This generally confirms our above intuition. With zero transaction costs ($\tau_f = 0$), the investor is not willing to pay a fee, as he is able to construct a perfectly diversified portfolio on his own at zero transaction cost. As transaction costs increase, diversifying the portfolio comes at an increasing cost, implying that the investor is willing to pay the mutual fund both to avoid these costs and simultaneously gain access to a well-diversified portfolio.

3.4 Impact of wealth level

An investor's wealth level is fundamental to determining the optimal number of assets in a portfolio. Intuitively, with a low wealth level, the investor should hold fewer assets in order to avoid transaction costs which reduce his wealth over time. As the level of fee that makes the investor indifferent between direct and indirect stock holdings increases as the transaction cost f_i does, it increase as the investor's wealth level. Consequently, especially for investors with low wealth levels, mutual fund investments should therefore be a desirable option for getting access to a well-diversified portfolio at reasonable costs.

Please insert Figure 5 about here.

Figure 5 depicts the relationship between the investor's wealth level and the fee f_i of a mutual fund that would make him indifferent between an indirect investment through that mutual fund and a direct stock investment. Figure 5 indicates that f_i decreases monotonically as the investor's wealth level increases. This is driven by the relative impact of transaction costs on direct investments for investors with low and high wealth levels. For investors with low wealth levels, transaction costs are high, relative to the amount they invest. However, for wealthier investors, the relative transaction cost burden is considerably smaller. Consequently, investors endowed with low initial wealth, optimally hold few assets than wealthier investors. This implies that direct investments are less well-diversified for investors with low initial wealth levels than for wealthier investors. The former are therefore prepared to pay a substantially higher fee to a mutual fund in order to obtain a well-diversified portfolio. As shown above, whether an investor should prefer a direct or an indirect stock investment depends crucially on his wealth level and the mutual fund fee.

This finding corresponds with the empirical evidence in the 2007 Survey of Consumer Finances which indicates that direct stock holdings concentrated among high-wealth families. According to Khorana, Servaes, and Tufano (2009), the average value-weighted mutual fund fee for U.S. equity mutual funds is $f = 1.11\%$, whereas the worldwide average is $f = 1.29\%$. This implies that our investor would be indifferent between a mutual fund

investment and a direct stock investment at wealth levels of 11,500 and 8,400 dollars, respectively.

3.5 Impact of length of investment horizon

In this subsection, we study the tradeoff between the length of investment horizon and investor willingness to pay a mutual fund for its services. Given the multi-period nature of the investment problem, we distinguish between two types of trading strategies for the direct portfolio investment: 1) An investor who follows a buy-and-hold portfolio strategy and does not change portfolio weights over time and 2) an investor who rebalances his portfolio weights to the optimal equally-weighted portfolio in each and every period. The mutual fund is assumed to rebalance to the equally weighted portfolio in each and every period without.

Please insert Figure 6 about here.

Figure 6 depicts the relationship between the length of the investor's investment horizon and the fee f_i that makes him indifferent between a mutual fund and a direct stock investment. The dashed line shows our results for an investor with a buy-and-hold investment strategy for a direct stock investment and the solid line for an investor with a portfolio strategy that annually rebalances the portfolio.

Both lines show that with an increasing length of investment horizon, f_i declines. This is because, with a single-period investment horizon, the investor trades his entire portfolio both at time $t = 0$ and $t = 1$. That is, the investor faces the full transaction costs twice for a one-period investment horizon. For the multi-period investment horizon, however, the investor only faces the full transaction costs twice for a longer investment horizon. That is, the relative transaction costs burden declines as the length of investment horizon increases. Consequently, direct investment strategies are subject to lower relative transaction costs and the investor is therefore less willing to pay a high fee to a mutual fund. The solid line shows that investors who rebalance annually under a direct investment strategy are willing to pay a substantially higher fee to the mutual fund. This stems from

the fact that the mutual fund allows them to save the annual rebalancing costs. That is, our results suggest that the costs of rebalancing outweigh the diversification advantage.

4 Conclusion

We have studied the tradeoff between direct equity investments and indirect investments through mutual funds. Mutual funds provide investors with diversified portfolios and rebalance the portfolio at low transaction costs. However, they charge a fee for their services. Direct investments, on the other hand, are subject to higher rebalancing costs. Furthermore, transaction costs usually prevent private investors from attaining the same level of diversification as a mutual fund. Our results show that the level of fee an informed investor is prepared to pay for a mutual fund's services varies heavily with his wealth level, his risk aversion, the correlations between assets, transaction costs, and length of investment horizon. The lower the investor's wealth level, the greater the transaction costs, the higher his risk aversion and the shorter his investment horizon, the higher the fee the investor is willing to pay a mutual fund. Specifically, our results suggest that the fees of many actively managed equity mutual funds are at levels that make direct stock investments more appealing to a wide range of individual investors. The relatively low fee levels of passively managed equity mutual funds and exchange traded funds on the other hand, makes these investment vehicles appealing to a wide range of investors.

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Description	Parameter	Value
Number of assets in mutual fund	N	30
Risk aversion	γ	5
Expected return on each asset	μ	8.39%
Standard deviation of return on each asset	σ	29.02%
Pairwise correlation on return from any 2 assets	ρ	0.2503
Fixed transaction cost	τ_f	8
Initial wealth	W_0	35,000

Table 1: **Parameter values:** This table reports our choice of base-case parameter values.

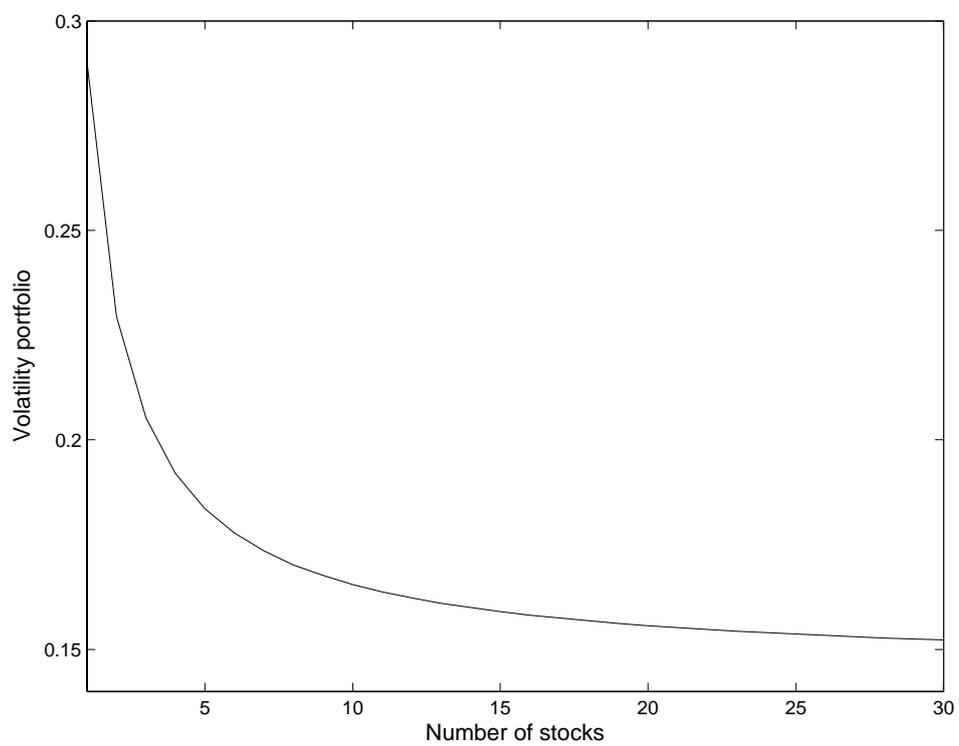


Figure 1: **Portfolio volatility:** This figure depicts the relationship between a portfolio's volatility and the number of stocks it contains.

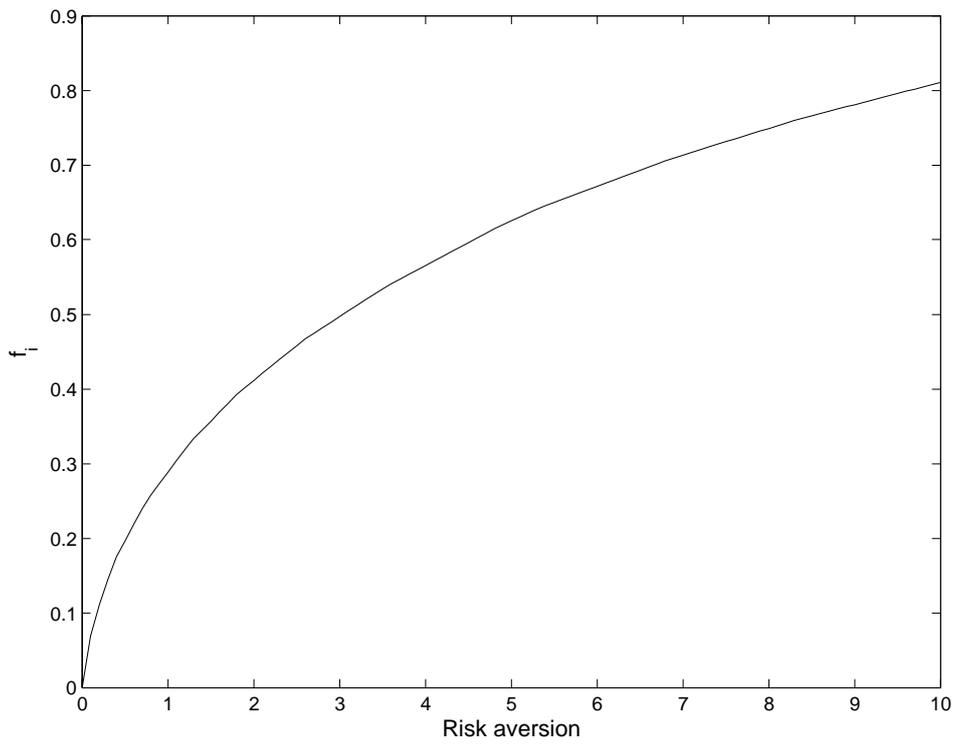


Figure 2: **Impact of risk aversion:** This figure depicts the relationship between the investor's risk aversion and the mutual fund management fee f_i in percentage points that makes the investor indifferent between a direct stock investment and holding the mutual fund.

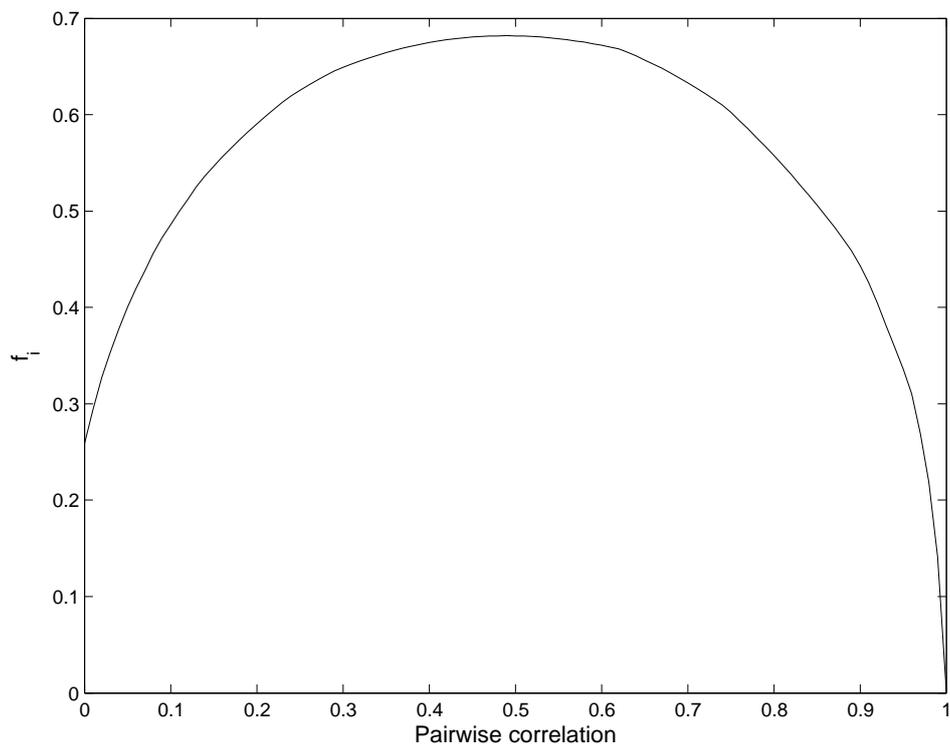


Figure 3: **Impact of correlation:** This figure depicts the relationship between the pairwise correlation between the assets and the mutual fund management fee f_i in percentage points that makes the investor indifferent between a direct stock investment and holding the mutual fund.

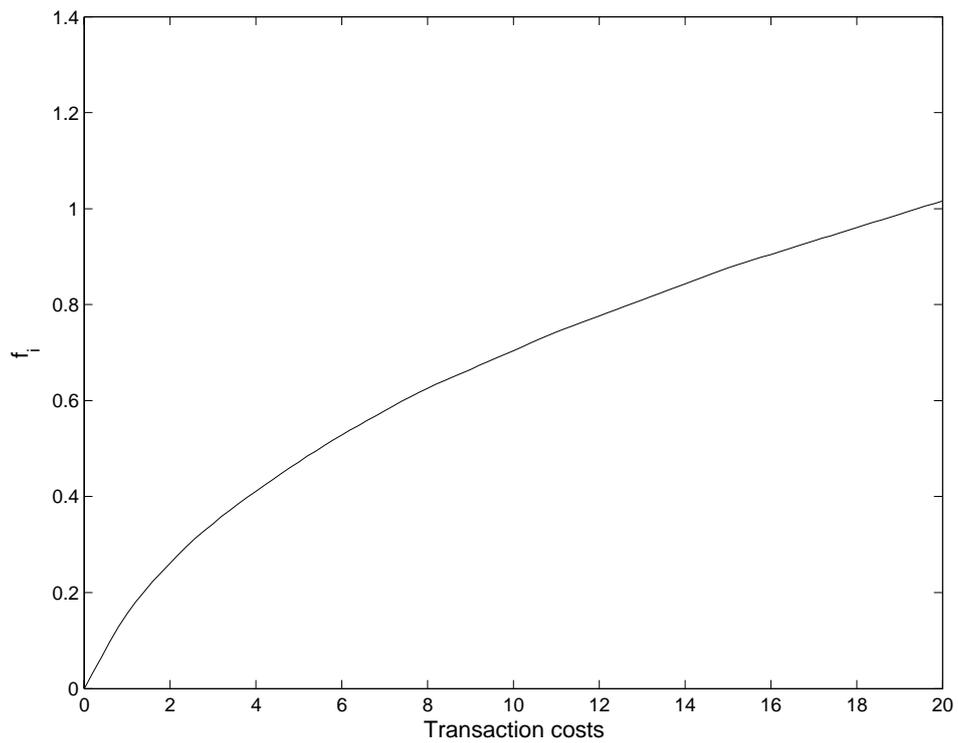


Figure 4: **Impact of transaction costs:** This figure depicts the relationship between the level of fixed transaction cost τ_f the investor has to pay each time he trades an asset and the mutual fund's management fee f_i in percentage points that makes the investor indifferent between a direct stock investment and holding the mutual fund.

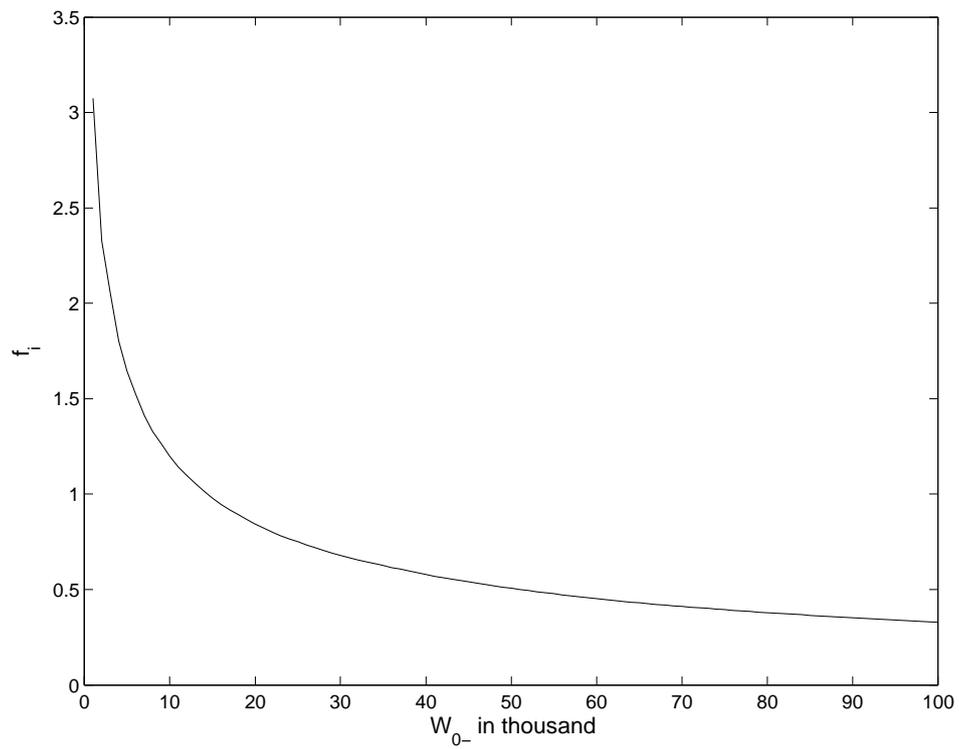


Figure 5: **Impact of wealth level:** This figure depicts the relationship between the investor's initial wealth level W_{0-} and the mutual fund's management fee f_i for a mutual fund in percentage points that makes the investor indifferent between a direct stock investment and holding the mutual fund.

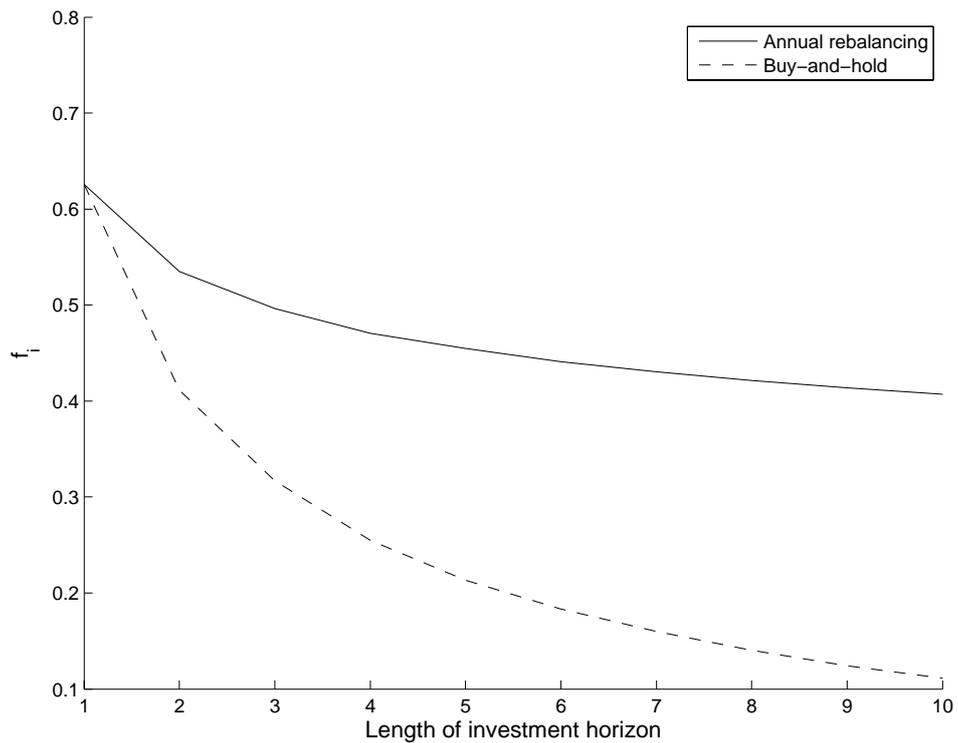


Figure 6: **Impact of investment horizon:** This figure depicts the relationship between the length of the investor's investment horizon T and the mutual fund's management fee f_i in percentage points that makes the investor indifferent between a direct stock investment and holding the mutual fund. The dashed line shows results for an investor who follows a buy-and-hold investment strategy for a direct stock investment, the solid one for an investor pursuing a portfolio strategy of rebalancing the portfolio annually.