Dynamic International Portfolio Adjustment: Rational Investors and the Home Bias*

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Abstract

This paper studies the dynamic adjustment process of international investors' asset allocations. Standard portfolio theory suggests that home biased investors should invest in foreign assets which have low comovement with their domestic stock market. The year-to-year portfolio adjustment process is studied in a dynamic panel System-GMM framework, taking explicit care of the potential endogeneity of comovement. CPIS data on bilateral cross-border equity holdings is used, capturing 40 source countries and 44 host countries from 2001-2007. Results show that investors adapt their international portfolio allocations, by investing less in foreign stock markets which correlate strongly with their domestic one. Failing to account for endogeneity results in biased estimates leading to potentially misleading conclusions. However, when calculating upper and lower tail dependence investors do not significantly diversify away from foreign stock markets which jointly crash with their domestic stock market. This shows that extreme negative risks are not optimally diversified. In contrast, investors do diversify away strongly from foreign equity markets that jointly boom with the domestic one.

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1 Introduction

Despite the well known benefits from international portfolio diversification international investors still exhibit a great deal of home bias in their equity allocations. Already in the late sixties and early seventies several authors show the large international diversification benefits (See e.g. Grubel, 1968; Solnik, 1974). Since the early seventies financial markets have liberalized, thereby reducing barriers of cross border asset holdings. However, the equity home bias anomaly remains present to date and economists have not been able to fully explain its causes. Not surprisingly, Obstfeld and Rogoff (2001) have singled out the equity home bias as one of the six major puzzles in macroeconomics.

Most research on the home bias focuses on explaining the frictions in international markets which hinder the investor to optimally diversify his portfolio. These frictions include, among others, transaction costs (Heathcote and Perri, 2004), capital controls (Chan et al., 2005), equity market development (Berkel, 2007) and informational asymmetries (Van Nieuwerburgh and Veldkamp, 2009).[1] These papers seek to find the determinants of the lack of international equity diversification.

This paper focuses on the factors explaining cross border asset holdings, thereby investigating the properties of only the foreign invested part of resident's equity portfolios. Early studies focus solely on the foreign equity position of the United States (e.g Ahearne et al., 2004). However, the IMF's construction of the Coordinated Portfolio Investment Survey has enabled researchers to use detailed bilateral data on aggregate bilateral asset holdings for a large number of countries. Recent studies find that geographical proximity, trade and currency unions appear to be the main determinants (See e.g. Aviat and Coeurdacier (2007); Lane and Milesi-Ferretti (2008)). Hence, many factors used to explained trade patterns are useful in describing bilateral asset holdings as well. In addition,

[1] Several institutional factors, which are difficult to quantify, play a role as well in explaining the equity home bias. For example, large investors such as pension funds are often constrained in the amount of foreign assets they may hold (Iglesias and Palacios, 2000). Another example are many employees in Anglo-Saxon countries and especially the United States who invest a large part of their pension savings in their own firm (Benartzi, 2001).

capital controls (Bekaert and Wang, 2009) and information asymmetries (Andrade and Chhaochharia, forthcoming) appear to remain important determinants as well.

The International Capital Asset Pricing Model (ICAPM) predicts that each investor holds a share of foreign equities equal to their respective share of world market capitalization. The existence of home bias in portfolio equity holdings implies that the investor overweights domestic equities, thereby creating hedging demands for equities that comove less with the domestic equity market. Put differently, given the existence of the home bias, investors need to overweight their investment in low comoving assets compared to the ICAPM market portfolio.[2] Hence, the investor aims to compensate for his overinvestment in domestic equities by bringing his portfolio closer to the market portfolio.

Existing studies find mixed evidence of the investor's behavior in response to stock market comovement. Portes and Rey (2005) establish a weak negative reaction of investors to covariance, once informational frictions are controlled for. The evidence is weak and changes across specifications. A related study by Lane and Milesi-Ferretti (2008) finds no relationship between portfolio equity allocations and correlations. This result questions the rationality of investors, because investors do not reap the benefits of global diversification if they do not overinvest in low comoving equities.

However, Coeurdacier and Guibaud (forthcoming) point at an endogeneity problem when correlation is used as an explanatory variable. There is a clear simultaneity bias, because equity holdings are determined by correlations, but correlations are also dependent on investors' equity demands. These authors find that once frictions and endogeneity concerns are controlled for, international investors behave rationally by overinvesting in low comoving assets and overinvesting in high comoving assets.

This paper offers two main contributions to the literature on international equity portfolio allocations. First, this paper models the international investor's portfolio allocation problem in a dynamic context by studying the year-to-year portfolio changes in response

[2] See Coeurdacier and Guibaud (forthcoming) for a more formal treatment of this prediction. It is important to realize that due to different correlations, the optimal foreign investment portfolio is different from the ICAPM prediction. However, the expected sign on correlation is always negative.

to observed international asset comovements. In contrast, previous studies model the investor's portfolio optimization in a static (equilibrium) context and do not consider potential dynamics. However, introducing dynamics offers several advantages, such as the ability to easily take time-invariant frictions into account. More importantly, as current equity allocations are surely not in equilibrium, it is probably more insightful to investigate the short run dynamics in international equity allocations.

The second main contribution is related to the measurement of comovement. Correlation is the standard method to measure the comovement of two time series. However, this paper also measures upper and lower tail comovement, where only a specific part of the return distribution is taken into account. Doing so provides more detailed information on the comovement properties in different states of the market. Several studies such as Ang and Bekaert (2002) show the importance of distinguishing between comovement across different parts of the return distribution. Most international investors seeking diversification benefits dislike situations where all markets turn bad, i.e. a joint stock market crash. This effect is not present for upper tail dependence and this paper investigates possible asymmetric reactions to upper and lower tail dependence.

Tail dependence is measured using the coexceedance probability methodology of Cappiello et al. (2005), where comovement of two return series is calculated on a specific part of the return distribution. In this paper the 5%, 10% and 25% lower tail and 75%, 90% and 95% upper tail coexceedance probabilities are calculated. Similar to correlations, coexceedance probabilities face also endogeneity issues as these are influenced by trade and financial integration as well (See e.g. Beine et al., 2010).

Bilateral aggregate international portfolio allocations for 40 source and 44 host countries from 2001-2007 are taken from the IMF's Coordinated Portfolio Investment Survey (CPIS) database. These bilateral allocations are studied empirically in a dynamic panel gravity framework using System GMM. Including dynamics is necessary due to the large persistence of equity positions across time. Ignoring serial correlation results in biased estimates. The System GMM framework is especially attractive when including dynamics and facing endogeneity problems. Specifically, portfolio allocations and asset market comovements are jointly determined by international financial integration. The System GMM approach is robust to endogeneity biases and the Nickell bias.

Using a dynamic portfolio adjustment approach, results show that investors diversify away from high comoving equities in favor of low comoving equities. These results are confirmed along two dimensions. First, as the full dataset faces homogeneity issues in the pooled estimation, two samples are constructed. One based on statistical poolability and the other on an economically homogeneous group. Second, both measures of comovement (correlation and coexceedance probabilities) have a negative impact on asset allocations in both samples. However, the left tail probabilities are not significantly negative indicating that investors do not strongly diversify away from extreme negative events. Perhaps surprising, investors do diversify away from equity markets that jointly experience a boom.

The most important control variables are the change in market capitalizations and changes in gdp per capita, which both have a positive impact on equity holdings. Capital account openness seems to matter in some estimations as well. Trade, industrial differences and exchange rate volatility seem to have a smaller impact in the short run adjustment process. Robustness checks show that additional control variables do not provide extra information.

When taking a dynamic equilibrium equity allocation approach and estimating the model in levels, there appears to be no relationship between comovement and equity positions. Here, all control variables have a significant effect with the signs in line with previous literature.

A final robustness check investigates the importance of home-biasedness on equity allocation changes. There appears to be a catch up process where strongly home biased countries' investors increase their foreign equity holdings faster than investors from countries with a low home bias. In addition, investors in strongly home biased countries react stronger to correlations than low home biased investors. This is consistent with the theory, which predicts that the former group has larger hedging demands and therefore needs to react stronger to comovement.

The paper is organized as follows. Section 2 introduces the methodology to measure stock market comovement and outlines the empirical framework. Section 3 discusses the database and Section 4 presents the results. Section 5 conducts several robustness checks and Section 6 concludes.

2 Empirical methodology

2.1 Capturing stock market comovement

This paper applies two distinct measures to capture stock market comovement. First, annual realized correlations are calculated using the method of Andersen et al. (2001) and second, the methodology of Cappiello et al. (2005) is used to calculate annual coexceedance probabilities. Correlations summarize the joint behavior of two return series using the entire return distribution, i.e. correlation is a measure of average comovement. Basically, coexceedance probabilities disaggregate the stock markets' return distributions and quantify the comovement of both series at a predetermined region of the return distribution. Each method is discussed in turn.

2.1.1 Realized correlation

Let $p_{i,t,d}$ be the value of the stock market index of country i during year t on day d, where $i = 1, ..., N$, with N being the number of countries considered, $t = 1, ..., T$, where T are the number of years and $d = 1, ..., D_t$, with D_t being the number of trading days in year t. Daily returns on stock index i are calculated by $r_{i,t,d} = [ln(p_{i,t,d}) - ln(p_{i,t,d-1})] * 100$.

Using the method of quadratic variation (Andersen et al., 2001), annual index volatility is given by

$$\sigma^2_{i,t} = \sum_{d=1}^{D_t} [r_{i,t,d}]^2, \tag{1}$$

with $\sigma^2_{i,t}$ being annual index volatility of stock market i. As shown by Andersen et al.

(2001) it is possible to calculate the annual covariance between two assets using the same methodology to obtain realized covariance

$$\sigma_{ij,t} = \sum_{d=1}^{D_t} [r_{i,t,d} * r_{j,t,d}]. \tag{2}$$

The calculation of realized correlation is straightforward from (1) and (2) as

$$\rho_{ij,t} = \frac{\sigma_{ij,t}}{\sigma_{i,t} * \sigma_{j,t}},$$

where $\rho_{ij,t}$ is the realized correlation between index i and index j during year t.

2.1.2 Coexceedance probabilities

Bilateral stock market coexceedance probabilities are calculated using the methodology of Cappiello et al. (2005), which in turn is based on the CAViaR method developed in Engle and Manganelli (2004). Given a return series $r_{i,t,d}$ as defined above, the CAViaR method aims to model only one specific quantile $q_{\theta,i,t,d}$ of the conditional distribution of returns, that is the value for which $\Pr[r_{i,t,d} < q_{\theta,i,t,d}|\Omega_{t,d}] = \theta$ holds, where $r_{i,t,d}$ is the actual return, $\Omega_{t,d}$ the information set up to time (t, d) and θ is the probability level (e.g. 10%) corresponding to the quantile whose process is to be modeled. In words, $q_{\theta,i,t,d}$ is the value such that there is a θ% probability that $r_{i,t,d}$ is lower than it and a $(1 - \theta\%)$ probability that $r_{i,t,d}$ is higher. The subscripts i and t are omitted below for notational convenience when only one time series is discussed. In case of ambiguity all subscripts are included.

An explicit data generating process describing the behavior of the quantiles is necessary to calculate the regression quantiles $q_{\theta d}$. Following Cappiello et al. (2005) the CAViaR specification is:[3]

$$q(\beta_\theta)_d = \beta_1 + \beta_2 * r_{d-1} + \beta_3 * q(\beta_\theta)_{d-1} + \beta_4 * r_{d-2} + \beta_5 * |r_{d-1}|. \tag{3}$$

[3] In Cappiello et al. (2005) β_4 is constrained as $-\beta_2 * \beta_3$. Here β_4 is unconstrained since no stability problems arise when no restrictions are imposed.

The parameter vector β_θ is estimated by minimizing the objective function:

$$\min_{\beta_\theta} D_T^{-1} \sum_{d=1}^{D_T} \rho_\theta(r_d - q(\beta_\theta)_d), \tag{4}$$

where $\rho_\theta(\lambda) = [\theta - I(\lambda \leq 0)]\lambda$ is the quantile loss function, $I(\cdot)$ the indicator function, and θ the probability level. This method, first introduced by Koenker and Bassett Jr. (1978), ensures that asymptotically there are $\theta \cdot T$ exceedances, that is realizations r_d such that $\mathrm{r}_d < \mathrm{q}_{\theta d}$. However, it may happen in finite samples that the number of exceedances does not equal the theoretical value $\theta \cdot D_t$.

In order to correct for this finite sample effect, a set of yearly dummies $\delta = \{d_t\}_{t=1,\dots,T}$ is included in (3), giving the new specification for the quantile process:

$$q(\beta_\theta, \delta)_d = \beta_1 + \beta_2 * r_{d-1} + \beta_3 * q(\beta_\theta, \delta)_{d-1} + \beta_4 * r_{d-2} + \beta_5 * |r_{d-1}| + \delta_1 d_1 + \dots + \delta_T d_T. \tag{5}$$

Due to the long time series available, in practical implementations it is often numerically infeasible to minimize (4) relative to the set of parameters $\{\beta_\theta, \delta\}$.

Therefore a two step estimation procedure is applied. First, solve the minimization problem (4) with respect to β_θ using the specification (3) for the conditional quantile. Then plug the estimates $\hat{\beta}_\theta$ into (5) to obtain a vector $\tilde{q}_{\theta d} = \{q(\hat{\beta}, \delta)_t\}_{t=1,\dots,T}$. In the second step substitute the $\tilde{q}_{\theta d}$ into (4) to obtain a new expected quantile loss function that is minimized to obtain the estimates of δ_t. The set of estimates from the above procedure delivers a fitted process $\hat{q}_{\theta d}$ such that the yearly rate of exceedances matches the nominal value of θ.

The following step is to build an indicator vector of exceedances, $\mathrm{I}_d^i(\hat{\beta}_\theta) \equiv I(r_d < q_{\theta d})$, that takes the value one for each date in which an exceedance takes place, i.e. $\mathrm{r}_d < \mathrm{q}_{\theta d}$ and value zero otherwise values of $\theta < 50\%$. The reverse is applied when $\theta > 50\%$. This procedure is repeated for each time series that enters the dataset. More specifically, each time series is given by returns on stock indexes in different countries. Since the present analysis focuses on comovements between series a measure of "coexceedance" is needed. Put differently, a measure of the frequency at which the index returns in two different countries is constructed, where $r_{i,t,d}$ and $r_{j,t,d}$, lie at the same date below the value of the respective quantiles, $q^i_{\theta d}$ and $q^j_{\theta d}$. This is obtained by multiplying the two indicator vectors to obtain the new variable $I^{ij}_d(\hat{\beta}_\theta) \equiv I^i_d(\beta_\theta) \cdot I^j_d(\beta_\theta)$. Finally, conditional "coexceedance" frequencies are transformed into "coexceedance" probabilities, that is the probability of $r_{i,t,d} < q^i_{\theta t}$ conditional on $r_{j,t,d} < q^j_{\theta t}$ at date d $(p(r^i_d < q^i_{\theta d}, r^j_d < q^j_{\theta d})/\theta)$.

In order to do so, it suffices to run a regression of I^{ij}_d/θ on yearly dummy variables. The coefficients of the dummy variables are estimates of the time varying conditional coexceedance probabilities $p_{ij,t}(\theta)$.[4]

2.2 Estimation method

This paper tests the adjustment of international investor's portfolio allocations in response to asset market comovement. According to portfolio theory, hedging demands emerge if investors overinvest in one asset. In response, rational investors increase their holding of low comoving assets at the expense of strong comoving assets. Hence, the model in levels is

$$log(Equity_{ij,t}) = \beta_1 log(Equity_{ij,t-1}) + \beta_2 Comovement_{ij,t} + \gamma \mathbf{X_{ij,t}} + \eta_{\mathbf{ij}} + \delta_{\mathbf{t}} + \epsilon^{\mathbf{l}}_{\mathbf{ij,t}}, \quad (6)$$

where $Equity_{ij,t}$ is the amount of portfolio equity residents of country i own in country j measured in US \$, *Comovement* is either captured by correlation or a specific coexceedance probability, $X_{ij,t}$ is a matrix of time-varying control variables, η_{ij} are cross sectional fixed effects, δ_t are time dummies and $\epsilon^l_{ij,t}$ is the residual of the level equation.

In this set-up international investors determine this period's equity allocations based on previous period's allocations and observed comovement. Studying a full adjustment

[4]For more details and proof of the consistency of the estimators, see Cappiello et al. (2005). The analysis is conducted in Matlab and based on the codes of Simone Manganelli.

to equilibrium is unrealistic as only seven observation are available for each country pair. Hence, it makes more sense to investigate if investor reallocations are in the correct direction. Therefore, in an alternative approach the dependent variable can be written in first differences. Since $\Delta log(Equity_{ij,t})$ turns out to be serially correlated, dynamics in the first differences need to be included as well

$$\Delta log(Equity_{ij,t}) = \xi_1 \Delta log(Equity_{ij,t-1}) + \xi_2 Comovement_{ij,t} + \psi \mathbf{Z_{ij,t}} + \mu_{\mathbf{ij}} + \nu_{\mathbf{t}} + \epsilon^{\mathbf{d}}_{\mathbf{ij,t}}, \quad (7)$$

where fixed effects μ_{ij} and time dummies ν_t are allowed to be present in the first differences. Here $\epsilon^d_{ij,t}$ is the residual of the first difference equation. This model considers the dynamic adjustment process of international investors who decide to increase or decrease their holdings of certain foreign assets based on observed comovement. Some variables in $Z_{ij,t}$ are the first differences of their counterparts in $X_{ij,t}$, whereas other variables can remain in levels in the estimation.

Equations (6) and (7) are estimated using two-step System GMM (Blundell and Bond, 1998), where *Comovement* is treated as an endogenous variable. Hence the instrument space consists of lags 2 up to all possible further lags of $log(Equity_{ij,t})$ or $\Delta log(Equity_{ij,t})$ and $Comovement_{ij,t}$, plus the contemporaneous value of the exogenous variables $X_{ij,t}$ ($Z_{ij,t}$). The time dummies are only included as instruments in the level equation. These time dummies capture common shocks in the sample and reduce concerns of biases induced by cross sectional dependence (Phillips and Sul, 2003). The two-step System GMM procedure deals with potential heterogeneity problems. The Hansen test is used to judge on the validity of the instrument set and robust standard errors are reported.[5] Furthermore, the Windmeijer (2005) correction is applied.

The main advantage of using System GMM compared to a fixed effects specification is the ability of the former to deal with the potential endogeneity of *Comovement*. Dealing with endogeneity is also possible in fixed effects instrumental variable set-up. However,

[5]The Sargan test is not robust against heteroskedasticity and cannot be interpreted appropriately in two-step System GMM estimation procedure.

the main challenge is to find appropriate instruments for the endogenous variable. Finding variables that explain *Comovement*, but without having a direct effect on *Equity*, will be especially difficult.[6] For example, trade has important explanatory power for both equity positions (Portes and Rey, 2005) and coexceedance probabilities (Beine et al., 2010). A System GMM approach overcomes these problems.

In addition, System GMM avoids the well know Nickell bias, known to be especially severe in a large N, small T sample such as in this paper. System GMM allows for time-constant fixed effects, which may capture important variables such as distance or a common language. It is not necessary to include these explicitly. Even worse, including these may even lead to inefficiencies. The importance of time constant variables favors even more a first difference approach by explaining the annual changes in equity allocations.

One caveat in the estimation is the use of *Comovement*, which is an estimated variable and induces the generated regressor problem (Pagan, 1984). The issue is similar to a two stage least squares estimation, when one does not correct the standard errors for the first step instrumentation. Practically, accounting for the generated regressor problem increases the standard errors of the coefficient on the generated variable. It is important to note that the point estimate of the coefficients are unbiased in all estimations. However, the standard errors should be interpreted conservatively at the 5% significance level. Note that the standard errors have already been "blown up" using several corrections, such as the Windmeijer (2005) correction.[7]

[6]Coeurdacier and Guibaud (forthcoming) use correlations between equity markets during 1950-1975 as instruments for correlations during 2001-2005. However, the problem with this choice of instrument is the inability of the instrument to capture time varying effects during 2001-2005.

[7]A potential method to deal with the generated regressor problem would be to implement a bootstrap procedure. Unfortunately there are no bootstrap methods available for this specific situation. Several technical issues create difficulties in implementing a bootstrap procedure. First, the quantiles, from which the coexeedance probabilities are calculated, are modeled variables using an optimization algorith. Therefore, a quantile regression bootstrap in the spirit of Hahn (1995) is not possible. Second, Hall and Horowitz (1996) show that inference can be biased in GMM when the bootstrap estimates are based on an empirical distribution which implements a moment condition that does not necessarily hold in the population of bootstrap samples. Moreover, even after the adjustment of the moment conditions, biases in the augmented GMM bootstrap are reduced, but not eliminated.

3 Data

Aggregate bilateral portfolio equity allocations are recorded in the International Monetary Funds's Coordinated Portfolio Investment Survey (CPIS). The CPIS dataset records the amount of portfolio equity (in US$) that country i's residents own in country j. Based on data availability within the CPIS database and national stock market indexes, data from 40 source and 44 host countries is taken from 2001-2007.[8] The four excluded source countries are China, India, Mexico and Peru. China and Peru are excluded because they do not provide data on their resident's asset allocations, whereas India and Mexico are excluded because they do not provide data in the first years of the sample.

The dataset captures over 80% of all bilateral portfolio equity holdings. Even though, the included source and host countries account for 97% and 92%, respectively, of all international portfolio equity holdings in 2001 (92% and 89% in 2007). The attrition is due to several reasons Some data of the included source countries is missing because it is either classified as being unallocated or confidential. However, a large fraction of the gap between 80% and the full 100% is held by or invested into so called tax havens, such as Bermuda, Guernsey, Jersey and the Isle of Man.

Even though the CPIS database is recognized as the best database available on aggregate cross-border asset holdings, a careful treatment of the CPIS data is necessary. There are four issues pointed out by Lane and Milesi-Feretti (2007). First, the country coverage is incomplete (e.g. no source data for China, India, Mexico and Peru). Second, there is underreporting for some countries (e.g. the German data excludes households, which amounts to about 20% of the total). Third, some data are confidential and not reported (e.g. Australia does not report asset holding in a number of countries). Fourth, there is overreporting due to third party holdings, which is particularly present in the data of Ireland and Luxembourg. Basically funds are invested from an outside country into Ireland and Luxembourg and these countries channel investments again to other countries.

[8] See Table 7 in the Appendix for a complete list of all source and host countries.

Hence, the portfolio equity allocations in Ireland and Luxembourg do not only reflect investment in these countries' companies.[9] Special attention is directed to these issues in the empirical analysis. As long as these issues are relatively stable over time, they should not pose empirical problems because first differences are considered.

Daily stock market index data is retrieved from Thomson Datastream for all countries in US$. These Datastream indexes are selected because they capture all listed companies in a country and not e.g. only the 25 largest. Moreover, the methodology to calculate the index is the same across countries. When only local currency denominated returns are available, these are converted into US$ using daily exchange rates.[10]

Using daily data invokes the non-synchronous trading problem, where stock markets across the globe do not share the same trading hours. In order to overcome this problem this paper follows Bae et al. (2003) by assuming that the day starts in the U.S. Therefore, returns on day d in the Americas is matched with day $d+1$ returns in Asia, Australia, Europe and Africa.[11] From these series the comovement measures are calculated as shown in Section 2.1 above.

Several control variables are included to avoid misspecification biases and capture effects not explained by stock market comovements. An important determinant of portfolio allocation is the market capitalization of an asset w.r.t. total world market capitalization. Since bilateral relationships are considered, both the market capitalization of country i and j matter for the amount of country j equities residents from country i hold. Hence, $log(MCap_{it} * MCap_{jt})$ is used in the estimations, where market capitalization is recorded in US$ from Thomson Datastream.

There are many indicators to capture the "strength" of bilateral trade relationships (see e.g. Frankel and Rose, 1998). Here, $trade_{ijt}$ is captured by $log([export_{ijt} * import_{ijt}]/[gdp_{it} * gdp_{jt}])$. Both bilateral trade and gdp are recorded in US$ and taken from the IMF's Di-

[9]This is similar to the situation of the so called tax havens mentioned above.

[10]Results are qualitatively the same when local currency denominated returns are used. Estimation results can be provided upon request.

[11]For a discussion on this treatment of the non-synchronous trading problem and the underlying assumptions, please consult Beine et al. (2010).

rection of Trade Statistics and the World Bank's World Economic Outlook, respectively. The results are robust to using different measures of trade intensity, such as the one by Frankel and Rose (1998).

In order to proxy for the economic development of a country, $log(GDP/capita_{it} * GDP/capita_{jt})$ is used to capture the degree of economic development of the country pair i,j. The data are from the World Bank World Economic Outlook.

Annual bilateral exchange rate volatility is calculated using realized volatility calculated from daily exchange rate returns. Bilateral exchange rates for country pairs, e.g. Argentina and Japan, is calculated using a individual country exchange rates against the US$. Put differently, (ARS/US$) *(JPY/US$)$^{-1}$ = (ARS/JPY).

An important diversification motive is the different industrial structure of countries. The Krugman (1991) measure is used as an indicator to capture industrial structure differences. This indicator of industrial difference is computed by summing up the absolute value of the difference of an industry's market value between two countries:

$$\text{indus}_{ij,t} = \sum_{n=1}^{N} |s_{n,i,t} - s_{n,j,t}|,$$

where $s_{n,i,t}$ is the market value of industry n in country i or j at time t. There are N=40 industries considered in the specialization index using Datastream sector indexes.

Capital account openness is measured using the $KAOPEN$ indicator of Chinn and Itô (2008). This variable indicates the degree of financial openness for individual countries, hence $KAOPEN_{i,t}$ and $KAOPEN_{j,t}$ are both included.

Stock market turnover rate and the percentage of offshore deposits in the host country are used to in the robustness section to capture the attractiveness of the host country specifically. These data are taken from the World Bank Financial Structure database, constructed by Beck et al. (2000).

All estimations exploit the panel dimension of the dataset by including unobserved fixed effects. Doing so eliminates the need to include time-invariant variables such as distance, the existence of a colonial link, a common border or a common language.

4 Results

4.1 Baseline results

In order to capture the dynamic portfolio adjustment process Equation (7) is estimated, where the dependent variable is the annual change in $log(Equity_{ij,t})$. The dynamics are governed by the first lag of $\Delta log(Equity_{ij,t})$. Recall that $Equity_{ij,t}$ are country i's residents end of year portfolio equity holdings of country j's equities. These timing issues are important for the interpretation of the independent variables. All available data for all countries is used in this estimation, resulting in 1297 country pairs.

The independent variables are included as follows. First, the model assumes that comovement during year t directs the investor's portfolio change during year t. Comovement is measured in levels as investors observe actual correlations. Using first differences of correlations may lead to strange reallocations, e.g. a change from -0.5 to -0.2 is not the same a change from 0.6 to 0.9. Second, the change in $log(MCap_{i,t} * MCap_{j,t})$ captures market valuation changes during year t. This variable aims to capture the effect of increases and decreases in $\Delta log(Equity_{ij,t})$ due to valuation gains. Third, trade relationships stimulate the holding of bilateral equity assets. Fourth, the change in $log(GDP/capita)$ captures among others the change in economic development, making fast growing emerging markets an attractive destination for future equity gains. Industrial differences and capital account openness are taken in levels. Note that the one year lag (t-1) is used for industrial dissimilarity and capital account openness.

Table 1 shows the results of the first difference estimation using a System GMM estimation as outlined above. The dynamics have a strong and significant impact across all measures of comovement, indicating mean reversion behavior. Most importantly, the coefficient on correlation is economically large and statistically highly significant. For example, if correlation changes from 0.5 to 0.6, investors will reduce their portfolio holdings by about four percent.

[Table 1 about here.]

Since investors treat gains differently from losses (See e.g. Köbberling and Wakker, 2005) they will most likely worry more about comovement in bad states than in good states. Put differently, investors are more unhappy when their domestic and foreign investment jointly exhibit large losses than if these two investments jointly experience very high returns. This prediction is not confirmed by the results in Table 1. Both the left tail and right tail quantiles all have a negative sign indicating the diversification away from comoving assets across the entire return distribution. However, the effect seems to be more pronounced in the right tail as Q5 and Q10 are not significantly negative.

The control variables relating to market capitalization and gdp per capita all have the expected significant positive sign. The coefficient on trade is positive, but not significant. This result is surprising as previous literature always finds a strong impact of trade on bilateral asset holdings (See e.g. Aviat and Coeurdacier (2007)). One explanation for the current result is that trade relationships are relatively stable across time. By analyzing first-differences this variable is less important. Estimating trade in first-differences in the model does not lead to significant results either.

The coefficients on industrial differences and capital account openness are insignificant. One reason for this is the slow process of changes in industrial structure and capital account policies. These effects will be less relevant when first differences are considered. Exchange rate volatility is significantly negative at the 10% level for correlation and when using Q90 and Q95. Exchange rate volatility increases uncertainty about foreign return when converting these in local currencies. Hence, the negative sign indicates that the higher volatility is, the less investors will invest in those assets. Fidora et al. (2007) show the importance of (real) exchange rate volatility in the portfolio asset allocation decision. This factor appears to be of minor importance when considering first differences.

Quantitatively, the change in the product of market capitalizations is a major determinant of asset allocation changes. Basically, a 10% increase in the market capitalization products results in a 4% increase in country i's assets in country j. Combined with the negative coefficient on $log(Equity_{ij,t-1})$ the process is not explosive. Therefore, the process can safely be modeled in first differences without concerns over long term stability.

Note however that the Hansen test rejects the choice of the instrument set for all estimations at the 10% level and for most even at the 1% level. One possible reason for this is heterogeneity in the panel. Since all source and destination countries are pooled in one sample without considering the appropriateness of this assumption there may be biases due to outliers.

In order to overcome possible heterogeneity problems, two approaches are possible to find a poolable (valid) sample for the estimation. First, a statistical approach and second, an economic approach are implemented to find a homogeneous group of countries.[12] Due to the bilateral nature of the panel there are several restrictions possible: restrict source countries, restrict host countries, restrict bilateral pairs. This paper focuses on the asset allocation of source countries and a poolable sample is searched by restricting the number of source countries. Put differently, when e.g. Argentina is excluded as a source country all bilateral pairs with Argentina as source country are eliminated. The statistical and economic approach to restrict the source countries will be discussed in turn.

4.2 Statistical poolability

The objective of statistical poolability is to start with the largest sample possible and let the data decide which countries need to be excluded in order to obtain a poolable sample. Kapetanios (2006) proposes an information based criteria approach to find a poolable sample. The general idea of his approach is to split the data in several samples and

[12] A related approach is to restrict the number of lags used as instruments from $log(Equity_{ij,t})$ and $Comovement_{ij,t}$. Such a strategy has two disadvantages. First, the relatively small instrument set is reduced further, which decreases precision. Second, it is not possible to find one instrument set reduction that validates the Hansen test for all measures of comovement. Using different instrument sets for each quantile creates an undesirable arbitrariness.

choose that split of the data which maximizes the information criteria. Unfortunately, this set-up is in a maximum likelihood context and it is not clear how to generalize this to the System GMM approach. Another important assumption is $T >> N$, which is not the case in the current panel where $T = 7$ and $N > 1000$. Similar problems arise when using the approach of Paap et al. (2005).

Hence, an alternative method is needed. The main criterion to judge if a two-step System GMM estimation is valid is the Hansen test. Therefore, it is possible to exploit this test statistic to construct an algorithm maximizing the Hansen p-value. The algorithm is very simple. First, estimate the full model and exclude always one source country. Then proceed to the next step, where the country is excluded whose exclusion increases the Hansen p-value most. Continue excluding countries in this manner until the Hansen p-value is above 10%. The results of this approach are presented in Table 2.

[Table 2 about here.]

For each column the algorithm is conducted individually. This results in the following source countries being excluded: Malaysia and New Zealand for correlation; Chile, Hungary, Korea, New Zealand and South Africa for Q5; Chile, New Zealand and South Africa for Q10; Korea for Q25; Korea, New Zealand and South Africa for Q75; Austria, Belgium, Brazil, Indonesia, New Zealand, Norway and Singapore for Q90 and only New Zealand for Q95. Perhaps surprising is the exclusion of New Zealand in all estimations. Apparently the foreign asset allocation of New Zealand is quite different from the other countries. A closer inspection of the data for New Zealand shows that quite a large number of destination countries are labeled as consisting of confidential data. Therefore a large number of these has been excluded, providing a very poor representation of actual New Zealand's foreign equity allocations.

In general, very few countries need to be excluded to obtain a poolable sample passing the Hansen test. The results of Table 2 are in line with those of Table 1. Perhaps the contrast between the upper and lower tail is even sharpened in these results. In the lower tail, only Q25 is significantly negative at the 10% level. In contrast, the upper tail quantiles are all significant at at least 5%. The coefficient on correlation is again highly significantly negative. Note also that trade now has a significant positive impact on asset reallocations for correlation and the 95% quantile.

4.3 Economical poolability

An alternative method to constructing a statistically poolable sample is to make the decision on economic grounds. One important issue of the CPIS dataset is its accuracy. When comparing the CPIS dataset with micro data from mutual funds Hau and Rey (2009) find that the quality of the CPIS data is especially high for the asset allocations of developed countries.

Lane and Milesi-Ferretti (2008) show that there are important differences when investigating cross-border asset allocations for a full sample and a restricted sample with only OECD countries as source countries. For example, with all countries pooled the coefficient on stock market comovement is significantly positive, but when considering only OECD countries the coefficient on this variable is insignificant in their estimations. However, note that they do not account for endogeneity and dynamics.

Most developed countries liberalized their financial markets during the 1970s and 1980s, whereas developing countries only started doing so in the late 1980s and 1990s (Bekaert et al., 2005). This implies that residents in OECD countries had much earlier access to foreign equity markets than residents in developing countries. Hence, they have had more time to come closer to their "optimal" internationally diversified equity portfolios.

As only developed countries are member of the OECD this is likely to be a relatively homogeneous group with similar access to international equity markets. When estimating the model taking only OECD countries as source countries the results are again very much in line with previous results obtained in Tables 1 and 2, both quantatively and qualitatively. However, there are some minor differences for the lower tail quantiles, where Q5 is large and significantly negative and Q25 is not significant anymore. Unfortunately, the Hansen test rejects the instrument set for Q5, Q75 and Q90. These results are not reported but available on request.

In order to obtain a poolable sample for Q5 New Zealand, Norway and Turkey are excluded, for Q75 New Zealand and Turkey and for Q90 only New Zealand. Table 3 shows the results when these source countries are excluded from the OECD only for those quantiles involved. Note that the the results are close to the ones of Tables 1 and 2. Moreover, New Zealand appears to be an odd country in the sample w.r.t. international equity allocations. Most likely due to the reasons mentioned above.

[Table 3 about here.]

When excluding the three countries involved in Q5 from all estimated columns identical results are obtained. When comparing with previous results, the coefficient on Q25 becomes insignificant, whereas Q5 becomes marginally significant. However, the strong asymmetry between lower and upper tail returns pertains. Moreover, the size of the coefficients is very close to those in the statistical sample.

Again the magnitude of Δ lmcap_t is very large because a 10% growth in the bilateral product of market capitalizations results in an increase of about 5% in foreign equity holdings. This control variable is therefore the main determinant of changes in foreign asset holdings.

There is a negative coefficient on the capital account openness level of the origin county. This implies that the growth rate in foreign equity positions lower is for more financially open countries. One possible explanation may be that these countries are already closer to equilibrium than closed countries, which have accumulated fewer foreign assets in the past.

In addition, several other alternatives grouping of developed countries can be estimated as well. For example, Hong Kong and Singapore are not member of the OECD, but both countries have highly developed financial markets and a high standard of living. Including those countries leads again to similar results. These tables are omitted for brevity but can be provided on request.

5 Robustness

5.1 Additional control variables

Several robustness checks are conducted to verify the validity of the results obtained above. Both estimations of Table 2 and 3 are used when investigating the impact of additional control variables. In this section only correlation is considered as the measure of comovement.

Table 4 present the results with additional control variables added to the benchmark specification. Columns (1)-(3) consider the "statistically poolable sample" and columns (4)-(6) consider the "economically poolable sample".

First start with columns (1)-(3). In column (1) the bilateral exchange rate appreciation between the currency of country i and j during year t is added. Since all equity positions are measured in US$ it is likely that equity positions are influenced by currency appreciations or depreciations. For example, when Canadian residents invest in United Kingdom equities, these equities lose value (measured in US$) when the UK Pound depreciates against the US$, thereby altering Canadian portfolio equity investments in the UK. However, what crucially matters is the Canadian dollar vs. UK pound exchange rate development.

[Table 4 about here.]

Columns (1) and (5) shows that this effect is not present and appear to be fully taken into account by the $log(MCap_{it} * MCap_{jt})$ variable. Measuring all variables in US$ does not lead to biased results, i.e. the coefficient on correlation is virtually unchanged.

Investors are concerned about the institutional quality of the destination country, because an unreliable government will increase the riskiness of the investment. For example, Alfaro et al. (2008) show that institutional quality is an important factor to attract foreign capital. In this paper institutional quality is measured as the sum of three separate indicators in the World Bank Governance indicators: Government effectiveness, Rule of law and Control of corruption. Both the institutional quality of country i and j are included.

The results in column (2) show that this factor is not very important. Even though, a higher institutional quality of the source country increase asset holdings. One reason for the insignificance of institutional quality is a strong collinearity with capital account policy. Several authors show that these variables are closely related (See e.g. Edison et al., 2004). Including institutional quality as an additional control variable does not add additional information.

Several financial market characteristics may make the host country more attractive for equity investments. First, a more liquid stock market makes it easier to buy and sell assets when the investor decides to alter his investment positions. Longstaff (2009) argues that liquidity is an important factor guiding investor diversification. Put differently, investors prefer to concentrate their investments in a single asset when the alternative asset is very illiquid. The stock market turnover rate captures the liquidity of the market, where a higher turnover rate indicates higher liquidity. Column (3) shows that increased liquidity per se is apparently not an important factor considered by the investor. However, relatively liquid markets show strong persistence in liquidity, so this effect may be relatively constant across time.

Also the percentage of offshore deposits is a marginally significant factor guiding portfolio holdings. This percentage aims to capture the degree with which the country channels funds abroad. These results are in line with Lane and Milesi-Ferretti (2008), who argue that some countries are not the final destination of invested equity, but these countries only channel funds to other countries. As column (3) shows, including both of these control variables does not change the coefficient on correlation.

The final robustness check is the inclusion of expected returns in the model. In column (4) the actual return of equity market j during year $t+1$ is included, measured in local currency returns.[13] So, this variable aims to capture a possible increase in equity holdings during year t, when investors expect high future returns. Including expected returns is controversial and in this exercise I assume investors have perfect foresight by including realized future returns. Interestingly, there is no effect of expected future returns on equity allocations.

Dahlquist et al. (2003) report a strong relationship between corporate governance in countries and the equity positions of international investors. Basically, investors hold fewer shares in countries with bad corporate governance. As the timeframe considered in this paper (2001-2007) is quite short, no large changes are expected. Since first differences are considered, corporate governance is likely to be of minor importance here. In addition, including a variable of institution quality results in an insignificant coefficient for this variable.

When considering the addition of the extra control variables to the OECD sample, most results are identical. However, the expected future return has a negative effect on portfolio allocations. This seems odd, OECD countries appear to diversify away from markets that outperform in the future. Most important is the robustness of the coefficient on correlation, which is always around 0.4 across all six columns.

5.2 Asset allocations in levels

In order to compare the results in this paper with studies investigating asset allocations in levels (e.g. Coeurdacier and Guibaud, forthcoming; Bekaert and Wang, 2009) Equation (6) is estimated for the full dataset. Again one lag of the dependent variable is included to deal with the persistence of equity allocations. Due to the high persistence of $log(Equity_{ij,t})$ some instruments are invalid. When the dependent variable is close to a random walk, past levels do not provide much information on future changes, rending

[13]Including the actual return during year $t+1$ in US$ leads to same the results.

these instruments invalid (Blundell and Bond, 1998). Hence, lags of $log(Equity_{ij,t})$ and correlation/coexceedance are only used in the level equation.

Table 5 shows the results of the level equation. The persistence of the level is emphasized by a large AR(1) coefficient of around 0.8. Surprisingly, with the exception of Q5 no single indicator of comovement is significantly negative. In contrast, Coeurdacier and Guibaud (forthcoming) find a negative relationship and Bekaert and Wang (2009) find a positive relationship. Basically, the results in Table 5 are inbetween these results. However, it is important to keep in mind that previous studies do not take dynamics into account, whereas these are highly significant even in first-differences.

[Table 5 about here.]

All control variables appear to be important in the level equation and have the expected sign. First, the product of market capitalizations has a strong positive effect as do trade and gdp per capita. Trade is much more important in this case, which is in line with previous research (Aviat and Coeurdacier, 2007). Industrial dissimilarity has a positive effect on asset holdings and confirms that industry differences are an important motivation for asset diversification (See e.g. Campa and Fernandes, 2006). Exchange rate volatility has a negative effect on asset holdings, confirming the finding of Fidora et al. (2007). Capital account openness of the source country has a positive effect on foreign equity holdings. Put differently, countries which are financially more open hold larger shares of foreign assets. Perhaps unintuitive is the negative effect of capital account openness of the host country, where one would expect that more open countries attract more foreign equity investors.

When comparing the results of Table 5 with the results obtained before we can conclude that investors adapt their international equity portfolios in the "correct" direction effectively in response to observed comovements. However, their equity allocations as such do not take these comovements into account. Hence, this justifies viewing the equity allocation problem as a short run dynamic adjustment process.

5.3 Is home biasedness important for foreign equity positions?

The ICAPM predicts hedging demands favoring low comoving equities when the investor overinvests in his domestic market. This prediction implies that hedging demands are likely to be larger the more biased the investor is towards domestic equities. Therefore, in this section the effect of home biasedness on portfolio adjustment is investigated.

Define home bias using the standard measure of Warnock (2002):

$$HB_{it} = 1 - \frac{\frac{FA_{it}}{MCAP_{it}+FA_{it}-FL_{it}}}{1 - \frac{MCAP_{it}}{MCAP_{wt}}}, \tag{8}$$

where FA_{it} and FL_{it} are country i's total foreign assets and liabilities, respectively, $MCAP_{it}$ is country i's stock market capitalization and $MCAP_{wt}$ is total world stock market capitalization. The sum of $MCAP_{it}$ and FA_{it} minus FL_{it} is country i's aggregate equity wealth.

The one year lagged value of home bias is included in the regressions to avoid the simultaneity bias. This variable is treated as a predetermined variable in the instrument set. Table 6 presents the results of the estimations with home bias included. The left panel includes all countries, whereas the right panel consists only of OECD source countries (with New Zealand, Norway and Turkey excluded).

[Table 6 about here.]

Columns (1) and (4) show a negative effect of home biasedness on equity positions, with a negative coefficient on correlation, albeit not significant in column (4). However, the Hansen test indicates that the instrument set is not valid for this estimation. A closer inspection of the home bias variable shows that Ireland has a value below zero, whereas Luxembourg and Russia have values above one. This causes interpretation problems of the home bias variable and these countries are excluded in columns (2)-(3) and (5)-(6).

The estimations in columns (2) and (5) are not rejected by the Hansen test and show a quite different picture. First, correlation has a large significantly negative effect on equity holdings, which is consistent with previous results. In addition, the home bias variable has a significantly positive effect on equity holdings. This implies that countries with a large home bias are in a "catch up" process, with their foreign equity holding increasing faster than for low home biased countries.

Finally, columns (3) and (6) use the interaction variable $homebias * correlation$ in the estimation akin to Coeurdacier and Guibaud (forthcoming). The coefficient on *hbcorr* is larger than that on *correlation*, implying that more home biased countries' investors diversify away stronger from correlated equities than low home biased countries do. This confirms the results of Coeurdacier and Guibaud (forthcoming). Apparently, effective diversification of a small foreign equity share is more important or easier, compared to diversifying a large foreign equity share when a country is already internationally diversified.

6 Conclusion

In conclusion, this paper shows that international equity investors adjust their portfolio rationally in response to observed comovements. Since international investors overinvest in their domestic stock market, hedging demands are created to invest in equities which comove little with the domestic stock market. The empirical analysis shows that investors indeed reduce their holdings of strongly comoving equities. Portfolio adjustments are significantly negative related to correlations. However, when disaggregating the return distributions and distinguishing between left and right tail dependence, it appears that international investors do not strongly diversify away from equities showing large left tail dependence. Put differently, investors diversify away from equity market that boom jointly, but do not diversify away from equity markets that crash jointly.

Data for 40 source and 44 host countries from the Coordinated Portfolio Investment Survey during 2001-2007 is used to capture annual aggregate international portfolio adjustments. Stock market comovement is measured using realized correlation and coexceedance probabilities. These coexceedance probabilities disaggregate comovement across different parts of the return distributing and are constructed using the methodology of Cappiello et al. (2005).

The equity allocation process is modeled as a dynamic adjustment process, where the effect of comovement on year-to-year changes in equity holdings is explained. This model is estimated using a two-step System GMM procedure, with comovement being treated as an endogenous variable. Taking care of dynamics is necessary due to the large persistence of equity allocations. In addition, the System GMM procedure is a straightforward method to deal with endogeneity problems when it is not possible to find appropriate outside instruments.

By using two different samples to address potential poolability concerns, one sample based on statistical arguments and one based on economic arguments, results show that international equity investors diversify away strongly from high comoving equities. However, when disaggregating the return distribution these results illustrate also that investors do not diversify away from equities showing lower tail dependence with their domestic market. This hurts the effective use of international equity markets for risk diversification. Several robustness checks confirm the above mentioned results.

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A Data sources

Bilateral and total portfolio equity holdings in US$ are from the IMF's Coordinated Portfolio Investment Survey, 2001-2007.

Stock market return and capitalization data are retrieved from Thomson Datastream, both in US$ and local currency. Market capitalization is also disaggregated into 40 industries. This is used to calculated the industrial difference indicator.

GDP and GDP per capita in US$ are from the World Bank World Development Indicators.

Bilateral trade data in US$ are from the IMF's Direction of Trade Statistics.

Exchange rates vis-à-vis the US$ are from Global Financial Data. Bilateral exchange rates are calculated using the local currency vs. US$ exchange rates.

The Chinn and Itô capital account measure KAOPEN is used to measure the degree of financial openness. The data and a detailed description on its construction are available at http://www.ssc.wisc.edu/˜ mchinn/research.html

Institional quality is derived from the World Bank's Aggregate Governance Indicators. For more details, please consult Daniel Kaufmann, Aart Kraay and Massimo Mastruzzi (2009). "Governance Matters VIII: Governance Indicators for 1996-2008". World Bank Policy Research June 2009.

Data on the host country's financial system is derived from the World Bank's Financial Structure Dataset. More information is available in Thorsten Beck, Asli Demirg-Kunt and Ross Levine, (2000), "A New Database on Financial Development and Structure", World Bank Economic Review 14, 597-605.

B Country sample

[Table 7 about here.]

Table 1: Dynamic Adjustment International Equity Investment: System GMM, full sample

	corr	q05	q10	q25	q75	q90	q95
Δ lequity$_{t-1}$	-0.105***	-0.113***	-0.0921***	-0.0913***	-0.0984***	-0.117***	-0.105***
	(0.0263)	(0.0284)	(0.0268)	(0.0262)	(0.0273)	(0.0267)	(0.0263)
correlation$_t$	-0.389***						
	(0.127)						
q05$_t$		-0.416					
		(0.292)					
q10$_t$			-0.428				
			(0.301)				
q25$_t$				-0.533**			
				(0.245)			
q75$_t$					-0.673***		
					(0.214)		
q90$_t$						-0.546***	
						(0.179)	
q95$_t$							-0.525***
							(0.188)
Δ lmcap$_t$	0.431***	0.407***	0.407***	0.440***	0.419***	0.429***	0.406***
	(0.0712)	(0.0753)	(0.0739)	(0.0707)	(0.0737)	(0.0738)	(0.0713)
trade$_t$	0.00640	0.00546	0.00611	0.00427	0.00554	0.00559	0.00519
	(0.00396)	(0.00555)	(0.00517)	(0.00400)	(0.00400)	(0.00374)	(0.00360)
Δ lgdp_cap$_t$	0.566***	0.434**	0.426**	0.607***	0.609***	0.647***	0.609***
	(0.183)	(0.187)	(0.190)	(0.177)	(0.180)	(0.183)	(0.183)
indus$_{t-1}$	0.0275	0.0664	0.0663	0.0568	0.0221	0.0243	0.0167
	(0.0487)	(0.0526)	(0.0509)	(0.0479)	(0.0482)	(0.0484)	(0.0488)
xvol$_t$	-0.00371*	-0.00254	-0.00302	-0.00236	-0.00396*	-0.00384*	-0.00372*
	(0.00203)	(0.00206)	(0.00216)	(0.00215)	(0.00206)	(0.00213)	(0.00203)
kaopen_o$_{t-1}$	0.00857	0.00879	0.00996	0.0113	0.00966	0.0116	0.0123
	(0.0161)	(0.0169)	(0.0161)	(0.0161)	(0.0164)	(0.0164)	(0.0159)
kaopen_d$_{t-1}$	-0.00817	-0.0140	-0.0146	-0.00464	-0.0109	-0.00335	-0.0105
	(0.0111)	(0.0120)	(0.0126)	(0.0115)	(0.0108)	(0.0109)	(0.0107)
Observations	5678	5678	5678	5678	5678	5678	5678
Number of id	1297	1297	1297	1297	1297	1297	1297
AR(2)	0.710	0.804	0.561	0.544	0.552	0.772	0.632
Hansen	0.0270	1.38e-05	0.00168	0.0432	0.00598	0.000674	0.0675

Note: Estimation of Equation (7) using Two Stage System GMM, where either correlation or a coexceedance probability (Q5, Q10, Q25, Q75, Q90, Q95) is used as a measure of comovement. *,**,*** imply significance at the 10%, 5% and 1%, respectively.

Table 2: Dynamic Adjustment International Equity Investment: Restricted Sample, statistical reduction

	corr	q05	q10	q25	q75	q90	q95
Δ $lequity_{t-1}$	-0.102***	-0.115***	-0.0999***	-0.0934***	-0.103***	-0.104***	-0.101***
	(0.0263)	(0.0278)	(0.0279)	(0.0255)	(0.0256)	(0.0283)	(0.0260)
$correlation_t$	-0.415***						
	(0.126)						
$q05_t$		-0.303					
		(0.285)					
$q10_t$			-0.135				
			(0.315)				
$q25_t$				-0.427*			
				(0.237)			
$q75_t$					-0.510**		
					(0.201)		
$q90_t$						-0.465**	
						(0.189)	
$q95_t$							-0.535***
							(0.185)
Δ $lmcap_t$	0.424***	0.411***	0.392***	0.431***	0.371***	0.501***	0.406***
	(0.0722)	(0.0690)	(0.0733)	(0.0700)	(0.0738)	(0.0808)	(0.0722)
$trade_t$	0.00828**	0.00643	0.00353	0.00284	0.00449	0.00414	0.00613*
	(0.00397)	(0.00519)	(0.00521)	(0.00388)	(0.00381)	(0.00447)	(0.00350)
Δ $lgdp\_cap_t$	0.550***	0.312*	0.423**	0.513***	0.606***	0.696***	0.586***
	(0.183)	(0.183)	(0.190)	(0.173)	(0.172)	(0.198)	(0.183)
$indus_{t-1}$	0.0459	0.0770	0.0933*	0.0656	0.0319	0.00501	0.0179
	(0.0474)	(0.0498)	(0.0500)	(0.0466)	(0.0455)	(0.0526)	(0.0479)
$xvol_t$	-0.00380*	0.000268	0.000226	-0.00168	-0.000884	-0.00463**	-0.00377*
	(0.00209)	(0.00194)	(0.00213)	(0.00205)	(0.00197)	(0.00213)	(0.00203)
$kaopen\_o_{t-1}$	0.0155	0.0110	-0.0368*	0.0425***	0.0217	0.00595	0.0116
	(0.0176)	(0.0207)	(0.0198)	(0.0141)	(0.0189)	(0.0160)	(0.0157)
$kaopen\_d_{t-1}$	-0.0119	-0.0140	-0.0232*	-0.00639	-0.0156	0.00346	-0.0113
	(0.0112)	(0.0111)	(0.0127)	(0.0111)	(0.0107)	(0.0120)	(0.0105)
Observations	5491	4872	5356	5545	5367	4685	5633
Number of id	1249	1106	1215	1264	1218	1074	1282
AR(2)	0.816	0.300	0.964	0.514	0.637	0.664	0.589
Hansen	0.139	0.129	0.121	0.172	0.148	0.123	0.172

Note: Estimation of Equation (7) using Two Stage System GMM, where either correlation or a coexceedance probability (Q5, Q10, Q25, Q75, Q90, Q95) is used as a measure of comovement. *,**,*** imply significance at the 10%, 5% and 1%, respectively.

Table 3: Dynamic Adjustment International Equity Investment: OECD Sample, economic

	corr	q05	q10	q25	q75	q90	q95
Δ lequity$_{t-1}$	-0.125***	-0.113***	-0.0907***	-0.115***	-0.110***	-0.113***	-0.114***
	(0.0311)	(0.0350)	(0.0323)	(0.0315)	(0.0345)	(0.0324)	(0.0332)
correlation$_t$	-0.378***						
	(0.141)						
q05$_t$		-0.424*					
		(0.247)					
q10$_t$			-0.0183				
			(0.316)				
q25$_t$				-0.239			
				(0.235)			
q75$_t$					-0.696***		
					(0.186)		
q90$_t$						-0.465***	
						(0.163)	
q95$_t$							-0.431**
							(0.170)
Δ lmcap$_t$	0.464***	0.498***	0.451***	0.484***	0.568***	0.467***	0.440***
	(0.0735)	(0.0735)	(0.0750)	(0.0733)	(0.0783)	(0.0783)	(0.0739)
trade$_t$	0.00614	0.0111*	-0.00321	-0.000238	0.00930**	0.00593	0.00348
	(0.00507)	(0.00621)	(0.00698)	(0.00466)	(0.00413)	(0.00376)	(0.00392)
Δ lgdp_cap$_t$	0.662***	0.516**	0.472**	0.604***	0.610***	0.633***	0.730***
	(0.197)	(0.204)	(0.202)	(0.178)	(0.189)	(0.195)	(0.202)
indus$_{t-1}$	0.0369	0.125**	0.111**	0.0796*	0.0499	0.0640	0.0524
	(0.0490)	(0.0490)	(0.0513)	(0.0453)	(0.0444)	(0.0466)	(0.0501)
xvol$_t$	-0.00289*	-0.00186	-0.00178	-0.00261	-0.00299*	-0.00357**	-0.00267*
	(0.00165)	(0.00160)	(0.00175)	(0.00169)	(0.00161)	(0.00171)	(0.00160)
kaopen_o$_{t-1}$	-0.110***	-0.251***	-0.104***	-0.0945***	-0.242***	-0.111***	-0.102***
	(0.0342)	(0.0278)	(0.0319)	(0.0321)	(0.0269)	(0.0349)	(0.0334)
kaopen_d$_{t-1}$	-0.0139	-0.0175	-0.0331**	-0.0194	-0.0132	-0.0190*	-0.0222**
	(0.0115)	(0.0112)	(0.0132)	(0.0123)	(0.0103)	(0.0105)	(0.0109)
Observations	4505	4203	4505	4505	4398	4460	4505
Number of id	995	924	995	995	964	980	995
AR(2)	0.537	0.791	0.877	0.662	0.859	0.688	0.700
Hansen	0.414	0.123	0.153	0.384	0.101	0.186	0.557

Note: Estimation of Equation (7) using Two Stage System GMM, where either correlation or a coexceedance probability (Q5, Q10, Q25, Q75, Q90, Q95) is used as a measure of comovement. *,**,*** imply significance at the 10%, 5% and 1%, respectively.

Table 4: Dynamic Adjustment International Equity Investment: Robustness

	Statistical sample				Economical sample			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ lequity$_{t-1}$	-0.103***	-0.103***	-0.102***	-0.100***	-0.123***	-0.124***	-0.123***	-0.117***
	(0.0264)	(0.0265)	(0.0263)	(0.0262)	(0.0315)	(0.0313)	(0.0313)	(0.0306)
correlation$_t$	-0.411***	-0.415***	-0.415***	-0.438***	-0.363***	-0.385**	-0.379***	-0.436***
	(0.125)	(0.138)	(0.125)	(0.126)	(0.140)	(0.154)	(0.142)	(0.145)
Δ lmcap$_t$	0.422***	0.427***	0.423***	0.426***	0.462***	0.467***	0.459***	0.475***
	(0.0725)	(0.0742)	(0.0724)	(0.0722)	(0.0740)	(0.0751)	(0.0736)	(0.0734)
trade$_t$	0.00808**	0.00835**	0.00857**	0.00866**	0.00537	0.00637	0.00727	0.00782
	(0.00397)	(0.00420)	(0.00391)	(0.00400)	(0.00509)	(0.00519)	(0.00498)	(0.00506)
Δ lgdp_cap$_t$	0.551***	0.551***	0.550***	0.562***	0.657***	0.666***	0.665***	0.690***
	(0.183)	(0.185)	(0.183)	(0.185)	(0.197)	(0.198)	(0.197)	(0.202)
indus$_{t-1}$	0.0462	0.0430	0.0466	0.0435	0.0378	0.0329	0.0358	0.0316
	(0.0474)	(0.0500)	(0.0479)	(0.0474)	(0.0489)	(0.0510)	(0.0498)	(0.0494)
xvol$_t$	-0.00378*	-0.00380*	-0.00384*	-0.00378*	-0.00292*	-0.00295*	-0.00294*	-0.00287*
	(0.00209)	(0.00213)	(0.00209)	(0.00209)	(0.00165)	(0.00169)	(0.00166)	(0.00165)
kaopen_o$_{t-1}$	0.0149	0.0110	0.0147	0.0153	-0.113***	-0.112***	-0.111***	-0.112***
	(0.0177)	(0.0225)	(0.0178)	(0.0177)	(0.0339)	(0.0346)	(0.0340)	(0.0349)
kaopen_d$_{t-1}$	-0.0125	-0.0165	-0.0110	-0.0121	-0.0153	-0.0150	-0.0122	-0.0133
	(0.0113)	(0.0138)	(0.0113)	(0.0113)	(0.0117)	(0.0134)	(0.0116)	(0.0116)
xrate_app$_t$	-0.00122				-0.00158			
	(0.00140)				(0.00145)			
instqual_o$_{t-1}$		0.00376				0.00293		
		(0.00933)				(0.00824)		
instqual_d$_{t-1}$		0.00303				0.00111		
		(0.00755)				(0.00786)		
stturnover$_t$			-0.0112				-0.0271	
			(0.0214)				(0.0225)	
offdep$_t$			-0.000674				-0.000808	
			(0.00277)				(0.00291)	
ret_loc$_{t+1}$				-0.0609				-0.144*
				(0.0824)				(0.0761)
Observations	5491	5491	5491	5491	4505	4505	4505	4505
Number of id	1249	1249	1249	1249	995	995	995	995
AR(2)	0.825	0.827	0.811	0.814	0.540	0.540	0.551	0.546
Hansen	0.129	0.133	0.140	0.127	0.395	0.417	0.406	0.288

Note: Estimation of Equation (7) using Two Stage System GMM, where correlation is used as a measure of comovement. *,**,*** imply significance at the 10%, 5% and 1%, respectively.

Table 5: Dynamic Level International Equity Investment: System GMM

	corr	q05	q10	q25	q75	q90	q95
$lequity_{t-1}$	0.816***	0.836***	0.794***	0.815***	0.820***	0.782***	0.845***
	(0.0468)	(0.0643)	(0.0569)	(0.0490)	(0.0471)	(0.0577)	(0.0470)
$correlation_t$	-0.170						
	(0.231)						
$q05_t$		-0.828*					
		(0.468)					
$q10_t$			-0.494				
			(0.459)				
$q25_t$				-0.237			
				(0.213)			
$q75_t$					-0.0459		
					(0.435)		
$q90_t$						0.118	
						(0.365)	
$q95_t$							-0.391
							(0.267)
$lmcap_t$	0.106***	0.0920**	0.118***	0.109***	0.108***	0.128***	0.0924***
	(0.0286)	(0.0373)	(0.0342)	(0.0285)	(0.0296)	(0.0343)	(0.0282)
$trade_t$	0.0259***	0.0325**	0.0319***	0.0251***	0.0221***	0.0256***	0.0234***
	(0.00902)	(0.0136)	(0.0103)	(0.00833)	(0.00852)	(0.00986)	(0.00857)
$lgdp\_cap_t$	0.195***	0.182**	0.223***	0.191***	0.174***	0.223***	0.162***
	(0.0594)	(0.0859)	(0.0713)	(0.0620)	(0.0566)	(0.0700)	(0.0612)
$indus_{t-1}$	0.209**	0.169*	0.228**	0.241***	0.247***	0.304***	0.196**
	(0.0856)	(0.0949)	(0.0974)	(0.0794)	(0.0888)	(0.0999)	(0.0835)
$xvol_t$	-0.00922***	-0.00926**	-0.0106***	-0.00919***	-0.00847***	-0.00958***	-0.00837***
	(0.00312)	(0.00361)	(0.00332)	(0.00317)	(0.00312)	(0.00328)	(0.00307)
$kaopen\_o_{t-1}$	0.106***	0.0941**	0.119***	0.104***	0.108***	0.118***	0.0890***
	(0.0328)	(0.0404)	(0.0373)	(0.0323)	(0.0336)	(0.0371)	(0.0310)
$kaopen\_d_{t-1}$	-0.123***	-0.114***	-0.133***	-0.121***	-0.117***	-0.138***	-0.106***
	(0.0310)	(0.0411)	(0.0368)	(0.0328)	(0.0305)	(0.0366)	(0.0310)
Observations	7098	7098	7098	7098	7098	7098	7098
Number of id	1374	1374	1374	1374	1374	1374	1374
AR(2)	0.174	0.175	0.167	0.170	0.169	0.185	0.190
Hansen	0.310	0.230	0.428	0.459	0.761	0.00706	0.354

Note: Estimation of Equation (6) using Two Stage System GMM, where either correlation or a coexceedance probability (Q5, Q10, Q25, Q75, Q90, Q95) is used as a measure of comovement. *,**,*** imply significance at the 10%, 5% and 1%, respectively.

Table 6: Dynamic Adjustment International Equity Investment: System GMM and Home Bias

	Statistical sample			Economical sample		
	(1)	(2)	(3)	(4)	(5)	(6)
Δ lequity_{t-1}	-0.102***	-0.105***	-0.0942***	-0.117***	-0.124***	-0.111***
	(0.0276)	(0.0264)	(0.0276)	(0.0329)	(0.0318)	(0.0317)
correlation_t	-0.292**	-0.285**		-0.208	-0.290**	
	(0.120)	(0.124)		(0.141)	(0.139)	
hb_{t-1}	-0.0128***	0.890***		-0.0161***	0.823***	
	(0.00475)	(0.247)		(0.00480)	(0.207)	
hbcorr_t			-0.572**			-0.645**
			(0.229)			(0.266)
Δ lmcap	0.394***	0.405***	0.417***	0.436***	0.452***	0.466***
	(0.0727)	(0.0776)	(0.0803)	(0.0760)	(0.0799)	(0.0837)
trade_t	0.00371	0.00947**	0.00514	-0.00177	0.00875	0.00381
	(0.00386)	(0.00435)	(0.00408)	(0.00531)	(0.00588)	(0.00529)
Δ lgdp_cap_t	0.479***	0.858***	0.806***	0.501**	1.037***	0.969***
	(0.185)	(0.197)	(0.218)	(0.219)	(0.229)	(0.242)
indus_{t-1}	0.103**	0.134**	0.0570	0.115**	0.128**	0.0523
	(0.0505)	(0.0537)	(0.0556)	(0.0542)	(0.0564)	(0.0589)
xvol_t	-0.00374*	-0.00302	-0.00350	-0.00296*	-0.00218	-0.00262
	(0.00208)	(0.00225)	(0.00233)	(0.00170)	(0.00183)	(0.00185)
kaopen_o_{t-1}	0.0247	0.0903***	-0.00456	-0.130***	-0.00487	-0.140***
	(0.0173)	(0.0239)	(0.0200)	(0.0387)	(0.0478)	(0.0373)
kaopen_d_{t-1}	-0.0125	-0.0203	-0.0138	-0.0166	-0.0207	-0.0125
	(0.0114)	(0.0128)	(0.0127)	(0.0117)	(0.0131)	(0.0136)
Observations	5491	5045	5045	4505	4098	4098
Number of id	1249	1152	1152	995	911	911
AR(2)	0.808	0.870	0.788	0.603	0.509	0.584
Hansen	0.00129	0.121	0.0871	5.48e-05	0.265	0.433

Note: Estimation of Equation (7) using Two Stage System GMM, where correlation is used as a measure of comovement. *,**,*** imply significance at the 10%, 5% and 1%, respectively.

Table 7: Source and host country sample

Source countries			
Argentina	Finland	Japan	Russia
Australia	France	Korea	Singapore
Austria	Germany	Luxembourg	South Africa
Belgium	Greece	Malaysia	Spain
Brazil	Hong Kong	Netherlands	Sweden
Canada	Hungary	New Zealand	Switzerland
Chile	Indonesia	Norway	Thailand
Colombia	Ireland	Philippines	Turkey
Czech Republic	Israel	Poland	United Kingdom
Denmark	Italy	Portugal	United States
Host countries			
Argentina	Finland	Japan	Portugal
Australia	France	Korea	Russia
Austria	Germany	Luxembourg	Singapore
Belgium	Greece	Malaysia	South Africa
Brazil	Hong Kong	Mexico	Spain
Canada	Hungary	Netherlands	Sweden
Chile	India	New Zealand	Switzerland
China	Indonesia	Norway	Thailand
Colombia	Ireland	Peru	Turkey
Czech Republic	Israel	Philippines	United Kingdom
Denmark	Italy	Poland	United States