Understanding International Portfolio Diversification and Turnover Rates

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ABSTRACT

This paper argues that international trading costs of a fixed type can help explain home bias in international equities markets. Two stylized facts have been widely noted: while the holdings of foreign equities are low, trading volume in foreign equities is high. The second fact has been broadly interpreted to indicate that international trading costs are not an explanation for the home bias. While this argument may rule out trading costs of a proportional type, this paper finds that fixed costs of international trading may nonetheless be at work. The paper first documents that the puzzling pair of stylized facts are valid in recent data. It then uses a simple portfolio allocation model to study the effects on investor decisions of several configurations of per unit and fixed trading costs. One configuration, with per unit costs heterogeneous among agents and a homogeneous fixed cost of entering the foreign market, is found to generate the pair of stylized facts among these agents.

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1. Introduction

Over the past couple of decades the international finance literature has been puzzled by two phenomena that seem inconsistent with traditional theoretical models of equity markets. The first phenomenon is that of "home bias:" despite the potentially significant gains from foreign diversification implied by standard international portfolio models,[1] investors hold a disproportionately small amount of foreign equity. (See French and Poterba, 1991, and Tesar and Werner, 1995.[2]) The second phenomenon is that of higher foreign turnover rates. Specifically, in spite of differences in transactions costs, fees, and exchange rates, the share of holdings bought or resold in a period of time is higher for assets held in a foreign market than for domestic assets.

One intuitively appealing explanation raised initially in the literature is that there are extra costs to purchasing an asset in a foreign market. But the literature has tended to dismiss this transactions-cost explanation, largely due to the second of the two facts. If buying foreign equities carried a higher cost than equities in one's own market, not only would one tend to accumulate a smaller stock of these foreign assets, but there likely would be a smaller flow of purchases. Surprisingly the opposite appears to be true in the data. As a result the literature quickly moved on to other types of explanations. Research within the open economy macroeconomics literature has focused on limitations in international goods trade which limit the ability to benefit from diversifying in the asset market.[3] Research within the finance literature has focused on the role of information asymmetry between countries. Ahearne, Griever, and Warnock (2004) discuss such information costs, and find empirically that proxies for them are quantitatively important in international asset allocations.[4]

However, while the stylized fact on trading volume may argue against trading costs of the usual proportional type as a sole explanation for home bias, it does not rule out the presence of

[1] This follows from the international version of the CAPM put worth by Sharpe (1964) and Linter (1965). In the macroeconomic literature, some studies offer reasons why the gains might be small (Cole and Obstfeld, 1991; Tesar, 1995); but van Wincoop (1994, 1999) finds large potential gains from international risk sharing.

[2] For a more recent analysis, see Amadi (2004a).

[3] See Tesar (1993) and Pesenti and van Wincoop (2002) for examples of nontraded goods arguments. See van Wincoop (1994) and Aizenman (1999) for preferences. See Obstfeld and Rogoff (2001) and Engel and Matsumoto (2004) for various types of goods market imperfections. Rowland and Tesar (2004) investigate the role of multinational firms as a substitute for portfolio diversification.

[4] While Ahearne, Griever, and Warnock (2004) find that trading costs are not important quantitatively, their conclusion applies to costs of a proportional type, while we argue here instead for the importance of costs of a fixed type.

costs of a fixed type, that is, costs that are not proportional to the volume of trading. Recent research in the field of international trade theory has found that fixed costs of entry can be very useful in understanding aspects of international trade in goods markets.[5] This paper studies theoretically if such fixed costs can be useful in understanding the puzzling aspects of international trade in equities markets, and what characteristics these costs would need to possess.

The fixed costs we model could be interpreted in a number of ways. In fact, since the costs of accessing information on a foreign firm is not likely proportional to the number of shares one purchases in that firm, the information costs emphasized in recent empirical finance literature may well be examples of the type of fixed costs we try to model here. Other examples are various types of establishment costs, like the need to deal with foreign languages and legal codes, since these too are of a fixed rather than proportional nature. Grinblatt and Keloharju (2001) find in a study of Finish and Swedish investors that they prefer firms with the same language and culture, even where this does not correspond directly to national borders. Amadi (2004a) also shows that common language, distance and immigrant populations may matter for foreign investment. All these factors, usually ignored in models of international portfolio choices, might be roughly represented by including a fixed cost of international asset trade.[6]

The model in this study finds that a particular combination of fixed costs and proportional costs is able to generate the combination of stylized facts observed in the data. In the context of a very simple portfolio allocation model, a heterogeneous per-unit trading cost and a homogenous fixed entry cost produce an environment where agents exhibit an equity home bias, but trade on foreign holdings has greater turnover. Specifically the model includes proportional trading costs that are not heterogeneous between foreign and domestic assets, which would contradict the empirical results mentioned earlier, but rather heterogeneous among agents within a country. Some agents have a cost advantage in executing financial trades, be it due to larger size, better technology, or expertise. The second component, that of a fixed foreign entry cost, represents the costs involved in entering a foreign market, such as language, legal, and institutions differences.

[5] See for example Bernard and Jensen (2004), and Helpman, Melitz, and Yeaple (2004).
[6] Methods for introducing fixed costs into general portfolio models have been demonstrated by Merton (1987) and others In international models, Black (1974) and Stulz (1981) consider costs of a different type, proportional to the size of holdings of foreign assets. This is different from a purely fixed cost, as considered here.

This combination implies that only efficient agents with low per unit costs find it profitable to enter the foreign market. Therefore high cost agents remain solely in the domestic market, thereby resulting in a home bias. In addition, low per unit costs mean that the low cost agents tend to adjust their portfolio more often, resulting in a higher trading volume wherever they are located. And since these agents are the only agents trading in the foreign market, this results in a relatively higher turnover rate in foreign investments.

In work related to this paper, Warnock (2002) argues on the basis of survey data that the gap between foreign and domestic turnover is much smaller than that found in Tesar and Werner (1995), which brought the stylized fact to light. Our empirical work leads us to agree with this conclusion that the magnitude of the gap is smaller; nonetheless, the puzzle remains, in that the turnover in foreign equities consistently exceeds that in the domestic markets. In other related work, Rowland (1999) proposes an explanation for the puzzle, suggesting that the volume of trade between home and foreign equities is high when agents are in the initial stages of diversifying their portfolios. Since the stock of foreign equities is small at this point, the ratio of foreign trades to holdings is large. While this may be part of what explains the puzzle, our study of the data in the empirical section to follow suggests that this most likely is not the dominant explanation.

The next section examines recently improved international data on turnover to show that the basic stylized facts still are broadly relevant. Section 3 presents the portfolio allocation model, and section 4 shows how it can generate results similar to the stylized facts. Section 5 explores the model's sensitivity to alternative parameter values, while Section 6 compares the model to alternative configurations of the trading costs. The final section summarizes results and draws implications for other related questions regarding international equity markets.

2. What Recent Data Have to Say

In Tables 1 and 2 we verify that the puzzling stylized facts motivating our model are generally valid in current data. While the main focus is on turnover rates, we document first that there still is substantial home bias in equity holdings, as shown in Amadi (2004b). The first column of Table 1 reports the share of country portfolios in foreign equities by country and by date. The data on foreign equity positions are obtained from the International Monetary Fund's

IFS database, compiled using both survey and capital flow data. Likewise, the first column of Table 2 reports the same variable but using equity holdings data from the IMF's coordinated portfolio investment survey, which uses purely survey data (see the data appendix for a more detailed discussion of the data sources). While one notes an interesting upward trend in the degree of diversification, it remains quite small for most countries, and certainly it is smaller than the share implied by simple optimal portfolio models. The trend of rising globalization in equity markets has also been noted in Amadi (2004b), Heathcote and Perri (2003), and Lane and Milesi-Ferretti (2003).

The empirical literature defines the foreign turnover rate as the total foreign transactions that occur within a given year divided by the foreign asset position at the end of the year. The domestic turnover rate is defined as the total domestic market transactions in a year divided by the year-end domestic market's capitalization.[7] Tesar and Werner (1995) drew attention to the gap between home and foreign turnover rates for their data from 1989, finding a foreign turnover of 7.7 for Canada compared to a domestic turnover of only 0.61, and finding foreign turnover of 2.5 for the U.S. compared to 1.07 for domestic.

Table 1 shows updated turnover rates for Canada, Germany, Japan, and the United States for the last decade. The foreign turnover rates appear to be generally lower than those reported by Tesar and Werner, but nonetheless, they are almost uniformly higher than the corresponding domestic turnover rate. The only possible exception is for some recent years in the U.S., depending on whether Nasdaq values are included along with NYSE. Nasdaq reports notably higher turnover, though this may largely reflect a different convention for reporting turnover in this market.[8]

Warnock (2002) has correctly criticized Tesar and Werner's estimates for using data on foreign stock holdings that rely upon cumulated capital flows and estimated valuation adjustments. He finds that this leads to an underestimation of the holdings used in the denominator of the foreign turnover ratio, so the ratio itself is overestimated. To correct for this

[7] The theoretical literature generally takes the values for the denominator from the midpoint of the year, rather than the end of the year. It is mainly due to the fact that asset position data are sometimes unavailable on a consistent annual basis that the empirical literature uses end of year values. The two definitions seem to produce similar results.

[8] Standard and Poor's 2003 Global Stock Markets Factbook notes that Nasdaq values include both sides of transactions when reporting 'value traded,' used in computing turnover (page 29).

problem, he recommends using survey data. Such data have been available for the United States since 1989, and he constructs an estimate for Canada to use in comparisons with Tesar and Werner.

Following Warnock, Table 2 computes turnover rates[9] using data from the IMF's Coordinated Portfolio Investment Survey, which relies on survey data. The results are essentially the same as those in Warnock for 1997 (the year of survey data available to him).[10] We also report values for subsequent years of the surveys, which at times vary from the 1997 values substantially. Although the surveys are available for only a few years, we can compare the common entries for Tables 1 and 2. For the U.S. and Japan, the turnover rates are unaffected, for Canada the adjusted ratios are indeed lower, but for Germany the adjusted ratio is higher. Overall, the ratios are very close to those reported in the larger data set of Table 1. Most importantly, the foreign turnover rates remain higher than their domestic counterparts in almost every case.

We conclude that the foreign turnover rates are generally lower than those reported in the initial empirical literature, but the puzzling stylized fact remains, in that there is a consistently positive gap between turnover rates in foreign compared to domestic equity holdings. This would seem to support the common wisdom that transaction costs cannot be important here as an explanation for home bias. After all, if buying foreign equities carried a higher cost than equities in one's own market, not only would one tend to accumulate a smaller stock of these foreign assets, but there likely would be a smaller flow of purchases. Clearly, this is not the case in the data.

Before turning to the theoretical model, it is worth noting that the turnover in foreign equities is greater than 100% of the stock of foreign equity holdings in almost all cases. Given that the growth in the stock of foreign holdings in Table 1 evolves fairly slowly in some countries, it would seem that the turnover cannot solely be in the form of net sales of home for foreign equities, as implied by the theoretical model of Rowland (1999). Either domestic participants in the foreign market are selling foreign equities back and forth to each other or, more likely, domestic participants in the foreign market are also tending to adjust their portfolio

[9] Here the empirical definition for turnover rates are used since this survey data is not available on an annual basis.

[10] The U.S. domestic turnover rate that we reported is a composite of the NYSE and Nasdaq. Warnock (2002) presents the NYSE and Nasdaq rates separately.

of foreign assets, trading one foreign asset for another. That is, we are seeing turnover within the foreign market as well as between home and foreign assets. This observation helps motivate the model below, which allows turnover within the foreign market between distinct foreign assets.

3. A Simple Fixed Cost Portfolio Allocation Model

This study uses a Markowitz (1952) mean-variance model augmented with transactions costs, similar to that presented in Wang (2002)[11]. This class of models characterizes the optimal portfolio choice of individual investors, given asset returns that follow an exogenous stochastic process.[12] The objective here is to demonstrate that, contrary to the common perception, trading costs of a particular type can induce higher turnover in foreign markets among these agents, at the same time as inducing home bias in their equity holdings. Specifically the agent's utility function is expressed as:

$$U(c) = E(c) - \frac{l}{2} Var(c) \tag{1}$$

where:

$$E(c) = W\left(\sum_{i=1}^{4} R_i x_i + R_0 x_0 - t_k \sum_{i=1}^{4} \left| x_i - x_{i,t-1} \right|\right) - F \cdot z \tag{2}$$

$$Var(c) = W^2 \left(\sum_{i=1}^{4} \sum_{j=1}^{4} x_i x_j s_{ij}\right) \tag{3}$$

Here, W represents the agent's wealth, and c represents the agent's consumption, which is based on his or her asset holdings and other parameters. R_i represents the risky asset *i's* expected return and *?* represents a coefficient describing risk aversion. In the model there are four risky assets (i=1,2,3,4), the first two are in the local market, while the latter two are in the foreign market[13].

[11] Cooper and Kaplanis (1986) also present a portfolio model with trading costs, though of a different type than ours, which they use to estimate the size of such costs.

[12] The model examines the behavior of a group of agents who share similar beliefs; in actuality the trade between agents in equilibrium presumably arises from heterogeneity in beliefs regarding expected returns. Thus this model does not attempt to provide a full equilibrium explanation for turnover in an entire market. However, the model's main mechanism applied here to a set of agents, can in principle be incorporated into an aggregate analysis of the entire market. But given the difficulty of the theoretical literature in providing a satisfactory general equilibrium explanation for the source of turnover, especially if we need to model heterogeneous expectations, we concluded that the clearest and most appropriate way to demonstrate our point was to avoid this problem by using a simple standard portfolio allocation approach.

[13] As stated previously, although other studies typically use just one risky domestic and foreign asset to examine home bias and turnover, a four asset model seems more appropriate. Under a two risky asset

Here x_i represents the share of the agent's wealth devoted to asset i in the current period, while $x_{i,t-1}$ represents last period's share of wealth devoted to asset i. Similarly x_0 and R_o represent the share of wealth invested in the riskless asset and its return.

The two discerning features of this model are the proportional transactions cost t and the fixed foreign entry cost F. Specifically t_k is the constant transaction cost associated with a per-unit change in the share of asset i. That is, it is associated with both the purchase and the sale of asset i[14]. In this model, different agents incur inherently different trading costs. F represents the fixed cost associated with entering the foreign market, and therefore z is a dummy variable, equal to unity if $x_3 > 0$ or $x_4 > 0$.

The agent maximizes his or her utility based on the following constraints:

$$\sum_{i=1}^{4} x_i = 1 \quad and \quad x_i \geq 0 \tag{4}$$

That is, the sum of the asset shares need to equal the agent's wealth, and short sales are not permitted.

The motivation for using a common fixed foreign entry cost is frequently addressed in the theoretical and empirical literature. When agents invest in foreign markets, they typically wish to have as much information about that market as they do about their own domestic market. Such barriers as language, institutional, and legal differences might prevent this. As noted earlier, Amadi (2004a) and Grinblatt and Keloharju (2001) have shown that investors typically invest in markets that possess the same language, culture, or some other form of familiarity. One way of modeling this familiarity barrier is through a fixed cost. That is, one can assume that there is a fixed cost of operating in a foreign market, which represents the cost involved in acquiring equivalent information about that market. Also Ahearne, Griever, and Warnock (2004), as well as Martin and Rey (2000), find that cross-listing significantly increases foreign diversification, which could be thought of as overcoming this fixed cost. Once again this concept is not entirely new to the theoretical literature. Portfolio allocation models like Merton (1987), involve

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model, asset trading only involves trading between the domestic and foreign market assets, whereas a four risky asset model captures the effect of trading both between domestic and foreign market and within the foreign market itself.

[14]This is consistent with equity investment and other models, as agents are typically charged for both the purchase and the sale of an asset. The subscript k refers to the type of agent.

investors that pay "setup" or "receiver" costs in order to acquire detailed information regarding a firm's earnings or signals, although the models are applied in a domestic context.

The motivation for having different transactions costs is quite intuitive. Typically institutional investors and large brokerage houses face lower transactions costs than do average individual investors. These larger entries trade in significantly higher volumes, have access to less costly trading mechanisms, and typically have trade agreements that make their transactions relatively inexpensive. For example, many mutual fund companies charge reduced fees or no fees to investors who purchase a certain level of shares, typically in the millions. Again, in general, some agents have a cost advantage in executing financial trades, be it due better technology or expertise. It is reasonable, therefore, to assume that different agents face different per-unit transactions costs.

One can also calculate asset turnover rates from the model presented. The domestic and the foreign turnover rates for the agents, respectively, are measured as:

$$TO_D = \frac{\sum_{i=1}^{2} \left| x_i - x_{i,t-1} \right|}{\frac{1}{2} \sum_{i=1}^{2} (x_i + x_{i,t-1})} \tag{5}$$

$$TO_F = \frac{\sum_{i=3}^{4} \left| x_i - x_{i,t-1} \right|}{\frac{1}{2} \sum_{i=3}^{4} (x_i + x_{i,t-1})} \tag{6}$$

Here the numerator represents the total changes in the asset shares, while the denominator represents the average position in the assets between the beginning and the end of the period. The turnover definitions used here are similar to those used in the theoretical literature discussed earlier.

It is difficult to draw analytical results from the first order conditions of the maximization problem above, so we will rely upon simulations and comparative static analysis in the next section to demonstrate the model characteristics. Nonetheless the fundamental properties of the model are highly intuitive and are discussed here briefly. First, as t (proportional transaction cost) increases, the amount of transactions decreases. Second, as F (fixed foreign entry cost) increases, entry into the foreign market decreases. These results are obvious. Another implication

is that as *t* decreases more agents will enter the foreign market. This is because agents with lower proportional costs gain more by entering the foreign market than agents with higher proportional costs, so they will be more likely to pay the fixed cost to enter the foreign market. Furthermore, agents with lower proportional trading costs naturally trade more actively and have higher turnover rates. Since we concluded that it is these agents that tend to be present in the foreign market, we should expect to find that foreign holdings have a higher turnover rate than domestic holdings, which are averaged over agents with both high and low trading costs.

In order to better grasp these implications, several simplifying assumptions are made, and a comparative static analysis is presented. First it is assumed that agents have identical wealths normalized to unity. Second, with reference to the transactions costs, we only examine two types of agents, that of a "low cost" and a "high cost" agent. Furthermore these two types of agents carry the same weight and therefore are distributed evenly. However this could be extended to a model with a continuum of different types of agents with different weights. Finally it is also assumed that all risky assets have the same market weight. Therefore a fully diversified portfolio is one that would contain 50% foreign risky assets as a share of all risky assets. These simplifying assumptions help make the general implications of the model clearer.

As stated earlier, this model is applied for two periods in a comparative static exercise in order to distinguish between the home bias and the turnover rate implications. In this analysis, returns are realized at the end of each period. In the first period agents enter the asset market and optimize their portfolio based on the market's characteristics and their own. One can imagine a case in which agents inherit wealth and would like to invest that wealth in the stock market, or a case in which agents would like to transfer money from their savings account into their investment account, and so this seems the most natural initial point for a model[15]. This period examines the extent to which agents diversify internationally. In the second period, the comparative static experiment considers the arrival of new information that shifts the expected returns of the assets. These agents thereby adjust their portfolios accordingly.[16] This period examines the model's implications with respect to the domestic and foreign turnover rates.

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[15] $x_{i,t-1} = 0$ in the first period.

[16] While the experiment perhaps could be extended to a fully dynamic stochastic setting, the underlying logic we wish to highlight is more transparently demonstrated in the comparative static experiment we detail shortly. Further, a comparative static approach fits more naturally with the mean-variance model at

In the course of research, we explored several versions of this model with various combinations of costs, before we found that this particular combination is best suited for generating results similar to that of the stylized facts. In a later section we report alternative configurations of the costs, and discuss why they are less successful.

4. Deriving Benchmark Results

To explore the implications of the model, a numerical example is needed. Again a simple comparative static exercise is most effective in revealing the basic logic at work. For simplicity let us assume that all risky asset returns are equal to 1.15, the riskless asset return is equal to 1.05, variances are equal to 0.2, and correlation coefficients are equal to 0.25. These numbers are within a reasonable range of actual parameter values for the past decade[17], and in the sensitivity analysis section a wider range of numbers are presented for comparison. Also the parameter describing risk aversion is set equal to 2, which is common in the literature. As stated previously, the model only looks at two types of agents for simplicity; a low cost and a high cost agent. Here let us assume the low cost agent incurs a per-unit trading cost of 0.01, while the high cost agent incurs a per-unit trading cost of 0.03. These also represent reasonable values that are consistent with those used in other studies[18].

Consider the first period problem: agents will enter the foreign market only if the extra utility they receive from the foreign market investment is greater than the fixed cost of entry, so in order to assess their decision, one needs to compare the maximum possible utility each type of agent receives if they chose to enter the foreign market versus if they chose to remain solely in the domestic market.

We solve the optimization problem for the high cost agent conditional on the two possible choices for international investment.[19] First, if the agent chooses to invest only in the domestic market, optimal asset allocations are x_i=0.14 for the domestic risky assets i=1,2, and x_0

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the heart of the analysis. Inducing portfolio reallocation requires a shift in the distribution of returns, not just a stochastic shock to a random variable following an invariant distribution, which is the standard approach for a stochastic experiment.

[17] Specifically the values were chosen based on the annualized returns, rolled over monthly, from 1994-2004 of Citigroup, Ford, Deutsch Bank, and Volkswagen. These large cap stocks make an appropriate representation of two domestic and foreign assets.

[18] Rowland (1999) uses similar values to differentiate between the costs associated with trading in the domestic and foreign markets.

[19] All computations performed in this study were done using Mathematica's Multiplier Method Algorithm.

=0.72 for the riskless asset, with resulting utility level U=1.0598. Alternatively if the agent enters the foreign market, optimal asset allocations are x_i=0.10 for the two domestic and the two foreign assets (i=1,2,3,4) and x_0=0.60 for the riskless asset, with resulting utility U=1.0640. Therefore if the foreign fixed cost of entry is less than 0.004, the high cost agent will optimally choose to enter the foreign market.

Solving similarly for the low cost agent, the solution for domestic investment is only x_i=0.18 for both domestic assets 1 and 2, with utility U=1.0662. Entering the foreign market, the solution is x_i=0.13 for all four assets, with utility U=1.0731, and so if the foreign fixed cost of entry is less than 0.007, the low cost agent will enter the foreign market.

Let us assume that the fixed cost of entry equals 0.005, so that only low cost agents invest in the foreign market[20]. At the end of the initial period, when the returns are realized, the agents end up with the allocations reported in the first section of table 3, labeled as model 1 and period 1. Recall that both types of agents are given the same market weight. This implies an overall average foreign diversification of 32%, since the low cost agent is fully diversified, while the high cost agent remains solely in the domestic market and holds more of the riskless asset. Together these agents produce a degree of diversification close to the empirical values we reported for some countries. These values can also be adjusted downward, if desired, by assigning weights to the two groups of agents.

In the second period, suppose that new information arrives that leads these agents to revise expected returns upward for one asset in each country and downward for the other asset in each country. In particular, suppose that the returns on assets 1 and 3 increase to 1.2, while the returns of assets 2 and 4 decrease to 1.1. This symmetric experiment is intended to represent the type of information received that might affect agents' expectations. Solving the optimization problem for this period, the portfolios are reallocated toward the higher-paying assets, and the values are reported in Table 3, as model 1 and period 2. The agent that is able to execute trades at a lower cost naturally reallocates his portfolio more actively, both in the domestic and foreign

[20] Although this difference in the utility gains between the two agents might seem small, if this example is extended into a more realistic multiple periods, this difference would become relatively more significant. Again, for simplicity, the utility gain is examined over one period.

markets. These reallocations allow us to compute a turnover rate for these agents with respect to the domestic and foreign markets.[21]

$$TO_D = \frac{|0.267 - 0.147| + |0.133 - 0.147| + |0.276 - 0.134| + |0.010 - 0.134|}{0.5((0.267 + 0.147) + (0.133 + 0.147) + (0.276 - 0.134) + (0.010 + 0.134))} = 0.642$$

$$TO_F = \frac{|0.276 - 0.134| + |0.010 - 0.134|}{0.5((0.276 + 0.134) + (0.010 + 0.134))} = 0.964$$

As one can see, the turnover rate is indeed higher for the foreign investments. This example demonstrates, therefore, that the model can produce results similar to the two stylized facts that have been observed in the existing literature. First, fixed costs pose a hurdle for participating in the foreign market, and this hurdle will be prohibitive to those investors who also face high proportional trading costs in general, but it will not be prohibitive to agents with low proportional trading costs. So one implication is the desired result of 'home-bias.' But the second implication becomes obvious when we combine this with the fact that these low-cost traders have higher turnover in response to new information. Given that the foreign assets are held by these agents, average turnover for foreign assets will be relatively high. Turnover for domestic assets, however, is averaged over the high cost traders as well, and hence will be relatively low. Although this model is a highly simple example and cannot hope to explain all of the dynamics involved in portfolio allocation, it can provide a revealing and useful framework to help understand the key stylized facts.

5. Checking Sensitivity to Parameter Assumptions

Given that we rely upon a calibrated simulation to demonstrate the model's results, it is useful to check robustness to alternative reasonable values of the calibrated parameters. We begin by checking the utility gain from participating in the foreign market. Recall that agents will participate in the foreign market if the utility gain exceeds some fixed cost. We wish to verify that we can always posit some reasonable fixed cost, such that those agents with high proportional costs will not diversify internationally, while agents with low proportional costs will diversify; we then know we can always generate a fractional degree of diversification.

[21] Note that we here follow the convention in the theoretical literature of using the midpoint of the asset holdings in the denominator of the turnover rate.

First, we consider varying the size of proportional costs themselves. Figure 1 shows that raising this trading cost progressively from 0 to 0.05 uniformly lowers the utility gain from investing in the foreign market. This indicates that regardless of the absolute size of these costs, agents with higher costs compared to others with lower costs are less willing to enter the foreign market, so some fixed cost indeed will generate partial entry and home bias.

Figure 2 examines the effect of altering the variances of the risky assets from 0.1 to 0.4. As the variances increase, the utility gain of both agent types increases at first and then remains fairly constant.[22] This is perhaps because as the variance increases, risk adverse agents would find it progressively more beneficial to diversify their risk by investing in the foreign market. However, once the variance exceeds a certain point, the riskless asset becomes a progressively more attractive alternative, thereby decreasing the benefits of international diversification. Note that despite these fluctuations in the gain from diversifying, the gain remains uniformly higher for low cost agents. This again indicates that some fixed cost could be specified between these two gains to generate an intermediate degree of home bias.

The next figure looks at how changing the risky assets' return from 1.1 to 1.2 affects the utility gain. Here, as the return increases, the gain in utility from investing in the foreign market for both agents increases. This result is fairly intuitive, for as the asset returns increase it becomes more beneficial to invest, both domestically and abroad. This would rightly suggest that as the risky asset returns increase, more agents will be inclined to enter the foreign market.

The following figure varies the coefficient of correlation from 0 to 0.5. As the correlation coefficient increases, the gain in utility from investing in the foreign market for both agents decreases. This result is consistent with general financial theory. As the correlation coefficient increases, the benefits of diversification decreases, and hence the benefit of entering the foreign market decreases.

Figure 5 varies the riskless asset's return from 1.03 to 1.07. As the return on the riskless asset increases, the gains to international diversification decreases. This result follows the same reasoning as changing the risky asset returns; that is as the riskless asset return increases, the

[22] In the following figures the abbreviation "LC" represents low cost agents, while the abbreviation "HC" represents high cost agents.

gains of diversification both domestically and internationally decreases. This suggests that as the riskless asset's return increases, fewer agents will find it beneficial to enter the foreign market.

The next figure shows that as the risk aversion parameter increases from 1 to 3, the benefits of investing in the foreign market increase. This is due to the fact that as an agent's risk aversion increases, they derive more and more benefit from diversifying their risk, and hence are more likely to invest in the foreign market. Note that in each of the figures above, the utility gain from diversifying internationally is consistently higher for low-cost agents than for high-cost agents, confirming the consistency of the model for generating the home bias result.

The next six figures examine the model's ability to correctly generate differences in turnover rates with varying parameter values. In particular, it checks how parameter values affect turnover rates in the second period, with a special interest in whether foreign turnover is higher than domestic. The first such figure, Figure 7, looks at the transactions costs; it examines a situation where all agents start out with the same per-unit trading cost of 0.01, and then separate into two groups. One group, the low cost agents, maintains a trading cost of 0.01. The other group, the high cost agents, steadily increases its trading cost from 0.01 to 0.05. As predicted, as the trading costs of the two groups diverge, so do the turnover rates of domestic investments and foreign investments.

Figure 8 examines the effect of the variances on turnover rates. It seems that as the variance increases from 0.1 to 0.3, the two turnover rates fall together, as the agents hold a smaller portion of their portfolio in risky assets. However, what is more important, is that the model shows that even with a wider array of variances, the two turnover rates remain notably different, with foreign turnover remaining distinctly higher.

The following figure shows that as the coefficient of correlation rises, initially the turnover rates spread apart, only to stabilize at higher correlations. This is because, as seen in Figure 9, as the correlation coefficient become greater, fewer agents will find it beneficial to diversify. Eventually they will only invest in those assets with greater returns, thereby causing the investment behavior in the two markets to converge.

Figure 10 shows that increasing the riskless asset's return raises both turnover rates, but the difference in the rates tends to stay fairly constant. Figure 11 shows that the risk aversion parameter has only small effects on the turnover rates. Altogether, these results demonstrate that

even with a wide range of parameter values, the model consistently produces foreign turnover rates that are distinctly higher than that of the domestic rates. This robustness suggests that our mechanism for explaining high turnover should apply to a wide array of different countries.

6. Considering Alternative Cost Specifications

As noted previously, it was not immediately obvious what configuration of costs would work best for explaining the stylized facts, and a range of alternative versions of the model reported above were considered. Table 3 reports results for some of these alternative cases, and shows why the particular configuration of costs in section 3 is needed to generate the desired results.

The first alternative, and the simplest, is that of having proportional costs and fixed costs that are both homogenous across agents and markets. Here all agents are assumed to have a proportional trading cost equal to 0.01. Labeled as model 2, Table 3 shows that this case fails to replicate either stylized fact: there is no home bias, and domestic turnover equals foreign turnover. We conclude that the mere presence of fixed costs is not sufficient; some type of heterogeneity is needed.

The next alternative is to invert our benchmark case, with heterogeneity in fixed rather than proportional costs. All agents face a trading cost of 0.01, but different agents face different fixed costs of participating in the foreign market, such that only one group finds it beneficial to diversify internationally. Labeled model 3 in Table 3, we indeed see home bias in asset holdings, as well as a higher turnover abroad. While the gap in turnover rates is small compared to that in our benchmark case and to that in much of the data, it is surprising that foreign turnover exceeds that of domestic at all in this case. Recall that the reason the benchmark case achieves higher foreign turnover is that the home agents in the foreign market by construction have lower trading costs – it was these lower proportional costs that lead them to enter the foreign market. But proportional trading costs are uniform for all agents in this alternative case, so what induces the agents in the foreign market to trade more aggressively in this experiment?

The reasoning for this case is a bit subtle. Recall that the experiment here is a symmetric rise in the expected returns of asset 1 in the home market and asset 3 in the foreign market. These agents would like to maximize the overall expected return of the portfolio by reallocating away

from asset 2 and towards asset 1 in the home market, and away from asset 4 and towards asset 3 in the foreign market (for the agents who have invested in the foreign market). The cost of this less balanced portfolio, of course, is a rise in the overall risk (variance) of the portfolio. This tradeoff limits the degree of reallocation by investors, but the tradeoff is less severe for the agent with a portfolio diversified internationally. This is because the extra dimension of diversification gives the internationally diversified agent a lower overall risk (variance), which in turn gives the agent a greater flexibility in having a more unbalanced portfolio within each national market. Therefore the international agent responds more to the shift in expected returns, resulting in a higher turnover. While interesting, we do not emphasize this configuration of costs as the most likely explanation for the turnover puzzle for several reasons. First, the magnitude of the turnover gap is small. Second, the result is not robust to alternative experiments with different shocks, as will be demonstrated shortly.

The last configuration of costs to consider posits no fixed cost at all, but just heterogeneous proportional trading costs among assets. In particular, suppose a trading cost of 0.01 for the domestic assets and a trading cost of 0.03 for the foreign. This case is considered, mainly because it formalizes the simple type of explanation considered and discarded in earlier research on home bias, such as Tesar and Werner (1995). Confirming earlier conjectures, model 4 of the table shows that such a configuration of costs can generate home bias, but it cannot replicate the turnover puzzle.

Some recent research on the issue of turnover has focused on a different type of experiment. Rather than a shift in expected returns of one home asset relative to another, it has considered a shift in expected returns of the foreign market relative to the home market.[23] Table 4 repeats the cost-configuration cases in Table 3 for this new type of experiment. The rise in foreign returns in this experiment naturally leads to a significant rise in foreign diversification in the second period of each case as agents shift toward foreign assets.

First is the benchmark case. Table 4 shows that this case continues to reproduce the stylized fact that foreign turnover is higher than domestic turnover. Thus the benchmark theory is robust to the alternative experiment. Model 2 continues to fail to replicate the stylized facts, as

[23] In particular, Rowland (1999) naturally considers a shock of this type, as his model limits the number of risky assets to one representative asset in each country.

was found for the previous experiment. More informative is the fact that model 3 also fails here. Although foreign turnover was higher than domestic for this case in Table 3, it is reversed here. We conclude that a heterogeneous fixed cost is not a very robust explanation for the puzzle here.

Finally, model 4 again considers the case of higher proportional trading costs in the foreign market. This configuration is similar to that used in the theoretical model of Rowland (1999), and further, the experiment here of an asymmetric shock between regions is roughly patterned after his. Table 4 shows that this configuration still does not work to generate foreign turnover higher than domestic. Why is the result different from Rowland? He argues that his explanation works best for the initial stages of diversification, where the turnover ratio is high because the stock of foreign holdings in the denominator is small. Due to the nature of our experiment with four assets, the initial degree of home bias is greater than one quarter, which already may be too high for Rowland's explanation to be operative.

We think there is reason to prefer our mechanism as a general explanation. First, our data analysis in Table 2 shows a wide range in the degree of home bias among our sample countries, especially in the most recent years. But even for those cases with fairly high degrees of diversification, the foreign turnover rates in these countries still continue to exceed domestic turnover rates. Our theory is applicable to this recent data, as it can explain high turnover for a wide range in the degree of home bias.

There are other reasons one might prefer our explanation to that raised by Rowland. In his model, once the cost adjusted Sharpe ratio[24] of the foreign market exceeds that of the domestic market, as in this case, home bias disappears and the domestic turnover rate becomes greater than the foreign rate. In his analysis, Rowland examines the US market in the 1980s, where this did not occur[25]. However if we examine the Japanese market in the 1990s, the cost-adjusted Sharpe ratio of the world market likely exceeded that of the Japanese market. However, as Tables 1 and 2 indicate, Japan still exhibits a substantial equity home bias, while maintaining higher foreign turnover rates. Therefore his model could not justify this phenomenon, whereas our model can potentially still produce the necessary results, as shown in the table. This is combined with the fact cited earlier that econometric evidence argues against a significant relationship between

[24] The mean market return, adjusted for its transactions cost, divided by its standard deviation.
[25] In his highest cost difference example, adjusting for the costs produces the necessary results.

higher per unit costs of foreign transactions and home bias. Altogether, the evidence gathered here seems to be pointing toward the presence of costs of a fixed type, an explanation which has not received adequate attention in the theoretical literature on this issue.

7. Concluding Argument and Extensions

The international economics literature continues to be puzzled by home bias in equity holdings, especially since turnover rates tend to be higher among foreign compared to domestic holdings. In contrast to the usual presumption in the literature, this study points to trading costs of a particular type in the asset market as a useful approach. It demonstrates this point in a portfolio choice model with heterogeneous per-unit transactions costs and a homogenous fixed foreign entry costs. First, using current data, it shows that the foreign turnover rates are still notably higher than the domestic rate. Second, through its model, this paper demonstrates that having agents that face inherently different trading costs produces a world in which there exists a notable home bias and higher foreign turnover rates. The fixed cost of entry presented in the model also compliments empirical evidence in the finance literature showing that the cross-listing of equity and factors such as a common language increase foreign diversification. While the model used to demonstrate these points is simple, we think it points out a useful direction for future research in international macro on this issue.

We conclude by noting that our model also has implications that could help us understand other developments in international equity markets. Recall from Tables 1 and 2 that there appears to be a trend over time of rising international diversification starting in the second half of the 1990s for many of the countries. Our model suggests two types of candidate explanations for this development. One explanation could be a fall in the fixed costs of participating in a foreign market, which our model clearly indicates would reduce home bias. Such a fixed cost might reflect development or harmonization of institutions across countries, increased access to information abroad, or perhaps most likely, the development of market institutions like mutual funds that allow average agents to participate in foreign markets without incurring large fixed costs on their own.

However, the model also raises a second candidate explanation, in the form of falling per unit costs of trading in either home or foreign markets. Given that either falling fixed or per unit

costs could explain the rising diversification in table 1, how could the two explanations be distinguished? Fortunately, they have distinct implications for turnover rates. While falling per unit costs would imply rising trading volume and turnover in both home and foreign markets, a fall in the fixed cost would tend to raise holdings without raising turnover, thus lowering the foreign turnover ratio. Unfortunately, there is no clear pattern that emerges from comparing different time periods in tables 1 and 2. Addressing this question will likely require more time to pass and observations to accumulate, and may provide fruitful ground for future research.

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Data Appendix

Foreign Equity Asset Holdings: One source is The International Monetary Fund's International Financial Statistics (IFS) database. This data is based on both survey and cumulated capital flows data. Valuations and estimation adjustments were made accordingly. The data for most nations runs 1993-2001. The second source is the International Monetary Fund's International Coordinated Portfolio Investment Survey. This survey was conducted in 1997, 2001, and 2002. It was performed after recommendations were put forth so that all participating countries provided accurate consistent data on asset holding. Since this data is based almost purely on survey, it provides for accurate comparison.

Foreign Transactions: Foreign transactions include data on the sales and purchases of foreign equity. For the United States, the data comes from the Treasury Department's United States Transactions with Foreigners in Long-Term Securities. The Canadian data comes from Statistics Canada's International Transactions in Securities and Foreign Stocks. The data for Japan comes from The 2003 Tokyo Stock Exchange Fact Book Gross Capital Flow Data on Japanese Investment in Foreign Securities. The German data comes from Balance of Payments Statistical Supplement to the Monthly Report 3, Financial Transactions with Non-Residents.

Domestic Transactions and Market Capitalization: The Standard and Poor's Global Stock Markets Factbook. For the U.S. we report data both including and excluding transactions in the NASDAQ stock exchange. This adjustment was made as the NASDAQ measurement for trading volume are different than other exchanges in that the S&P Factbook states that academic studies have shown that the NASDAQ computes "both sides of a trade."

Table 1 : Turnover Rates Based On IFS Data

Country	Year	Foreign Diversification	Domestic Turnover Rate		Foreign Turnover Rate
Canada	1993	11.46	0.44		2.10
	1994	13.71	0.51		2.15
	1995	13.45	0.50		2.43
	1996	12.33	0.55		2.07
	1997	11.64	0.52		3.08
	1998	13.57	0.61		2.52
	1999	12.06	0.44		3.36
	2000	13.29	0.75		3.79
	2001	16.01	0.66		3.28
Germany	1993	23.75	0.65		1.61
	1994	28.21	0.98		1.11
	1995	26.24	0.99		0.99
	1996	26.11	1.17		1.51
	1997	27.44	0.65		3.03
	1998	31.55	0.70		3.15
	1999	32.41	0.57		1.49
	2000	37.22	0.84		2.44
	2001	39.65	1.32		1.96
Japan	1995	4.17	0.34		0.72
	1996	5.29	0.41		0.98
	1997	7.58	0.56		1.33
	1998	8.72	0.38		1.12
	1999	7.14	0.41		1.11
	2000	9.14	0.85		1.50
	2001	10.81	0.81		1.22
United States	1993	10.25	0.65*		1.51
	1994	11.85	0.70		1.31
	1995	10.96	0.74		0.95
	1996	11.38	0.84	0.55#	0.96
	1997	10.44	0.90	0.60	1.29
	1998	10.79	0.98	0.66	1.26
	1999	11.89	1.12	0.66	1.15
	2000	11.97	2.11	1.00	1.97
	2001	11.30	2.10	0.92	1.82

The foreign turnover rate is equal to the sum of the domestic country's purchases and sales of foreign equity within the year divided by the domestic country's foreign asset equity position at the end of the year. The domestic turnover rate is equal to the total transactions in the domestic market within the year divided by the domestic market's capitalization at the end of the year. Foreign diversification is equal to the foreign equity assets held by the country divided by the sum of its stock market capitalization and foreign equity assets adjusted for its foreign equity liabilities. *includes the NASDAQ, while #excludes the NASDAQ. Data on foreign transactions are from individual country sources. Data on foreign equity positions are from the International Monetary Fund's IFS database. Data on domestic transactions and capitalization are from the Standard and Poor's Global Stock Market Factbook. See data appendix for more detail.

Table 2 : Turnover Rates Based On CPIS Data

Country	Year	Foreign Diversification	Domestic Turnover Rate		Foreign Turnover Rate
Canada	1997	17.60	0.52		2.22
	2001	25.21	0.75		2.12
	2002	30.51	0.71		3.82
Germany	2001	32.31	1.32		2.62
	2002	39.61	1.80		2.38
Japan	1997	7.44	0.56		1.33
	2001	10.58	0.81		1.22
	2002	10.41	0.74		1.32
United States	1997	9.99	0.90*	0.60#	1.29
	2001	10.88	2.10	0.92	1.82
	2002	11.37	2.30	2.01	1.95

The foreign turnover rate is equal to the sum of the domestic country's purchases and sales of foreign equity within the year divided by the domestic country's foreign asset equity position at the end of the year. The domestic turnover rate is equal to the total transactions in the domestic market within the year divided by the domestic market's capitalization at the end of the year. Foreign diversification is equal to the foreign equity assets held by the country divided by the sum of its stock market capitalization and foreign equity assets adjusted for its foreign equity liabilities. *includes the NASDAQ, while #excludes the NASDAQ. Data on foreign transactions are from individual country sources. Data on foreign equity positions are from the International Monetary Fund's Coordinated Portfolio Investment Survey. Data on domestic transactions and capitalization are from the Standard and Poor's Global Stock Market Factbook. See data appendix for more detail.

Table 3: Simulation Results for Symmetric Experiment

Model	Agent Type	per-iod	equity share x_1	x_2	x_3	x_4	Foreign Divers.	Domestic Turnover	Foreign Turnover
1. benchmark:	Domestic	1	0.147	0.147					
heterog.		2	0.267	0.133					
prop. cost	International	1	0.134	0.134	0.134	0.134			
		2	0.276	0.010	0.276	0.010			
	Combined	1					0.323		
		2					0.294	0.642	0.964
2. uniform	N/A	1	0.134	0.134	0.134	0.134	0.500		
costs:		2	0.276	0.010	0.276	0.010	0.500	0.964	0.964
3. heterog.	Domestic	1	0.190	0.190					
fixed costs		2	0.333	0.067					
	International	1	0.134	0.134	0.134	0.134			
		2	0.276	0.010	0.276	0.010			
	Combined	1					0.293		
		2					0.294	0.801	0.964
4. no fixed	N/A	1	0.155	0.155	0.083	0.083	0.349		
cost		2	0.276	0.010	0.210	0.076	0.500	0.896	0.589

In the first period R1=R2=R3=R4=1.15, R0=1.05, all variances=0.2, all covariances=0.05, and the risk aversion parameter equals 2. In the second period **R1=R3=1.2, R2=R4=1.1**, R0=1.05, all variances=0.2, all covariances=0.05, and the risk aversion parameter equals 2. The allocations reported in Period 1 are after returns are realized, whereas for Period 2, the allocations reported are before returns are realized, so that the difference in the two allocations is used to calculate the trading volume.

Table 4: Simulation Results for Alternative Experiment

Model	Agent Type	per-iod	asset share x_1	x_2	x_3	x_4	Foreign Divers.	Domestic Turnover	Foreign Turnover
1. benchmark:	Domestic	1	0.147	0.147					
heterog.		2	0.140	0.140					
prop. cost	International	1	0.134	0.134	0.134	0.134			
		2	0.009	0.009	0.291	0.291			
	Combined	1					0.323		
		2					0.661	0.610	0.742
2. uniform	N/A	1	0.134	0.134	0.134	0.134	0.500		
costs:		2	0.009	0.009	0.291	0.291	0.970	1.742	0.742
3. heterog.	Domestic	1	0.190	0.190					
fixed costs		2	0.120	0.120					
	International	1	0.134	0.134	0.134	0.134			
		2	0.009	0.009	0.291	0.291			
	Combined	1					0.293		
		2					0.594	0.858	0.742
4. no fixed	N/A	1	0.155	0.155	0.083	0.083	0.349		
cost		2	0.029	0.029	0.229	0.229	0.888	1.376	0.931

In the first period R1=R2=R3=R4=1.15, R0=1.05, all variances=0.2, all covariances=0.05, and the risk aversion parameter equals 2. In the second period **R1=R2=1.1, R3=R4=1.2**, R0=1.05, all variances=0.2, all covariances=0.05, and the risk aversion parameter equals 2. The allocations reported in Period 1 are after returns are realized, whereas for Period 2, the allocations reposted are before returns are realized, so that the difference in the two allocations is used to calculate the trading volume.

Figure 1

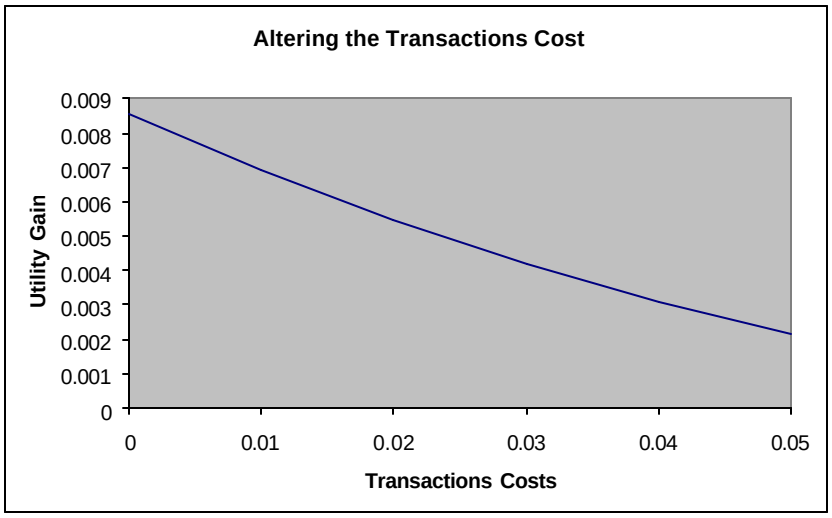


Figure 2

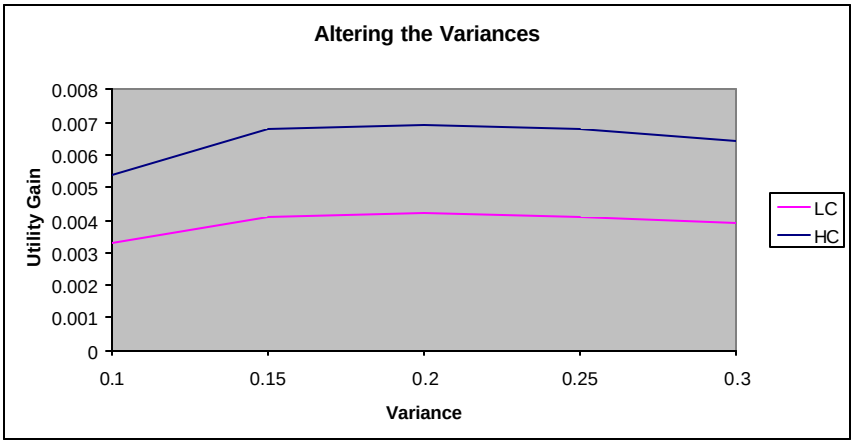
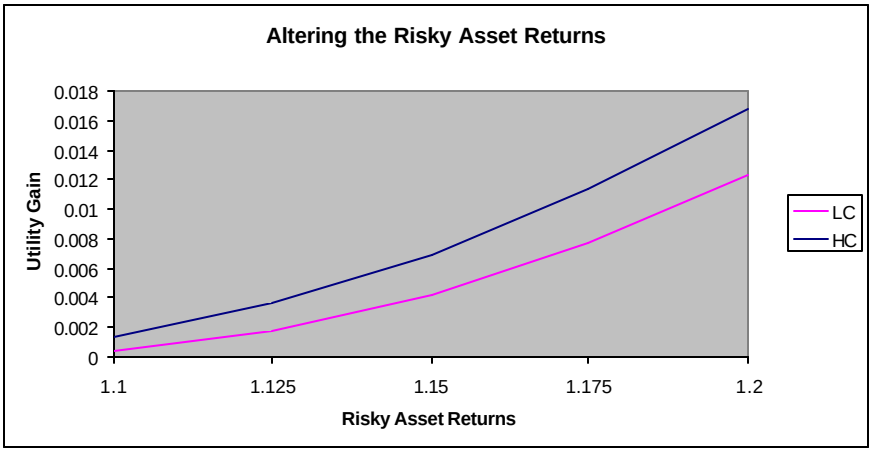


Figure 3



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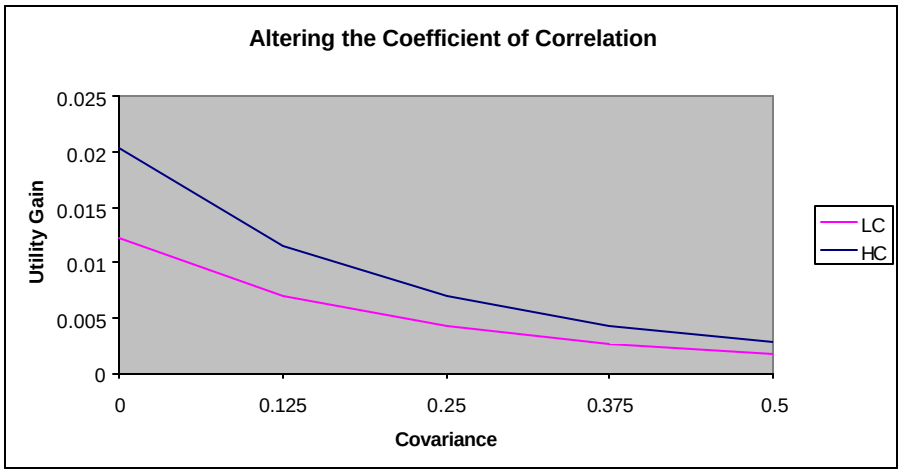

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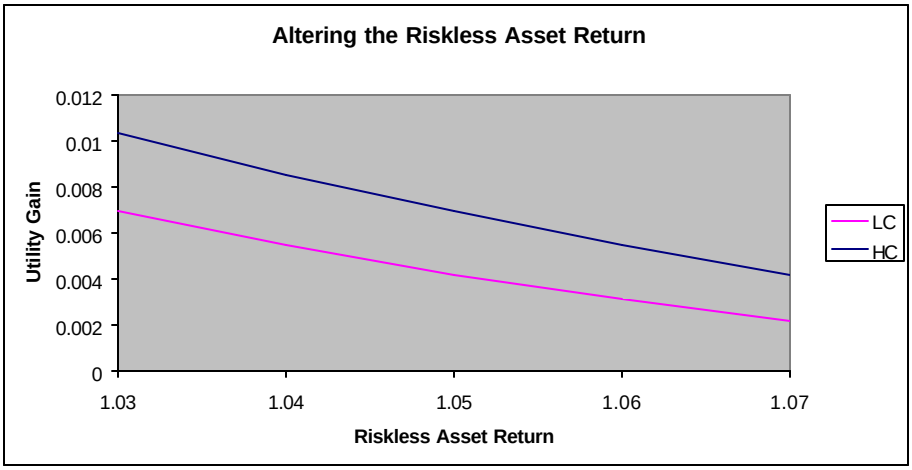

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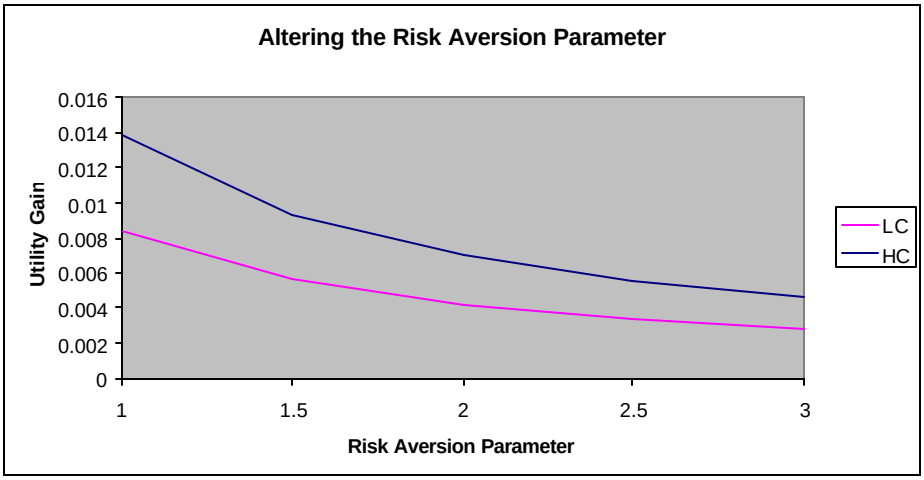

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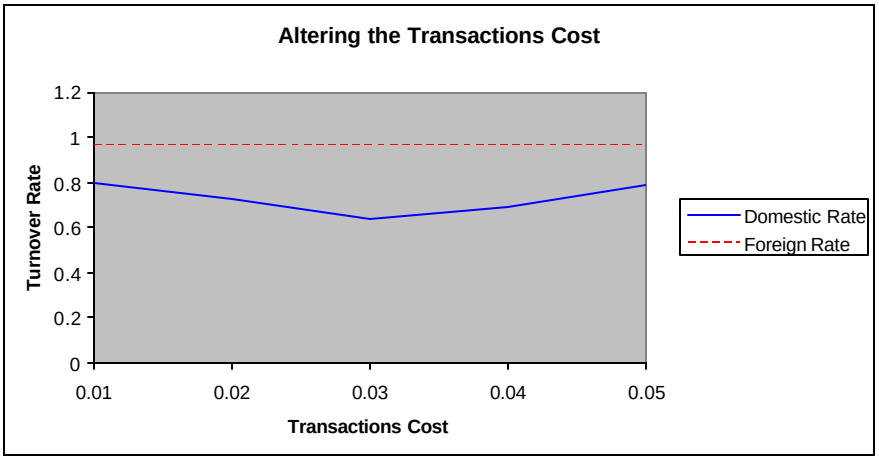

Figure 8

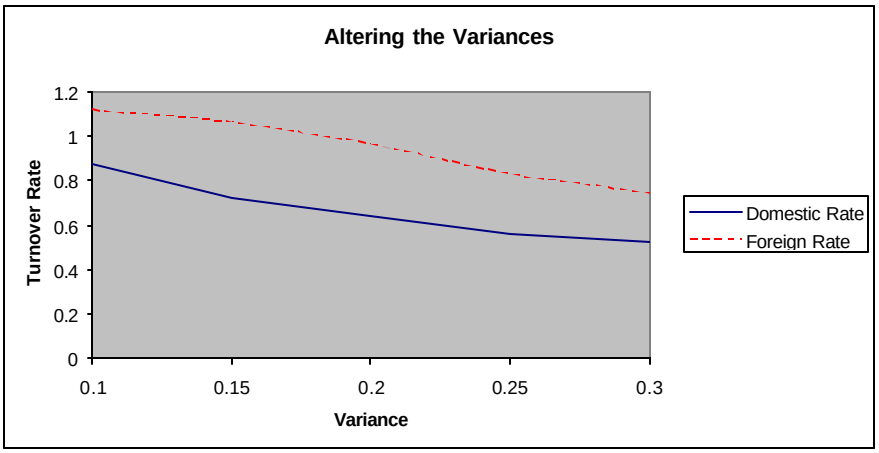

Figure 9

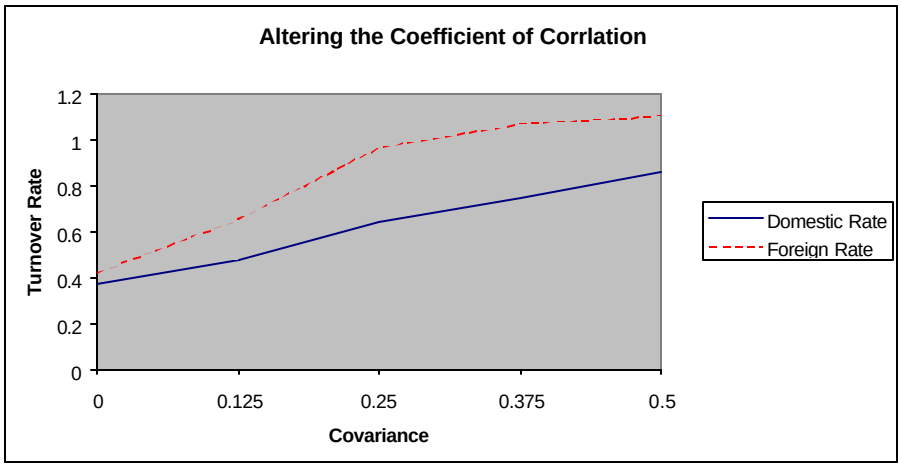

Figure 10

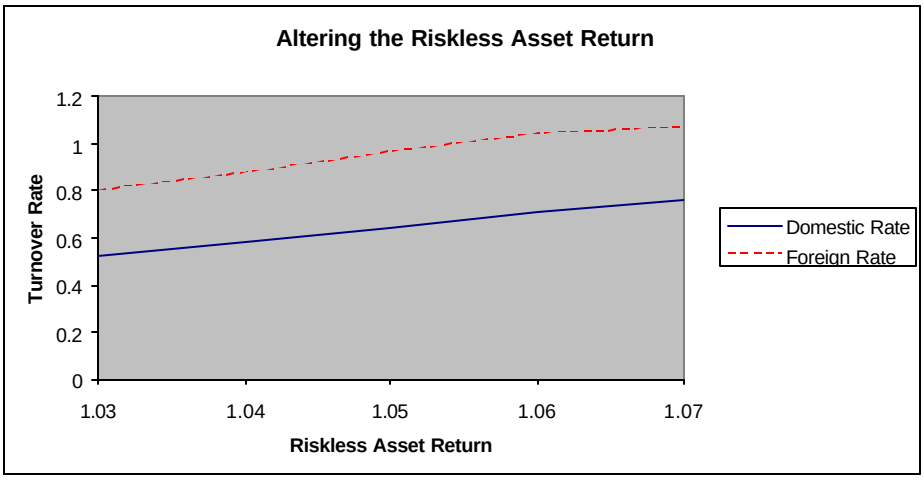

Figure 11