Home Advantage (not Bias) in Perfect Markets with Global Firms:

Necessary Conditions and Empirical Implications

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Keywords: International asset pricing; Firm globalization, Home bias, Home advantage.

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ABSTRACT

Existing explanations for home bias depend on market imperfections such as government restrictions, information asymmetry, or behavioral reasons. We show that home bias can exist in perfect markets with information symmetry and with rational firms and investors. We develop a parsimonious asset pricing model where firms operate domestically and globally. Home advantage emerges if firms' operations can be diversified more efficiently with domestic rather than global risks. This is possible when domestic diversification across industries yields greater gain than international diversification across countries. We therefore obtain a rationale for 'home advantage' rather than home bias and discuss empirical implications.

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1. Introduction

Since the pioneering work by French and Poterba (1991), the home bias puzzle in international portfolio allocation has been well recognized; Obstfeld and Rogoff (2000) consider it as one of the six major puzzles in international macroeconomics. Home bias exists when the actual investment in a home market is materially greater than that indicated by a normative portfolio model. The literature considers two main venues of arguments to explain the puzzle, frictions to foreign investments and behavioral biases. We expand on both in the brief literature review, below. While the academic literature has made significant strides in understanding relevant factors and consequences, a review of the then-updated literature by Cooper et al. (2013) concluded that the core question of why investors resist international diversification remained unanswered; their conclusion appears to be valid to date.

We show in this paper that 'home bias' can exist even in a world of perfect markets, information symmetry, and without recourse to frictions or behavioral factors. Therefore, 'home bias' in international investments may not be a 'bias' against rational choice, but rather a reflection of greater advantages investing at home rather than globally. We develop a parsimonious asset pricing model with global firms, assuming real flexible exchange rates, real returns, and purchasing power parity. We harness a two-country setting with a given pool of firms, each may choose the proportion of business conducted at home and/or abroad (globalization), where local and foreign businesses have different risk-return profiles. Because no taxes or other restrictions are imposed on local and foreign investors, all hold the global market portfolio, which is made of all local and foreign real businesses.

There are three obvious motives for a domestic firm to go global: global operations may offer higher expected returns, lower risk, or better risk reduction opportunities via real asset diversification. The first two motivations are straight-forward, but in our setup the third gives rise to three types of international risk factors in addition to the familiar beta that measures the home market risk. Our model formalizes and expands the scope of early empirical papers such as Errunza et al., (1999), who showed that one can mimic rather successfully international diversification by holding locally traded foreign assets. We find 8 risk factors that can be grouped into four factor-types by the ways they affect firms' cost of capital and the global Sharpe ratio.

While the model has several interesting implications, this paper focuses on the most intriguing one, home bias. We obtain a necessary condition for 'home bias', or actually, 'home advantage'. Domestic advantage may exist if domestic diversification across local firms of different industries, and particularly foreign firms traded domestically, reduce risk more than international diversification across countries does. If the home and foreign markets offer different expected returns or variances, those considerations would augment the advantages derived by the real asset diversification motive.

We apply comparative static analyses with historically consistent parameters to show that the global Sharpe ratio may increase or decrease as a function of the proportion of global operations, and corner solutions of full or zero globalization may be optimal. However, depending on the relative magnitude of local vs. global correlations, interior optimal globalization policies may exist. The cost of equity capital for local firms varies as the four correlation types vary, obtaining corner solutions in some cases. The correspondence of Sharpe ratio and the cost of capital depends on the type of correlation and its level; for example, if foreign assets that trade in the home country outweigh (in terms of level and market value) other types of correlations, local firms can minimize the cost of equity capital by not operating globally, and because Sharpe ratio is maximized, the global market portfolio is tilted toward the local country – home advantage.

This article contributes in several areas. First, we derive a necessary condition under which home advantage should exist in perfect markets because of 'home-made diversification' (Errunza et al., 1999). Second, unlike existing international asset pricing models that focus on government restrictions or taxes, we present an alternative model based on global firm operations. Third, an interior optimal globalization policy may exist because the Sharpe ratio is not linear with the extent of global business operations.

In the remainder of the paper, we develop a model of optimal asset allocation with global firms and investors in section 2. In section 3 we discuss the implications of optimum global business exposure on the Sharpe ratio. Section 4 studies the expected returns of firms under domestic and global pricing. In section 5, we derive the necessary conditions for home bias, and discuss their empirical implications in section 6. Concluding remarks are given in section 7.

2. A brief literature review

Home bias in equity portfolios, where investors disproportionately prefer domestic assets over international diversification, has been a long-standing puzzle in finance. Many studies have attempted to shed light on the underlying factors and mechanisms driving home bias and foreign bias. By and large, the literature can be partitioned to frictional and behavioral explanations for home bias. Early theoretical contributions entertained rational asset pricing models with frictions along two paths: one that incorporates government restrictions or taxes under constant exchange rates (Black, 1974; Stulz, 1981; Errunza & Lolq, 1985; Eun & Janakiramanan, 1986; Mishra & Ratti, 2013) and one that incorporates the effect of real exchange rate risk (Solnik, 1974, Adler and Dumas, 1983) under otherwise perfect capital market assumptions. Adler & Dumas, (1983) and Choi (1989) derived hedging and speculative demand motives for foreign assets based on the effect of real exchange rate risk. These two latter studies do not examine home bias. Other frictional explanations for home bias are based on partial market segmentation due to government restrictions, asymmetric information, and incomplete hedgeability of international risks (e.g., Ahearne, Griever, and Warnock 2004; Van Nieuwerburgh and Veldkamp 2009; Ke, Ng, and Wang 2009; Eichler 2012). Errunza and Losq (1985) show the asset pricing implications when some assets are ineligible for some investors, and Eun and Janakiramanan (1986) study the implications of a constraint on the fraction of local assets held by foreigners. However, as Karolyi and Stulz (2002) note, such barriers have fallen over time while domestic bias continues, and there is a question as to whether barriers are of sufficient magnitude to explain domestic bias (Glassman and Riddick, 2001; Quinn and Voth, 2008). An empirical argument for home bias that is closely related to our theoretical model has been proposed by Errunza et al., (1999), whereby global firms traded in the local market provide exposure to global diversification, the 'homemade diversification' effect mentioned in the introduction.

As an alternative to frictional explanations, behavioral effects are mentioned in the literature, such as unfamiliarity and excessive optimism (Li, 2004) or Solnik and Zuo (2016), who explored the relationship between relative optimism and home bias using survey data from professional asset managers. They found that investors' optimism about their domestic markets leads to a preference for domestic bonds, not only stocks, reinforcing the home bias phenomenon. Schumacher (2017) investigates international mutual funds and reveals their inclination to allocate a more significant share of their portfolios to industries of significance in their domestic stock markets, manifesting a noticeable foreign industry bias, primarily linked to familiarity. Boermans et al., (2022) utilize the European Central Bank's database to investigate the factors influencing home and foreign bias in European equity portfolios. They find that information effects play a more significant role than familiarity bias in shaping portfolio choices. Cooper et al., (2018) distinguish between home and foreign bias and propose a distance-based model to analyze these biases. They find pure home bias primarily in emerging markets. Karolyi (2016) draws attention to academic home bias in financial research. He observed that only a small percentage of studies published in top finance journals focus on non-US markets, despite the importance of global financial markets. Interestingly, non-US papers received higher citations than US-focused ones, reflecting the importance of global perspectives in finance research.

3. Setup - dissection of the covariance matrix

Assume a two-country setup in which stocks and bonds trade in continuous time in frictionless markets, specifically no taxes or trading costs. Investors may invest in financial assets globally under purchasing power parity (PPP), real exchange rates, and real asset returns. Each of the two countries is endowed with a certain number of firms. Firms may opt to conduct business in country *h* only, defined as the home country, in the foreign country *g* only, or they may conduct business in both. The proportion of business conducted in either country, measured as market-value of the business over each firm's value, is determined by the firms independently, and taken as exogenous parameters in the model. Unless justified by the context, we shall refer henceforth to individual business operations as "tradable real assets", instead of "firms", because the term "firm" is not well defined; it may stand for one (local *or* foreign) or two (local *and* foreign) real assets. All real assets are listed for trade therefore we shall abbreviate and refer to them as "real assets". We assume that firms register for trade some of their shares in the country or countries where they conduct business, *h* and/or *g*, such that the market value of registered shares is equal to the value of real business conducted in the country.

Before developing the model, we must present our notations. We have three indexes, one for the country of origin (lower-left index), one for the country of operation (upper-left index), and one for the specific asset (right-lower index). For example, the expected rate of return ${}^{h}_{h}\mu_i$ indicates that asset *i* is operational in the home country, *h*, which is also its country of origin.

Conversely, ${}^{h}_{g}\mu_p$ is the expected rate of return of real asset *p* that is operational in country *h* while its home country is *g*. Depending on context, we shall refer to assets as “local” if the firm does not have foreign operations, or “international” if it does.

There are ${}^{h}_{h,g}n$ (${}^{g}_{h,g}n$) unique real risky assets operating in country *h* (*g*) as the upper left index shows, domiciled in either country *h* or *g* (lower left index). Their sum across the two countries makes the world (interchangeably “global”) portfolio of real assets, ${}^{w}n = {}^{h}_{h,g}n + {}^{g}_{h,g}n$ (not necessarily equal to the number of firms, denoted by *n*, with no superscript, as some firms may operate in one country). Table 1 shows a covariance matrix that captures eight types of covariances that will be used later to identify the different risk factors.

Table 1: Different correlation types in the global market portfolio

			Country h				*Country g*			
			Firm i		*Firm j*		*Firm p*		*Firm q*	
			${}^{h}_{h}\mu_i$	${}^{g}_{h}\mu_i$	${}^{h}_{h}\mu_j$	${}^{g}_{h}\mu_j$	${}^{h}_{g}\mu_p$	${}^{g}_{g}\mu_p$	${}^{h}_{g}\mu_q$	${}^{g}_{g}\mu_q$
Country h	*Firm i*	${}^{h}_{h}\mu_i$	${}^{h}_{h}\sigma_i^2$	${}^{h,g}_{h}\nu_i$	${}^{h}_{h}\rho_{i,j}$	${}^{h,g}_{h}\phi_{i,j}$	${}^{h}_{h,g}\kappa_{i,p}$	${}^{h,g}_{h,g}\theta_{i,p}$	${}^{h}_{h,g}\kappa_{i,q}$	${}^{h,g}_{h,g}\theta_{i,q}$
		${}^{g}_{h}\mu_i$		${}^{g}_{h}\sigma_i^2$	${}^{g,h}_{h}\phi_{i,j}$	${}^{g}_{h}\zeta_{i,j}$	${}^{g,h}_{h,g}\tau_{i,p}$	${}^{g}_{h,g}\eta_{i,p}$	${}^{g,h}_{h,g}\tau_{i,q}$	${}^{g}_{h,g}\eta_{i,q}$
	Firm j	${}^{h}_{h}\mu_j$			${}^{h}_{h}\sigma_j^2$	${}^{h,g}_{h}\nu_j$	${}^{h}_{h,g}\kappa_{j,p}$	${}^{h,g}_{h,g}\theta_{j,p}$	${}^{h}_{h,g}\kappa_{j,p}$	${}^{h,g}_{h,g}\theta_{j,q}$
		${}^{g}_{h}\mu_j$				${}^{g}_{h}\sigma_j^2$	${}^{g,h}_{h,g}\tau_{j,p}$	${}^{g}_{h,g}\eta_{j,p}$	${}^{g,h}_{h,g}\tau_{j,q}$	${}^{g}_{h,g}\eta_{j,q}$
Country g	*Firm p*	${}^{h}_{g}\mu_p$					${}^{h}_{g}\sigma_p^2$	${}^{h,g}_{g}\nu_p$	${}^{h}_{g}\zeta_{p,q}$	${}^{h,g}_{g}\phi_{p,q}$
		${}^{g}_{g}\mu_p$						${}^{g}_{g}\sigma_p^2$	${}^{g,h}_{g}\phi_{p,q}$	${}^{g}_{g}\rho_{p,q}$
	Firm q	${}^{h}_{g}\mu_q$							${}^{h}_{g}\sigma_q^2$	${}^{h,g}_{g}\nu_q$
		${}^{g}_{g}\mu_q$								${}^{g}_{g}\sigma_q^2$

In this matrix of rank 8 there are (64-8)/2=28 unique correlation terms and 8 variance terms. We assign similar Greek letters and background color to those correlation terms that represent a similar economic meaning, such as ${}^{h,g}_{h}\nu_{i}$ and ${}^{h,g}_{g}\nu_{p}$. Both represent correlations between two assets that are owned by the same firm, *i* in the first term and *p* in the second term, where the two same-firm assets are traded in two different countries.

The interpretation of all eight types of covariance terms is given in Table 2, along with the symbols of correlations assigned to them. For example, the term ${}^{h,g}_{h}\phi_{i,j}$ represents correlation between assets *i* and *j*, both are owned by different firms whose country of origin is *h*, yet asset *i* is traded in country *h* and asset *j* is traded in country *g* (e.g., CarMax traded in US and Google traded in UK). Or a different example, ${}^{g,h}_{h,g}\tau_{i,q}$ represents correlation between asset *i* that is owned by a firm domiciled in country *h* while the asset is traded in country *g*, and asset *q*, which is owned by a firm domiciled in country *g*, but is traded in country *h* (e.g., Apple traded in UK and Unilever traded in US).

Table 2: Covariances and correlations

In this table we explain the nature of the different correlations between expected rates of return in the global market portfolio, with examples using these firms: Apple and Google – international firms, US is home country; Carvana and CarMax – two car dealers operating in US only; Unilever – international firm, UK is home country. Severn Trent – a UK water utility firm operating in UK only.

The term	*Represents covariability between…*	*Correlation symbols*
$Cov({}_h^h\mu_i, {}_h^h\mu_j)$	Covariance between expected return ${}_h^h\mu_i$, a real asset owned by firm *i*, and a real asset owned by firm *j*, ${}_h^h\mu_j$. Both operate in their home country *h*. Note: in the empirical analysis we shall distinguish between firms that do, or do not have, foreign operations aiming to measure diversification across local-only assets. E.g., Carvana and CarMax in US (two local car dealers).	${}_h^h\rho_{i,j}$
$Cov({}_h^h\mu_{i(k)}, {}_h^g\mu_{i(l)})$	Covariance between real assets *k* and *l*, owned by the same firm *i*, where asset *k* is operational in the firm's home country *h*, and asset *l* is operational in the foreign country, *g*. (This further level of sub-index is needed in this type of covariance only; we avoid adding it to other covariances in order to simplify notation). E.g., Apple in US and Apple in UK.	${}_h^{h,g}\nu_{i(k,l)}$
$Cov({}_h^g\mu_i, {}_h^h\mu_j)$	Covariance between a country *h* asset operating in *h* (whether the firm is domiciled in *h* or *g*) with a country *h* asset operating in country *g*, except for same firm operations ($i \neq j$, captured by ν_i). E.g., Apple or CarMax in US and Google in UK	${}_h^{g,h}\phi_{i,j}{}_{i\neq j}$
$Cov({}_h^g\mu_i, {}_h^g\mu_j)$	Covariance between two real assets that operate in country *g* and owned by two different firms, *i* and *j*, both have *h* as their home country. E.g., Apple in UK and Google in UK.	${}_h^g\zeta_{i,j}{}_{i\neq j}$
$Cov({}_h^h\mu_i, {}_g^h\mu_p)$	Covariance between an asset *i* domiciled and operating in country *h*, with asset *p* of country *g*, also operating in country *h*. E.g., Apple or CarMax in US and Unilever in US.	${}_{h,g}^h\kappa_{i,p}$
$Cov({}_h^g\mu_i, {}_g^g\mu_p)$	Covariance between a real asset operating in country *g* but owned by firm *i* that is domiciled in country *h*, with a real asset also operating	${}_{h,g}^g\eta_{i,p}$

	in country *g* but owned by firm *p* domiciled in country *g*. E.g., Apple in UK and Unilever or Severn Trent in UK.	
$Cov({}^{g}_{h}\mu_i, {}^{h}_{g}\mu_p)$	Covariance between an asset operating in country *g* and owned by firm *i* domiciled in country *h*, with an asset operating in country *h*, but owned by firm *p* that is domiciled in country *g*. E.g., Apple in UK and Unilever in US.	${}^{g,h}_{h,g}\tau_{i,p}$
$Cov({}^{h}_{h}\mu_i, {}^{g}_{g}\mu_p)$	Covariance between asset *i* operating in country *h*, with asset *p*, domiciled and operating in country *g*. E.g., Apple or CarMax in US and Unilever or Severn Trent in UK.	${}^{h,g}_{h,g}\theta_{i,p}$

The first correlation term, ${}^{h}_{h}\rho_{i,j}$, is the only term that would remain if country *h* is autarky, as in the local version of the CAPM. All other terms grow more relevant in determining the global portfolio risk the more the home country is engaged with global operations, i.e., having more international firms in its capital market. The specific impact of each correlation type depends on the count of paired covariances, on their absolute values, and the specific assets' weights in the global portfolio. The different correlation types represent different ways by which a focal country engages economically with other countries.

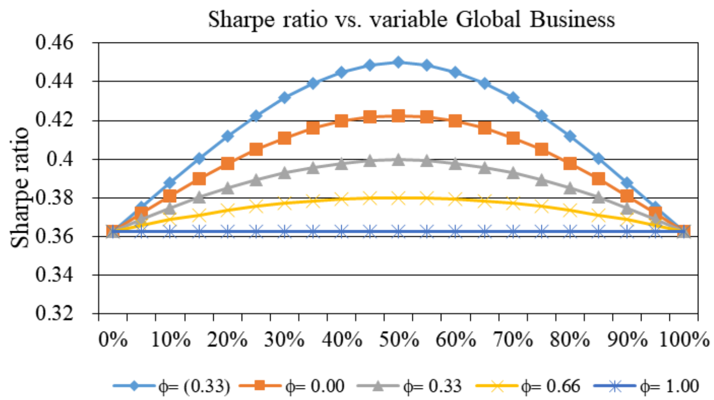
Our perfect markets assumption implies that there are no barriers on firms to conduct business in any country, and no barriers on investors to hold local or foreign assets, that is, fully liberalized financial markets. Empirically however, we plan to control for levels of liberalization and relate the findings with specific advantages different countries may have given the business profile of residing firms. In other words, we plan to test whether less liberalized countries have greater home advantage.

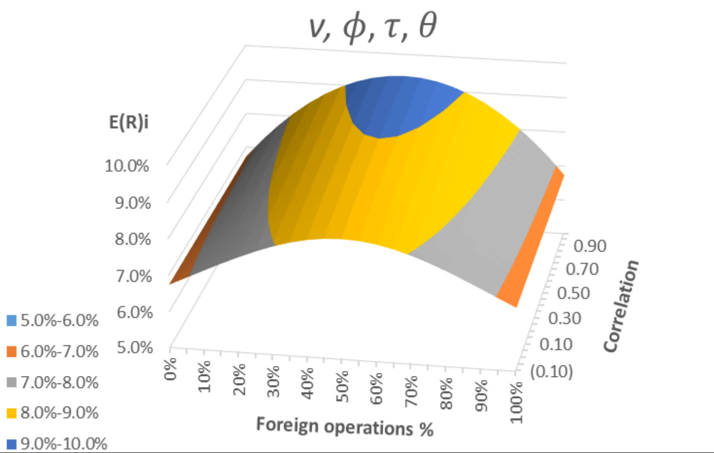
We show in four Panels in Figure 1 that there are four basic patterns by which the specific correlations affect Sharpe ratio in the global portfolio and the cost of equity capital as global exposure increases. The first chart in each correlation type measures the proportion of global exposure over the range 0-100% on the horizontal axis, and Sharpe ratio is measured on the vertical axis, for 5 levels of the correlation coefficient. Together with each of the four correlation types, we show how the cost of capital varies along those dimensions. Additionally, we offer a brief explanation for the economic rationale and main characteristics of those four correlation types, both on Sharpe ratio and on the cost of capital. All explanations are given from the home-country perspective.

Figure 1: Global business exposure and Sharpe ratio

Grouping into 4 types the eight correlation coefficients of Table 2. Sharpe ratio is measured for varying levels of foreign operations ranging 0% to 100% and five alternative values of correlation coefficients, ranging from -0.33 to +1.0. The expected cost of capital is measured for levels of foreign operations, 0%-100% (left horizontal axis) and the level of the relevant correlation coefficient (right horizontal axis). Other parameters assumed: All returns=12%; all standard deviations=40%; riskless rate=2%; all assets are of equal weight.

Panel A: Relevant for ${}^{h,g}_{h}\nu_{i(k,l)}$, ${}^{g,h}_{h}\phi_{i,j_{i\neq j}}$, ${}^{g,h}_{h,g}\tau_{i,p}$, ${}^{h,g}_{h,g}\theta_{i,p}$; e.g., ϕ



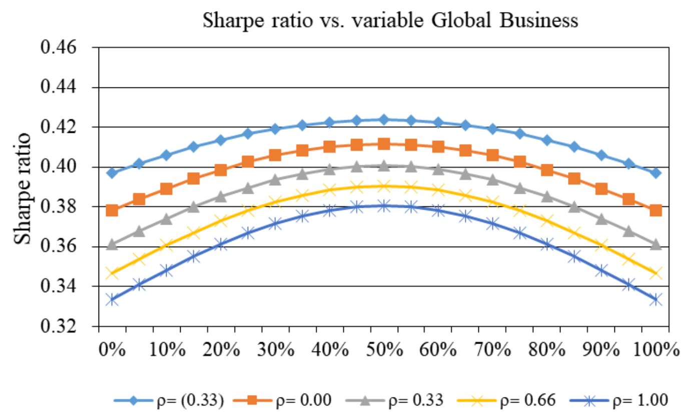


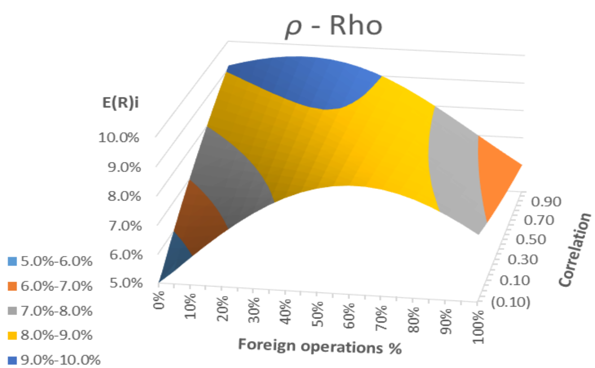
Identification: The pair of assets being correlated are domiciled in country *h*, or one from each country, but all pairs trade in the opposite country. (Superscript *g*&*h*)

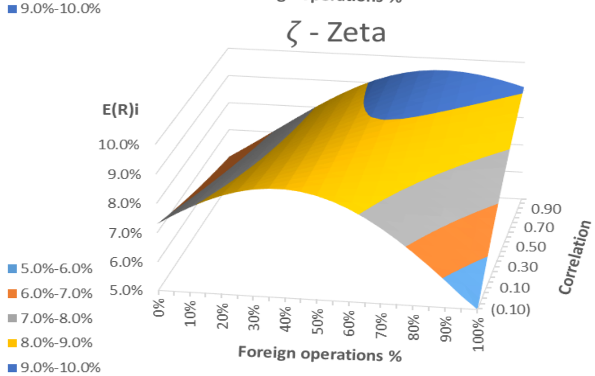
Sharpe ratio: Because, by construction in this example, local and foreign correlations are similar, changes in the portfolio variance stem only from changes in weights. Global operations are advantageous only if correlations are less than unity and increase as the correlations decline. The maximum exposure to foreign operations is achieved at the maximal product of weights, 50% in this example.

Expected cost of capital: For all relevant correlation coefficients, the expected cost of capital is concave across levels of foreign operations, with a maximum at about 50% of foreign operations. The lowest cost of capital is at zero foreign operations and lowest correlations thus Sharpe ratio is lowest as well. As foreign operations increase, diversification advantages increase Sharpe ratio by reducing risk in the denominator, despite an increase of the cost of capital. Because the lowest cost of capital is achieved at the extreme levels of foreign operations, liberalization is either full or nil. The level of those correlations has little effect on the liberalization decision.

Panel B: Relevant for ${}^{h}_{h}\rho_{i,j}$, ${}^{g}_{h}\zeta_{i,j}{}_{i\neq j}$; e.g., ρ







Identification: The assets being correlated are owned by two firms, either domiciled in country *h* with operations in country *h* (ρ), or in country *g* with operations in *g* (ζ).

Sharpe ratio: The smaller these correlations are, the greater the risk-reduction opportunities. Because the correlations are within a country but not between the countries, Sharpe ratio increases as correlations decline even at zero or full foreign operations. These assets are indirectly correlated with other assets in the global portfolio.

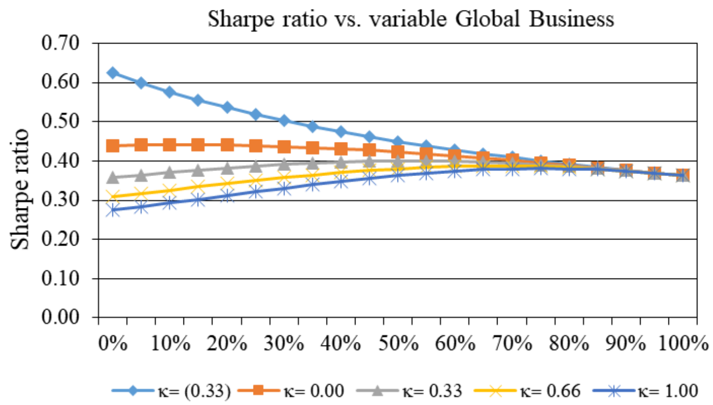
Expected cost of capital: ${}^{h}_{h}\rho_{i,j}$

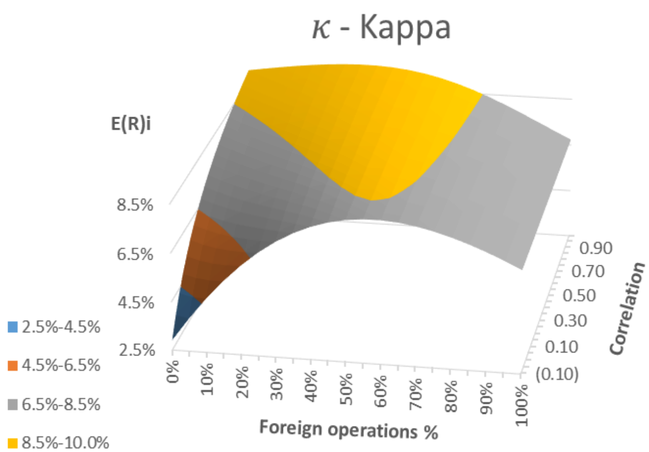
Because the ${}^{h}_{h}\rho_{i,j}$ correlation is between assets traded in the home country, its lowest levels reduce the cost of capital most when foreign operations are zero. As foreign operations increase, the cost of capital increases to a maximum and then declines. Yet, as the correlation coefficient increases, the cost of capital increases at a moderately increasing (declining) pace for low (high) levels of foreign operations. This implies that if the correlation is low no liberalization is advantageous from the perspective of minimizing the cost of capital, but for higher correlations liberalization may be preferable.

Expected cost of capital: ${}^{g}_{h}\zeta_{i,j}{}_{i\neq j}$

The ζ correlation is a symmetric reflection of the ρ correlation. Because it captures correlations among assets traded in country *g* only, the lowest cost of capital for a country-*h* firm is obtained when it shifts all its operations to country *g*, if the ζ correlation is low, but not necessarily if high. This implies the contrary liberalization policy, i.e., country *h* may liberalize.

Panel C: Relevant for ${}_{h,g}^{h}\kappa_{i,p}$





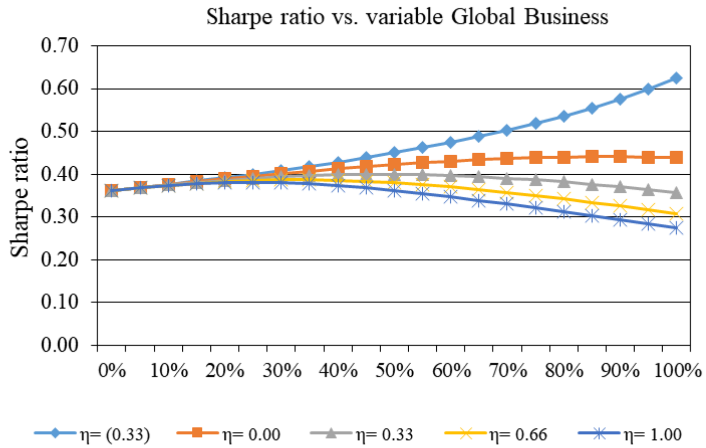
Identification: The assets being correlated are domiciled in both countries, one from each, but both trade in country *h*.

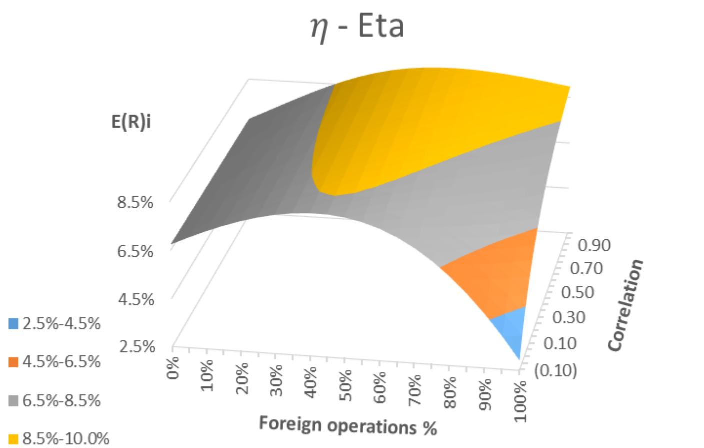
Sharpe ratio: Staying at home, in country *h* (corner solution of 0% global operations) is advantageous if the correlation of country *g* assets traded in *h* with the local ones is negative. However, with positive correlations an increase in the weight of global operations increases Sharpe ratio to an interior maximum, capturing the benefits of diversification, with no corner solutions.

Expected cost of capital:

Because the assets trade in country *h*, the expected cost of capital is lowest if the correlation coefficient is low, therefore staying at home is advantageous, i.e., no liberalization. As the correlation coefficient increases, the cost of capital increases as well. This increase is more meaningful if foreign operations are low, because the assets are traded in country *h*. If the firm's operations are 100% in country *g*, changes in this correlation coefficient increase the cost of capital moderately through indirect interactions with other assets in the global portfolio.

Panel D: Relevant for ${}_{h,g}^{g}\eta_{i,p}$





Identification: The assets being correlated are domiciled in both countries, one from each, but both trade in country *g*.

Sharpe ratio: The opposite case of Panel C. Diversifying globally to the extreme of 100% is advantageous (a corner solution) if the correlation of country *h* assets traded in *g* with the country *g* assets is negative. However, with positive correlations global diversification increases Sharpe ratio to an interior maximum, thus no corner solution. This concave pattern emerges since the positive correlations make the corner solutions of zero or full global exposure inferior to some non-extreme levels of exposure.

Expected cost of capital:

This correlation coefficient term presents a symmetric case to the κ coefficient in Panel C above; here the two assets trade in country *g*, therefore the lowest cost of capital is achieved with 100% of foreign operations, and lowest level of the correlation coefficient, justifying full liberalization. Yet, with higher levels of this correlation coefficient, the lowest cost of capital is achieved by staying at home, thus no liberalization.

4. An international asset pricing model

Assume a riskless domestic bond is available at infinitely elastic supply in country h (g), thus yields an instantaneously constant riskless rate of return ${}_h^h r$ (${}_g^g r$). Therefore, the bond price process is non-stochastic, taking this form in country h,

$$\frac{d\,{}_h^h B}{{}_h^h B} = {}_h^h r dt, \tag{1}$$

where ${}_h^h B$ is the domestic bond price, traded at home. Same specification applies to country g's bond.

We are interested in the ways different global business operations affect the global pricing of local and foreign operations. In the following, and until further notice, we consider firm *i*, domiciled in country *h*, and may operate in its home country, *h*, and/or in country g.

$$\frac{dP_i}{P_i} = \left(1 - {}_h^g\pi_i\right){}_h^h\mu_i dt + {}_h^g\pi_i\,{}_h^g\mu_i dt + \left(1 - {}_h^g\pi_i\right){}_h^h\sigma_i dz_i + {}_h^g\pi_i\,{}_h^g\sigma_i dy_i, \tag{2}$$

where P_i is the normalized weighted average price of firm *i*, where the firm's value is the sum of its two real assets in both countries. The firm operates in both countries if the proportion of business conducted in country g, denoted ${}_h^g\pi_i$, satisfies $0 < {}_h^g\pi_i < 1$, where ${}_h^h\pi_i = 1 - {}_h^g\pi_i$. Each one of the firms' real assets yields expected return ${}_h^h\mu_i$ (${}_h^g\mu_i$) from domestic (foreign) operations, and ${}_h^h\sigma_i$ (${}_h^g\sigma_i$) are their respective standard deviations. Domestic business risk enters through the diffusion z_i and foreign business risk affects firm *i*'s aggregate value through the diffusion y_i. The two processes are correlated, thus by diversifying operations globally the firm may benefit from overall risk reduction.

There are two representative investors, one in the domestic and the other in the foreign country, indexed by subscript $k = \{h, g\}$. Let $N_{k,i,t}$ be the number of firm *i* shares held by investor *k* at time *t*. Focusing on country *h* we have the following wealth dynamics for investor *k*,

$$W_{k,t} = \sum_{i=1}^{n} N_{k,i,t} P_{i,t} + {}_{h}^{h}Q_{k,t}\, {}_{h}^{h}B_t, \tag{3}$$

where ${}_{h}^{h}Q_{k,t}$ is the quantity of local bonds held by investor *k* at *t* and *n* is the number of firms (not real assets at this point). The total change in investor *k*'s wealth over time is made of changes in prices and in quantities,

$$dW_{k,t} = \sum_{i=1}^{n} N_{k,i,t} dP_{i,t} + {}_{h}^{h}Q_{k,t}\, d\,{}_{h}^{h}B_t + \sum_{i=1}^{n} dN_{k,i,t}\left(P_{i,t} + dP_{i,t}\right) + d\,{}_{h}^{h}Q_{k,t}\left({}_{h}^{h}B_t + d\,{}_{h}^{h}B_t\right). \tag{4}$$

The two right-most terms are additions to wealth from non-capital-gain sources net of consumption, i.e., available income. Assuming zero wage income, consumption is defined as,

$$-C_{k,t}dt \equiv \sum_{i=1}^{n} dN_{k,i,t}\left(P_{i,t} + dP_{i,t}\right) + d\,{}_{h}^{h}Q_{k,t}\left({}_{h}^{h}B_t + d\,{}_{h}^{h}B_t\right). \tag{5}$$

The investor's proportional holdings in the risky firms is defined as the product of quantity and price over wealth, $\alpha_{k,t} \equiv \sum_{i=1}^{n} \frac{N_{i,k,t}P_{i,t}}{W_{k,t}}$, and proportional bond holding as $1 - \alpha_{k,t} \equiv \frac{{}_{h}^{h}Q_{k,t}\,{}_{h}^{h}B_t}{W_{k,t}}$. By using (1) and (2) we have the following wealth dynamics for investors residing in country *h*, in terms of firms,

$$dW_{k,t} \sum_{i=1}^{n}\left(N_{k,i,t} dP_{i,t}\right) + {}_{h}^{h}Q_{k,t}\, d\,{}_{h}^{h}B_t - C_k dt.$$

However, at this point we must be explicit about the locality of real assets, which we index by $l1 = \{h, g\}$, and their country of operations, indexed by $l2 = \{h, g\}$. Therefore, we count across real assets $1,2,\ldots,{}^{w}n$, rather than firms, $1,2,\ldots,n$. In terms of real assets, we have

$$dW_{k,t} = \sum_{l1} \sum_{i=1}^{{}^{w}n} w'_i \left({}_{l1}^{h}\mu_i dt + {}_{l1}^{h}\sigma_i dz_i + {}_{l1}^{g}\mu_i dt + {}_{l1}^{g}\sigma_i dy_i\right)\alpha_{k,t} W_{k,t} + \left(1 - \alpha_{k,t}\right) W_{k,t}\, {}_{h}^{h}r dt - C_{k,t}dt, \tag{6}$$

where w'_i is real asset *i*'s weight in the global market portfolio ($w'_i = \frac{V_i}{V_M}$), in which V_i is the market value of a single real business i, and ${}^{w}V_M$ is the market value of all real assets in the global portfolio. Note that ${}_{l1}^{h}\mu_i$ and ${}_{l1}^{h}\sigma_i$ represent the expected return and standard deviation of all real assets operating in country h, whether their home country is *l*1=*h* or *l*1=*g*. The same holds for all assets operating in country g, with ${}^{g}_{l1}\mu_i$ and ${}^{g}_{l1}\sigma_i$, thus counting all real assets in the global portfolio.

Our domestic and foreign representative investors are assumed to have a power utility function in consumption, yet they may differ with respect to their degree of risk aversion,

$$U_k(C,t) = e^{-\rho_k t}\,\frac{1-\gamma_k}{\gamma_k}\left(\frac{C_k}{1-\gamma_k}\right)^{\gamma_k}, \tag{7}$$

where their relative risk aversion (RRA) parameters are constant, $\delta_k \equiv 1-\gamma_k$. The parameter ρ_k is assumed identical for both investors, and the utility function is constrained by $\gamma_k \neq 1$, and $\frac{C_k}{\delta_k} > 0$. Investors maximize expected utility of consumption to infinity: $J(W,P,t) = \underset{\{\alpha,C\}}{Max}\, E_0\left[\int_0^\infty U_k\{C(s)\}ds\right]$, conditional on $W_k(0) = W_{k,0}$ and subject to the budget constraint (6). The first order optimality conditions satisfy $0 = \underset{\{\alpha,\tilde{C}\}}{Max}\left[U_k(C,t) + J_W dW_k + \frac{1}{2}J_{WW}dW_k{}^2\right]$, where subscripts represent partial derivatives. The first order condition with respect to consumption equates marginal utility of consumption with marginal utility of wealth: $0 = \left(\frac{C_k}{\delta_k}\right)^{-\delta_k} - J_W$. The first order condition with respect to the optimal asset allocation, $\alpha_{k,t}$, yields

$$\alpha_{k,t} = -\frac{J_W}{J_{WW}W_{k,t}}\frac{{}^{w}\bar{\mu}_P - {}^{h}_{h}r}{{}^{w}\sigma_P{}^2}, \tag{8}$$

where ${}^{w}\bar{\mu}_P$ is an expected rate of return of an efficient portfolio and ${}^{w}\sigma_P{}^2$ is its variance. Replacing the Arrow-Pratt measure of relative risk aversion, $R_{W,k,t}$, of the utility function (7) into (8) yields the optimal allocation to the risky asset portfolio by investor k,

$$\alpha^*_{k,t}W_{k,t} = \frac{{}^{w}\bar{\mu}_P - {}^{h}_{h}r}{\delta_k\,{}^{w}\sigma_P{}^2}W_{k,t} = \frac{{}^{w}\lambda}{\delta_k}W_{k,t}, \tag{9}$$

where ${}^{w}\lambda$ is the market price of variance risk.

In perfect markets with global operations, all investors hold the global market portfolio, which constitutes of all domestic and foreign real assets, weighted by their market capitalization. Thus, foreign ownership of domestic shares is allowed, therefore domestic and foreign investor's demands for the global market portfolio should be aggregated. The resulting equilibrium pricing is a function of the harmonic mean of risk preferences of the representative domestic and foreign investors:

$$\sum_{i=1}^{{}^{w}n} V_{i,t} = {}^{w}\lambda\left(\frac{W_{h,t}}{\delta_h} + \frac{W_{g,t}}{\delta_g}\right). \tag{10}$$

The first term in the brackets represents the demand for risky assets by domestic investors, and the second term represents the demand by foreign investors; if both investors have similar preferences, the solution is identical to Merton (1971).

5. Different risk factors in the global market portfolio

While the derivation of the optimal portfolio as presented above is rather straight forward, the key messages of our model stem from the different types of correlations between local and foreign real assets' returns. These different correlation types give rise to eight risk factors, corresponding to the eight correlation coefficients shown in Table 2. The expected rate of return of the global market portfolio can be rewritten as

$${}^{w}\bar{\mu}_M = \sum_{l1}^{l2} \sum_{i=1}^{{}^{w}n} w'_i \left({}_{l1}^{l2}\mu_i\right), \qquad l1, l2 = \{h, g\} \tag{11}$$

while the market portfolio variance can be presented as

$${}^{w}\sigma_M^2 = \sum_{l1}^{l2} \sum_{i=1}^{{}^{w}n} w'^2_i Var\left({}_{l1}^{l2}\mu_i\right) + 2 \sum_{l1}^{l2} \sum_{i=1}^{{}^{w}n} \sum_{\substack{j=2 \\ (j>i)}}^{{}^{w}n} w'_i w'_j Cov\left({}_{l1}^{l2}\mu_i, {}_{l1}^{l2}\mu_j\right). \tag{12}$$

Technically, the variance of the market portfolio can be computed across all real assets in the global portfolio, and the result would be similar to the one presented in (12), however, the distinction between countries of origin and countries of operations is needed in order to estimate the implications of global operations by domestic and foreign firms.

The first addend in (12), $Var\left({}_{l1}^{l2}\mu_i\right)$, represents individual real-assets' variance of returns, while $Cov\left({}_{l1}^{l2}\mu_i, {}_{l1}^{l2}\mu_j\right)$ represents the eight different covariance terms as presented in Table 2, depending on the locality of business risks, domestic or foreign. It is worthy to note that if all domestic and foreign firms do not engage with global operations, the only remaining covariance term is the one listed in the first line of Table 2, $Cov\left({}_{h}^{h}\mu_i, {}_{h}^{h}\mu_j\right)$, represented by the correlation ${}_{h}^{h}\rho_{i,j}$. In this case, there are no foreign assets and no international firms, thus the model reverts to the local version of the CAPM with only domestic risks. This case highlights the potential importance of incorporating global operations in pricing local assets because such exposure gives rise to *seven additional* risk factors, which we pool into four types of factors based on the similarity of their economic rationale, as shown in Figure 1.

The global market portfolio has an expected rate of return ${}^{w}\bar{\mu}_M$ and standard deviation ${}^{w}\sigma_M$. Its variance is the weighted sum of all variances and covariances of individual risky assets, whether the real asset operates in the home or in the foreign country. Based on the above, we define the global Sharpe ratio as

$$ {}^{w}\hat{\lambda} = \frac{{}^{w}\bar{\mu}_M - {}_{h}^{h}r}{{}^{w}\sigma_M}. \quad (13) $$

Assuming that investors use their home country's riskless asset as the relevant one, the global CML under perfect capital markets is

$$ {}^{w}\bar{\mu}_P = {}_{h}^{h}r + \left({}^{w}\bar{\mu}_M - {}_{h}^{h}r\right)\frac{{}^{w}\sigma_P}{{}^{w}\sigma_M}. \quad (14) $$

A straight-forward derivation of the security-market line which differentiates between the different covariance terms yields the following pricing equation:

$$ {}^{h}\bar{\mu}_i = {}_{h}^{h}r + \left({}^{w}\bar{\mu}_M - {}_{h}^{h}r\right)\left({}^{w}\beta_{i,\rho} + {}^{w}\beta_{i,\nu} + {}^{w}\beta_{i,\phi} + {}^{w}\beta_{i,\zeta} + {}^{w}\beta_{i,\kappa} + {}^{w}\beta_{i,\eta} + {}^{w}\beta_{i,\tau} + {}^{w}\beta_{i,\theta}\right) \quad (15) $$

where the variance of the global market portfolio is the denominator for all covariances, and the betas are defined as follows:

$$ {}^{w}\beta_{i,\rho} \equiv \frac{{}_{h}^{h}\sigma_i \, {}_{h}^{h}\sigma_j \, {}_{h}^{h}\rho_{i,j}}{{}^{w}\sigma_M^2}, \quad {}^{w}\beta_{i,\nu} \equiv \frac{{}_{h}^{h}\sigma_{i(k)} \, {}_{h}^{g}\sigma_{i(l)} \, {}_{h}^{h,g}\nu_i}{{}^{w}\sigma_M^2}, \quad {}^{w}\beta_{i,\phi} \equiv \frac{{}_{h}^{g}\sigma_i \, {}_{h}^{h}\sigma_j \, {}_{h}^{g,h}\phi_{i,j_{i\neq j}}}{{}^{w}\sigma_M^2}, \quad {}^{w}\beta_{i,\zeta} \equiv \frac{{}_{h}^{g}\sigma_i \, {}_{h}^{g}\sigma_j \, {}_{h}^{g}\zeta_{i,j_{i\neq j}}}{{}^{w}\sigma_M^2}, $$

$$ {}^{w}\beta_{i,\kappa} \equiv \frac{{}_{h}^{h}\sigma_i \, {}_{g}^{h}\sigma_p \, {}_{h,g}^{h}\kappa_{i,p}}{{}^{w}\sigma_M^2}, \quad {}^{w}\beta_{i,\eta} \equiv \frac{{}_{h}^{g}\sigma_i \, {}_{g}^{g}\sigma_p \, {}_{h,g}^{g}\eta_{i,p}}{{}^{w}\sigma_M^2}, \quad {}^{w}\beta_{i,\tau} \equiv \frac{{}_{h}^{g}\sigma_i \, {}_{g}^{h}\sigma_p \, {}_{h,g}^{g,h}\tau_{i,p}}{{}^{w}\sigma_M^2}, \quad {}^{w}\beta_{i,\theta} \equiv \frac{{}_{h}^{h}\sigma_i \, {}_{g}^{g}\sigma_p \, {}_{h,g}^{h,g}\theta_{i,p}}{{}^{w}\sigma_M^2}. $$

The pricing equation (15) specifies the implications of global operations on the exposure of domestic investors to global risks. Greater exposure to global operations will not necessarily reduce a domestic firm's cost of capital, as it depends on the covariance matrix between the business activities of firm *i* in the global market, and foreign firms' operations in the domestic market. The implications of these covariances are augmented by potential differences between expected returns and idiosyncratic volatilities emanating from real business activities of other firms.

6. A necessary condition for home advantage

Assume that an investor residing in the domestic country holds a (globally inefficient) domestic market portfolio as if no firm engages in global operations. This investor bears the risk level ${}^{h}\sigma_M$ and expects earning ${}^{h}\bar{\mu}_M$. If firms do engage in global operations, and this investor maintains same risk level by investing in an efficient global portfolio, i.e., ${}^{w}\sigma_P \coloneqq {}^{h}\sigma_M$, she should be better off through the benefits of real-business diversification. Because efficient global portfolios are priced along the global CML, the expected rate of return from bearing same risk level as in the home market portfolio can be measured by the global CML,

$$ {}^{w}\bar{\mu}_P = {}_{h}^{h}r + \left({}^{w}\bar{\mu}_M - {}_{h}^{h}r\right)\frac{{}^{h}\sigma_M}{{}^{w}\sigma_M}. \quad (16) $$

The pricing of the local market portfolio M as an inefficient sub-portfolio in the global portfolio is given by the global SML (15),

$$ {}^{h}\bar{\mu}_M = {}^{h}_{h}r + \left({}^{w}\bar{\mu}_M - {}^{h}_{h}r\right)\left({}^{w}\beta_{M,\rho} + {}^{w}\beta_{M,\nu} + {}^{w}\beta_{M,\phi} + {}^{w}\beta_{M,\zeta} + {}^{w}\beta_{M,\kappa} + {}^{w}\beta_{M,\eta} + {}^{w}\beta_{M,\tau} + {}^{w}\beta_{M,\theta}\right), \quad (17) $$

where all betas are defined in accordance with (15), except that here the covariances are between the local portfolio M and the global market portfolio, w. The return differential between (16) and (17), measured at the risk level ${}^{w}\sigma_P := {}^{h}\sigma_M$, reveals a necessary condition for home advantage,

$$ {}^{w}\bar{\mu}_P - {}^{h}\bar{\mu}_M = {}^{w}\hat{\lambda}\left({}^{h}\sigma_M - {}^{w}\sigma_M\left({}^{w}\beta_{M,\rho} + {}^{w}\beta_{M,\nu} + {}^{w}\beta_{M,\phi} + {}^{w}\beta_{M,\zeta} + {}^{w}\beta_{M,\kappa} + {}^{w}\beta_{M,\eta} + {}^{w}\beta_{M,\tau} + {}^{w}\beta_{M,\theta}\right)\right). \quad (18) $$

Several interesting implications emerge from (18) pertaining to global diversification and home bias. First, it is immediately clear that if no firm engages with global operations, (18) reduces to

$$ {}^{w}\bar{\mu}_P - {}^{h}\bar{\mu}_M = {}^{h}\sigma_M\, {}^{w}\lambda\left(1 - \rho_{M,G}\right), \quad (19) $$

where $\rho_{M,G}$ represents the correlation between the home and the foreign market, if all local firms operate only locally and foreign firms operate solely in the foreign country, i.e., markets are segmented. This is the classic result of the benefit of global diversification under symmetric information, no exchange rate risks, and no imperfections. It implies that the benefit from international diversification increases as the correlation between the domestic and the world market portfolios declines.

Furthermore, equation (18) yields a necessary condition for home advantage: an advantage of domestic over global diversification. If ${}^{w}\bar{\mu}_P - {}^{h}\bar{\mu}_M > 0$ in (18) measures the excess return an investor is expected to earn by holding a globally well diversified portfolio over holding the inefficient local-only market portfolio, the condition ${}^{w}\bar{\mu}_P - {}^{h}\bar{\mu}_M < 0$ implies the contrary: the superiority of the domestic market over the efficient global one. Therefore, ${}^{w}\bar{\mu}_P - {}^{h}\bar{\mu}_M < 0$ is a necessary condition for home advantage:

Proposition:

A necessary condition for home advantage can be derived from (18) in the form of the following inequality:

$$\frac{{}^{h}\sigma_M}{{}^{w}\sigma_M} - {}^{w}\beta_{M,\rho} < {}^{w}\beta_{M,\nu} + {}^{w}\beta_{M,\phi} + {}^{w}\beta_{M,\zeta} + {}^{w}\beta_{M,\kappa} + {}^{w}\beta_{M,\eta} + {}^{w}\beta_{M,\tau} + {}^{w}\beta_{M,\theta}. \quad (20)$$

Intuitively, if the domestic market portfolio is as risky as the global market portfolio, i.e., $\frac{{}^{h}\sigma_M}{{}^{w}\sigma_M} = 1$, and if the beta of the domestic market portfolio with respect to the global one is neutral, i.e., ${}^{w}\beta_{M,\rho}$=1, the left-hand-side in (19) turns zero. In this case, if the sum of all other seven betas on the right-hand-side is positive, domestic diversification is preferable over global diversification.

7. Empirical implications

How likely would our 'home advantage' Proposition explain some of the home bias? Given the empirical cross-country correlations of about 0.8-0.9 in the past decades, the higher the product between the various ${}^{h}_{g}\pi$ and ${}^{g}_{h}\pi$ terms (i.e., firms operating in the other country), the more likely the necessary condition in (19) would hold. With even no more than moderate exposure to global operations and positive correlations, all betas on the right-hand-side of (19) would be positive, increasing the likelihood that global interactions would explain more of the empirically measured 'home bias'. Globally active countries, like the U.S., Japan, Germany, UK, and other developed economies exhibit large proportions of global interactions, but this condition is not enough. To favor the domestic market, domestic firms must have diversification opportunities at home that would be advantageous vs. global markets. This implies that domestic bias is likely to be greater in larger countries with sufficient domestic diversification opportunities. Baxter and Jermann (1997) show that home bias is even greater if domestic diversification includes investment in human capital, which is more valuable in developed, than in developing countries. Denis, et al. (2002) indicate that global diversification does not substitute for industrial diversification and the costs of global diversification outweigh the benefits.[1] As a result of the above, in perfect markets, investors holding efficient portfolios will also tilt their portfolios toward domestic assets.

> **Implication 1:** Home advantage **increases** as: 1) average domestic inter-industrial correlations are lower than international correlations; 2) average domestic assets' returns are higher, and 3) average domestic assets' variances are lower vs. global diversification.

Given the conditions in Implication 1:

> **Implication 2**: Home advantage increases with the number and value of international real-business interactions between the domestic and foreign countries.
>
> **Implication 3**: Home advantage increases with the industrial diversity within the domestic country.
>
> **Implication 4:** Home advantage increases with the level of domestic development, measurable by the value of human capital.

[1] The latter view on the value discount of global diversification, however, is disputed by Gande, et al. (2009) and others. See Martin and Sayrak (2003) for a survey of literature on corporate diversification and shareholder value.

Jacquillat and Solnik (1978), Errunza, Hogan, and Hung (1999) and others examined the possibility that the gains from international diversification are achieved without trading abroad. This includes the investment in a portfolio of domestically traded multinational firms, as well as international mutual funds, country funds, and exchange traded funds. For instance, U.S. investors are exposed to a variety of domestic industries and a multitude of multinational firms. They can obtain gains from international diversification by engaging in 'homemade diversification,' that is, investing in a portfolio of domestically listed multinational corporations. Our model offers a specific condition where such homemade diversification is possible based on domestic and foreign correlations, as well as relative market volatilities and returns.

8. Summary and conclusions

Existing explanations of domestic bias focus on causes of market segmentation, such as government restrictions, or behavioral biases. While we do not argue against frictional or behavioral explanations for home bias, we study the implications of different risk-return profiles of foreign vs. domestic real firm operations in perfect capital markets. We derive a necessary condition for 'home bias,' which is shown to be a function of eight risk factors, seven of them stem from global business operations. Because the preference to invest domestically is rational in our framework, we suggest that the term 'home advantage' better describes the motivations for preferring domestic over global investments.

We derive a necessary condition for home advantage and discuss a few empirical implications. We conclude that home advantage would increase with the superior risk, return and diversification opportunities in the domestic market over international markets, and the extent by which firms actually engage with such investments. Admittedly, we do not consider industry factors specifically in our model, but we do relate the condition to "homemade diversification," which is recognized in the international investment literature.

References

Adler, M., & Dumas, B. (1983). International Portfolio Choice and Corporation Finance: A Synthesis. *The Journal of Finance*, *38*(3), 925–984. https://doi.org/10.1111/j.1540-6261.1983.tb02511.x

Ahearne, A. G., Griever, W. L., & Warnock, F. E. (2004). Information costs and home bias: an analysis of US holdings of foreign equities. *Journal of International Economics*, *62*(2), 313–336. https://doi.org/10.1016/s0022-1996(03)00015-1

Black, F. (1974). International capital market equilibrium with investment barriers. *Journal of Financial Economics*, *1*(4), 337–352. https://doi.org/10.1016/0304-405x(74)90013-0

Boermans, M. A., Cooper, I. A., Sercu, P. M. F. A., & Vanpee, R. (2022). Foreign Bias in Equity Portfolios: Informational Advantage or Familiarity Bias? *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4060950

Choi, J. J. (1989). Diversification, Exchange Risk and Corporate International Investment. *Journal of International Business Studies*, *20*(1), 145–155. https://doi.org/10.1057/palgrave.jibs.8490356

Cooper, I. A., Sercu, P., & Vanpee, R. (2018). A measure of pure home bias. *Review of Finance*, *22*(4), 1469–1514. https://doi.org/10.1093/rof/rfx005

Eichler, S. (2012). Equity home bias and corporate disclosure. *Journal of International Money and Finance*, *31*(5), 1008–1032. https://doi.org/10.1016/j.jimonfin.2011.12.008

Errunza, V., Hogan, K., & Hung, M.-W. (1999). Can the Gains from International Diversification Be Achieved without Trading Abroad? *The Journal of Finance*, *54*(6), 2075–2107. https://doi.org/10.1111/0022-1082.00182

Errunza, V., & Lolq, E. (1985). International Asset Pricing under Mild Segmentation: Theory and Test. *The Journal of Finance*, *40*(1), 105–124. https://doi.org/10.1111/j.1540-

6261.1985.tb04939.x

Eun, C. S., & Janakiramanan, S. (1986). A Model of International Asset Pricing with a Constraint on the Foreign Equity Ownership. *The Journal of Finance*, *41*(4), 897–914. https://doi.org/10.1111/j.1540-6261.1986.tb04555.x

Glassman, D. A., & Riddick, L. A. (2001). What causes home asset bias and how should it be measured? *Journal of Empirical Finance, 8*(1), 35–54. https://doi.org/10.1016/s0927-5398(00)00026-8

Jacquillat, B., & Solnik, B. (1978). Multinationals are Poor Tools for Diversification. *The Journal of Portfolio Management*, *4*(2), 8–12. https://doi.org/10.3905/jpm.1978.408629

Karolyi, G. A. (2016). Home Bias, an Academic Puzzle. *Review of Finance*, *20*(6), 2049–2078. https://doi.org/10.1093/rof/rfw007

Karolyi, G. A., & Stulz, R. (2002). *Are Financial Assets Priced Locally or Globally?* National Bureau of Economic Research. https://doi.org/10.3386/w8994

Ke, D., Ng, L., & Wang, Q. (2009). Home bias in foreign investment decisions. *Journal of International Business Studies, 41*(6), 960–979. https://doi.org/10.1057/jibs.2009.48

Li, K. (2004). Confidence in the Familiar: An International Perspective. *Journal of Financial and Quantitative Analysis*, *39*(1), 47–68. https://doi.org/10.1017/s0022109000003884

Mishra, A. V, & Ratti, R. A. (2013). Home bias and cross border taxation. *Journal of International Money and Finance, 32*, 169–193. https://doi.org/10.1016/j.jimonfin.2012.04.004

Quinn, D. P., & Voth, H.-J. (2008). A Century of Global Equity Market Correlations. *American Economic Review, 98*(2), 535–540. https://doi.org/10.1257/aer.98.2.535

Schumacher, D. (2017). Home Bias Abroad: Domestic Industries and Foreign Portfolio Choice. *The Review of Financial Studies, 31*(5), 1654–1706. https://doi.org/10.1093/rfs/hhx135

Solnik, B. H. (1974). An equilibrium model of the international capital market. *Journal of Economic Theory*, *8*(4), 500–524. https://doi.org/10.1016/0022-0531(74)90024-6

Solnik, B., & Zuo, L. (2016). Relative Optimism and the Home Bias Puzzle. *Review of Finance*, rfw021. https://doi.org/10.1093/rof/rfw021

Stulz, R. M. (1981). On the Effects of Barriers to International Investment. *The Journal of Finance*, *36*(4), 923–934. https://doi.org/10.1111/j.1540-6261.1981.tb04893.x

Van Nieuwerburgh, S., & Veldkamp, L. (2009). Information Immobility and the Home Bias Puzzle. *The Journal of Finance*, *64*(3), 1187–1215. https://doi.org/10.1111/j.1540-6261.2009.01462.x