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A Home Bias based on International Asset Pricing model

Ikrame Ben Slimane[1], Inass El Farissi[2] and Makram Bellalah[3]

Abstract

This paper presents an international asset pricing model based on investors' behaviour in the presence of asymmetric information about home and international markets. In this model, international asset allocation is based on the information availability about home and international assets. In these markets, only a proportion of international investors trade on home assets, and they are willing to pay for information costs in order to diversify their portfolios. Our model gives an explicit measure of market integration/segmentation through the international investor proportion trading in the home country. At equilibrium, this model has the merits of explaining the behavioral expected rate of return for different degrees of market segmentation. We suggest, in addition, an explanation of the home bias both in domestic and international settings. Under special assumptions, we obtain

[1] CRIISEA, Université de Picardie Jules Verne, Amiens, France,
e-mail : Ikrame.benslimane@u-picardie.fr
[2] CERGI, Groupe ISCAE School of Management, Morocco,
e-mail : inasselfarissi@yahoo.fr
[3] CRIISEA, Université de Picardie Jules Verne, Amiens, France,
e-mail : makram.bellalah@u-picardie.fr

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Merton's (1987) model that characterizes the relation between home and international returns.

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1 Introduction

Despite the gains from international diversification, nearly most investors' wealth remains in domestic assets. This is referred to in international finance as "home bias equity". Many authors explain this phenomenon by market frictions such as transaction costs, taxes, restrictions on foreign ownership, asymmetric information, and in recent studies, by the regret theory. Black (1974) presents a model of international asset pricing in the case of market segmentation. He develops a two country-model in the presence of explicit barriers to international investments in the form of a tax (on holdings of assets in one country by residents of another country). The tax is intended to present various kinds of barriers to international investment, such as the possibility of expropriation of foreign holdings, or a transaction cost on trading assets. Black's (1974) model was extended by Stulz (1981) to account for the tax on the short and long positions. These models explain home bias equity by the effect of transaction costs that prevent domestic investors from investing in foreign countries. Lewis (1999) uses a similar tax as Black (1974) in order to explain the home bias equity. The tax used by Lewis is considered as a transaction cost paid by foreign investors in the home country. The Stulz's model (1981) was extended to the case of many countries by Cooper and Kaplanis (2000), in order to show the effect of transaction costs on capital budgeting. The authors confirm that capital budgeting rules depend largely on the level of these costs that discourage the foreign investors from investing abroad. The home bias is therefore explained by such costs that decrease the gains of international diversification.

In a domestic setting, Viard (1995) studies the effect of fixed holding costs on the asset pricing. The equilibrium relation derived by the author explains the lack of diversification in a domestic setting due to these costs. The model presented by Viard can be seen as a general version of the CAPM. In a general context, the author examines the deviations from pricing relationships induced by fixed holding costs. In an international setting, Cooper and Kaplanis (1994) extend the model developed by Adler and Dumas (1983) to account for deadweight costs or taxes. Their empirical tests show that the effect of inflation rate risk and the differences between the consumption baskets do not explain the home bias.

Errunza and Losq (1985) present a two-country model to characterize mild segmentation. Foreign investors (called unrestricted) can trade on assets both ‘ineligible’ or restricted and ‘eligible’ or unrestricted. Domestic investors trade only in ‘eligible’ or unrestricted assets. Domestic investors cannot participate in the foreign market due to the restriction imposed by the foreign government. Errunza and Losq (1985) show that unrestricted assets are priced as if the international markets were integrated, and that the restricted assets are priced differently. The unrestricted investors recommend a super risk premium for the restricted assets, which is proportional to the conditional market risk. This model was used by Errunza and Miller (2000) to study the effect of market globalization and segmentation on the cost of capital. This contribution shows that financial market liberalizations lower the cost of capital. The empirical work conducted by the authors shows a decrease of 42% in the cost of capital. Eun and Jankirmannan (1986) consider a two-country model (a domestic and a foreign). In the presence of constraint on equity ownership, the authors show that at equilibrium, the price of the same asset is different for the domestic and foreign investors. This difference is explained by the constraint imposed on the domestic investors.

However, under no restrictions, domestic investors are willing to pay a premium over the price of foreign assets, while the foreign investors demand a discount on the same assets.

Bellalah Ma. (2001) extends the model of Eun and Jankirmannan (1986). The author presents an international asset pricing model in the presence of a constraint and ownership restrictions in the domestic and the foreign countries. He shows that at equilibrium, the domestic and foreign assets are priced differently for both investors. The premiums and the discounts paid and demanded by the investors are proportional to their ratio of risk aversion. The numerical results presented by the author show that constraints binding increases premiums and discounts. This is consistent with empirical tests documented in the emerging markets and the European countries that maintain the legal restriction. The model and numerical results show that the constraint explains the price behaviour in segmented and integrated markets.

Hietala (1989) presents a two-country model. The domestic country has two types of assets, restricted assets which can be held only by the domestic investors, and unrestricted assets held by the foreign and domestic investors. Domestic investors cannot trade in the foreign country. Hietala shows that the unrestricted assets are traded at premium prices from the domestic investors' point of view. He explains how the partial market segmentation affects the expected rate of return and the premium of the same assets. This segmentation explains the home bias equity observed in domestic portfolios. Errunza and Losq (1989) show that the removal of investment barriers generally leads to an increase in the aggregate market value. They suggest that the introduction of different types of index funds in the international market increases world market integration and investor welfare.

Stulz and Wasserfallen (1995) develop a model where the demand function for domestic assets differs between domestic and foreign investors due to the deadweight costs. They show the existence of a price risk premium for the unrestricted assets. Consistently with Hietala (1989), Stulz and Wasserfallen (1995) show that the ownership restrictions explain the higher price paid by the foreign investors for the domestic assets than the domestic investors. Basak (1996) extends the analyses in Black (1974), Stulz (1981), Errunza and Losq (1985, 1989), Eun and Jankirmannan (1986), and Hietala (1989) to incorporate intertemporal consumption behaviour. In a richer model, the author re-examines the implications of segmentation for price and welfare. Domowitz and Madhavan (1997) examine the relationship between stock prices and market segmentation induced by the ownership restrictions in Mexico. They document a significant stock price premium for unrestricted shares. This lends support to the model developed by Stulz and Wasserfallen (1995).

The restrictions imposed by governments explain the segmentation observed on the international market. Gultekin, Gultekin and Penati (1989) show that the price of risk is different before Japanese market liberalization, but not after. Hargis (2000) extends the model of Eun and Jankirmanan (1987) to the case of fixed cost to list the endowment on the domestic and foreign markets. These costs can be interpreted as participant costs or transaction costs. Hargis shows that international cross listings can transform a segmented local equity market from an equilibrium of low liquidity to an integrated market with high liquidity.

The remainder of the paper is organised as follows. In the next section, we examine the effect of asymmetric information on portfolio choice throughout the literature. In section 3, we present investors' allocations and we derive the international asset pricing model in our context. We discuss the different implications of this model on portfolio choice, on asset prices when we move from market integration to market segmentation. Then, we propose an explanation for the home bias in domestic and international settings. Section 4 presents some concluding remarks.

2 The Effect of Asymmetric Information on Portfolio Choice

The effects of asymmetric information are largely documented on the domestic and international levels. The empirical evidence provided initially by Kang and Stulz (1997), and confirmed subsequently by Dahlquist and Robertsson (2001), shows that international asset allocation is based on investor endowment information. The authors prove that the domestic and the international investors exhibit a bias in home and in international settings. The empirical results show that the investors tend to overweight their portfolio by 'known' assets. The bias in favour of these assets is explained by the advantage of information in the domestic country. Kang and Stulz (1997) show that the investor portfolio is biased against small firms and that investors overinvest in large firms in Japan due to the availability of information about these large firms. The authors find that holdings are relatively significant in firms with large export sales. From this fact, the authors suggest that the home bias is derived by informational asymmetries. Falkenstein (1996) shows that the preference of some assets is explained by low transaction costs and low volatility. He shows that the investors tend to trade assets about which they are better informed. In his model, the information is detected by the investors through the publication of the new stories and the age of these assets.

Brennan and Cao (1997) develop a model of international equity portfolio investment flows based on informational endowments between foreign and domestic investors. The authors show in this model that when domestic investors possess an information advantage over foreign investors about their domestic market, they tend to purchase foreign assets in periods when rates of return are high.

Zeng (2004) presents a model of asset pricing under asymmetric information about distribution of risk aversion. The author shows in a dynamic competitive model that asymmetric information plays a role in long run risk premiums. He shows that the presence of a large proportion of informed investors decreases the risk premium. In the case of a small fraction of informed investors, the risk premium increases.

Solnik (2008) uses the regret theory to explain the home bias puzzle. The author presents a model when the investor feels the pain of regret if the foreign assets underperform compared to the domestic ones. The regret theory presented by Solnik shows that investors construct their portfolios based on their aversion to risk and regret. In our idea, the regret theory explains the home bias well but, as presented by the author, does not take into account the effect of asymmetric information.

In this paper, we propose a model where asset allocation will be based on risk aversion, and information costs linked with gathering, processing and spread of information about foreign and domestic assets. We suggest an explanation of the regret felt by the investor due to the lack of information on foreign assets, a feeling which induces an over-estimation in the assets' expected rate of returns. To avoid this regret, the investor should base his allocation on information concerning the foreign assets. Therefore, in the situation of foreign asset information availability, the feeling of pain can be reduced[4].

In the next section, we derive the asset pricing model and we present the merits of this relation in explaining the home bias in domestic and international settings. Then, we discuss the effect of this pricing relation in different cases of market segmentation and integration.

3 The Model

Our economy is composed of two countries that maintain a fixed exchange rate and all valuations are conducted in a common currency. In this economy, the first

[4] Our model accounts for the effect of asymmetric information about the home and foreign assets, but we do not use the regret theory to derive asset pricing. This extension remains a challenge for future research.

country is referred to as a 'Home' and populated by N_H investors. The N_H investors trade in the home and in the international markets. The second country is called 'International' and populated by N_I investors. The N_I investors are two types. The first are labelled global investors denoted by g, and they trade in both countries 'Home and International'. The second are the foreigners f and they trade only in their local market. The decision taken by investors f is motivated by the lack of available information about the home assets, and they are not willing to pay a cost in order to get information about the home assets and diversify in an international setting. Under this condition, their portfolios are composed only by their domestic assets. The behaviour of the foreign investors is justified by some pessimistic views about home assets' expected rate of return. This behaviour can be seen as a psychological aspect of individual behaviour based on the familiarity that the investors have about their domestic assets.

The international asset pricing proposed in this paper characterizes a situation of asymmetric information about domestic and foreign assets. The costs linked with this market situation are market imperfections that prevent a fraction of international investors from investing in the home country. In this case, we identify only a percentage of international investors that diversify their portfolio and participate in the home market. This fraction is given by θN_I that characterizes the global investors diversifying in an international setting in the case of asymmetric information. These investors trade in both the home and international markets. The rest of the international investors, f, $(1-\theta)N_I$ prefer trading only in their market and pay for getting information about their local assets. The parameter θ measures the degree of market integration and segmentation.

3.1 The Portfolio Choice

In this paper, we consider that the investor maximizes the expected utility of his/her end-of-period wealth. We do not assume the strong assumption underlying the standard financial theory that investors are perfectly informed about security returns. In our suggested model, information is costly and investors do not invest in all available assets in the market place. Each investor trading in the home and international markets paid a cost for information about assets. These costs are defined in the spirit of Merton's (1987) model of capital market equilibrium with incomplete information. We denote the information cost paid by the international and the local investors about home assets by λ_H. The foreign investors from the international market do not trade in the home market and are not willing to pay λ_H to obtain information. In this situation, they do not diversify in an international setting but rather in the local market. In the same way, we consider that all investors trading in the international market paid a cost in order to be informed. We denote this cost paid in the international market by λ_I. In the model below, we do not consider the difference between the cost paid by the home investors and the global investors[5].

The problem of a representative investor j $(j = h, g, f)$ based on maximizing his end-of-period wealth, is given by:

$$\max E\left(\tilde{W}_j^1\right) - \frac{\delta}{2} Var\left(\tilde{W}_j^1\right) - \lambda_H x_{H_j} - \lambda_I x_{I_j} \tag{1}$$

Where index h refers to the home investor trading in both home and international markets, and paying for that respective costs λ_H and λ_I. Index g refers to the global investor trading in his/her country "international", in the home country, and paying respective costs λ_I and λ_H. The index f refers to the foreign investor who trades in his/her market "international" and does not trade in the home market, paying only a cost λ_I. δ is the risk aversion of

[5] This model can be extended to the case of difference in information costs paid by the local and the global investors for the same assets. We expect that the information costs paid by domestic investors about their local assets are less than the costs paid by foreign investors for the same assets. The implications of this assumption will be discussed later.

investor j, which is assumed to be the same for all investors[6]. $\tilde{W}_j^1$ is the wealth of investor j in period 1. x_{H_j} is the proportion invested by investor j in the home market. x_{I_j} is the proportion invested by investor j in the international market.

The expected end-of-period wealth is valued as:

$$E\left(\tilde{W}_j^1\right) = \left(W_j^0 - x_{H_j} - x_{I_j}\right)\left(1+r\right) + x_{H_j}\left(1+\mu_H\right) + x_{Ij}\left(1+\mu_I\right) \tag{2}$$

where $1 + \mu_H$ is the mean of the random rate on home equity $\tilde{R}_H$, $1 + \mu_I$ is the mean of the random rate on international equity $\tilde{R}_I$, and r is the risk free interest rate.

The variance of the end-of-period wealth is given by:

$$Var\left(\tilde{W}_j^1\right) = x_{H_j}^2 Var\left(\tilde{R}_H\right) + x_{I_j}^2 Var\left(\tilde{R}_I\right) + 2 x_{H_j} x_{I_j} Cov\left(\tilde{R}_H, \tilde{R}_I\right) \tag{3}$$

Based on the optimization problem given by (1) and from relations (2) and (3), we obtain the first-order conditions for investor j :

$$\frac{\partial}{\partial x_{H_j}} = \mu_H - r - \delta\left(x_{H_j}\sigma_H^2 + x_{I_j}\sigma_{HI}\right) - \lambda_H = 0 \quad \text{for} \quad j = h, g \tag{4}$$

$$\frac{\partial}{\partial x_{I_j}} = \mu_I - r - \delta\left(x_{I_j}\sigma_I^2 + x_{H_j}\sigma_{HI}\right) - \lambda_I = 0 \quad \text{for} \quad j = h, g, f \tag{5}$$

The two previous relations are very important to deduce our asset pricing. These relations show that the investment in the international and domestic markets depends on the market risks and the effect of the information costs. In the next section, we will derive the asset pricing model and we will give the market equilibrium condition for all investors.

3.2 Market Equilibrium and Asset Pricing Model

[6] The same assumption is used by Cooper and Kaplanis (1994).

To come up with our formula of asset pricing, we define the market equilibrium in the home market as:

$$N_H x_{Hh} + \theta N_I x_{Hg} = X_H \tag{6}$$

This condition shows that the total demand in the home market is equal to the total supply X_H. In the same way, we define the equilibrium in the international market as follows:

$$N_H x_{Ih} + \theta N_I x_{Ig} + (1-\theta) N_I x_{If} = X_I \tag{7}$$

Relation (7) shows that the total demand is equal to the international market supply X_I. The total demand contains three components. The first one is attributed to the home investors demand in the international market, the second refers to the demand of the global investors in international market, and the third refers to the foreign investors demand in their local market.

Let us now turn to deriving the international asset pricing. To achieve our goal, multiplying relation (4) by N_H for $j = h$ gives:

$$N_H(\mu_H - r) = N_H \lambda_H + N_H \delta (x_{Hh} \sigma_H^2 + x_{Ih} \sigma_{HI}) \tag{8}$$

and we multiply relation (4) by θN_I for $j = g$ to obtain:

$$\theta N_I (\mu_H - r) = \theta N_I \lambda_H + \theta N_I \delta (x_{Hg} \sigma_H^2 + x_{Ig} \sigma_{HI}) \tag{9}$$

adding (8) to (9) yields:

$$\begin{aligned}(N_H + \theta N_I)(\mu_H - r) &= (N_H + \theta N_I)\lambda_H + \delta \sigma_H^2 (N_H x_{Hh} + \theta N_I x_{Hg}) \\ &\quad + \delta \sigma_{HI} (N_H x_{Ih} + \theta N_I x_{Ig})\end{aligned} \tag{10}$$

Based on (6) and (7), equation (10) becomes:

$$\begin{aligned}&(N_H + \theta N_I)(\mu_H - r) \\ &\quad = (N_H + \theta N_I)\lambda_H + \delta \sigma_H^2 X_H + \delta \sigma_{HI} [X_I - (1-\theta) N_I x_{If}]\end{aligned} \tag{11}$$

Relation (11) shows the interaction between the expected rate of return of the home assets, information costs, and market risk. The last term in this expression gives the link between the total supply in the international market and the parameter of market integration given by the investors proportion θ.

In the same spirit, we will find an interaction between the expected rate of return on the foreign assets, information costs, and the total demand and supply in the international market. To achieve our goal, first, we multiply (5) by N_h for investor $j = h$, we find:

$$N_H (\mu_I - r) = N_H \lambda_I + N_H \delta x_{Ih} \sigma_I^2 + N_H \delta x_{Hh} \sigma_{HI} \tag{12}$$

and second, we multiply (5) by θN_I for investor $j = g$ to have:

$$\theta N_I (\mu_I - r) = \theta N_I \lambda_I + \theta N_I \delta x_{Ig} \sigma_I^2 + \theta N_I \delta x_{Hg} \sigma_{HI} \tag{13}$$

We use relation (5) and we multiply by $(1-\theta)N_I$ for investor $j = f$, to obtain:

$$\begin{aligned}&(1-\theta)N_I (\mu_I - r)\\ &\quad = (1-\theta)N_I \lambda_I + (1-\theta)N_I \delta x_{If} \sigma_I^2 + (1-\theta)N_I \delta x_{Hf} \sigma_{HI}\end{aligned} \tag{14}$$

In our formula, we have considered that the foreign investor does not invest in the home market. This investor's behaviour is explained by the lack of information availability about the home assets. In this case, the foreign investor feels pessimistic about the home assets, invests all his/her wealth in domestic assets, the value of $x_{Hf} = 0$, and relation (14) becomes:

$$(1-\theta)N_I (\mu_I - r) = (1-\theta)N_I \lambda_I + (1-\theta)N_I \delta x_{If} \sigma_I^2 \tag{15}$$

Adding equations (12), (13) and (15), we find:

$$\begin{aligned}&[N_H + \theta N_I + (1-\theta)N_I](\mu_I - r)\\ &\quad = [N_H + \theta N_I + (1-\theta)N_I]\lambda_I + [N_H x_{Ih} + \theta N_I x_{Ig} + (1-\theta)N_I x_{If}]\sigma_I^2 \delta\\ &\qquad + \delta \sigma_{HI} (N_H x_{Hh} + \theta N_I x_{Hg})\end{aligned} \tag{16}$$

After arrangement, and based on market clearing conditions given by relations (6) and (7), relation (16) becomes:

$$\begin{aligned}&[N_H + \theta N_I + (1-\theta)N_I](\mu_I - r)\\ &\quad = [N_H + \theta N_I + (1-\theta)N_I]\lambda_I + X_I \sigma_I^2 \delta + \delta \sigma_{HI} X_H\end{aligned} \tag{17}$$

Relation (17) shows the interaction between the excess return on the international market, risk aversion, total supply and demand in this market, and the number of participant investors in the international market.

To get the asset pricing relation, we resolve for X_I from expression (17) and for x_{If} from (15), we replace these variables by their expressions in (11), and so we have[7]:

$$\mu_H = r + \lambda_H + \delta\left(\sigma_H^2 - \frac{\sigma_{HI}^2}{\sigma_I^2}\right)\frac{X_H}{N_H + \theta N_I} + \frac{\sigma_{HI}}{\sigma_I^2}\left(\mu_I - r - \lambda_I\right) \tag{18}$$

Arranging equation (18) gives our international asset pricing model in the presence of information costs and restrictions on number of investors :

$$\mu_H = r + \lambda_H + \delta\left(\sigma_H^2 - \frac{\sigma_{HI}^2}{\sigma_I^2}\right)\frac{X_H}{N_H + \theta N_I} + \beta_I\left(\mu_I - r - \lambda_I\right) \tag{19}$$

Relation (19) shows that the expected rate of return on home assets depends on the information costs in the home and in the international market, the risk aversion and the number of the home and global investors trading in the home market. This relation gives the degree θ of market integration/segmentation and the risk premium in the international market. From relation (19), an increasing number of the home and international investors decreases the market risk, and the international diversification gives potential gains in the presence of information costs. In order to explain the home bias exhibited by the home and international investors, we should compare the gain linked with diversification and the costs paid by the domestic and international investors. In our model, as suggested by Merton (1987), a total diversification is not achievable because investors are not informed about all assets. In this case, the specific risk is not totally diversifiable in domestic and international settings. Relation (19) shows that investor behaviour influences the value of the expected rate of return of the domestic assets. The increasing value of θ indicates a tendency towards market integration. This situation is explained by some optimistic views about the home assets, and the global investor tends to overweight his/her portfolio with foreign assets which reduce the home bias equity. In our point of view, the real optimistic view is justified by the information cost paid by the international investor to be informed.

[7] The demonstration is provided in the A ppendix.

In the case of Solnik (2008), the regret felt by the investor is due to over-estimation in the expected return of the foreign assets. This overestimation is explained by the lack of information about the foreign assets.

In the proposed model, we can use another form of regret which we call the expected regret linked to the differential expected rate of return between a perfect and an imperfect market. This differential is explained by the effect of investor behaviour and information costs. In the same way, we can have a risk regret measured by the market volatility in the case of perfect and imperfect situations. This regret can be named a spread volatility which explains the home bias equity. This risk regret is explained by the high volatility in the home market, and the foreign investor ignores this situation due to the lack of information about the home returns. One part of this spread volatility is in $\sigma_H^2 - \sigma_{HI}^2 / \sigma_I^2$ and the other part is related to the international beta β_I.

In our context, the number of the global investors trading in the home market gave an explicit explanation for the empirical works conducted by Huberman (2001) and Strong and Xu (2003). Both of these papers show that the home bias is explained by superior information that investors have about their local assets. In our study, this situation corresponds to a decreasing value of θ. As a result, in this case, the global investor becomes a foreign one and trades more in his/her home assets due to information availability. Our finding is consistent with the empirical work presented by these authors and we can argue that in an international setting, the information costs that investors are not willing to pay create a home bias. In addition, our model explains the home bias in the domestic market by the effect of information costs needed to pay for local assets. In Huberman (2001) and Strong and Xu (2003), familiarity with assets induces costless information. In real situations, the information about home assets, or about a subset of these assets, is costly and our λ_H is a proxy for these costs.

We can see from this model that the value taken by θ varies between zero and one. This parameter gives an explicit solution for the degree of market integration and segmentation. In order to understand these situations, we will discuss some special cases as a function of θ value.

4 Special Cases

4.1 Perfect segmentation in the case of information costs

Let us consider the case of perfect market segmentation (i.e. the value of $\theta = 0$). In this situation, no international investors trade in the home market, and relation (19) becomes:

$$\mu_H = r + \lambda_H + \delta\left(\sigma_H^2 - \frac{\sigma_{HI}^2}{\sigma_I^2}\right)\frac{X_H}{N_H} + \beta_I\left(\mu_I - r - \lambda_I\right) \tag{20}$$

This relation shows the effect of information costs on asset pricing. The home assets are priced as if there were a situation of market integration due to the existence of international market portfolio. This situation is justified by international interactions between the domestic and foreign markets such as market volatility, interest rate, inflation and commodity prices. This model lent support to the work presented by Stulz (1995a, b) about the cost of capital. The author shows the mistakes of using the local approach in estimating the cost of capital instead of using the international approach.

Our model shows a positive relation between the expected rate of return and the risk aversion. From relation (20), we can conclude that an increasing value of δ increases the expected return demanded by investors. This situation induces an elastic demand for the home assets. Relation (20) is notable to show that in our economy, complete market segmentation remains difficult to verify. This situation is difficult due to the interaction between the home and the international returns which we call beta effects; and to the information costs spent by managers to keep abreast of other countries.

4.2 Perfect integration in the case of information costs

We now consider the case of perfect market integration, where $\theta = 1$. In this case, there is a large number of foreign investors trading in the home market, and the value of N_I becomes very large and tends to infinity. This case reflects the advantage of international diversification through decreasing market risk.

When the number of foreign investors trading in the home market is large, the home bias decreases rapidly. This situation reflects an elastic demand for the home assets, and their supply X_H is not sufficient on the international market. In this case, the

$$\delta\left(\sigma_H^2 - \sigma_{HI}^2 / \sigma_I^2\right) X_H / \left(N_H + \theta N_I\right)$$

will be close to zero and equation (20) becomes:

$$\mu_H = r + \lambda_H + \beta_I (\mu_I - r - \lambda_I) \tag{21}$$

Under the previous conditions, the proposed model is reduced to Merton's (1987). This relation gives the expected rate of return in the home market as a function of information costs and a new market risk premium. At this level, we can argue that we can obtain complete market integration ($\theta = 1$) while being in the presence of incomplete information on assets. This situation shows that the assumption about perfect markets is very hard to verify due to asymmetric information but we end up with a situation with an integrated market and investors allocating their resources in the presence of theses imperfections. We conclude from this case that the complete market integration remains reachable, but asymmetric information persists in the home and international markets. We call such a case mild integration.

If we consider a situation of perfect markets and the case of no restrictions, no asymmetric information and that investors tend to diversify their portfolio by using the available assets, in this case, we have $\lambda_H = \lambda_I = 0$, N_H and N_I are very large, and our suggested model is reduced to the classic CAPM:

$$\mu_H = r + \beta_I (\mu_I - r) \tag{22}$$

5 Conclusion

In this paper, we have presented an international asset pricing model in the case of information costs and investors' behaviour. The behavioural investor influences the expected rate of return and shows that markets can be integrated or segmented. The behaviour is captured through his/her portfolio selection and it is represented in this model by the proportion of overall investors trading in the home country. This paper explained the home bias in domestic and international settings and gave a special value to the degree of market integration/segmentation. In our model, we did not consider any differences in the value of information costs supported by investors in the home and in the international markets. Relaxing this assumption remains a challenge for future research.

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Appendix

From expression (15), we can write:

$$x_{If}=\frac{\mu_I-r-\lambda_I}{\delta\sigma_I^2}$$

and from relation (17), we have:

$$X_I=\frac{\left[N_H+\theta N_I+(1-\theta)N_I\right](\mu_I-r)-\left[N_H+\theta N_I+(1-\theta)N_I\right]\lambda_I-\delta\sigma_{HI}X_H}{\delta\sigma_I^2}$$

Inserting x_{If} and X_I in equation (11) we get:

$$\begin{aligned}&(N_H+\theta N_I)(\mu_H-r)\\&=(N_H+\theta N_I)\lambda_H+\delta\sigma_H^2X_H\\&+\delta\sigma_{HI}\left\{\begin{array}{l}\dfrac{\left[N_H+\theta N_I+(1-\theta)N_I\right](\mu_I-r)-\left[N_H+\theta N_I+(1-\theta)N_I\right]\lambda_I-\delta\sigma_{HI}X_H}{\delta\sigma_I^2}\\-(1-\theta)N_I\dfrac{1}{\delta}\dfrac{\mu_I-r-\lambda_I}{\sigma_I^2}\end{array}\right\}\end{aligned}\quad\text{(A1)}$$

Arranging relation (A1) gives:

$$\begin{aligned}\mu_H-r=\lambda_H+\frac{\delta\sigma_H^2X_H}{N_H+\theta N_I}+\frac{\sigma_{HI}}{\sigma_I^2}\left[\frac{N_H+N_I}{N_H+\theta N_I}(\mu_I-r-\lambda_I)\right]\\-\frac{\sigma_{HI}^2}{\sigma_I^2}\frac{\delta X_H}{N_H+\theta N_I}-(1-\theta)\frac{N_I}{N_H+\theta N_I}\frac{\sigma_{HI}}{\sigma_I^2}(\mu_I-r-\lambda_I)\end{aligned}\quad\text{(A2)}$$

We arrange expression (A2), which then becomes:

$$\begin{aligned}\mu_H-r=\lambda_H+\delta\left(\sigma_H^2-\frac{\sigma_{HI}^2}{\sigma_I^2}\right)\frac{X_H}{N_H+\theta N_I}\\+\frac{\sigma_{HI}}{\sigma_I^2}(\mu_I-r-\lambda_I)\left[\frac{N_H+N_I}{N_H+\theta N_I}-(1-\theta)\frac{N_I}{N_H+\theta N_I}\right]\end{aligned}\quad\text{(A3)}$$

The following verifies that the last term in (A3) is equal to one:

$$\frac{N_H+N_I}{N_H+\theta N_I}-(1-\theta)\frac{N_I}{N_H+\theta N_I}=1$$

and so we find our formula given in (18).