Home Bias and Financial Market Integration:

Has Time Eroded the Puzzle?

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Abstract

This paper examines whether globalization and increased regional integration have reduced the equity home bias. To measure the home bias, we compare observed foreign equity holdings to a number of benchmarks, starting with the International CAPM (I-CAPM) whose average investor holds the market portfolio. We depart from the traditional prediction of the I-CAPM by applying two recent methodological contributions to the field. First, we allow for a certain amount of mistrust in the I-CAPM and involve the return data in computing the mean-variance optimal allocations and secondly we correct for uncertainty about the sample estimates of expected returns. Using this methodology, we obtain more robust and realistic measures of home bias and investigate their evolution. We find that European integration has driven down the home bias of developed EU member states in the last decade. This suggests that *time* working towards financial market integration works also towards eroding the home bias “puzzle”.

1 Introduction

The home bias "puzzle" may be solved through financial market integration. Globalization and regionalization create the proper incentives and investors rise to the challenge. They appear to be correcting their well-known and costly preference for overinvesting in domestic equities. As shown by *French and Poterba (1991)* investors idealise the performance of their domestic markets and treat foreign assets with unduly distrust when making their allocation decisions. This attitude is costly in terms of forgone gains from international diversification estimated in the range of 20% to 100% of lifetime (permanent) consumption *(Lewis, 1996)*[1].

According to the I-CAPM, the average investor holds the world market portfolio and domestic allocations should not exceed the relative country share in the world market capitalization (based on the proportionality result of *Linter, 1965*). Especially for smaller European countries this portfolio prediction is rather restrictive as it implies optimal domestic allocations lower than 10% of portfolio. If the model is not a valid description of the data, computing a country's home bias as deviation from its relative market share is no longer reasonable. The more general result of the standard mean-variance (MV) optimisation problem expresses optimal investment weights only in terms of the first two moments of the distribution of returns. This analytical result deals with the true population parameters, unavailable and unattainable in practice and therefore calls for a decision on how to estimate moments of returns. One option, called the "model based" approach uses classical asset pricing models which decompose asset returns into priced sources of risks or benchmark portfolios. The I-CAPM, whose single benchmark is the world market portfolio, is one possible model choice. The second option, so called "data based", leans on historical records of asset returns and takes the sample mean and covariance matrix as the parameters needed to compute optimal portfolio weights *(Pástor, 2000).*

An asset pricing model has the advantage of a clear prediction over the noise that is present in any data sample. On the other hand models are constantly confronted with empirical rejections, which question their usefulness for pricing assets. Using the sample moments of asset returns, faces as well a long standing critique. The average

[1] *Lewis (1996)* compares the consumption growth paths associated with domestic returns and respectively with returns of optimal international portfolios derived using time additive constant relative risk aversion as well as Epstein-Zin-Weil utility functions. The utility functions are defined as a function of wealth, which is indirectly a function of stock returns as in *Ingersoll (1987).* The forgone consumption gains from diversification for certain coefficients of risk aversion indicate that foreign asset diversification could lead to almost doubling permanent consumption.

of a time series of realized returns is a highly imprecise estimate of the true expected returns *(Merton, 1980).* The sample average translates directly into volatile and unreliable optimal weights. The investor is trapped between the clear prescriptions of heavily challenged asset pricing models and the often erratic "data-based" optimal weights.

To bridge these apparently extreme positions, *Pástor (2000)* proposes a refined view of the interplay between data and theory and a subtle alliance of the two. He models varying degrees of confidence in the asset pricing model in a Bayesian framework, neither unconditionally accepting the pricing relation nor completely discarding it in favour of data. The Bayesian investors incorporate both the CAPM and historical data on asset returns in their decisions depending on their level of trust in the model. In this way, investors suspicious of the CAPM are not entirely abandoned to the untamed "data-based" allocations. However, this hybrid approach uses the sample data to some extent and consequently inherits some of its volatility. A possible solution is given by *Garlappi, Uppal and Wang (2004)* who explicitly correct for estimation error in the sample expected returns.

Our paper contributes to the literature dedicated to the home bias "puzzle" in several ways. Methodologically, we explore alternative ways to define optimal investment "benchmarks", apart from the I-CAPM market share allocation, which is traditional in the home bias literature. Allowing for Bayesian updating provides a partial explanation to home bias behaviour. Previous empirical tests of this methodology by *Li (2002)* for G7 countries and by *Asgharian and Hansson (2005)* for European pension fund data show that varying degrees of mistrust in the model contribute to the solution and lead to lower, yet still positive, levels for home bias measures. Our results corroborate these findings. In a panel of twenty-five developed and emerging markets that account for over 90% of the world market capitalization, we find that average Bayesian home bias is 30% lower if we depart from the rather restrictive prediction of the I-CAPM. In the case of the Netherlands, for instance, for a small degree of mistrust in I-CAPM leads to a sharp decrease in home bias which is fully eliminated in the days of the common currency.

Conceptually, we conjecture that financial market integration gradually solves the home bias "puzzle". We link financial market integration to the causes of home bias in order to change the perspective on the phenomenon. The novelty of our approach is that we regard home bias as the result of a complex combination of causes, including government restrictions cost related, informational and behavioural factors that have been pointed out in the literature. We identify several channels through financial market integration affects many potential causes of home bias and may erode it.

Empirically, we confirm this hypothesis. Our results show that the recent surge in international integration challenges home bias through both its global and regional components. Time, which we interpret as a proxy for global phenomena appears to work against home bias. Besides a moderate negative trend, we note a sharp bias correction effect of EU and more importantly of the common currency. The latter could be interpreted as support for the cost related explanations to home bias.

The evolution of home bias is consistent across several measures and gives additional weight to our claim that while globalization slowly erodes home bias, more intense financial integration as in the case of the European integration and the monetary union, effectively slashes down the "puzzle".

The remainder of this study is organised as follows. Section 2 discusses the possible causes of home bias advanced in the literature and shows how financial market integration may affect them. Section 3 reviews theoretical considerations related to computing optimal investment weights. Section 4 presents the data as well the methodology for computing home bias. Section 5 reports our empirical results and section 6 summarizes our main findings.

2 Home Bias: The "Puzzle"

Equity home bias is considered one of the major unsolved puzzles of international finance *(Obstfeld and Rogoff 2000).* Various attempts to match observed deviations from optimality in investment to their probable causes suggest that no single reason justifies home bias and more importantly, that all candidate factors (from market frictions to bounded rationality) could be eroded through financial market integration.

Institutional barriers to foreign investment (government restrictions, tax differentials) are the first candidate for an explanation to home bias as well as the first target of market integration. However, they are not credited with enough explanatory power to solve the home bias "puzzle". Government restrictions are fading faster than home bias, remaining limits on cross-border investment (such as caps to foreign exposure) are hardly binding, taxes on foreign investments are not prohibitive and turnover rates for international equity flows are large. Notwithstanding, international holdings of sophisticated investors, such as mutual funds from UK, Germany or Canada are persistently lower than 20% in the period 1980 - 1993 (*Lewis, 1999).*

The direct institutional barriers add to other transaction costs specific to foreign investment such as fees, commissions, and higher spreads. *Glassman and Riddick (2001)* report actual costs of foreign investment in the range of 1 - 4% per year while they estimate that, in order to explain the home bias these figures[2] for France, Germany, Japan and the UK, should rise to 14 - 19%.

Market frictions are extended to include costs in international goods trade and information factors. *Obstfeld and Rogoff (2000)* propose a model of international exchange in which plausible trade costs go a long way towards explaining actual levels of equity home bias, their calibrations suggesting optimal shares of domestic assets of over 70%. *Engel (2000)* endorses this intuition and suggests that time – considering the speed of technological development – alleviates market frictions and may gradually solve the "puzzle". *Portes and Rey (2005)* use a "gravity" model[3] to show that international trade, as well as portfolio equity holdings share the same strong inverse relationship with distance, which they interpret as a proxy for information.

Empirical studies find evidence of causality between costs (direct or informational) and home bias, but not sufficient to explain the puzzle. *Ahearne, Griever and Warnock (2002)* use recent data from an IMF survey on international portfolio holdings and find that the empirical link between home bias and direct transaction costs is statistically significant but economically weak.

Direct transaction costs are bound to decline in a more integrated financial market and especially in the presence of the common currency. This is another channel through which we expect the process of market integration in Europe to correct home bias.

Information asymmetries and the risk of ending up with a foreign "lemon" arise from differences in accounting principles, disclosure requirements, regulatory conditions, specificity of the local business and political environment (*Ahearne, Griever and Warnock, 2002, Portes and Rey, 2005).* The fear of unknown translates into perceiving foreign markets as more risky and appears to be a non trivial factor in

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[2] The estimates of transaction costs needed to explain home bias result from comparing the implied mean of domestic returns (should the observed portfolio allocations be optimal) with the historical mean of domestic returns (lower by more than 1% per month) (*Glassman and Riddick, 2001*).

[3] "Gravity" models, frequent in trade economics, link trade flows between two entities by their "mass" (GDP) and distance with possible extensions given by inclusion of dummies related to cultural, trade bloc affinities a.s.o. (*Portes and Rey, 2005*)

explaining home bias *(Ahearne, Griever and Warnock, 2002; Mann and Meade, 2002)*. This provides another channel through which home bias may respond to financial and monetary integration. Increased international trade, as well as common rules and a more transparent business environment decrease the "distance" in an informational sense, among the countries.

However, there are several limitations to the transaction costs and information asymmetry motifs. An empirical study by *Tesar and Werner (1995)* subsequently revised by *Warnock (2001)* observed that transaction costs do not deter investors from frequent and substantial dealings in international equity markets, hence they cannot explain the low levels of foreign holdings. Moreover, in theory, informed (domestic) investors should be biased for the domestic market *only* in times of good prospects and should divert funds from the domestic "lemon" in the opposite case. There is no evidence that domestic investors make use of their superior information in this manner *(Jenske 2001).*

The intuition that possible causes of home bias should be considered as combination of quantitative and qualitative aspects is motivated by work of *Glassman and Riddick (2001).* They speculate on the properties of a "mystery" asset, omitted from the investment opportunity set in the computation of optimal allocations. This omitted asset could be the cause the home bias "puzzle" to the extent it is useful as a diversification tool, *i.e.* has low correlation with domestic equities. This possible "cause" of home bias combines the following features: large idiosyncratic risk, significant proportion of domestic wealth, similar correlations with both domestic and foreign equities and non-negligible transaction costs. Human capital[4], domestic or foreign bonds and real estate are in turn ruled out by the authors. The omitted asset retains an unknown identity. However, its characteristics may well respond to market integration through its impact on risk, market correlations and transaction costs.

Another possible reason for home bias and also a beneficiary of financial market integration is the investor himself. The investor is only human after all, and empirical studies show clear tendencies to subjectivity in investment decisions. *Coval and Moskowitz (2001)* find that not only information but also personal ties among local executives and psychological reasons such as a certain local patriotism affect portfolio allocations. In an international setting, the set of psychological factors is expanded by aspects related to culture and language *(Grinblatt and Keloharju, 2000*

[4] The link between human capital and home bias is examined by *Brainard and Tobin, 1992*, *Baxter and Jermann, 1995, Bottazzi, Pesenti and Wincoop, 1996* and *Boonstra and Sterken, 2001.*

and 2001). This familiarity explanation to home bias lies on the border between rational and behavioural models. The link that keeps them in the sphere of rationality is their potential information content. In a survey conducted on 234 German fund managers, *Lütje and Menkhoff (2003)* find that the prevalent causes of home bias, besides relative return optimism are non-fundamental information (chart analysis, statements of economic opinion leaders such as Alan Greenspan, following the trend) and an unexplainable perception of risk (home bias of German fund managers is negatively correlated with estimation of foreign risk). In conclusion, they reject full rationality. Perceptions and familiarity can only be improved in a better integrated market and inherent competition pressures may also increase managerial competence. In this way, the European Union creates the proper environment for less biased investment behaviour.

In absence of a single acceptable explanation, home bias retains the title of "puzzle", but one that may respond better to a single antidote such as the integration of financial markets and be driven towards a solution rather than fully explained.

3 Optimal Portfolio Weights

Home Bias is by definition a deviation from optimum, specifically MV optimum. Naturally, different values for the "benchmark" result in different levels of home bias and researchers have been tempted to cut the Gordian knot and prove that the home bias is not as much a "puzzle" as the mismeasurement of the MV "benchmark". This section reviews several candidate "benchmarks".

The common starting point is the standard decision of a mean-variance (MV) investor who directs his wealth towards domestic and foreign equity so as to maximize his expected utility,

$$\max_{\boldsymbol{\omega}} \ \boldsymbol{\omega}'\boldsymbol{\mu} - (\gamma/2)\boldsymbol{\omega}'\boldsymbol{\Sigma}\boldsymbol{\omega},$$

where $\boldsymbol{\omega}$ is the vector of portfolio weights, i.e. domestic and foreign equity allocations, $\boldsymbol{\mu}$ is the vector of their expected returns, $\boldsymbol{\Sigma}$ is the variance-covariance matrix and γ is the coefficient of relative risk aversion.

The first order conditions are $\boldsymbol{\mu} = \gamma\boldsymbol{\Sigma}\boldsymbol{\omega}$ and the well-known solution to this portfolio choice problem is

$$\boldsymbol{\omega}^* = (1/\gamma)\boldsymbol{\Sigma}^{-1}\boldsymbol{\mu}.$$

Imposing the budget constraint $\boldsymbol{\omega}'\iota = 1$, the solution becomes

$$\boldsymbol{\omega}^* = (1/\gamma)\,\boldsymbol{\Sigma}^{-1}(\boldsymbol{\mu} - \eta\boldsymbol{\iota}),$$

where η, the Lagrangian multiplier of the constraint is also the expected return on the zero-beta portfolio corresponding to the optimal portfolio. The budget constraint effectively fixes γ for a known value of zero-beta expected return through $\gamma = \boldsymbol{\iota}'\boldsymbol{\Sigma}^{-1}(\boldsymbol{\mu} - \eta\boldsymbol{\iota})$ and determines uniquely the optimal portfolio weights. If risk-free rate is available and chosen as the zero-beta portfolio, the coefficient of risk aversion becomes $\gamma = \boldsymbol{\iota}'\boldsymbol{\Sigma}^{-1}\boldsymbol{\mu}_e$, where $\boldsymbol{\mu}_e$ is the vector of the expected excess returns (over the risk-free rate). The analytical portfolio choice solution when short sales are allowed is: $\boldsymbol{\omega}^* = \dfrac{\boldsymbol{\Sigma}^{-1}\boldsymbol{\mu}^e}{\boldsymbol{\iota}'\boldsymbol{\Sigma}^{-1}\boldsymbol{\mu}^e}$.

In practice, computing optimal allocations is confronted with serious data problems. The solution to the optimization problem involves the true (unobserved) expected returns and variance-covariance matrix. Available returns data enables us to use the sample moments as estimates of the true parameters. *Merton (1980)* shows that this choice is reasonable for the second moment but the estimation of expected returns $\boldsymbol{\mu}$ based on historical data is very unreliable due to the high volatility of returns. The impact of the estimated mean is amplified in the context of portfolio choice, as the inverse of the variance-covariance matrix tends to be a large number when the correlations between the countries are high *(Jenske 2001)*. The “data-based” optimal weights directing investors to take extreme and volatile positions become thus even less reasonable.

Assuming equilibrium is reached, I-CAPM provides an alternative to solving for optimal portfolio weights. I-CAPM is valid in perfectly integrated world, where the law of one price holds universally and markets clear (total wealth is equal to total value of securities). The world market portfolio can then be defined as the sum of all individual portfolios weighted by the positions held by MV investors. Being a linear combination of mean-variance efficient portfolios, the world market portfolio is also on the mean-variance frontier. Hence, in the perfectly integrated world of the I-CAPM, the optimal international investment weights of a country are given by the relative shares of domestic and foreign equities in the world market capitalization.

The I-CAPM results in the well-known linear beta relationship between risk premium on domestic markets and the expected excess return on the world market portfolio. Regressing excess returns on domestic portfolio on an intercept and excess returns on the world market portfolio becomes a straightforward test of the model. We accept it if estimates of the intercept, $\hat{\alpha}$ are zero.

The assumption of perfect market integration translates practically into pointing out the complex link between the *actual* degree of integration and the home bias issue. Market segmentation is fundamental to measuring home bias. Its manifestations include the effect of non-tradability of some foreign assets that erodes the assumption of liquid and tradable wealth in the I-CAPM (*Lewis 1999*). Human capital is a chief example of non-tradable wealth whose implications for home bias are not strictly identified *(Glassman and Riddick, 2001).* Market segmentation in effect challenges the foundation of the asset pricing model.

The empirical studies reviewed in Section 2 measure home bias as deviation from market capitalisation shares, *i.e.* they fully endorse the I-CAPM. However, considering the stringency of its assumptions it is reasonable to expect that some investors do not accept the model unconditionally. Modelling their degree of belief in the accuracy of the I-CAPM as description of reality, adds another dimension to measuring home bias. In terms of the beta pricing relationship, this translates into assessing the importance that investors attach to a nonzero sample estimate of the intercept $\hat{\alpha}$ *(Pástor, 2000).* The dogmatic prescription of the I-CAPM is that the intercept is zero, as the world benchmark is assumed to fully describe the asset returns and capture all sources of priced risk. Therefore, the degree of belief in the model is expressed in values of the standard errors of the intercept σ_α and involved in the allocation decision. A small value indicates strong belief in the relevance of the theoretical model and results in comparable optimal portfolio weights while a larger value leads to a different set of optimal weights and brings us closer to the results of the data based approach. This interpretation is an insightful reconciliation of the two approaches. For instance, a nonzero value for $\hat{\alpha}$, even if it were insignificant according to a standard t-test (and therefore did not lead to a rejection of the I-CAPM), could be instrumental in explaining why observed allocation deviate from the model prescriptions.

Here, the data is used for updating the prior belief in the validity of the model, *i.e.* the belief in a zero value for the intercept $\hat{\alpha}$. This ultimately results in different estimates for the mean and variance covariance matrix of returns, used to compute the portfolio weights.

These Bayesian MV optimal weights are computed as:

$$\boldsymbol{\omega}^* = \frac{\boldsymbol{\Sigma}^{*-1}\boldsymbol{\mu}_e^*}{\boldsymbol{\iota}'\boldsymbol{\Sigma}^{*-1}\boldsymbol{\mu}_e^*},$$

where $\boldsymbol{\mu}_e^*$ and $\boldsymbol{\Sigma}^*$ are the predictive mean and variance that replace in this approach the moments of the distribution of returns.

The predictive density is defined as:

$$p\left(r_{t+1}\middle|\Phi\right) = \int_\theta p\left(r_{t+1},\theta\middle|\Phi\right)d\theta = \int_\theta p\left(r_{t+1}\middle|\theta,\Phi\right)p\left(\theta\middle|\Phi\right)d\theta,$$

where $p(r_{t+1}|\Phi)$ is the probability density of excess returns conditional on Φ (the sample data) and θ, the set of parameters of the statistical model that describes the stochastic behaviour of asset returns. This form for the predictive density involves $p\left(\theta\middle|\Phi\right)$, the conditional probability of the parameters of the model given the data available. According to Bayes' Rule, the *predictive distribution* is proportional to the product of the *posterior density* and the *likelihood function*:

$$p\left(\theta\middle|\Phi\right) \propto p\left(\Phi\middle|\theta\right)p\left(\theta\right),$$

where $p\left(\theta\middle|\Phi\right)$ is the *posterior density*, $p\left(\Phi\middle|\theta\right)$ the *likelihood function*, or probability distribution function for the data given the parameters of the model and $p\left(\theta\right)$, the *prior density*, that reflects the non-data information available about θ *(Koop 2003).* In our setting, the prior follows naturally from assuming a valid I-CAPM which is subsequently updated through incorporation of the information revealed by the data. The I-CAPM gives therefore the starting belief that intercepts, the sample mispricings, are zero. This information is expressed through σ_α, the standard errors of the intercept, a measure of its claim for significance in the eyes of the investors. The methodology is presented in more detail in Appendix 1.

A degree of mistrust in the I-CAPM that is justified by the country conditions may result in optimal weights that are closer to the observed allocations and thereby imply for certain countries, lower home bias than the deviation from the market capitalisation share.

This Bayesian approach uses the I-CAPM as the starting point and departs from its prediction in proportion with the investors' degree of mistrust in the model. Larger mistrust in the I-CAPM makes historical return data more relevant in estimating the optimal allocations which become in turn, more volatile. To minimise this drawback, *Garlappi et al. (2004)* tackle directly the problem of volatile data by extending the mean-variance framework to incorporate the investors' aversion to uncertainty around the estimate of the mean returns. This changes the standard mean-variance problem in two ways: (1) binds the expected returns to a confidence interval around their estimate, thus taking into account the eventual estimation error and (2) allows the investor to minimize over the choice of expected returns, thus manifesting its aversion to uncertainty.

The multi-prior framework of *Garlappi et al. (2004)* is defined by the following problem:

$$\max_{\boldsymbol{\omega}} \ \min_{\boldsymbol{\mu}} \ \boldsymbol{\omega}'\boldsymbol{\mu} - (\gamma/2)\,\boldsymbol{\omega}'\boldsymbol{\Sigma}\boldsymbol{\omega},$$

subject to

$$f\left(\boldsymbol{\mu}, \hat{\boldsymbol{\mu}}, \boldsymbol{\Sigma}\right) \leq \in,$$

$$\boldsymbol{\omega}'\iota = 1,$$

where $\hat{\boldsymbol{\mu}}$ is the sample mean of asset returns. If the confidence intervals are defined jointly for all assets, f can be taken as $\frac{T(T-N)}{(T-1)N}\left(\hat{\boldsymbol{\mu}}-\boldsymbol{\mu}\right)' \boldsymbol{\Sigma}^{-1}\left(\hat{\boldsymbol{\mu}}-\boldsymbol{\mu}\right)$ and $\in$ as a quantile for the $F-$distribution.[5] N is the number of assets and T, the number of observations. The constraint translates into the $P\left(f \leq \in\right) = 1-p$ for a corresponding probability level. This framework can be extended to include uncertainty over a chosen return-generating model, such as the I-CAPM.

The solution to the multi-prior max-min problem is a set of optimal weights with a considerably smoother behaviour compared to the ones obtained through the direct influence of the data. Appendix 2 highlights the analytical results obtained by *Garlappi et al. (2004)* when short sales are allowed.

[5] If asset returns are normally distributed and $\boldsymbol{\Sigma}$ is known, f has a χ^2 distribution with N d.f. If $\boldsymbol{\Sigma}$ is not known, it follows a F distribution with $N, T-N$ d.f. *(Garlappi et al. 2004)*

4 Home Bias Measures and Data Issues

4.1 Home Bias Measures

In line with other works in this field[6], we quantify home bias of country $[i]$ in terms of its actual (ACT_i) and optimal (OPT_i) foreign portfolio weights as:

$$HB_i = 1 - \frac{ACT_i}{OPT_i}.$$

The optimal portfolio weights correspond are computed according to the methodologies described in the previous sections. The actual portfolio holdings are determined using data from the International Investment Position as follows. The share of international portfolio of country [*i*] is computed as the ratio of foreign equity holdings of the reference country[7] (FA_i), to the total (foreign and domestic) equity holdings. The domestic equity holdings are computed as the difference between the market capitalization of the country (MC_i) and the total domestic equity stocks held by foreign investors[8] (FL_i):

$$ACT_i = \frac{FA_i}{FA_i + MC_i - FL_i}.$$

In the typical case, when actual foreign involvement is lower than the optimal share of international stock, and the country is subject to home bias, the measure takes values between 1 (corresponding to no foreign portfolio investment) and 0 (when actual and optimal portfolio weights are equal). For instance, if a country should optimally hold 80% of its portfolio in foreign stocks and has an actual allocation of 20%, the country shows a corresponding home bias as high as 0.75. However, at times, the data might offer cases when the actual weights exceed optimal weights, for instance when the performance of the domestic index is compelling and negative or very low weights are assigned to the world market index. This can be the case when the world market index has a high variance and covariance with the domestic index and with a lower mean.

In such cases, when the country is not home biased, but on the contrary, overinvesting abroad, the former measure of home bias would be misleading. We

[6] *Mann & Meade (2002)* present a similar measure of home bias.
[7] Reported in *International Investment Position / Assets / Portfolio Investment / Equity*.
[8] Reported in *International Investment Position / Liabilities / Portfolio Investment / Equity.*

modify the formula to take into account the case of overinvestment abroad (negative "home bias") and obtain comparable results, as follows:

$$\widetilde{HB}_i = \frac{\min\left(\left|OPT_i\right|, ACT_i\right)}{\text{sign}\left(OPT_i\right)\max\left(\left|OPT_i\right|, ACT_i\right)} - 1.$$

We use this formula to compute a negative measure of "home bias" when optimal allocations are lower than the observed foreign investment. For example, if actual foreign holdings are 20% and the optimal weight in the foreign assets is 1%, the negative "home bias" is -0.95. This extended formula has a lower bound at -1 for the cases when it the optimal foreign stock holdings are zero. It achieves values below -1 when short sales are allowed and the optimal strategies put negative weights on the world market index. In this range, the results are home bias is no longer monotonically increasing in the difference between optimal and actual weights. If actual foreign holdings are 20% but the optimal weight is -5%, the resulting negative "home bias" value is -1.25. By construction, this formula also smoothes out the effect of any extreme values in the optimal weights. For instance, if a country should optimally sell short foreign equities (in proportion of -500%) and holds 20% in foreign assets, the corresponding negative "home bias" is -1.04. The value is negative indicating that the country is overinvesting abroad, and lower than -1, indicating that short sales of foreign equities are optimal.

4.2 Data and Possible Biases

Home bias behaviour is tested on a sample of twenty-five countries of which nineteen are European: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Italy, The Netherlands, Poland, Portugal, Spain, Switzerland, Sweden, United Kingdom, Turkey and six form a non European control group: Australia, Canada, Hong Kong, Japan, New Zealand and United States. The variation of this group, combining developed as well as emerging countries, members of EU and EMU together with outsiders, is useful for isolating any EU/euro effect in the evolution of home bias. However, the heterogeneity of the sample results into an unbalanced panel, with distinctively better data coverage for the most developed countries. Three types of data serve our analysis.

First, monthly series for returns data of varying lengths within January 1970 – December 2004 are used to obtain the optimal portfolio weights. The US one-month

Treasury Bill is considered the global risk free rate and the Morgan Stanley World Index stands as a proxy for the global market portfolio. In order to have the largest possible dataset, we combine return data from several sources. The data library available on the website of Kenneth French is the main source for market return data and for data on the risk free rate. For countries and periods that are not covered there, returns and market capitalization figures are obtained from Datastream (for developed countries) and the Emerging Markets Database, respectively.

A second set of data refers to the International Investment Position (IIP) in foreign portfolio assets and liabilities (a chapter of the Balance of Payments) recorded with annual frequency in the IMF's International Financial Services database. The IIP is defined by the IMF as a balance sheet of a country's stock of financial assets and liabilities and I records t the value of financial transactions (e.g. Balance of Payments flows), valuation changes (e.g. changes in exchange rates, prices) and other adjustments (e.g. reclassifications, corrections) at the end of year. It distinguishes between direct investments, portfolio investments (holdings of less than 10% of the share capital of the company) and other investments (including financial derivatives). Equity securities include: shares, preferred stocks and participation shares, depositary receipts (e.g. ADRs), units issued by collective investment institutions (e.g. investment funds), as well as equity securities that have been sold under repurchase agreements and equity securities that have been lent under securities lending agreements.

The information on IIP presented above is gathered during *periodical* benchmark surveys, conducted by the government to obtain the current value of domestic holdings of foreign securities, surveys that take place several years apart. The yearly figures presented in IIP are *estimated* stocks based on the transactions involving non-residents, which are reported yearly to the central government according to the Balance of Payments accounting and the periodical benchmark surveys. Data on capital flows, or transacting data, are then used to extrapolate the foreign investment positions in the years between surveys *(Tesar and Werner, 1995).* IMF has conducted Coordinated Portfolio Investment Surveys (CPIS) in 1997 and 2001 for twenty-nine, respectively sixty-four countries, in which most countries take an aggregate approach and report foreign holdings by country in a reliable fashion.

The IIP data is a virtually unique source for international portfolio holdings of relatively wide geographical and temporal coverage. However, eventual in-built biases have been associated with it. The biases that have been identified in the literature regarding the IIP arise in three situations. First, if a foreign subsidiary located in the reference country invests (for the ultimate benefit of its foreign owner) in a third country, the reference country appears as the foreign investor and not the country of the parent company. Thus the foreign involvement of the reference country may be upward biased, if this country is typically used for such intermediary transactions. The problem is more acute in studies of bilateral investment positions than in our study in which we take a more aggregate view. Second, "the data are only as reliable as the government's ability to accurately incorporate the effects of changes in asset prices, exchange rates and changes in the composition of security holdings on the value of the portfolio" *(Tesar and Werner 1995).* Recent figures provided by more experienced and open governments can be expected to be more reliable. Third, in the process of extrapolation of the yearly foreign stock positions between two successive benchmark surveys, as the data in the Balance of Payment is an aggregation over all foreign securities held by residents of the country of reference, the choice of the price index that should be used for revaluation in the estimation of IIP holdings is not unambiguous *(Griever, Lee and Warnock 2001). Warnock (2001)* points out that use of a 1994 benchmark survey in US to re-estimate positions in foreign holdings for the previous years led to serious upward corrections with consequently lower figures for home bias. However, given that the frequency of surveys increases, the chances of significant backward corrections in the future are lower.

The same IMF source is used for data needed to compute trade openness (import, export and GDP).

5 Empirical Results

5.1 International Financial Linkages

The last decade has been associated with increased linkages among most participants to the world financial market. Table 1 presents descriptive statistics for the portfolio holdings of foreign assets and liabilities (in million USD) for the twenty-five countries in our dataset. For most countries, the mean value of foreign assets/liabilities exceeds significantly the median, suggesting a common increasing trend, relatively sharp and specific to the second half of the series. In countries like Austria, Denmark, Finland, Germany, Italy, Spain, Turkey and the USA the mean is several times higher than the median suggesting a boom in international portfolio exposure over the 1990s. Some countries in our sample take clear net positions of in the international financial markets. Foreign assets holdings are several times higher than liabilities in Belgium, Iceland, Italy, Canada and New Zealand. Net receivers are Czech Republic, Denmark, Finland, Greece, Hungary, Poland, Spain and Turkey. Increasing financial linkages as such do not prove deeper financial integration unless a causal relationship can be established theoretically and tested empirically. We start from data on portfolio holdings to analyse the home bias phenomenon, make claims on the evolution of international investment strategies and test the causal link to financial market integration.

5.2 I-CAPM

The I-CAPM is not only at the core of the classical definition of home bias, but may also justify the claims of alternative methods such as the Bayesian approach of *Pástor (2000)* and the multi-prior correction of *Garlappi et al (2004).* The I-CAPM imposes that the relative market capitalization share of a country is the optimal domestic allocation. For all European countries, average domestic allocations should not exceed 10%. In the twenty-five countries of our sample only Japan and USA can justify in the I-CAPM framework, domestic investment (as annual averages) of over 20% and over 40% respectively. In contrast to the sharp increase of financial linkages, relative market capitalization shares are relative stable across the period and most countries maintain their position in the world market (Table 1). The evolution of home bias according to the I-CAPM is due to the changes in international equity holdings.

We test the I-CAPM for each of the countries in our sample in order to assess its credibility as a data generating process. In order to make the results comparable with the Bayesian approach, we divide our sample in two periods. The first subsample covers the first two years of available data that are needed at a later stage, to estimate moments of the prior distribution. The remaining sample after exclusion of the first twenty-four months of observations is used cumulatively to obtain the yearly estimates of optimal weights.

Tables 2 and 3 present the results of the I-CAPM tests on the two samples. The latter uses all the remaining data and corresponds to estimates of optimal portfolios and home bias at the end of 2004. Bearing in mind the short sample in Table 2 as well as the different starting points of the time series, we notice a large variety in the performance of I-CAPM across the twenty-five countries. The estimates of the intercept are relatively high and noisy and in this small sample they suggest considerable mistrust in the model.

Table 3 completes the perspective with the results on testing the model on the longer sample. The improvement is evident, with only one country, Iceland, failing the model. UK and Sweden are the only countries whose alphas are significantly different from zero, thus raising direct challenges to the I-CAPM. Japan, on the other hand stands out with a zero estimate of the intercept and respective standard errors of 0.27. It gives an example in which the model holds and suggests that the I-CAPM allocation "benchmark" is appropriate in this example for computing home bias. However, the average of the estimated standard errors of the intercepts over the entire group is noteworthy at 0.41. This suggests that levels of mistrust in I-CAPM up to this figure are reasonable for investors in our panel of countries. The point estimates of the intercept are mostly positive and around a third of a percent per month. In view of this evidence, the expectation that all investors believe dogmatically in the I-CAPM, common to the largest part of home bias studies, appears overly stringent.

We interpret the results on the two I-CAPM tests as ample justification for alternative allocation strategies.

5.3 Home Bias Measures

In order to test not only the evolution of home bias, but also the persistence of the phenomenon across several measurement options, we compute estimates of optimal portfolio holdings and home bias under five optimization frameworks. The first case is traditional in the home bias literature and assumes that I-CAPM is a valid description of the data. Optimal holdings are given by the relative country shares in the world market capitalization. The second case follows a pure data-based approach, where the sample moments are substituted in the solution to the MV portfolio choice problem. The third case is the Bayesian conciliation of the first two, proposed by *Pástor (2000),* where a certain degree of mistrust in the model is taken into account to determine the predictive moments of distribution. These are substituted in the analytical solution of the MV optimal weights. The remaining two alternative measures of home bias result from applying the Multi-Prior correction of *Garlappi et al. (2004)* to the pure data-based approach and to the Bayesian approach respectively.

In the latter case, the predictive moments of distribution rather than the sample estimates are used in the Multi-Prior optimization setting.

Initially, short sales are allowed in all optimizations. As expected, the pure data based approach and the Bayesian approach of *Pástor (2000),* are most sensitive to data fluctuations and occasionally result in large negative positions in either the domestic or the world market index. Table 4 suggests this by the large increase of the standard deviation of the home bias from the model to the data based measure. For many countries (Belgium, Finland, France, Hungary, Iceland, Netherlands, Sweden, UK, Australia and USA) the standard deviation increases by five to ten times. A second set of optimizations is done numerically imposing short sales constraints.

The Bayesian home bias results are reported for a value of σ_α^2 of 0.1, which in view of the standard errors reported in the previous subsection represents a reasonably high degree of trust in the model. In computing the Multi-Prior home bias the value of $\in$ (the bound on the added constraint) is chosen so that the percentage size of the confidence interval for $F_{N,T}$ implied by $\in$ is 90%. This rather high value results in substantial smoothing of the optimal portfolio weights and subsequently of home bias figures. The final case, which combines the former two, by applying the Multi-Prior data correction to the moments of posterior distribution (rather than the sample moments) is computed for a higher value of σ_α^2, in this case 0.2 which implies a larger deviation from I-CAPM.

Figures 1 and 2 show the time series of home bias obtained under the five different settings, without and respectively with short sales constraints. The graphs exhibit significant heterogeneity among countries and across the five different measures of home bias. However, the most common trend is the decreasing I-CAPM home bias, most intense at the end of the '90s. Only Greece, Hungary, Iceland, Poland, Turkey and Canada except from this trend. This behaviour is in many cases mimicked by the alternative measures. Moreover, reasonable measurement corrections, in the Bayesian and the Multi-Prior cases, succeed in eliminating home bias in Belgium, Iceland, Netherlands, Switzerland, Sweden, United Kingdom and United States. These are generally the high alpha countries. On the other hand, in some countries home bias is high and insensitive to the way it is measured. These countries are Japan, Canada, Turkey, Poland and Greece. Not surprisingly they are among the countries with the lowest estimates of intercepts.

Table 4 presents descriptive statistics of five home bias measures computed without imposing short sales constraints. They confirm several characteristics of home bias behaviour in our sample. Taking the perspective of I-CAPM, we obtain the highest figures to home bias. In all cases home bias is higher than 0.50, with most countries averaging around 0.70-0.80 home bias per year. For many countries, the mean is slightly lower than the median, suggesting a stronger decreasing trend in the second half of the sample. Greece, Hungary, Poland and Turkey are insignificantly involved in the foreign markets. In the I-CAPM world, they stand to lose the most from their lack of international diversification. The data based approach, where the investor completely disregards the I-CAPM, changes this perspective for some of the countries in our sample. One feature of the data based home bias is that it is generally lower than the I-CAPM measure. These improvements in home bias figures are insignificant for countries such as Greece, Poland, Turkey and Japan and large for Austria, Finland, Hungary, Switzerland and Sweden. Occasionally, average home bias is negative (for Belgium, Iceland, Netherlands, UK and USA) consistent with times where benefits of international diversifications are insignificant by comparison to the performance of the domestic market, which is optimally dominant in the portfolio. However, the classical critique raised by *Merton (1980)* with respect to the volatility of the data based optimal weights is appropriate in the present case too and the results of the corresponding home bias should be regarded with caution. The Bayesian approach, combining the previous two measures, results in more moderate home bias figures, less volatile but also closer to the I-CAPM home bias levels. The relatively low degree of mistrust in the model incorporated in the Bayesian approach is able to decrease to a large extent the average home bias in Belgium, Iceland and Sweden and reverse it to negative values for the Netherlands and the USA. The differences among the first three alternative measures to home bias show that the phenomenon is to a large extent sensitive to measurement choices and the responses are significantly country dependent. However, highly volatile allocation prescriptions make noisy variables for analysis and difficult objectives to be implemented by the investor. The final two alternative home bias measures use the Multi-Prior correction of *Garlappi et al. (2004)* to benefit from the advantages of methodologies that depart from the I-CAPM with minimum expense in terms of volatility of series. Smoother series of home bias confirm the previous findings. Belgium, Iceland, the Netherlands, Switzerland, UK and USA are the countries where departing from home bias contributes significantly to solving the "puzzle". The average I-CAPM home bias for these countries takes values between 0.55 (Belgium) to 0.82 (USA). The corresponding home bias figures computed using the Multi-Prior correction for the data-based approach range from 0.12 (Netherlands) to 0.49 (Switzerland). On the other extreme, Turkey, Japan, Poland and Greece exhibit high and persistent home bias regardless of our choice of benchmarks. Investors in these countries choose to forego significant diversification benefits and the investment "puzzle" in these countries seems insensitive to methodological solutions.

5.4 The impact of the European integration on home bias

The choice of investment benchmark from the options presented in the previous section results in lower figures of home bias. This may be regarded as a methodological solution to the "puzzle" for a certain country only to the extent to which I-CAPM is not the appropriate model for that market. Consequently, regardless of these measurement aspects, home bias behaviour can objectively be linked to the combination of the causes put forward in the literature and be sensitive to financial market integration, as described in Section 2.

In this section, we relate the time series home bias for all the countries in our dataset to possible explanatory variables consistent with several theoretical conjectures regarding the causes of the phenomenon. Controlling for the relative growth of market capitalization, we examine the existence of β-convergence, trends and influences of the European Union or the common currency as well as the effects of international trade in goods.

We test three different specifications, using panel data and allowing for fixed country effects:

$$\Delta HB_{it} = \alpha_i + \beta_1 \cdot \Delta RMC_{it} + \beta_2 \cdot HB_{it}(-1) + \beta_3 \cdot TIME + \beta_4 \cdot I_{it}(EU/EMU) + \beta_5 \cdot \Delta OPN_{it} + \varepsilon_{it} \quad \text{(I)}$$

$$\Delta HB_{it} = \alpha_i + \beta_1 \cdot \Delta RMC_{it} + \beta_2 \cdot \Delta OPN_{it} + \beta_3 \cdot \Delta OPN_{it} \cdot I_{it}(EU/EMU) + \varepsilon_{it} \quad \text{(II)}$$

$$\Delta HB_{it} = \alpha_i + \beta_1 \cdot \Delta RMC_{it} + \beta_2 \cdot HB_{it}(-1) + \beta_3 \cdot I_{it}(EU/EMU) + \varepsilon_{it}, \quad \text{(III)}$$

where: ΔHB_{it} - annual growth rate (in percentages) of home bias of country [*i*], measured using all five methods presented in the previous section;

ΔRMC_{it} - annual growth rate (in percentages) of relative share of market capitalization of the country [*i*] in the world market capitalization;

$HB_{it}(-1)$ - level of home bias in the previous year;

$TIME$ - trend variable;

$I_i(EU/EMU)$ - indicator function taking the value 1 if country [*i*] joined the European Union (respectively the European Monetary Union) and 0 otherwise;

ΔOPT_{it} - annual growth rate (in percentages) of the openness index of country [*i*], measured as the ratio of foreign trade (import and export) of the country to its GDP.

Testing for β-convergence amounts to estimating the causal relationship between the level of home bias of the previous year and the growth rate in the current year. A negative coefficient indicates convergence. The size of the coefficient can be interpreted as the speed of the process *(Adam et al., 2002)*.

A trend variable and EU/EMU dummy variables are included to isolate the influence of time (and the influence of universal processes such as globalization) and that of the more intensive process of European integration. Replacing the EU dummy variable to one corresponding to the common currency allows us to distinguish the potential benefits of the Monetary Union, the most advanced form of financial integration achieved in EU. The impact of globalization and regionalization on international investment behaviour gives evidence that in absence of a unique explanation to the "puzzle", financial market integration erodes at the same time many of the causes of the home bias.

Last but not least, we test the hypothesis that the informational advantage carried by the increased international trade has been incorporated into international portfolio investment strategies in EU. International trade is regarded as proof of stronger economic ties and proxy of international openness of a country *(Aba Al-Khail, 2003)*. We investigate the direct effect of the growth rate of international openness of a country as well as the mediating effect of the European integration, through an interaction effect between the openness index and the dummy variable.

Tables 5 to 9 present the results of estimating the models described above to the five alternative measures of home bias. All panel data estimations are obtained in two cases: (A) unweighted OLS with country fixed effects and (B) feasible GLS with cross-section weights, assuming the presence of cross-section heteroskedasticity.

Panel A of Table 5 shows highly significant evidence of β-convergence at relatively low speed. Sizes of the coefficient are between -0.16 and -0.32. We note also significant influence of the time, which we interpret as a proxy to globalization, but the influence is limited in size. Most credit for the decrease of I-CAPM home bias goes to the European Integration which is responsible for lowering home bias by 4-6% per year and even more to the common currency where the coefficients are in the range of 5-7%. We find support also for the hypothesis that European integration mediates the relationship between international trade in goods and investment behaviour as the coefficient of the interaction term between the European integration variables and the openness index is significant and usually increases when the EU indicator function is replaced by the corresponding EMU dummy variable. Panel B of Table 5 presents the results of the weighted regressions, which correct for part of the noise in the data and corroborate entirely the findings presented above. Size and signs of the coefficients are consistent with the unweighted regressions.

Table 6 reiterates the estimations for the data based home bias as dependent variable. The results are markedly noisier, with large values of coefficients combined with sizeable standard errors. The strong and significant negative effect of the monetary integration of home bias counteracts the positive trend that is picked up in the data. Many of the coefficients have expected signs but are insignificant. The Bayesian home bias, the explained variable in Table 7 has similar characteristics. In the weighted regressions (panel B), the negative impact of the common currency on home bias is significant and larger than 10% annually. When the Multi-Prior correction is applied to the data-based home bias (Table 8), the results are still relatively noisy in the unweighted regressions. Using cross-section weights we find that home bias is directly affected by trend (or globalization), the monetary union and indirectly by international trade. The size of the coefficients of the common currency variable are stable and close to 5%.Table 9 contains the results of regressions for the series of Bayesian home bias with Multi-Prior correction. We find support for β-convergence at a speed of less than 1% annually, statistical significance of time and of the interaction term between the openness index and the integration dummies and more importantly sizeable impact of the common currency on the decrease of home bias, as high as 5-6%.

6 Concluding Remarks

In this study we raise two challenges to home bias behaviour in investment strategies investigated in a group of twenty-five countries. The first one involves the effects of market integration. We find that the financial market integration, and especially its most intense form in the European (Monetary) Union contribute significantly to the decrease of home bias. The second challenge is methodological. We propose alternative measures of home bias that depart from the standard I-CAPM framework, allowing for varying degrees of mistrust in the model and also correcting for the uncertainty about the sample estimates of expected returns. These alternative measures achieve two goals. First, they show that for many countries, home bias becomes significantly lower when these concerns are taken into account and the I-CAPM framework is not always an appropriate investment "benchmark". Second, these measures offer a comprehensive view of the phenomenon and support a more robust and confident conclusion. We conclude that the solution to the home bias "puzzle" emerges through financial market integration.

Appendix 1

The Bayesian Framework

This appendix outlines the steps of deriving the moments of the predictive distribution of excess returns, r_{t+1}, conditional on the set of sample data, Φ in terms of the prior and the likelihood function.

The Prior

The way in which the prior distribution incorporates the information given by the estimated intercept reflects the degree of belief in the model. Complete belief in the model assumes that the eventual nonzero intercepts are merely a result of sampling or estimation error and ignores them when computing the expectations of excess returns (the fitted value of the dependent variable) while complete disbelief in the model uses the sample mean as the estimate of expected returns.

As our main interest lies in the intercept it sufficient to construct a prior which is informative only with respect to α and diffuse (highly volatile, non-informative) for the other parameters. *Pástor (2000)* chose a normal inverted Wishart **prior** for the intercept:

$$\alpha \Big| \Sigma \sim N\left(0, \sigma_\alpha^2 \left(\frac{1}{s^2}\Sigma\right)\right),$$

with Σ following a inverted Wishart distribution: $\Sigma^{-1} \sim W(H^{-1}, \upsilon)$, with H^{-1} the parameter matrix of the Wishart distribution and υ, the degrees of freedom. The expectation of the inverted Wishart distribution is given by $E(\Sigma) = H/(\upsilon - N - 1)$, where *N* is the number of asset returns in our time series. We can rewrite the expectation for the prior residual covariance matrix, as $E(\Sigma) = s^2 I_N$, for $H = s^2(\upsilon - N - 1)$. The prior involves a diagonal and homoskedastic covariance matrix for the residuals, which is set to be non-informative, by choosing υ=15, the equivalent of the sample of 15 observations. The prior of homoskedasticity can easily be reversed under the pressure of data that enters the computation of the posterior density.

At this point, taking expectation of the conditional prior distribution of α, leads to an unconditional distribution in the from:

$$\alpha \sim N\left(0, \sigma_\alpha^2 I_N\right),$$

where σ_α^2 incorporates the degree of disbelief in the model. Based on the interpretation that the intercepts different than zero reflect omitted sources of risk from the model, the size of this mispricing is directly linked to the size of the residual covariance matrix. If the variance of the intercepts has been large, the model is consequently less trusted.

The asset pricing model is linear in the benchmark risk factor, the world returns under the I-CAPM[9]: $R_t = \alpha + \beta F_t + \varepsilon_t$, assuming $E(\varepsilon_t) = 0$, $E(\varepsilon_t \varepsilon_t') = \Sigma$, $E(F_t) = \mu_F$, $E\left[(F_t - \mu_F)(F_t - \mu_F)'\right] = \Omega_F$, $\operatorname{cov}(F_t, \varepsilon_{i,t}) = 0,\ \forall i = \overline{1,N}$.

The **prior joint distribution** is:

$$p(\theta) = p(\alpha \mid \Sigma)\, p(\Sigma)\, p(\beta)\, p(\mu_F)\, p(\Omega_F),$$

where only the priors on the last three distributions are diffuse as derived by *Pástor and Stambaugh (2000):*

$$p(\alpha \mid \Sigma) \propto |\Sigma|^{-\frac{1}{2}} \exp\left\{ -\frac{1}{2} \alpha' \left(\frac{\sigma_\alpha^2}{s^2} \Sigma \right)^{-1} \alpha \right\},$$

$$p(\Sigma) \propto |\Sigma|^{-\frac{\upsilon+N+1}{2}} \exp\left\{ -\frac{1}{2} trH\Sigma^{-1} \right\},$$

$$p(\beta) \propto 1,$$

$$p(\mu_F) \propto 1,$$

$$p(\Omega_F) = \Omega_F^{-1}.$$

The Likelihood

In the linear model for asset returns, the disturbances are assumed uncorrelated and homoskedastic. The benchmark returns are assumed i.i.d., normal, independent over time and independent of the error terms. Under these independence assumptions, the **likelihood function** can be written as a product of two normal likelihood functions, for the returns on the assets and respectively for the returns on the benchmark factor :

$$p(\Phi \mid \theta) = p(R \mid \theta, F)\, p(F \mid \theta).$$

[9] *Pástor (2000)* derives the results for the general case of N assets and K benchmarks. In the case of International CAPM, the only benchmark is given by the world returns. Notation follows closely *Asgharian and Hansson (2005).*

The product terms are further expanded using computational results of *Pástor and Stambaugh (2000)* into:

$$p(R \mid \theta, F) \propto |\Sigma|^{-\frac{T}{2}} \exp\left(-\frac{T}{2} tr \hat{\Sigma}\Sigma^{-1} - \frac{1}{2}\left(b-\hat{b}\right)\left(\Sigma^{-1} \otimes F'F\right)\left(b-\hat{b}\right)\right),$$

$$p(F \mid \theta) \propto |\Omega_F|^{-\frac{T}{2}} \exp\left(-\frac{T}{2} tr \hat{\Omega}_F \Omega_F^{-1} - \frac{1}{2}(\mu_F - \hat{\mu}_F)(\mu_F - \hat{\mu}_F)' \Omega_F^{-1}\right),$$

where $b = vec(B)$ [10] and $B = (\alpha \quad \beta)'$.

The Posterior Density

We return to the key relation of Bayesian analysis, that defines the posterior distribution via proportionality with the product of prior density and likelihood functions. *Pástor and Stambaugh (2000)* combine the results for the priors with the ones for the likelihood functions separately for the regression parameters and for the benchmark returns.

The **posterior means** of the model parameters result from:

$$b \equiv E(b \mid \Phi) = \left(I_N \otimes P^{-1} X' X\right)\hat{b},$$

where $\hat{b}$ is the vector of OLS estimates of the model on the dataset, $X = (\iota_T \; F)$, $P = D + X'X$, $\underset{[2\times 2]}{D}$ is a matrix with the first element, $d_{(1,1)} = \frac{s^2}{\sigma_\alpha^2}$ and the rest of the elements $d_{(m,n)} = 0$, $m, n \neq 1$.

The **posterior variance** of the model parameters is given by:

$$Var(b \mid \Phi) = \tilde{\Sigma} \otimes P^{-1},$$

where $\tilde{\Sigma} = E(\Sigma \mid \Phi) = \frac{\left(H + T\hat{\Sigma} + \hat{B}'Q\hat{B}\right)}{T - \nu - N - K - 1}$, $Q = X'\left(I_T - XP^{-1}X'\right)X$ and $\hat{\Sigma}$ and $\hat{B}$ result from estimating the model on the available sample.

Finally, the **predictive means** and **variance** of asset returns are defined using the posterior moments.

The **predictive means** can be computed as:

$$\mu^* \equiv E\left[R_{T+1} \mid \Phi\right] = \tilde{\mu} = \tilde{\alpha} + \tilde{\beta}\tilde{\mu}_F,$$

[10] The transformation vec applied to a matrix, stacks its columns resulting into a vector.

where $\tilde{\mu}, \tilde{\alpha}, \tilde{\beta}, \tilde{\mu}_F$ are posterior means and parameters.

The **predictive variance –covariance** matrix of asset returns is given by:

$$\operatorname{cov}\left(R_{i,T+1}R_{j,T+1} \mid \Phi\right) \equiv \tilde{\beta}_i'\Omega_F^*\tilde{\beta}_j + tr\left[\Omega \operatorname{cov}\left(\beta_i, \beta_j \mid \Phi\right)\right] + \tilde{\sigma}_{i,j} + \left[1\ \tilde{\mu}_F'\right]\operatorname{cov}\left(b_i, b_j' \mid \Phi\right)\left[1\ \tilde{\mu}_F'\right]',$$

where $\tilde{\sigma}_{i,j}$ is the respective (i, j) of the posterior variance covariance matrix, $\tilde{\Sigma}$ and Ω_F^* is the predictive covariance matrix factor employed by the model explaining the returns: $\Omega_F^* = \tilde{\Omega}_F + Var\left(\mu_F \mid \Phi\right)$, where $\tilde{\Omega}_F = \frac{T\hat{\Omega}_F}{T-3}$, $Var\left(\mu_F \mid \Phi\right) = \frac{\hat{\Omega}_F}{T-3}$.

The analytical result for the **predictive variance covariance matrix** for the asset returns is:

$$\operatorname{cov}\left(R, F \mid \Phi\right) = \tilde{\beta}\tilde{\Omega}_F + \tilde{\beta}Var\left(\mu_F \mid \Phi\right).$$

Appendix 2

The multi-prior framework

Garlappi et al. (2004) prove that the multi-prior optimization problem in the case when uncertainty about the estimation of expected returns is expressed jointly for all assets, is equivalent to the maximization problem:

$$\max_{\boldsymbol{\omega}} \; \boldsymbol{\omega}'\boldsymbol{\mu} - (\gamma/2)\boldsymbol{\omega}'\boldsymbol{\Sigma}\boldsymbol{\omega} - \sqrt{\varepsilon\boldsymbol{\omega}'\boldsymbol{\Sigma}\boldsymbol{\omega}},$$

subject to

$$\boldsymbol{\omega}'\iota = 1,$$

where $\varepsilon = \in \frac{(T-1)N}{T(T-N)}$.

Without imposing short sales constrains, the problem can be solved analytically and the optimal weights are given by:

$$\boldsymbol{\omega}^* = \frac{\sigma_P^*}{\sqrt{\varepsilon} + \gamma\sigma_P^*}\boldsymbol{\Sigma}^{-1}\left(\hat{\boldsymbol{\mu}} - \frac{1}{A}\left(B - \frac{\sqrt{\varepsilon} + \gamma\sigma_P^*}{\sigma_P^*}\right)\boldsymbol{\iota}\right),$$

where σ_P^* is the variance of the optimal portfolio and the (unique) positive real solution to the polynomial equation:

$$A\gamma^2\sigma_P^4 + 2A\gamma\sigma_P^3 + \left(A\varepsilon - AC + B^2 - \gamma^2\right)\sigma_P^2 - 2\gamma\sqrt{\varepsilon}\sigma_P - \varepsilon = 0,$$

and $A = \boldsymbol{\iota}'\boldsymbol{\Sigma}^{-1}\boldsymbol{\iota}$, $B = \hat{\boldsymbol{\mu}}'\boldsymbol{\Sigma}^{-1}\boldsymbol{\iota}$ and $C = \hat{\boldsymbol{\mu}}'\boldsymbol{\Sigma}^{-1}\hat{\boldsymbol{\mu}}$.

Table 1 Descriptive statistics – International Investment Position

This table presents descriptive statistics (number of observations, mean, median and standard deviation) of the main data needed to compute home bias: portfolio holdings of foreign assets and foreign liabilities (in million USD) reported in the International Investment Position of the Balance of Payments and recorded in IMF International Financial Services Database, as well as relative market share in percentages (computed as the ratio of the domestic market capitalization to the MSCI World Market Capitalization). All series are recorded with annual frequency.

Country	Foreign Assets (million USD)				Foreign Liabilities (million USD)				Relative Market Share (%)			
	#	Mean	Med	Std	#	Mean	Med	Std	#	Mean	Med	Std
Austria	24	10267	3467	14049	24	6628	2589	7935	32	0.11	0.08	0.07
Belgium	23	53038	42616	44458	23	8355	5980	7098	32	0.55	0.57	0.13
Czech Rep	6	30	26	16	6	138	138	38	7	0.02	0.01	0.01
Denmark	11	1254	748	941	11	3213	3059	1442	11	0.07	0.07	0.04
Finland	24	5235	157	9881	18	50777	13696	71118	17	0.43	0.34	0.31
France	15	116820	73520	83458	15	232100	155320	174510	32	2.51	2.28	1.23
Germany	24	173700	76305	201950	24	125660	82210	118050	32	4.04	3.76	0.92
Greece	6	1551	1376	552	6	11512	10793	3551	30	0.24	0.18	0.17
Hungary	7	209	221	151	7	3454	2986	1084	14	0.06	0.04	0.07
Iceland	13	946	398	1066	9	37	15	39	8	0.02	0.02	0.02
Italy	32	48164	8689	95718	18	22415	13779	20124	32	1.39	1.33	0.70
Netherlands	22	98040	51936	98986	22	136290	79428	119720	32	1.98	1.96	0.37
Poland	8	76	43	76	10	3619	4350	1988	14	0.08	0.08	0.06
Portugal	8	7244	7391	2133	11	13991	15605	9477	28	0.12	0.13	0.09
Spain	24	15706	2114	26901	24	44111	21752	56327	18	1.23	1.18	0.31
Switzerland	21	117170	88919	95523	21	169330	134720	125640	24	2.61	2.61	0.36
UK	24	292620	230130	223280	24	291360	136070	317120	32	8.11	8.29	1.25
Sweden	21	31836	14830	38076	21	36957	13063	40526	23	0.66	0.64	0.31
Turkey	8	23	5	25	8	6701	5827	4049	28	0.15	0.14	0.11
Australia	18	38735	29274	30266	18	61867	55806	43528	32	1.34	1.27	0.32
Canada	6	131240	131290	20145	6	60054	54577	16068	32	2.40	2.26	0.62
Hong Kong	5	126190	95721	48568	5	115830	115690	26229	32	1.32	1.17	0.68
Japan	10	229420	219090	68915	10	240890	162080	226320	32	23.57	22.53	11.16
N. Zealand	14	4989	4427	5277.3	14	2885	1045	3583	17	0.12	0.12	0.05
USA	25	741070	314230	794070	25	638190	298960	663950	32	44.62	46.23	10.77
Total	*399*	*2245573*	*1396923*	*1904481*	*380*	*2286364*	*1389538*	*2059514*	*623*	*97.75*	*97.29*	*30.13*

Table 2 Test of I-CAPM for the first 24 monthly observations

This table reports the results of the OLS regressions of domestic monthly return indices on a constant and the World Market Index for 25 countries. The estimations are done on the first two years of available data for each country. As the length of time series varies across the group of countries, the date of the first observation included in the estimation is reported in the second column of the table. Values of the coefficients, their respective standard errors and R^2, as a measure of goodness of fit of the model are reported subsequently. Significance is denoted by *** (at 1%), ** (at 5%) and * (at 10%).

Country	1st obs.	Alpha	Std. Err.	Beta	Std. Err.	R^2
Austria	1973/02	1.31	1.05	0.61***	0.17	0.35
Belgium	1975/01	-0.76	0.66	1.10***	0.14	0.73
Czech Rep	1994/02	-4.09*	1.57	0.71	0.59	0.06
Denmark	1973/02	0.29	1.92	0.76**	0.32	0.20
Finland	1988/01	-0.56	1.12	0.54*	0.30	0.12
France	1975/01	-1.34	1.15	1.21***	0.25	0.52
Germany	1975/01	-0.23	0.81	0.90***	0.17	0.54
Greece	1990/02	2.22	3.47	0.42	0.63	0.02
Hungary	1992/01	1.48	1.32	-0.01	0.43	0.00
Iceland	1993/01	0.23	0.87	-0.37	0.26	0.08
Italy	1975/01	-3.07**	1.46	1.01***	0.31	0.31
Netherlands	1975/01	0.19	0.76	1.26***	0.16	0.73
Poland	1992/01	6.56*	3.51	3.06**	1.13	0.25
Portugal	1990/02	-1.34	0.90	0.58***	0.16	0.37
Spain	1975/01	-1.69	1.12	1.06***	0.24	0.46
Switzerland	1975/01	-0.13	0.71	1.26***	0.15	0.75
UK	1975/01	-0.45	2.15	2.59***	0.46	0.58
Sweden	1975/01	-0.11	0.82	0.77***	0.17	0.46
Turkey	1989/07	1.71	3.80	0.15	0.65	0.00
Australia	1975/01	-0.08	1.50	0.85**	0.33	0.24
Canada	1977/01	-0.01	0.66	0.87***	0.25	0.35
Hong Kong	1975/01	2.08*	1.17	1.67***	0.25	0.66
Japan	1975/01	0.16	0.75	0.96***	0.16	0.61
New Zealand	1988/01	-0.35	1.92	0.15	0.53	0.00
USA	1970/12	-0.34	0.22	1.10***	0.07	0.92
Average		*0.06*	*1.41*	*0.92*	*0.33*	*0.37*

Table 3 Test of I-CAPM on the remaining sample after exclusion of the first 24 observations

This table reports the results of the OLS regressions of domestic monthly return indices on a constant and the World Market Index for 25 countries. The estimations are done on the remaining sample after excluding the first 24 observations. As the length of time series varies across the group of countries, the date of the first observation included in the estimation is reported in the second column of the table. Values of the coefficients, their respective standard errors and R^2, as a measure of goodness of fit of the model are reported subsequently. Significance is denoted by *** (at 1%), ** (at 5%) and * (at 10%).

Country	**1st obs.**	**Alpha**	**Std. Err.**	**Beta**	**Std. Err.**	**R^2**
Austria	1975/02	0.31	0.32	0.51***	0.08	0.11
Belgium	1977/01	0.54	0.24	0.83***	0.06	0.38
Czech Rep	1996/02	0.51	0.76	0.59***	0.17	0.10
Denmark	1975/02	0.33	0.23	0.74***	0.06	0.36
Finland	1990/01	0.79	0.57	1.34***	0.13	0.47
France	1977/01	0.38	0.26	1.08***	0.06	0.43
Germany	1977/01	0.19	0.25	0.96***	0.06	0.19
Greece	1992/02	0.24	0.59	0.88***	0.15	0.27
Hungary	1994/01	1.03	0.82	1.29***	0.19	0.26
Iceland	1995/01	1.32	0.41	0.15	0.10	0.02
Italy	1977/01	0.40	0.36	0.93***	0.09	0.26
Netherlands	1977/01	0.40	0.18	0.95***	0.04	0.58
Poland	1994/01	-0.43	0.93	1.27***	0.22	0.20
Portugal	1992/02	0.25	0.38	0.73***	0.10	0.28
Spain	1977/01	0.34	0.33	1.02***	0.08	0.33
Switzerland	1977/01	0.27	0.21	0.84***	0.05	0.46
UK	1977/01	0.42**	0.20	0.97***	0.05	0.55
Sweden	1977/01	0.48*	0.29	1.07***	0.07	0.42
Turkey	1991/07	0.05	1.30	1.66***	0.33	0.14
Australia	1977/01	0.33	0.30	0.92***	0.07	0.33
Canada	1979/01	0.13	0.21	0.96***	0.05	0.54
Hong Kong	1977/01	0.63	0.43	1.05***	0.10	0.23
Japan	1977/01	0.00	0.27	1.07***	0.07	0.45
New Zealand	1977/01	0.20	0.39	0.84***	0.09	0.32
USA	1972/12	0.18	0.12	0.94***	0.03	0.73
Average		*0.37*	*0.41*	*0.94*	*0.1*	*0.33*

Table 4 Descriptive statistics – Home Bias Measures

This table presents descriptive statistics (number of observations, mean, median and standard deviation) of the measure of home bias: (1) home bias in I-CAPM framework, (2) data based home bias, (3) home bias in a Bayesian framework (σ_α^2=0.1). All series are computed with annual frequency.

Country	**(1) I-CAPM**				**(2) DATA**				**(3) BAYESIAN (σ_α^2=0.1)**			
	#obs	Mean	Med	Std	#obs	Mean	Med	Std	#obs	Mean	Med	Std
Austria	24	0.58	0.61	0.20	25	0.30	0.68	0.67	25	0.61	0.72	0.22
Belgium	23	0.55	0.54	0.06	23	-0.16	-0.24	0.51	23	0.10	0.03	0.37
Czech Rep	10	0.88	0.90	0.08	6	0.82	0.84	0.13	6	0.83	0.82	0.05
Denmark	11	0.69	0.71	0.09	11	0.54	0.59	0.15	11	0.66	0.69	0.10
Finland	16	0.90	0.96	0.13	13	0.01	0.79	1.11	13	0.62	0.91	0.57
France	15	0.77	0.78	0.03	16	0.44	0.58	0.36	16	0.68	0.72	0.11
Germany	24	0.73	0.74	0.13	25	0.61	0.56	0.25	25	0.66	0.62	0.21
Greece	6	0.98	0.98	0.01	7	0.97	0.98	0.03	7	0.97	0.98	0.02
Hungary	7	0.98	0.98	0.02	8	0.30	0.98	1.06	7	0.69	0.98	0.75
Iceland	7	0.74	0.74	0.07	8	-0.21	-0.12	0.75	8	0.25	0.47	0.71
Italy	18	0.84	0.90	0.11	19	0.75	0.86	0.19	19	0.81	0.89	0.14
Netherlands	22	0.62	0.64	0.07	23	-1.04	-1.35	0.71	23	-0.24	-0.33	0.60
Poland	8	1.00	1.00	0.00	9	1.00	1.00	0.00	9	1.00	1.00	0.00
Portugal	8	0.82	0.83	0.06	9	0.70	0.76	0.16	9	0.77	0.82	0.11
Spain	17	0.91	0.96	0.10	17	0.89	0.95	0.12	17	0.90	0.96	0.11
Switzerland	21	0.61	0.62	0.04	21	0.37	0.37	0.38	21	0.46	0.44	0.26
UK	24	0.69	0.69	0.03	25	-0.85	-1.02	0.78	25	0.63	0.64	0.06
Sweden	21	0.74	0.71	0.13	22	0.36	0.39	0.39	22	0.57	0.55	0.26
Turkey	8	1.00	1.00	0.00	9	1.00	1.00	0.00	9	1.00	1.00	0.00
Australia	18	0.83	0.83	0.02	18	0.78	0.79	0.06	18	0.82	0.83	0.03
Canada	6	0.81	0.82	0.04	6	0.78	0.77	0.06	6	0.79	0.79	0.05
Hong Kong	5	0.77	0.77	0.04	5	0.61	0.56	0.10	5	0.71	0.68	0.06
Japan	10	0.90	0.90	0.02	10	0.90	0.91	0.02	10	0.90	0.91	0.02
N. Zealand	14	0.83	0.86	0.15	13	0.64	0.88	0.57	13	0.69	0.86	0.54
USA	25	0.82	0.83	0.09	25	-0.34	-0.73	1.14	25	-0.36	-0.80	1.15

Table 4ctd Descriptive statistics – Home Bias

This table presents descriptive statistics (number of observations, mean, median and standard deviation) of the measure of home bias: (4) home bias with the Multi-Prior correction applied to the data based approach, (5) home bias with the Multi-Prior correction applied to the Bayesian approach (σ_α^2=0.2). All series are computed with annual frequency.

Country	(4) Multi-Prior Correction of Data Approach				(5) Multi-Prior Correction of Bayesian Approach (σ_α^2=0.2)			
	# obs	Mean	Med	Std	# obs	Mean	Med	Std
Austria	25	0.58	0.69	0.24	25	0.54	0.63	0.22
Belgium	23	0.26	0.24	0.19	23	0.31	0.30	0.16
Czech Rep	6	0.82	0.81	0.04	6	0.80	0.79	0.06
Denmark	11	0.57	0.61	0.13	11	0.63	0.66	0.11
Finland	13	0.79	0.90	0.21	13	0.82	0.91	0.17
France	16	0.70	0.73	0.08	16	0.73	0.75	0.07
Germany	25	0.66	0.61	0.18	25	0.66	0.63	0.18
Greece	7	0.97	0.98	0.03	7	0.97	0.98	0.02
Hungary	8	0.98	0.98	0.02	7	0.98	0.98	0.02
Iceland	8	0.27	0.25	0.28	8	0.45	0.43	0.19
Italy	19	0.80	0.88	0.15	19	0.81	0.89	0.14
Netherlands	23	0.12	0.06	0.40	23	0.24	0.25	0.36
Poland	9	1.00	1.00	0.00	9	1.00	1.00	0.00
Portugal	9	0.74	0.79	0.11	9	0.75	0.79	0.10
Spain	17	0.90	0.96	0.11	17	0.90	0.96	0.10
Switzerland	21	0.49	0.47	0.17	21	0.50	0.50	0.15
UK	25	0.37	0.43	0.22	25	0.66	0.67	0.05
Sweden	22	0.64	0.59	0.19	22	0.66	0.61	0.18
Turkey	9	1.00	1.00	0.00	9	1.00	1.00	0.00
Australia	18	0.81	0.82	0.03	18	0.82	0.83	0.03
Canada	6	0.80	0.80	0.04	6	0.80	0.80	0.04
Hong Kong	5	0.72	0.71	0.05	5	0.74	0.73	0.04
Japan	10	0.91	0.91	0.02	10	0.91	0.91	0.02
New Zealand	13	0.81	0.87	0.17	13	0.81	0.86	0.16
USA	25	0.36	0.55	0.59	25	0.33	0.52	0.60

Table 5 The EU/EURO effects on home bias – the I-CAPM measure

This table reports the results of panel regressions of annual growth rate of home bias (in percentages) on selected variables including: previous year levels -LEVEL(-1)-, annual growth rates (in percentages) of the relative market capitalization –RMC- and the openness index -OPN-, the trend –TIME-, EU/EMU dummy variables -I(EU/EMU)- and an interaction term between the openness index the EU/EMU dummy variables. Panel A shows the results of an OLS estimation with fixed country effects. In panel B, the results are obtained through feasible GLS, assuming the presence of cross-section heteroskedasticity. Values of the coefficients, heteroskedasticity consistent standard errors and R^2, as a measure of goodness of fit of the model are reported subsequently. Significance is denoted by *** (at 1%), ** (at 5%) and * (at 10%).

HB Measure	**(1) I-CAPM**					
No Obs.	358	358	358	358	358	358
Panel A:						
Unweighted Regressions						
Intercept	-n.r.-[1]	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-
(Std. Err.)	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-
RMC	0.09***	0.09***	0.09***	0.08***	0.09***	0.08***
(Std. Err.)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
LEVEL(-1)	-	-	-0.29***	- 0.32***	-0.16**	-0.24***
(Std. Err.)	-	-	(0.10)	(0.09)	(0.10)	(0.07)
TIME	-	-	-0.40***	- 0.33***	-	-
(Std. Err.)	-	-	(0.09)	(0.12)	-	-
I(EU)	-	-	-4.30*	-	-6.32**	-
(Std. Err.)	-	-	(2.54)	-	(2.59)	-
I(EMU)	-	-	-	-5.38***	-	-7.22***
(Std. Err.)	-	-	-	(1.83)	-	(1.75)
OPN	0.12*	0.08*	-0.01	-0.01	-	-
(Std. Err.)	(0.07)	(0.04)	(0.07)	(0.06)	-	-
OPN*I(EU)	-0.28***	-	-	-	-	-
(Std. Err.)	(0.10)	-	-	-	-	-
OPN*I(EMU)	-	-0.64***	-	-	-	-
(Std. Err.)	-	(0.18)	-	-	-	-
R^2	0.17	0.19	0.25	0.27	0.21	0.24
Panel B:						
Cross section Weights						
Intercept	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-[1]	-n.r.-
(Std. Err.)	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-
RMC	0.07***	0.07***	0.06***	0.05***	0.08***	0.06***
(Std. Err.)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LEVEL(-1)	-	-	-0.14***	-0.19***	-0.09**	-0.15***
(Std. Err.)	-	-	(0.04)	(0.03)	(0.04)	(0.03)
TIME	-	-	-0.27***	-0.23***	-	-
(Std. Err.)	-	-	(0.04)	(0.04)	-	-
I(EU)	-	-	-2.79***	-	-4.24***	-
(Std. Err.)	-	-	(0.66)	-	(0.83)	-
I(EMU)	-	-	-	-5.41***	-	-6.71***
(Std. Err.)	-	-	-	(0.75)	-	(0.64)
OPN	0.06***	0.08***	0.01**	0.01	-	-
(Std. Err.)	(0.01)	(0.01)	(0.00)	(0.02)	-	-
OPN*I(EU)	-0.13**	-	-	-	-	-
(Std. Err.)	(0.06)	-	-	-	-	-
OPN*I(EMU)	-	-0.48***	-	-	-	-
(Std. Err.)	-	(0.13)	-	-	-	-
R^2	0.49	0.81	0.56	0.37	0.79	0.68

[1]-n.r.-=not reported

Table 6 The EU/EURO effects on home bias – the data based measure

This table reports the results of panel regressions of annual growth rate of home bias (in percentages) on selected variables including: previous year levels -LEVEL(-1)-, annual growth rates (in percentages) of the relative market capitalization –RMC- and the openness index -OPN-, the trend –TIME-, EU/EMU dummy variables -I(EU/EMU)- and an interaction term between the openness index the EU/EMU dummy variables. Panel A shows the results of an OLS estimation with fixed country effects. In panel B, the results are obtained through feasible GLS, assuming the presence of cross-section heteroskedasticity. Values of the coefficients, heteroskedasticity consistent standard errors and R^2, as a measure of goodness of fit of the model are reported subsequently. Significance is denoted by *** (at 1%), ** (at 5%) and * (at 10%).

HB Measure			**(2) DATA**			
No Obs.	348	348	348	348	348	348
Panel A:						
Unweighted Regressions						
Intercept	-n.r.- [1]	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-
(Std. Err.)	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-
RMC	0.05	-0.04	-0.04	-0.09	-0.12	-0.10
(Std. Err.)	(0.21)	(0.21)	(0.25)	(0.24)	(0.27)	(0.26)
LEVEL(-1)	-	-	-0.06	-0.05	-0.28	-0.28
(Std. Err.)	-	-	(0.26)	(0.25)	(0.21)	(0.22)
TIME	-	-	5.10**	6.46**	-	-
(Std. Err.)	-	-	(2.52)	(2.81)	-	-
I(EU)	-	-	7.07**	-	33.38	-
(Std. Err.)	-	-	(2.82)	-	(32.77)	-
I(EMU)	-	-	-10.62	-	-	5.66
(Std. Err.)	-	-	(36.29)	-	-	(15.62)
OPN	-2.52	-1.11	-	-46.77**	-	-
(Std. Err.)	(2.62)	(2.34)	-	(23.87)	-	-
OPN*I(EU)	2.21	-	-1.64	-1.80	-	-
(Std. Err.)	(2.93)	-	(0.69)	(1.77)	-	-
OPN*I(EMU)	-	-1.42	-	-	-	-
(Std. Err.)	-	(4.16)	-	-	-	-
R^2	0.04	0.04	0.07	0.08	0.05	0.05
Panel B:						
Cross section Weights						
Intercept	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-
(Std. Err.)	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-
RMC	-0.01	-0.02	-0.08	-0.10	-0.01	-0.01
(Std. Err.)	(0.04)	(0.03)	(0.06)	(0.07)	(0.02)	(0.01)
LEVEL(-1)	-	-	-0.04	-0.05	-0.01	-0.10
(Std. Err.)	-	-	(0.11)	(0.10)	(0.05)	(0.06)
TIME	-	-	-0.01	0.85*	-	-
(Std. Err.)	-	-	(0.40)	(0.51)	-	-
I(EU)	-	-	9.06	-	2.63	-
(Std. Err.)	-	-	(8.29)	-	(5.03)	-
I(EMU)	-	-	-	-16.31***	-	-8.91***
(Std. Err.)	-	-	-	(4.94)	-	(2.18)
OPN	-0.01	-0.09	-0.07	-0.14	-	-
(Std. Err.)	(0.15)	(0.13)	(0.17)	(0.17)	-	-
OPN*I(EU)	-0.12	-	-	-	-	-
(Std. Err.)	(0.16)	-	-	-	-	-
OPN*I(EMU)	-	-0.73	-	-	-	-
(Std. Err.)	-	(0.54)	-	-	-	-
R^2	0.07	0.10	0.06	0.08	0.05	0.08

[1]-n.r.-=not reported

Table 7 The EU/EURO effects on home bias – the Bayesian (σ_α^2=0.1) measure

This table reports the results of panel regressions of annual growth rate of home bias (in percentages) on selected variables including: previous year levels -LEVEL(-1)-, annual growth rates (in percentages) of the relative market capitalization –RMC- and the openness index -OPN-, the trend –TIME-, EU/EMU dummy variables -I(EU/EMU)- and an interaction term between the openness index the EU/EMU dummy variables. Panel A shows the results of an OLS estimation with fixed country effects. In panel B, the results are obtained through feasible GLS, assuming the presence of cross-section heteroskedasticity. Values of the coefficients, heteroskedasticity consistent standard errors and R^2, as a measure of goodness of fit of the model are reported subsequently. Significance is denoted by *** (at 1%), ** (at 5%) and * (at 10%).

HB Measure			**(3) BAYESIAN (σ_α^2=0.1)**			
No Obs.	347	347	347	347	347	347
Panel A:						
Unweighted Regressions						
Intercept	-n.r.- [1]	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-
(Std. Err.)	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-
RMC	1.35	0.06	1.31	1.03	1.22	0.99
(Std. Err.)	(0.20)	(0.0)	(1.00)	(0.76)	(0.96)	(0.73)
LEVEL(-1)	-	-	-0.35	-0.21	0.02	-0.33
(Std. Err.)	-	-	(0.31)	(0.26)	(0.25)	(0.23)
TIME	-	-	-5.74	1.86	-	-
(Std. Err.)	-	-	(6.04)	(3.02)	-	-
I(EU)	-	-	90.73	-	34.69	-
(Std. Err.)	-	-	(80.30)	-	(43.56)	-
I(EMU)	-	-	-	-179.95	-	-165.12
(Std. Err.)	-	-	-	(154.36)	-	(144.94)
OPN	3.48	2.32*	-5.79	-6.28	-	-
(Std. Err.)	(1.86)	(1.21)	(8.41)	(8.92)	-	-
OPN*I(EU)	-18.02	-	-	-	-	-
(Std. Err.)	(16.50)	-	-	-	-	-
OPN*I(EMU)	-	-1.36	-	-	-	-
(Std. Err.)	-	(1.17)	-	-	-	-
R^2	0.07	0.08	0.06	0.07	0.05	0.06
Panel B:						
Cross section Weights						
Intercept	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-
(Std. Err.)	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-
RMC	0.08*	0.06	0.08	0.11**	0.17***	0.17***
(Std. Err.)	(0.04)	(0.04)	(0.05)	(0.02)	(0.05)	(0.05)
LEVEL(-1)	-	-	0.10	0.13	0.06	-0.02
(Std. Err.)	-	-	(0.10)	(0.28)	(0.08)	(0.11)
TIME	-	-	-0.32	-0.02	-	-
(Std. Err.)	-	-	(0.24)	(0.25)	-	-
I(EU)	-	-	-0.32	-	-6.57	-
(Std. Err.)	-	-	(7.38)	-	(5.54)	-
I(EMU)	-	-	-	-11.25***	-	-18.68***
(Std. Err.)	-	-	-	(4.14)	-	(3.28)
OPN	0.65	0.33	0.32	0.37	-	-
(Std. Err.)	(0.40)	(0.24)	(0.28)	(0.30)	-	-
OPN*I(EU)	-0.64***	-	-	-	-	-
(Std. Err.)	(0.23)	-	-	-	-	-
OPN*I(EMU)	-	-1.82	-	-	-	-
(Std. Err.)	-	(1.36)	-	-	-	-
R^2	0.07	0.06	0.08	0.09	0.11	0.12

[1]-n.r.-=not reported

Table 8 The EU/EURO effects on home bias – the Multi-Prior Correction of the data-based measure

This table reports the results of panel regressions of annual growth rate of home bias (in percentages) on selected variables including: previous year levels -LEVEL(-1)-, annual growth rates (in percentages) of the relative market capitalization –RMC- and the openness index -OPN-, the trend –TIME-, EU/EMU dummy variables -I(EU/EMU)- and an interaction term between the openness index the EU/EMU dummy variables. Panel A shows the results of an OLS estimation with fixed country effects. In panel B, the results are obtained through feasible GLS, assuming the presence of cross-section heteroskedasticity. Values of the coefficients, heteroskedasticity consistent standard errors and R^2, as a measure of goodness of fit of the model are reported subsequently. Significance is denoted by *** (at 1%), ** (at 5%) and * (at 10%).

HB Measure	(4) Multi-Prior Correction of Data Approach					
No Obs.	348	348	348	348	348	348
Panel A:						
Unweighted Regressions						
Intercept	-n.r.-[1]	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-
(Std. Err.)	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-
RMC	-0.08*	-0.08	-0.09	0.07	-0.08	-0.07*
(Std. Err.)	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)	(0.04)
LEVEL(-1)	-	-	0.39	0.41	0.33*	0.40*
(Std. Err.)	-	-	(0.28)	(0.29)	(0.18)	(0.24)
TIME	-	-	0.43	0.03	-	-
(Std. Err.)	-	-	(1.29)	(1.48)	-	-
I(EU)	-	-	1.21	-	5.33	-
(Std. Err.)	-	-	(11.50)	-	(7.04)	-
I(EMU)	-	-	-	14.71	-	14.61
(Std. Err.)	-	-	-	(19.17)	-	(15.01)
OPN	1.10	0.87	0.90*	0.94*	-	-
(Std. Err.)	(0.94)	(0.60)	(0.44)	(0.46)	-	-
OPN*I(EU)	-0.31	-	-	-	-	-
(Std. Err.)	(1.07)	-	-	-	-	-
OPN*I(EMU)	-	0.43	-	-	-	-
(Std. Err.)	-	(1.01)	-	-	-	-
R^2	0.06	0.06	0.07	0.07	0.06	0.07
Panel B:						
Cross section Weights						
Intercept	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-
(Std. Err.)	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-
RMC	0.05***	0.04***	0.04***	0.07	0.02***	0.01**
(Std. Err.)	(0.01)	(0.01)	(0.01)	(0.04)	(0.00)	(0.00)
LEVEL(-1)	-	-	-0.08	-0.10	0.11**	0.02
(Std. Err.)	-	-	(0.06)	(0.06)	(0.04)	(0.04)
TIME	-	-	-0.48***	-0.31**	-	-
(Std. Err.)	-	-	(0.15)	(0.15)	-	-
I(EU)	-	-	-0.75	-	-1.23**	-
(Std. Err.)	-	-	(1.69)	-	(0.50)	-
I(EMU)	-	-	-	-4.90**	-	-4.77**
(Std. Err.)	-	-	-	(1.89)	-	(1.84)
OPN	0.17	0.11	0.04	0.01	-	-
(Std. Err.)	(0.12)	(0.07)	(0.09)	(0.09)	-	-
OPN*I(EU)	-0.28**	-	-	-	-	-
(Std. Err.)	(0.11)	-	-	-	-	-
OPN*I(EMU)	-	-0.55**	-	-	-	-
(Std. Err.)	-	(0.22)	-	-	-	-
R^2	0.07	0.09	0.12	0.13	0.13	0.14

[1]-n.r.-=not reported

Table 9 The EU/EURO effects on home bias – the Multi-Prior Correction of the Bayesian (σ_α^2=0.2) measure

This table reports the results of panel regressions of annual growth rate of home bias (in percentages) on selected variables including: previous year levels -LEVEL(-1)-, annual growth rates (in percentages) of the relative market capitalization –RMC- and the openness index -OPN-, the trend –TIME-, EU/EMU dummy variables -I(EU/EMU)- and an interaction term between the openness index the EU/EMU dummy variables. Panel A shows the results of an OLS estimation with fixed country effects. In panel B, the results are obtained through feasible GLS, assuming the presence of cross-section heteroskedasticity. Values of the coefficients, heteroskedasticity consistent standard errors and R^2, as a measure of goodness of fit of the model are reported subsequently. Significance is denoted by *** (at 1%), ** (at 5%) and * (at 10%).

HB Measure	**(5) Multi-Prior Correction of Bayesian Approach (σ_α^2=0.2)**					
No Obs.	347	347	347	347	347	347
Panel A:						
Unweighted Regressions						
Intercept	-n.r.- [1]	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-
(Std. Err.)	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-
RMC	-0.05	-0.03	-0.02	-0.02	-0.04	-0.03
(Std. Err.)	(0.04)	(0.04)	(0.05)	(0.04)	(0.03)	(0.04)
LEVEL(-1)	-	-	-0.88*	-0.90*	-0.16	-0.12
(Std. Err.)	-	-	(0.51)	(0.54)	(0.24)	(0.28)
TIME	-	-	-1.34***	-1.29***	-	-
(Std. Err.)	-	-	(0.49)	(0.47)	-	-
I(EU)	-	-	-7.02	-	-0.35	-
(Std. Err.)	-	-	(8.33)	-	(5.69)	-
I(EMU)	-	-	-	-7.45	-	-7.91
(Std. Err.)	-	-	-	(17.89)	-	(12.12)
OPN	-2.08	-1.32	0.20	0.24	-	-
(Std. Err.)	(1.47)	(0.89)	(0.41)	(0.24)	-	-
OPN*I(EU)	2.62*	-	-	-	-	-
(Std. Err.)	(1.46)	-	-	-	-	-
OPN*I(EMU)	-	3.76***	-	-	-	-
(Std. Err.)	-	(1.18)	-	-	-	-
R^2	0.07	0.07	0.12	0.12	0.05	0.05
Panel B:						
Cross section Weights						
Intercept	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-
(Std. Err.)	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-	-n.r.-
RMC	0.10***	0.08***	0.06***	0.05***	-0.01***	0.01***
(Std. Err.)	(0.01)	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)
LEVEL(-1)	-	-	-0.11**	-0.13**	-0.05	-0.03
(Std. Err.)	-	-	(0.05)	(0.01)	(0.03)	(0.03)
TIME	-	-	-0.54***	-0.32***	-	-
(Std. Err.)	-	-	(0.10)	(0.10)	-	-
I(EU)	-	-	0.14	-	-1.56***	-
(Std. Err.)	-	-	(1.54)	-	(0.37)	-
I(EMU)	-	-	-	-5.90***	-	-6.16***
(Std. Err.)	-	-	-	(1.38)	-	(0.85)
OPN	0.27	0.12	0.04	0.02	-	-
(Std. Err.)	(0.18)	(0.08)	(0.08)	(0.07)	-	-
OPN*I(EU)	-0.42**	-	-	-	-	-
(Std. Err.)	(0.17)	-	-	-	-	-
OPN*I(EMU)	-	-0.84***	-	-	-	-
(Std. Err.)	-	(0.16)	-	-	-	-
R^2	0.14	0.11	0.19	0.23	0.18	0.26

[1]-n.r.-=not reported

Figure 1 Home Bias (short sales allowed)

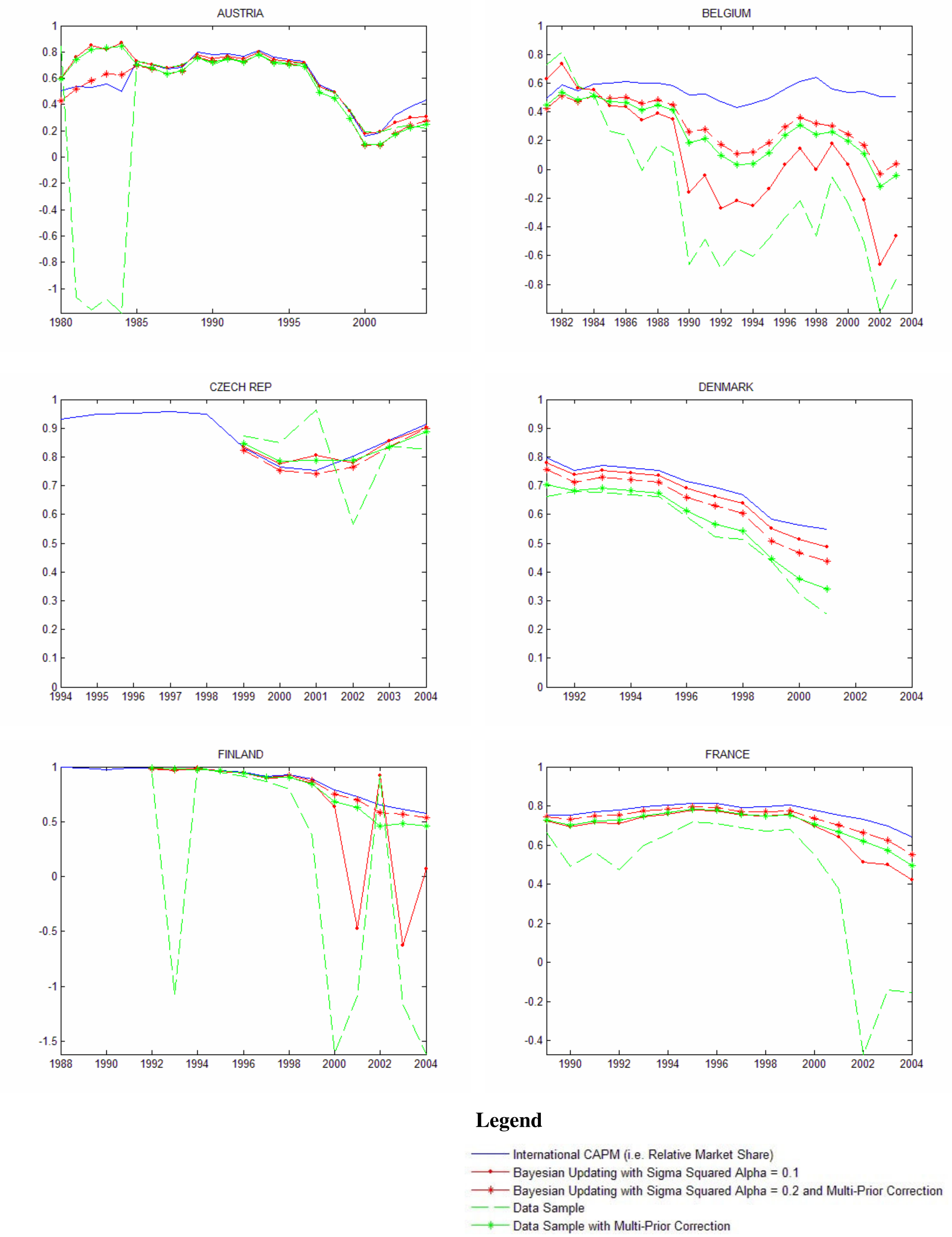
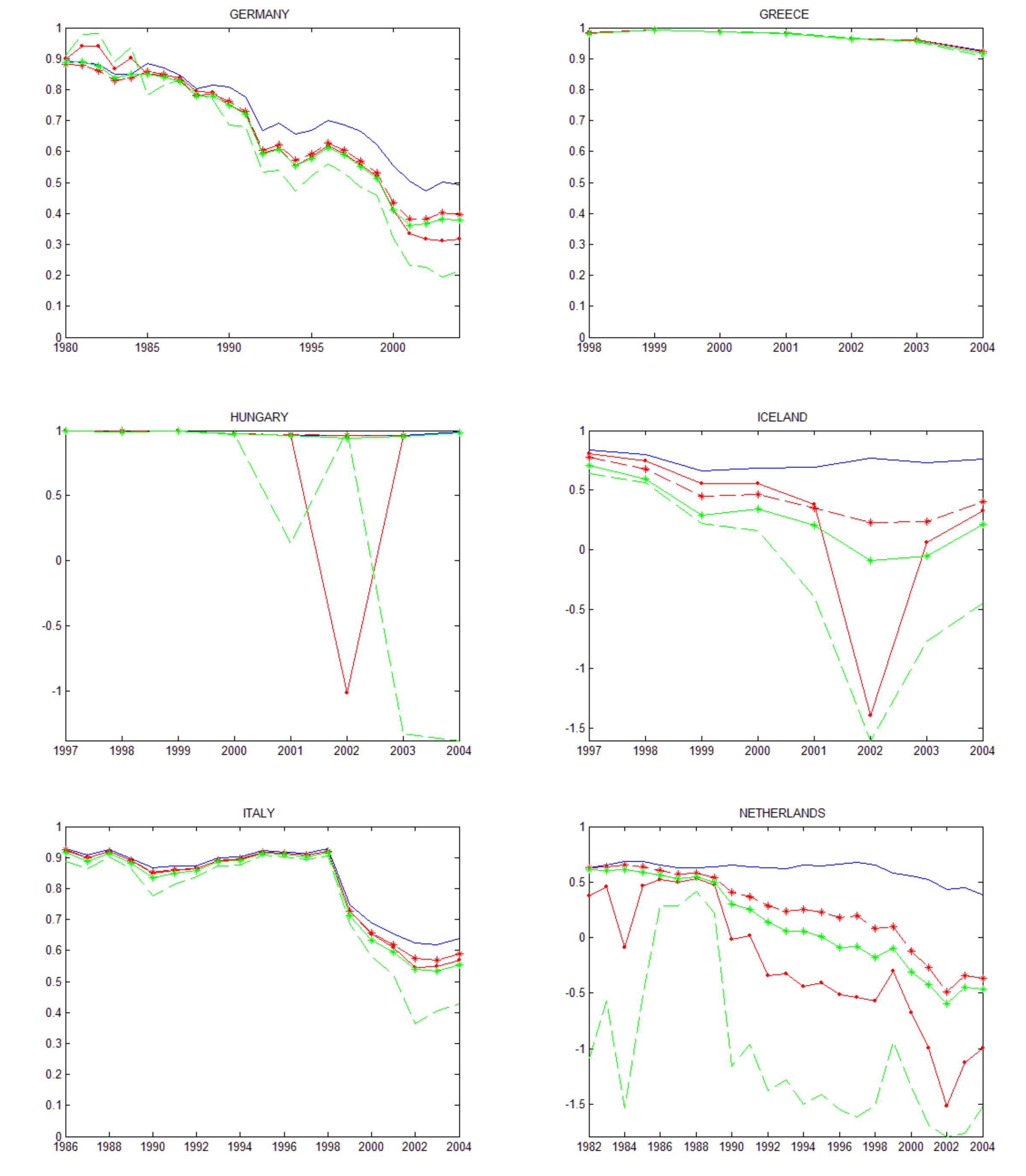


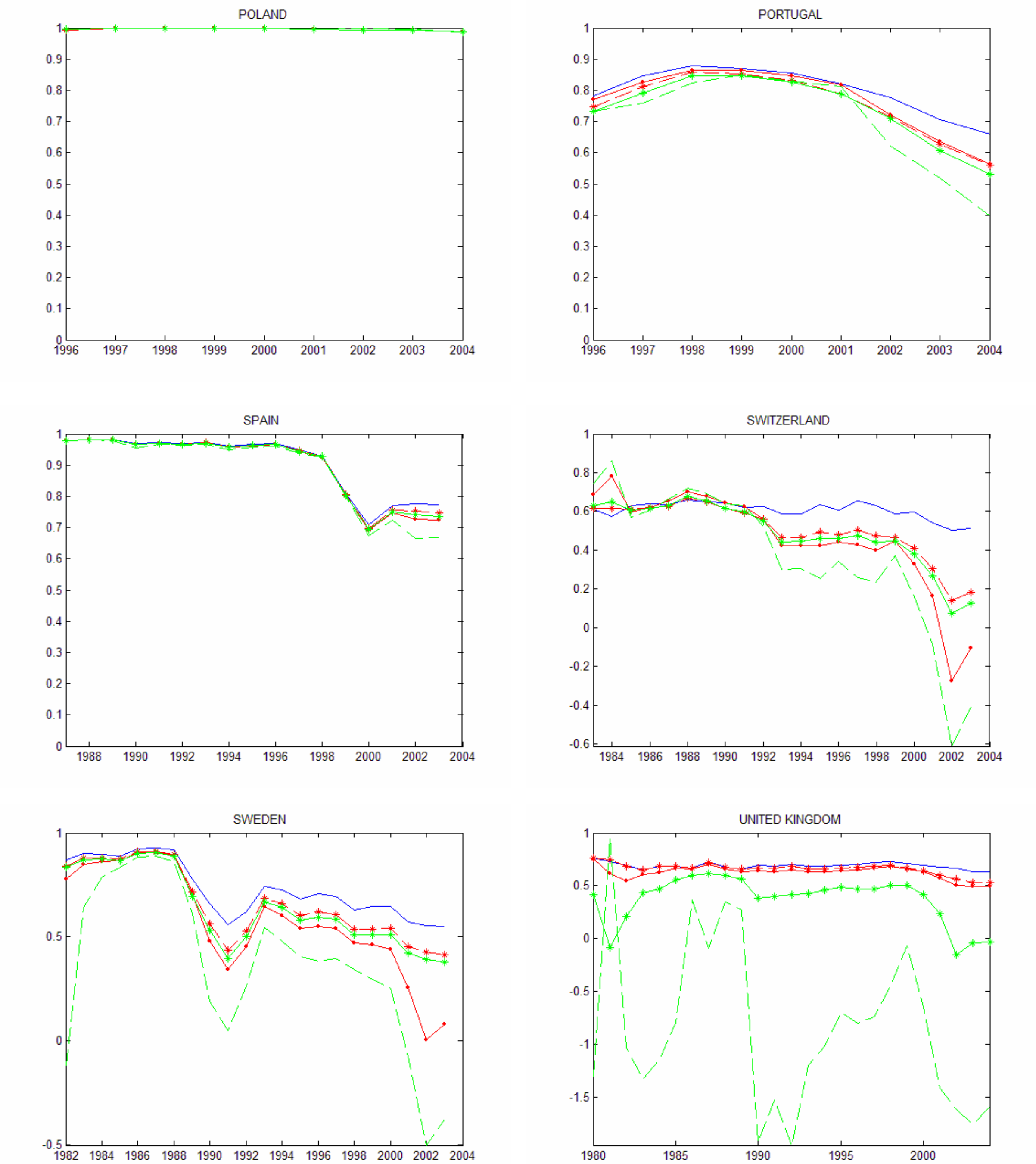
Figure 1ctd Home Bias (short sales allowed)



Legend

- International CAPM (i.e. Relative Market Share)
- Bayesian Updating with Sigma Squared Alpha = 0.1
- Bayesian Updating with Sigma Squared Alpha = 0.2 and Multi-Prior Correction
- Data Sample
- Data Sample with Multi-Prior Correction

Figure 1ctd Home Bias (short sales allowed)



Legend

International CAPM (i.e. Relative Market Share)
Bayesian Updating with Sigma Squared Alpha = 0.1
Bayesian Updating with Sigma Squared Alpha = 0.2 and Multi-Prior Correction
Data Sample
Data Sample with Multi-Prior Correction

Figure 1ctd Home Bias (short sales allowed)

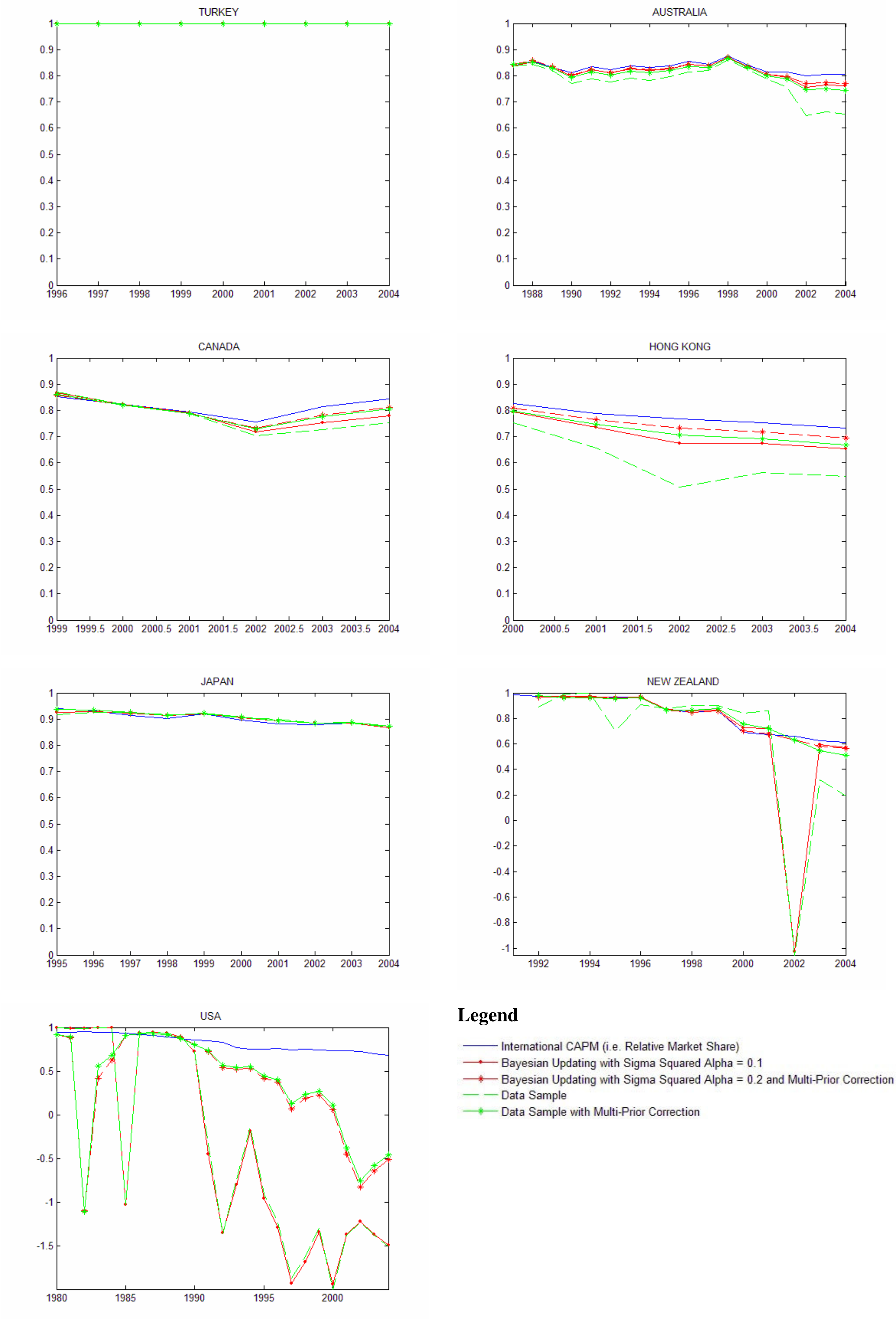
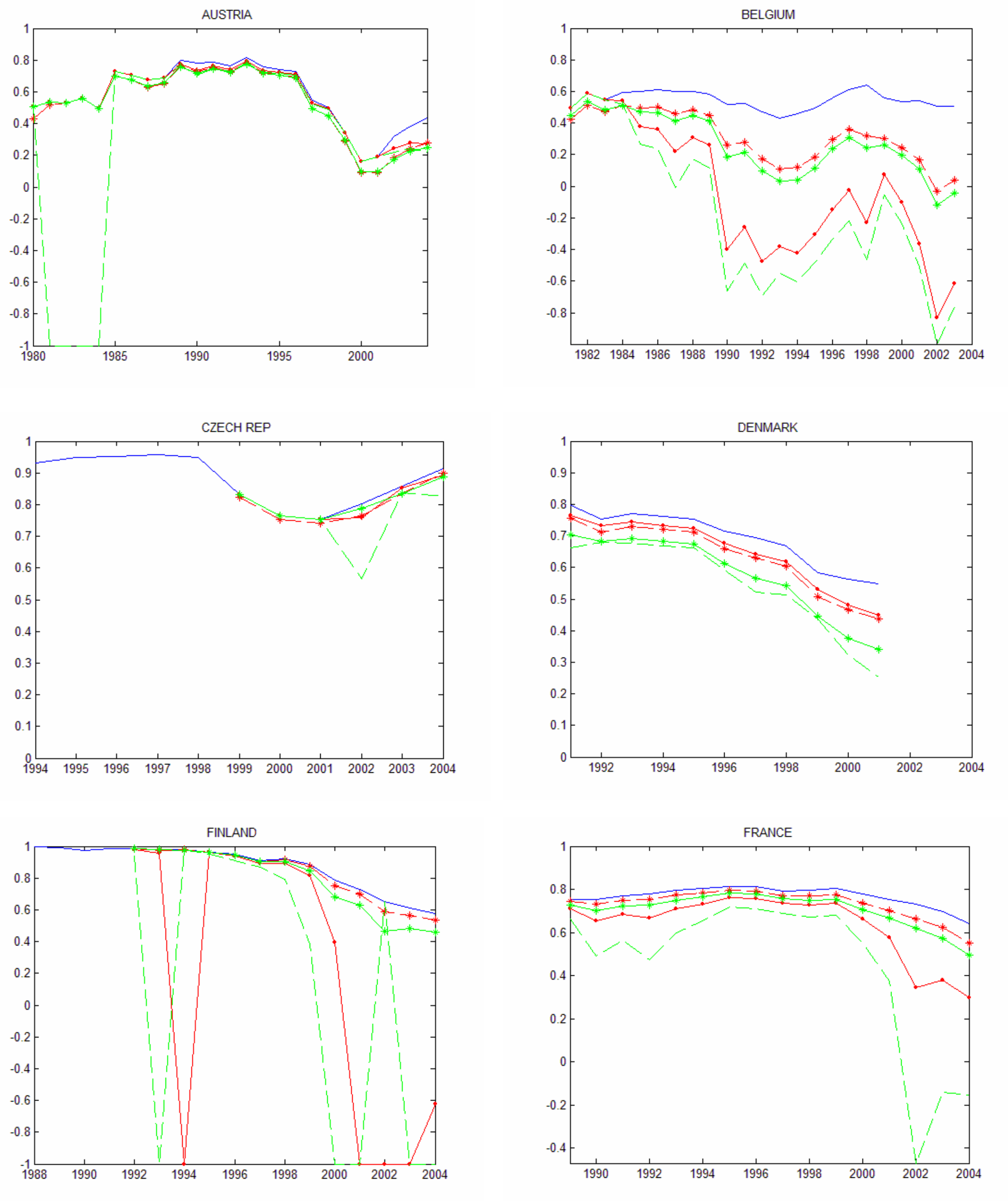


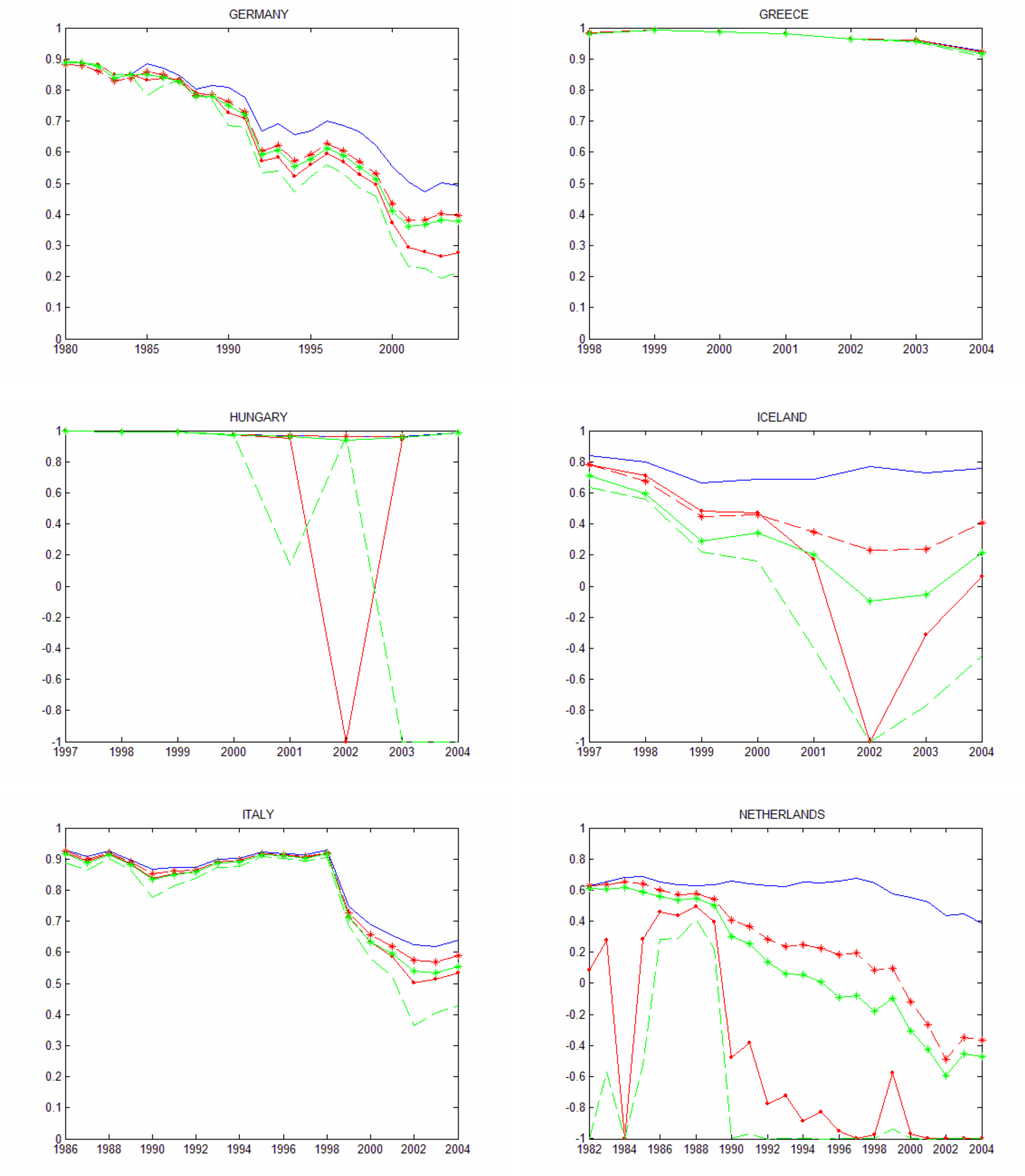
Figure 2 Home Bias (with short sales constraints)



Legend

- International CAPM (i.e. Relative Market Share)
- Bayesian Updating with Sigma Squared Alpha = 0.1
- Bayesian Updating with Sigma Squared Alpha = 0.2 and Multi-Prior Correction
- Data Sample
- Data Sample with Multi-Prior Correction

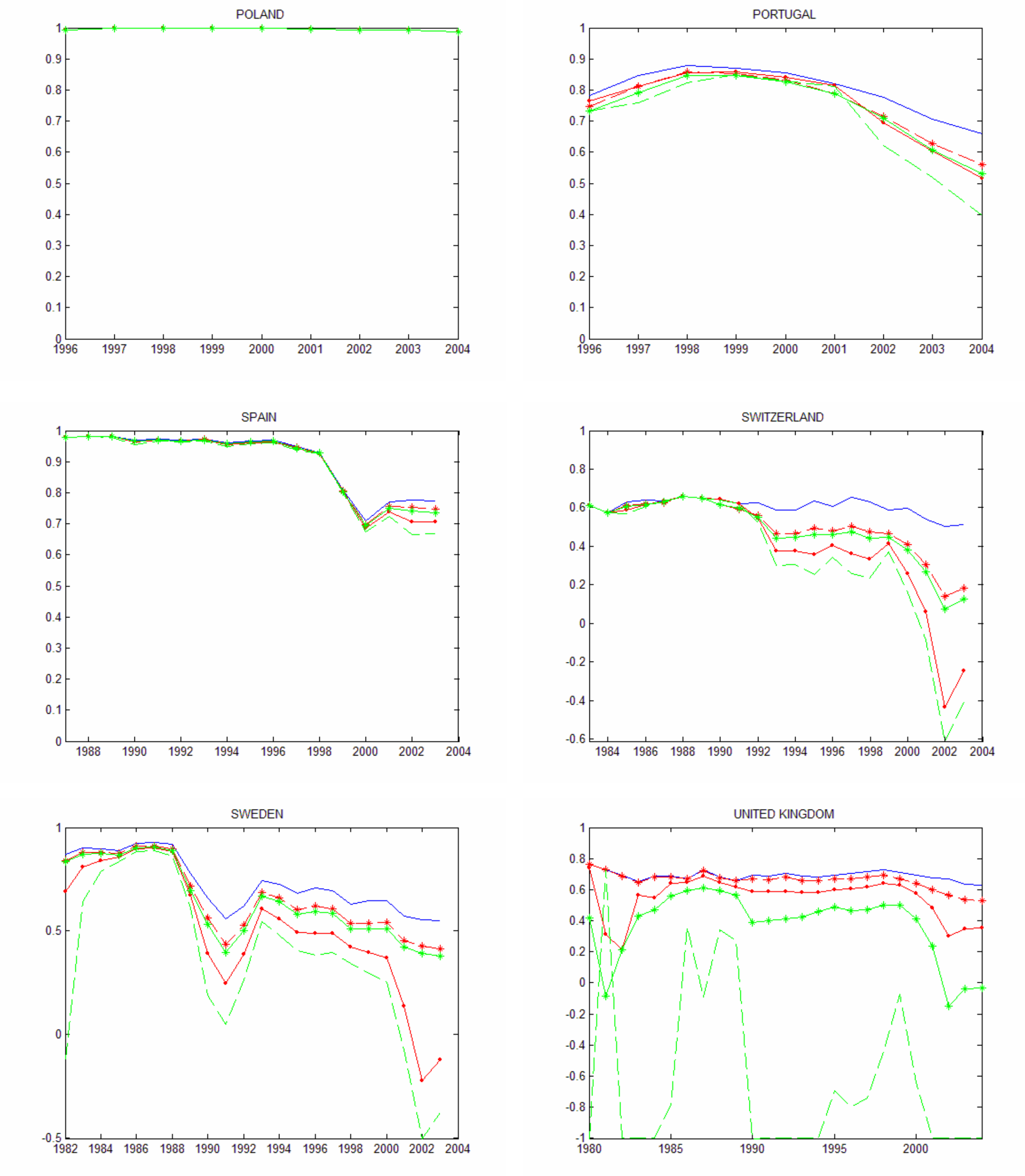
Figure 2ctd Home Bias (with short sales constraints)



Legend

International CAPM (i.e. Relative Market Share)
Bayesian Updating with Sigma Squared Alpha = 0.1
Bayesian Updating with Sigma Squared Alpha = 0.2 and Multi-Prior Correction
Data Sample
Data Sample with Multi-Prior Correction

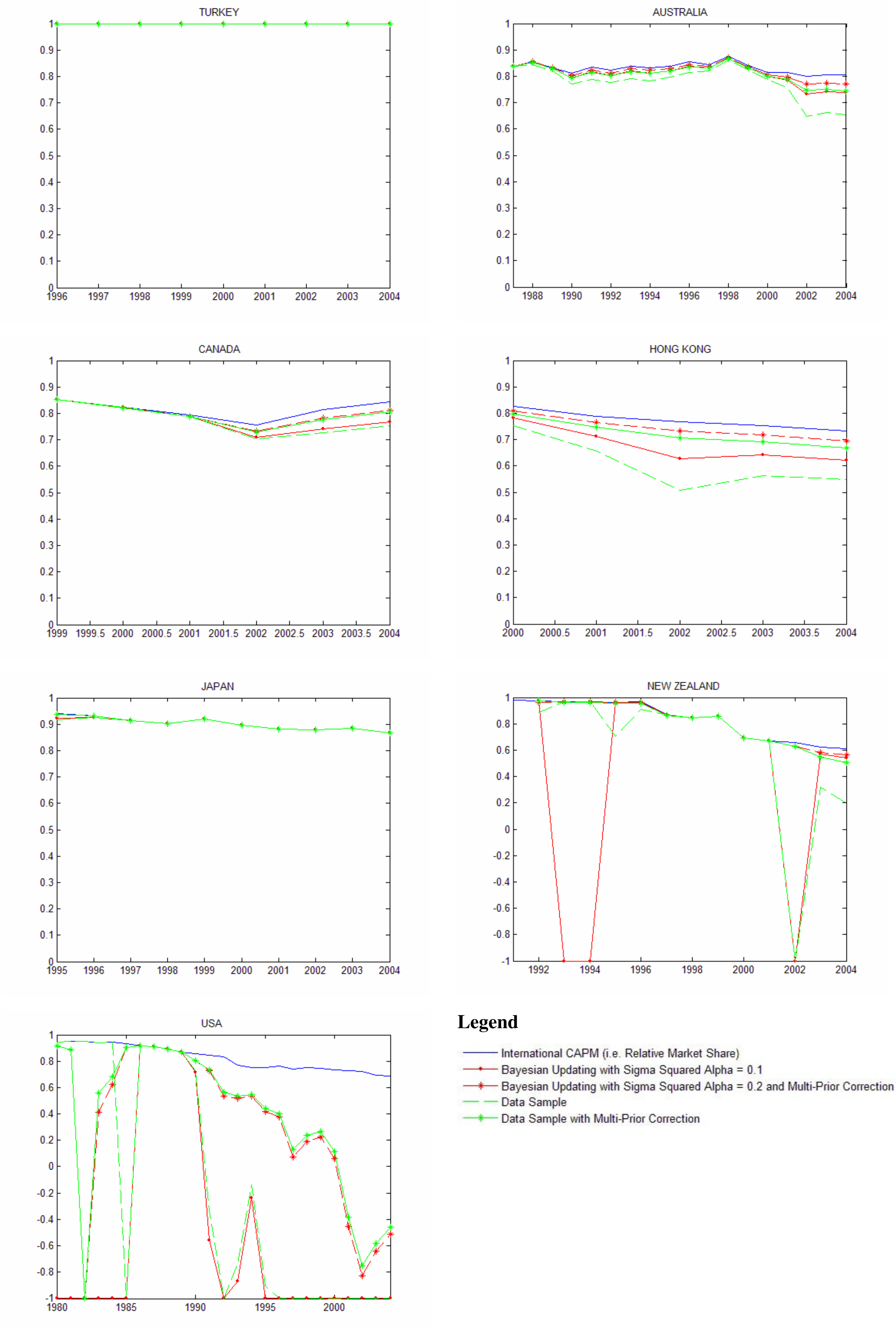
Figure 2ctd Home Bias (with short sales constraints)



Legend

- International CAPM (i.e. Relative Market Share)
- Bayesian Updating with Sigma Squared Alpha = 0.1
- Bayesian Updating with Sigma Squared Alpha = 0.2 and Multi-Prior Correction
- Data Sample
- Data Sample with Multi-Prior Correction

Figure 2ctd Home Bias (with short sales constraints)



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