Global Diversification Strategy and Firm Performance:

A Modelling and Simulation Study

Abstract

This paper explores the connections of global diversification strategies to company performance. It considers structural characteristics of markets and explains how these characteristics relate to the relative success of global diversification strategies. The paper starts with a replication of propositions that can be derived from straightforward applications of basic International Business theories. Then, it uses a simulation model to illustrate how different global diversification strategies affect performance differently. It shows how different effects trade off against each other quantitatively, and it investigates how firms can optimally choose a global diversification strategy under competition.

INTRODUCTION

International business (IB) literature has explored many aspects of what drives a firm's global diversification strategy. This literature is concerned with decision rules that a firm applies to decide which countries it should enter. The analysis covers a range of topics, including: a firm's motives for international expansion (e.g., Luo, 2003; Luo and Park, 2001), firms' market knowledge (e.g., Robertson and Wood, 2001; Mitra and Golder, 2002), target country characteristics (e.g., Flores and Aguilera, 2007; García-Canal and Guillén, 2008), and home-country effects on target country choice (e.g., Makino et al., 2002; Duanmu, 2012). The various streams of literature consider, among others, three key drivers of a global diversification decision: expected returns from internationalization (e.g., Lu and Beamish, 2001), the level of risk involved (e.g., Wheeler and Mody, 1992; Reeb et al., 1998), or home-country characteristics (e.g., Ramamurti, 2016; Awate et al., 2015; Davidson, 1983). The research has explored these factors from several functional perspectives, and using several methodologies. Despite the plurality in the suggested factors and applied methodologies, however, it is still unclear how different global diversification strategies affect a firm's overall performance.

First, it is unclear which global diversification strategy is successful under what circumstances. Second, IB literature is silent about how a firm's global diversification strategies relate to some central IB concepts, such as liabilities of foreignness (LoF). Third, there is a paucity of studies showing how different global diversification strategies in firms with similar circumstances lead to differences in performance. Finally, theoretical literature on global diversification strategy in IB often sees a firm as an isolated actor, or at least treats the strategies of competing firms as static inputs into each firm's formulation of strategy. A main explanation for these gaps is that one can hardly compare different strategies of global diversification empirically. The fact that internationalization depends on the specific path a firm takes makes it difficult to compare alternative global diversification strategies among different firms. Consequently, a lot of literature assumes that, when a firm selects markets, it generally follows an incremental strategy of global diversifi-

cation (Johanson and Vahlne, 1977). However, it is difficult to uphold this assumption in the world of born globals (Knight and Liesch, 2016) and increasing digitalization (Knight and Cavusgil, 2004) we see today.

At the same time, IB literature makes little use of formal or simulation studies. There are three streams of IB research that are, to some extent, exceptions: papers use simulations to investigate how statistical results can play out in practice (e.g., Lu et al., 2014; Jensen and Szulanski, 2004; Vaaler, 2011; Maekelburger et al., 2012), illustrate methodological issues (e.g., Durvasula et al., 2006; Brouthers et al., 2016), or to model the behaviour of actors under a system of assumptions (e.g., Buckley and Hashai, 2009; Adler and Hashai, 2007; Mudambi, 1998; Christensen and Knudsen, 2008; Asmussen et al., 2019). It is rather literature outside traditional IB outlets that use simulations to explore how firms behave in an international context (e.g., Asmussen et al., 2016; Aggarwal et al., 2011). There remain, however, many fields that IB has not yet explored in context of simulation, and where simulation might provide insightful propositions that future research can investigate empirically. Particularly, simulations may provide insights into how different components of a firm's internationalization strategy interact, and how the components develop over time amidst competition. Simulation is particularly valuable to explore higher order interdependencies among factors, that go beyond linear models that still are the workhorse for theoretical predictions and empirical tests in IB. Considering the dynamic interdependencies, whether a more-than-one-round interaction leads to an equilibrium, and what such equilibria may be, including reasons for deviations, can only be explored using simulations or other iterative modelling strategies. For IB particularly, researchers and editors have called for simulations as complementary methods to traditional theory-building. Reuber et al. (2017, p.417), for example, explicitly suggest that "Simulation is not yet widely used in international business research but has promise for understanding dynamics". This is particularly true in cases in which empirical observation of alternative outcomes is difficult, because of path dependency, such as the comparison of different potential global diversification strategies.

Improvements in computational power, a general increase in the prominence of computationally intense research methods (particularly machine learning, of which this study is a simple application), and advances in the analysis of what drives a firm's internationalization make it possible to formally analyse and simulate firm behavior with regards to internationalization. Other fields have made substantial progress in using simulation studies to understand complex firm behaviors. Research in strategic entrepreneurship, for example, has used simulations to understand entrepreneurial rents (e.g., Keyhani et al., 2015), and innovation research has benefited greatly from using computer modelling (in context of N-K modelling) to investigate search behaviors (as pioneered for example by Levinthal, 1997; Levinthal and March, 1981; Gavetti and Levinthal, 2000; Kauffman, 1993). Strategy research has been quick to adopt some of these methods to expand the understanding of phenomena with properties that would otherwise be difficult to analyze. It is surprising that, in research of global diversification strategies, no studies exist with comparable approaches and that there are few in IB in general - with the exceptions noted above. This is particularly surprising, because firm internationalization lends itself to formal study due to clearly defined outcome constructs: market entries. Market entries can be treated like search outcomes in N-K models that investigate learning, with the advantage that entries can directly be observed empirically. Naturally, any formal model can only be a starting point for the more detailed investigation into a research topic. Nevertheless, the basic mechanisms established in such a simulation may straightforwardly be extended to account for additional phenomena.

This paper suggests a formal simulation model of how a firm's global diversification strategy affect its performance. The suggested model is in a simple, reduced form, to isolate the effects of prominent concepts in IB, such as LoF (Hymer, 1976; Zaheer, 1995), on firm performance. The model assumes that a firm makes market-entry decisions[1] according to different global diversification strategies, the success of which we compare and then investigate reasons for the relative success. This results in empirically testable propositions. The purity of this form of analysis makes it possible to see which assumptionns are necessary or sufficient to explain phenomena that one can observe in empirical studies. As with every reduced-form

model, its simplicity necessitates the omission of many factors that are potentially relevant. The quasi-experimental environment of a simulation, however, allows a valid exclusion of potentially confounding factors. The objective of the simulation is not to build a model that fully corresponds to reality, but rather to isolate which phenomena are consequences of which factors. In order to relate this simulation to existing literature on global diversification, a substantial section in this paper is dedicated to replicating propositions that can also be derived from other forms of theory-building. Only after having established that the simulation can reproduce propositions from earlier literature, this paper proceeds to investigate more deeply two aspects of global diversification strategy, that are particularly suited to investigation by simulation. First, this paper investigates how different phenomena trade off against each other quantitatively. In this sense, the simulation investigates how firms could behave to optimize the net effect they experience when confronted with variation in many aspects. Second, this paper investigates how competitive dynamics shape firms' decisions with regards to investment targets. It sheds light on the conditions under which firms should choose a similar or a different global diversification strategy than competitors.

This paper contributes to IB literature in several ways. First, it takes a step towards understanding how global diversification strategies relate to a firm's performance. This may help future IB research to identify the long-term outcomes of core assumptions, such as incremental internationalization (Johanson and Vahlne, 1977). The success of global diversification strategies is also a key concern for the practice of international business. Second, this paper provides insight into the success of different global diversification strategies depending on environmental conditions, such as a firm's industry and home country, as well as other firm strategies. It also separates the discussion of how internationalization affects performance into a discussion of risk and a discussion of changes to expected returns. Third, this paper investigates how firms should respond to competitors' global diversification strategies, given environmental conditions. Fourth, the paper at hand suggests a simple formalization of important concepts in IB research, an endeavor the literature has called for repeatedly (e.g., Reuber et al., 2017). A formal representation of important concepts may further

IB research simply because it requires defining all assumptions in a mathematically concise way. Although this tends to result in constructs that are narrowly defined, this narrowness in turn facilitates further research, by providing boundaries for the constructs discussed. In this sense, the simulation is a theory-building exercise. The simulation also provides potentially normative recommendations for practitioners and allows the direct comparison of strategies within the context of a single firm.

RELATED LITERATURE

Three major streams of literature investigate global diversification strategies on an MNC level. Each of these streams is interested in how firms choose where to invest, not as isolated investment decisions, but as part of an overarching plan regarding the factors that drive investment decisions. The first stream, internationalization theory (Johanson and Vahlne, 1977), suggests that, with regards to investment targets, a firm prefers countries that are psychically closer to those that are psychically more distant. The second stream, quantitative research on international market selection (Papadopoulos and Denis, 1988) considers that firms aim to maximize market potential in their global diversification strategy. Third, portfolio theory (Markowitz, 1991) suggests that firms maximize the ratio of investment returns over investment risk.

The basic mechanism in internationalization theory (Johanson and Vahlne, 1977; Johanson and Wiedersheim-Paul, 1975) suggests that a firm makes decisions about international commitments based on its knowledge of foreign markets. The more knowledge a firm has, the more likely it will commit resources to a foreign country (Prange and Verdier, 2011). Because market knowledge increases with the resources committed to a certain location, the intensity of current activities at a given location will also positively influence subsequent commitment to that location. Given that market knowledge about a certain location is a better proxy for knowledge about similar countries than for dissimilar countries, a firm will incrementally increase the

psychic distance between its home country and its investment locations (Child et al., 2009). An updated version of internationalization theory (Johanson and Vahlne, 2009) extends the original model and includes network characteristics as driving factors in how a firm chooses where to commit resources. The basic premise remains: firms internationalize sequentially by moving first to proximate and then to distant countries. This line of argumentation has recently been challenged to be too simplistic and to apply only to a limited amont of firms (Knight and Liesch, 2016).

Systematic approaches to international market selection (e.g., Brouthers and Nakos, 2005; Papadopoulos and Denis, 1988) highlight that a firm aims to maximize market potential when choosing where to invest. This literature acknowledges that, as a result of bounded rationality, other factors might also influence the international market selection, and yet the main thrust of quantitative methods in this stream of literature focuses on the selection of markets based on the demand a firm can expect for a certain product, either overall (e.g., Liander et al., 1967) or regarding the import component (e.g., Alexandrides and Moschis, 1977). If a firm internationalizes for market-seeking reasons, maximizing market potential would naturally drive location decisions.

Portfolio theory considers mean returns and variance of returns to judge optimal resource allocation (Markowitz, 1991). The higher the ratio of expected return over its expected standard deviation (Sharpe, 1966), the more attractive a portfolio of investments is to an investor. Some research argues that firms are similar in how they consider risk when choosing investment targets for international expansion (Reeb et al., 1998). Following the logic of Net Present Values (NPVs), the returns a firm can expect from an investment abroad increase with market potential and decrease with the firm's uncertainty about the ability to exploit the market potential. Consequently, the higher the ratio of market potential over its expected standard deviation, the more likely it is that a firm invests in a location.

Most of the literature investigating global diversification strategy is concerned with the effect of inter-

nationalization on performance[2]. IB and finance literature have particularly actively investigated how firm internationalization affects performace. In finance, the focus in this vein has been on portfolio characteristics of internationally diversified firms (e.g., Denis et al., 2002; Berger and Ofek, 1995; Errunza and Senbet, 1984). In this literature, international diversification is associated with a reduction in portfolio risk. In contrast to this focus, IB literature has suggested many ways that an increase in internationalization affects a firm's performance (e.g., Thomas and Eden, 2004; Delios and Beamish, 1999; Lu and Beamish, 2004). One suggestion provided to reconcile these findings is that, while internationalization tends to yield risk reductions on an aggregate level because of portfolio diversification (Reeb et al., 1998), every individual internationalization step confronts firms with LoF (Zaheer, 1995).

Despite an extensive amount of empirical investigations into the matter, however, no clear conclusion has been reached with regards to the internationalization-performance relationship, particularly considering differences in the paths that firms follow when they internationalize. While there seems to be evidence that more structural approaches to internationalization lead to better performance (Brouthers and Nakos, 2005), and that the relationship between internationalization and performance is nonlinear (Lu and Beamish, 2004) it is not clear which systematic approach to internationalization is superior. The literature argues that a key reason for this non-finding is that there is no theoretical reason to expect a general relationship between the degree of internationalization and firm performance (e.g., Verbeke et al., 2009). It is evident, however, that firm- and country-specific factors strongly condition the degree to which a firm can use internationalization to generate superior performance (e.g., Hitt et al., 1997). Some authors argue that internationalization may not be structurally related to performance because firms choose their investment targets and strategies based on complementarities with their own resources and transaction cost related characteristics (e.g., Hennart, 2011; Verbeke and Forootan, 2012). Nevertheless, if firms have structural investment strategies that govern internationalization as a whole, or if home and host country characteristics matter for internationalization, we should be able to identify an effect of internationalization on performance if we manage to model the

internationalization decisions that firms make. The model suggested in this paper shows, among other things, that we can derive explicit predictions about the internationalizational-performance relationship for certain firms and environments building on relatively well-established concepts in IB.

THE SIMULATION

This paper builds a simulation of 50 countries, in order to investigate how characteristics of a firm and its home country's characteristics influence the extent to which different systematic approaches to internationalization affect a firm's internationalization and performance. For 50 firms that start from randomly allocated home countries, it simulates 50 time periods in each of which an internationalization decision can be made (following one of several global diversification strategies). The simulation idea is related to N-K modelling. Initially, a single one in a string of zeros represents a firm's home country. The corresponding vector $\mathbf{p_{i,t}}$ summarizes the countries in which a firm (i) is present at time t. At time t_0, this could look like:

$$\mathbf{p_{i,t_0}} = (0, 0, .., 0, 1, 0, 0, .., 0).$$

If firm i decides to internationalize to, for example, a neighboring country in t_1, the string will change to

$$\mathbf{p_{i,t_1}} = (0, 0, .., 0, 1, 1, 0, .., 0).$$

The simulation assumes a certain market size (in terms of the product market the simulated firms operate in) for every country. As the paper proceeds, it uses different relationships across country markets as the simulation becomes more realistic (and hence more complicated). In all cases, there is a vector of possible returns for all countries (j) in the simulation for every year t (i.e., the market size). This vector is represented

by $\mathbf{\Pi}_t$. It will always have a randomly drawn component (following different multivariate distributions with mean α and covariance matrix $\mathbf{\Sigma}$), multiplied with a constant that represents the market potential (μ_j) of a certain country (as a consequence of e.g. differences in the Gross Domestic Product). There will also be a degree of autocorrelation (β) from one iteration to the next.

$$\mathbf{\Pi}_t = \mathbf{\Pi}_{t-1} \cdot \beta + \mathcal{N}(\alpha, \mathbf{\Sigma})_t \cdot \mu \cdot (1 - \beta),\ with\ \mathbf{\Pi}_0 = \mathcal{N}(\alpha, \mathbf{\Sigma})_0 \cdot \mu.$$

The profit a firm makes in a certain year (indicated by $\pi_{i,t}$) is the sum of the profits in all countries where a firm is present. This is represented by the scalar product of a firm's presence $\mathbf{p_{i,t}}$ and the country returns $\mathbf{\Pi}_t$ at time t.

$$\pi_{i,t} = \mathbf{p_{i,t}} \cdot \mathbf{\Pi_t}$$

Global diversification strategies may differ depending on many factors. This simulation investigates three plausible strategies that are present in IB literature, and briefly summarized in the section above. This selection is necessarily incomplete. It is mainly designed to illustrate how differences in the relative characteristics of country markets may influence which strategy is optimal. In the IB literature, the idea of an incremental internationalization is most prominent. Moreover, international marketing literature suggests that firms internationalize for market-seeking motives to choose markets that are particularly promising in terms of sales potential. Risk plays an important role in such considerations as well, which may drive firms to maximize the ratio of expected return over risk (i.e., the Sharpe-ratio). Finally, firms may randomly pick where to invest (this will serve as a benchmark for the different strategies). The simulation does not allow for market exits.

1. **Incremental or "distance-minimizing"**: Following the Uppsala model (Johanson and Vahlne, 1977), a firm moves to a country next to the (pool of) country (countries) it is already present in. The

simulation randomly chooses whether the next country to internationalize to is to the "left" or to the "right" (in the sense of the line-vector presented above as $\mathbf{p_{i,t}}$) of the countries it is already present in.

2. **Maximum market potential or "sales-maximizing"**: A firm chooses the country from the list of countries it is not yet present in where the market size in the past iteration $(t-1)$ was highest.

3. **Maximum Sharpe ratio or "risk-optimizing"**: A firm selects the country from the list of countries it is not yet present in where the Sharpe ratio (Sharpe, 1966), that is the ratio of average past returns over their standard deviation, is highest.

4. **Random**: A firm randomly chooses a new country to which to internationalize. This strategy is a benchmark for comparisons.

It is clear that a firm from a foreign country suffers from liabilities of foreignness, compared with local competitors (e.g., Hymer, 1976; Zaheer, 1995). A firm can partially overcome these liabilities of foreignness by adapting to and learning from the host environment, yet it will not manage to fully overcome its liability (e.g., Petersen and Pedersen, 2002; Mezias, 2002). The simulation factors this relationship into the profit a firm can appropriate (of the potential profit) in a country, by deducting a loss that results from LoF.

First, the extent of liabilities of foreignness is a positive function of the distance (be it psychic, institutional, cultural, or geographic) between a firm's home country and the respective foreign country (Bell et al., 2012). By definition, liabilities of foreignness is zero in a firm's home country. It will increase with the number of countries that lie between the home country and a specific foreign country. This simulation assumes that the degree of liabilities of foreignness decreases linearly with the number of countries between a firm's home country and a target country. Table 1 gives an example for the returns a firm will be able to generate. In column one, the firm's home country is in line 1, in column 2 the home country is in line 2, and so on. The values in the off-diagonal lines indicate the share of returns that a firm will lose because of

its foreignness. If, for example, a firm's home country is in line 3 (as represented by column 3), it will only be able to extract $1 - 0.556$ times the potential returns in country 7, which is represented by line 7. This amounts to 44.4% of the returns that a firm whose home country is country 7 would be able to extract. The vector of liabilities of foreignness that a firm i has in all potential target countries is denoted as $\mathbf{\Lambda_i}$. Note that the structure of the LoF matrix presented in Table 1 favors firms that originate from countries towards the "center" of the set of countries simulated (e.g., column 5 in the 10-country example presented in Table 1), because their average distance to potential target markets is lower than for example for firms that originate from the country represented by column 1. The returns of firm i in year t ($\pi_{i,t}$) corrected for the liabilities of foreignness ($\mathbf{\Lambda_i}$) will consequently be ($\circ$ indicates a line-wise multiplication)

$$\pi_{i,t} = \mathbf{p_{i,t}} \cdot \mathbf{\Pi_t} - (\mathbf{p_{i,t}} \circ \mathbf{\Pi}_t \cdot \mathbf{\Lambda_i}) \,.$$

[Table 1 about here.]

Second, the more experience a firm has in a certain target country, the closer will the liabilities of foreignness get to zero (Zaheer and Mosakowski, 1997). It will, however, approach zero only asymptotically, that is, there always remain small liabilities of foreignness, with the exception of in a firm's home country (Butler, 2016, p.276). The experience ($\mathbf{x_{i,t}}$) a firm i has in all countries j at time t is the ratio of years that have passed since a firm (i) entered a country (j) over the year the simulation is in (t). This is represented by the ratio of the sum of all presence vectors $\mathbf{p}_{i,\tau}$ for the past years τ (with $\tau < t$) over t. If, for example, the simulation is in year 10 and a firm entered a market j_0 in year 7, its experience in this market will be 30%. In year 50 of the simulation, the experience will be 86% (i.e., $\frac{43}{50}$).

$$\mathbf{x_{i,t}} = \frac{1}{t} \cdot \sum_{\tau=1}^{t-1} \mathbf{p}_{i,\tau}$$

As a result, liabilities of foreignness will decrease. In the simulation, this means that experience ($\mathbf{x_{i,t}}$)

affects the liabilities of foreignness ($\mathbf{\Lambda_i}$). As a consequence, the returns a firm (i) can collect in year t take the form

$$\pi_{i,t} = \mathbf{p}_{i,t} \cdot \mathbf{\Pi}_t - \left[\mathbf{p}_{i,t} \circ \mathbf{\Pi}_t \cdot \mathbf{\Lambda}_i \circ (\mathbf{1} - \mathbf{x}_{i,t})\right].$$

Usually, the K part of N-K modelling indicates the correlation between value functions of different individual configurations (e.g., Levinthal, 1997). In this simulation, the relationship between returns in different countries is somewhat more complex. Because of economic integration, the economic developments in neighboring countries have a strong common factor (Lumsdaine and Prasad, 2002), while the economies of countries that are more distant are less correlated. This means that there is a correlation between country returns that decreases with distance (the number of rows between a pair of countries in the vector $\mathbf{\Pi}_t$). The exact specification of the correlation matrix will be discussed together with the choice of parameters for the other factors.

In the simulation, a firm can only internationalize if its cumulative profits from the past are above a certain threshold. If a firm has enough resources to internationalize, internationalization follows the four strategies for global diversification presented above. The simulation computes outcomes of all of those strategies for each firm. The simulation hence gives four alternative paths to global diversification and corresponding returns for all firms. A firm cannot leave a country once it enters it (this assumptions is justified, as the average return in all countries will always be positive ($\alpha > 0$)). After each iteration (t), a firm's returns are captured cumulatively in annual values. The simulation uses these cumulative returns in the next iteration to check whether a firm's accumulated returns exceed the threshold for internationalization. For each firm, individual returns are captured as vectors for analysis. The simulation also stores a firm's steps of internationalization, as well as country returns over time. The simulation is run using an R 3.5.1 distribution (RCore, 2015).

BASIC RESULTS

This paper presents the simulation results in increasing complexity, with a more detailed investigation toward the end of a number of relationships of interest. The first set of results establishes a basis for comparison for later analyses, and establishes that the propositions derived from the simulation are in line with what one would expect given existing literature and intuition. While some of the results from these first simulation runs may seem obvious, it is important to establish these results to make sure the reduced-form simulation accurately reflects reality as IB scholars expect. In addition, even these basic results yield some insights into what the drivers of fundamental observations in IB are. Particularly, these basic results show what assumptions are necessary to obtain them.

Baseline Model

In the baseline model, all countries have the same average market size ($\mu_j = \mu_k = 1000\ \forall j, k$), there is no correlation across country returns at any time ($Cor(\Pi_{j,t}, \Pi_{k,t}) = 0\ \forall j, k$; equivalently $\mathbf{\Sigma} = \mathcal{N}(\alpha = 1, 1)$), there is no serial correlation in country returns from one year to the next ($\beta = 0$), and there is no liability of foreignness ($\Lambda_i = 0\ \forall i$). The threshold in cumulative returns that a firm needs to have in order to internationalize is set to 10,000. This baseline analysis simulates 50 time steps for 50 firms using the four global diversification strategies outlined above. Figure 1 shows the returns of four internationalization paths for each of 50 firms (from randomly selected home countries) among the 50 potential target countries.

[Figure 1 about here.]

As expected, under a purely random relationship among country returns, the choice of global diversification strategy does not affect firm performance. All firms internationalize at the same pace (albeit to

different countries of course), and returns grow linearly with the number of countries entered. There is a small portfolio diversification effect with increasing internationalization (i.e., the standard deviation of returns decreases with the degree of internationalization), but no particularly interesting differences among the global diversification strategies can be found in the oversimplified baseline scenario. Figure 1 represents the risk-return relationship of the different (colour-coded) global diversification strategies. Again, no substantial differences among the strategies can be identified.

Variation in Market Potential

The next step introduces to the simulation differences in the market potential for a country. This means that the vector μ is computed as a uniform distribution of market sizes between 100 and 1,000. The remaining parameters remain as in the baseline scenario. Figure 2 shows average cumulative returns over the 50 simulated paths for the four global diversification strategies. Two important observations can be made regarding the differences between Figure 1 and 2. First, the average returns under all strategies are lower in Figure 2 than in Figure 1. This is because firms that have small home countries will take longer until they have accumulated the 10,000 in returns that allows internationalization, and are therefore only able to tap fewer markets. On average, the firms in Figure 2 operate in 30 countries at the end of the simulation, and the firms in Figure 1 operate in 40 countries. Clearly, this is a straightforward consequence of the decrease in average country market as opposed to the baseline scenario above. Second, the sales-maximizing global diversification strategy is associated with higher returns than the other strategies.

[Figure 2 about here.]

The comparison of these two very simple simulation results yields a testable prediction:

Proposition 1a: The success of sales-maximizing global diversification is greater if the variation in

country size is larger.

Figure 2 shows the risk-return relationship for the four global diversification strategies. The green observations (corresponding to the sales-maximizing strategy) are set apart from the remainder. On average, the higher return comes with a somewhat increased standard deviation. This corresponds to the fixed relative variation in country returns $\mathbf{\Pi_t}$, which also gives larger markets more absolute variation in returns. In comparing Figure 2 to Figure 1, it becomes apparent that the relationship between risk and return is more concave in Figure 2. This is because the risk diversification effect takes longer to materialize, because on average firms internationalize more slowly.

Liabilities of Foreignness

This simulation sets the variation in market potential to zero ($\mu_j = \mu_k = 1000 \; \forall j, k$). Instead, it introduces Liabilities of Foreignness (LoF), as explained above. Firm returns in a country market are reduced if the country is distant from the home market (as expressed by $\mathbf{\Lambda}_i$). Experience in a country (as expressed by $\mathbf{x}_{i,t}$) reduces the LoF. Figure 3 shows a boxplot of the average returns from the respective global diversification strategies. In this simulation, the most successful is the global diversification strategy following the Uppsala model ("distance-minimizing"), because internationalizing firms can minimize the LoF.

[Figure 3 about here.]

The right panel in Figure 3 shows the risk-return plot for the respective global diversification strategies in this scenario. The distance-minimizing global diversification strategy leads to higher returns without higher risk: it is a dominant strategy also in the sense of portfolio theory. This is in contrast to the superiority of the sales-maximizing based strategy in the sub-chapter above, where Figure 2 shows that higher returns from choosing the largest target markets come at the "cost" of higher risk in the sense of standard deviation of

returns. We can again derive a simple proposition from the restrictive assumptions about how the LoF work:

Proposition 1b: The success of incremental ("distance-minimizing") internationalization is greater if liabilities of foreignness are more prominent.

Stickiness

This simulation resets variation in market potential and LoF to zero, and introduces auto-correlation ("stickiness", $\beta = 0.5$) in country returns between sequential years. Country returns in year t are $50 - 50$ linear combinations of country returns in year $t-1$ and a new draw from a distribution following $\mathcal{N}(1, 1)$. Figure 4 shows a boxplot and risk-return distribution for the four global diversification strategies under these assumptions. The boxplot shows that internationalization following a sales-maximizing strategy is most successful if country returns are sticky. This is because if stickiness is high, a random draw that leads to high market potential in one year will remain relevant over a longer period of time.

[Figure 4 about here.]

We can observe from the risk-return plot that risk under auto-correlation is somewhat lower than under the baseline scenario. This is because the variation in returns from a certain country, once a firm chooses that country, is lower following the $50 - 50$ logic assumed with $\beta = 0.5$. We can derive two propositions from these observations:

Proposition 1c: Larger stickiness (as expressed by auto-correlation) in market returns leads to more successful internationalization following the sales-maximizing strategy.

Proposition 1d: The higher the stickiness in market returns, the lower the risk of internationalization.

Economic Integration

Country returns are usually not distributed independently. Typically, there is a common factor in returns from countries that are geographically close (and consequently economically somewhat integrated), because of economic links between geographically close countries. In the sense of this simulation, this means that the entries in the correlation matrix $\mathbf{\Sigma}$ are not randomly distributed around zero. Instead, returns from countries that are close to each other are more strongly correlated than returns from countries that are far apart. $\mathbf{\Sigma}$ consequently takes an equivalent form as in the example in Table 1 above. For simplicity, these correlations are defined to be stationary over time. All other variables are re-set to the baseline scenario.

[Figure 5 about here.]

Figure 5 shows that the average return from internationalization is almost equivalent across the different strategies. The mean values in the boxplots are almost identical. There is, however, variation in the deviation from this mean. Because economic integration (and hence correlation) increases with proximity, the incremental ("distance-minimizing") global diversification strategy results in the higher standard deviation of cumulative returns, and the risk-optimizing strategy minimizes risk. Overall, when considering the right panel in Figure 5, it is immediately apparent that the risk of internationalization is substantially higher if there is cross-country correlation. That is because the diversification effect that emerges when a firm earns several uncorrelated return streams is reduced if these return streams are positively correlated. This indicates three propositions.

Proposition 1e: Internationalization is riskier when country returns are more strongly correlated.

Proposition 1f: Incremental internationalization is riskier than other global diversification strategies when country returns are positively correlated.

Proposition 1g: Risk-optimizing global diversification minimizes risk under positive correlation of country returns.

GLOBAL DIVERSIFICATION STRATEGY IN A COMPLEX WORLD

The next step combines the extensions presented above. What can we observe if there is variation in market potential, liabilities of foreignness exist, there is auto-correlation between yearly returns, and returns from close countries are positively correlated? This is a question that is very difficult to answer using traditional forms of theory-building. It is more straightforward using a simulation. The simulation approach allows for independent and joint variation of conditions Davis et al. (2007), which may result in novel and interesting insights Posen and Levinthal (2012). This section explores some quantitative trade-offs for a set of parameter combinations. For the purpose of this section, all specifications remain the same as above, with the exception that the number of firms simulated increases to 100 to get sharper separation of the implications for performance of the respective strategies. Figure 6 shows a boxplot and risk-return relationship for this scenario. What emerges is a combination of the results presented above in the respective sub-sections. Both the distance-minimizing and sales-maximizing global diversification strategies outperform the random and risk-optimizing strategies. Of the two better-performing ones, the sales-maximizing strategy is significantly more successful. The differences remain similar to those presented above. The risk-return relationship shows that the difference in risk, which was prominent above, between the sales-maximizing strategy and the other strategies is somewhat reduced.

[Figure 6 about here.]

In a scenario with all four components presented above, it is clear that there will be a trade-off, at least quantitatively, between the effects of the components. With different calibrations, we can observe how the

factors play out with each other. It is even more interesting, however, to observe on what this trade-off may be contingent. In terms of the simulation as presented above, there are two relationships of interest: How the degree of internationalization affects cumulative returns, and how the country of origin affects cumulative returns.

A hierarchical regression (with country-fixed effects c_j) investigates the effect of firms' internationalization on cumulative returns. The degree of internationalization (DoI) is measured by the number of countries entered at the end of the simulation (i.e., $\sum \mathbf{p}_{i,T}$, where T indicates the last year of the simulation). Liabilitieswof foreignness are represented by the average distance between a firm's home country and all potential target countries (i.e., the mean of $\mathbf{\Lambda}_i$ which is called λ_i). This is essentially a function of where the firm's home country is located (i.e., towards the edge of the vector p_i, which corresponds to high average distance, or towards the center of vector p_i, which corresponds to low average distance). Firm performance is simply the firm's profit at time τ (i.e., $\pi_{i,\tau}$ with $\tau < T$ and T being the final iteration of the simulation). The market potential of a firm's home country ($\mu_{i,home}$) is a control. Hence, the resulting model specification is

$$\pi_{i,\tau} = b_0 + b_1 \cdot DoI_{i,\tau} + b_2 \cdot \lambda_i + b_3 \cdot \mu_{i,home} + c_j + e_i.$$

[Table 2 about here.]

Table 2 shows regression results for this specification under the four global diversification strategies. There are three key takeaways from the regression table. First, the degree of internationalization has a stronger positive effect on cumulative returns under the sales-maximizing (3) global diversification strategy than under the other strategies. Second, the effect of the average distance from the home country is substantially smaller under the distance-minimizing (2) global diversification strategy than under the remaining strategies. Interestingly, the risk-optimizing global diversification strategy combines a high effect of lia-

bilities of foreignness with an effect of DoI on performance that is comparable to the distance-minimizing global diversification strategy. Third, the more remote a home country, the lower the benefits of internationalization.

The underlying reasons for the key takeaways are straightforward. First, the average (positive) country return from internationalization is higher under the market-size-based global diversification strategy than under the other strategies. Second, the incremental strategy is designed to minimize liabilities of foreignness, while these liabilities do not play a role in the country choice under the market-size based strategy. Third, higher average distance from other countries increases the liabilities of foreignness. Nevertheless, there are three testable propositions that we can derive from these simulation results:

Proposition 2a: Internationalization has a more strongly positive effect on firm performance under a sales-maximizing global diversification strategy than under other global diversification strategies.

Proposition 2b: The performance effects of liabilities of foreignness are less negative under a distance-minimizing global diversification strategy than under other global diversification strategies.

Proposition 2c: The more distant is a firm's home country from the average foreign country, the lower the returns from internationalization.

GLOBAL DIVERSIFICATION STRATEGY UNDER COMPETITION

The final element discussed in this paper is competition. In the sections above, the paper assumed that firms would internationalize independently of each other. Equivalently, one could have assumed that firms are sufficiently small so that competition would be atomistic and no substantial effect would result from one firm entering a foreign market. This assumption is relaxed in this section. It introduces competition in the sense of a competing firm that also internationalizes following a certain global diversification strategy. Literature

has discussed the internationalization behavior of firms in some contexts. Rose and Ito (2008), for example, established that oligopolistic firms follow specific patterns when they internationalize. In a similar vein, Ito and Rose (2002) show that firms consider their competitors' investment strategies when they invest abroad. These perspectives are in line with Knickerbocker (1973), who suggests that investments by multinationals abroad can serve defensive aims, by reducing the probability that a competitor in an oligopolistic market may access a foreign market without competition.

This simulation builds on this literature in arguing that investments in countries where firms face fierce competition will see lower returns. It deviates from Knickerbocker (1973) and Ito and Rose (2002) in suggesting that firms may internationalize following specific strategies (the ones listed above), while the investments by competition do not condition individual internationalization steps, but internationalization strategy as a whole. More concretely, this simulation run assumes that if a focal and a competing firm are present in a country, the focal firm's returns will be reduced by 50%. For example, if firm A enters country 36, and the competing firm is already present there, firm A's returns from country 36 will be 50% lower than in the scenario simulated above. The remaining assumptions remain in place in the exact same specifications as in the last section. For simplicity, the simulation ignores first mover (or second mover, etc.) advantages. This is, the performance consequences for the focal firm are independent of which firm enters a market first: as soon as the competing firm is present the focal firm's returns are reduced by 50%.[3]

How firms will react if competition is present will probably depend on the global diversification strategy of the competing firm. If we assume that no first-mover advantage exists, firms will plausibly pick a global diversification strategy independent of what a competitor chooses. Equivalently, one can assume that firms are not aware of a competitor's global diversification strategy. Either way, investing in markets where a firm has a monopoly will be more beneficial than investing in markets where a competitor is already present. Figure 7 shows the cumulative returns a focal firm can expect if it employs a certain global

diversification strategy given a global diversification strategy that competition uses. In all combinations of strategies it is clear that choosing a different strategy than the competitor becomes a better option than in the no-competition scenario of the last section (an exception is the random strategy, where there is very little difference). This implies proposition 6a.

Proposition 3a: Global diversification strategies are complements. Firms choosing global diversification strategies that are different from those of their competitors will be more successful than firms choosing the same global diversification strategy as competitors, everything else being equal.

[Figure 7 about here.]

An important contingency of what proposition 6a suggests is the extent to which firms have entered all possible markets. In a world with very few markets, all firms would enter all markets relatively quickly (because average returns would still be positive in all countries), which should reduce the benefit a firm can derive from choosing a different strategy than its competitors. The more untapped markets exist, the lower the probability that a firm will end up in many markets where a competitor that uses a different global diversification strategy is already present. A simulation of 50 iterations for a setting in which only 50 markets exist, as well as an equivalent simulation in which 500 markets exist compare these scenarios. In both simulations the global diversification strategy of the competing firm is to choose markets according to their market sizes ("sales-maximizing"). Figure 8 shows the results of these simulations. In the left panel, the differences between the respective global diversification strategies are quite small. In the right panel, sales-maximizing global diversification leads to worse performance than in the left panel.

Proposition 3b: The more potential markets exist, the more beneficial it is for a firm to choose a different global diversification strategy than its competitors.

[Figure 8 about here.]

DISCUSSION

A key insight of the simulation approach in this paper is connecting which assumptions are sufficient to obtain which empirically observable effects in international business, as the above chapter demonstrates. It is, however, also important to highlight how the relationships between assumptions and propositions can play out in practice, and to link this to prominent literature in IB. Proposition 1a suggests that we would see substantial variation in how firm internationalization affects performance, depending on the market size in different countries (e.g., Calof and Beamish, 1995). For industries in which the market potential is quite homogeneous across a (small) number of similarly large target countries, this simulation suggests that we would see quick internationalization by all firms into those countries. If we add variation in home country size, firms that originate from larger home countries get an advantage as a consequence of their resource base, because they can move abroad more quickly (Tuppura et al., 2008). Of those that do move abroad, the firms that manage to enter the largest markets will be the most successful. For industries in which liabilities of foreignness are substantial (like many service industries, or industries in which cultural fit is important), it is not the size of the home country, but rather its location relative to the average target country that is decisive (Zhou and Guillén, 2015). Firms will be more successful, the less they suffer from liabilities of foreignness, and strategies that minimize the liabilities of foreignness (such as incremental internationalization) will be most successful (as proposition 1b suggests).

The simulation runs on which propositions 1c and 1d are based suggest that predictability of country returns makes sales-maximizing internationalization most successful. If firms are able to relatively accurately predict the future market potential in a country market, market selection based on market potential will be (almost tautologically) particularly successful. In the reality of international business, industries with low

levels of dependency on fashions and economic cycles (such as basic foodstuffs) will show sales-maximizing internationalization to be most successful. At the same time, internationalization in those industries is characterized by relatively low risk (as proposition 1d suggests). The economic integration among countries is another important determinant of how successful internationalization will be. In the absence of liabilities of foreignness (which may be a rather strong assumption), proposition 1e suggests that diversification effects from uncorrelated returns from different countries are minor, and hence internationalization implies higher exposure to unsystematic risk (Agmon and Lessard, 1977). Since closer countries tend to show higher correlation among economic cycles, incremental internationalization has particularly low diversification benefits in terms of risk reduction (proposition 1f). In a world in which international business is essentially a question of managing investment portfolios, rather than of managing the "distance" between countries, internationalization becomes a problem similar to portfolio management, and the rules of portfolio management apply (Markowitz, 1991), which suggests that the maximum Sharpe ratio portfolio (Sharpe, 1966) is optimal (proposition 1g).

Starting from the development of propositions 2a-2c, the simulation combines different effects that the IB literature prominently discusses. The relationship between the degree of internationalization and firm performance is a key question in this regard (e.g., Delios and Beamish, 1999). Proposition 2a suggests that a global diversification strategy that puts maximization of market potential first is most successful under a combination of liabilities of foreignness, sticky country returns, a degree of economic integration, and variation in country size. Proposition 2b, however, highlights that firms that want to minimize the risk associated with internationalization should internationalize incrementally, in order to minimize liabilities of foreignness while reaping some of the benefits of internationalization (Figueira-de Lemos et al., 2011). Finally, proposition 2c suggests that firms that originate from countries with relatively low distance to the average target market can particularly benefit from internationalization. This may be one of the reasons that niche playes (so-called "hidden champions") may be among those firms that benefit most from internationaliza-

tion, because niche products tend to cater to similar needs in quite different countries.

A discussion of strategies in general, and of global diversification strategies in particular, would be incomplete without considering the optimal choice of strategy given a competitor's strategy. In internationalization, a key driver of success is choosing markets that the competition have yet to enter (e.g., Lieberman and Montgomery, 1988; Mohr and Batsakis, 2017). Firms may benefit from first mover advantages in such countries, and may even play a key role in the institutionalization of the rules and regulations that govern a market if they enter first (Cook and Barry, 1995). As a consequence, global diversification strategies that focus firms' operations on markets where it is unlikely that other firms will enter soon, or already have entered, will be most successful. Proposition 3a suggests this, indicating that the optimal conditional choice of global diversification strategy is generally to avoid following the same strategy as the competition. The more potential target markets exist, the higher are the benefits of choosing a different global diversification strategy than competition (proposition 3b).

CONCLUSION

The propositions this paper derives emerge directly from simple assumptions about how global diversification works. The selection of global diversification strategies discussed is of course eclectic. Nevertheless, the strategies presented represent important approaches to how firms choose markets they want to enter, particularly for market-driven internationalization. More complex combinations of factors will yield more specific, but also more opaque, predictions of how firms can be expected to behave under different assumptions about market returns.

It is important to note that this simulation envisions a somewhat luxurious situation, because there is a positive average return to be gained from every entry. In reality, this is not always the case and firms are well advised to not enter some markets where they can expect to generate losses. Nevertheless, we can draw

relevant conclusions (the propositions) from the quite simple reduced-form simulation that is experimented with here, particularly for situations where firms have already narrowed down the potential target markets to those that would yield positive returns (firms tend to select markets in a staged process (Andersen and Buvik, 2002), the last stage often is about choosing markets among a list of potential positive-NPV investments). The question that remains regards the sequence in which a firms should enter those markets.

The simulation approach has two distinct advantages over empirical papers that investigate firms' global diversification strategies. First, the simulation allows for comparison of different strategies within the same firm. Second, it makes a link between the selected strategy and performance possible without the usual problems of reverse causality. These two advantages may render formal or simulation studies of global diversification strategy an important addition to internationalization research. The link to internationalization performance also allows new insights into the relationship between internationalization and performance, which is another avenue for research that can be explored using a similar simulation design. With regards to simulation design, it is interesting to note that a methodology similar to N-K modelling studies provides interesting insights into how firms invest abroad. This is because choosing investment locations is fundamentally similar to a search process, which is evaluated based on the overall outcome of several decisions.

Clearly, a simulation study also has its limitations. Foremost, the environment in which firms operate in the simulation is substantially less complex than the real world. One can add additional complexity to the simulation, but it will necessarily always remain a simplified abstraction. Moreover, simulation studies require the choice of parameters that may seem arbitrary (e.g., the market potential values chosen in this paper). This paper clearly highlights that it is not the choice of parameters that drives the simulation results presented, but rather the variation on certain parameters. However, it is important to concede that as soon as several parameters interact in the simulation, the quantitative effect of trade-offs is not independent of the parameter values chosen.

Despite the limitations of the research design, this paper makes an important contribution to research on global diversification strategy in particular, and to IB literature in general. The most important element of the contribution is the link between global diversification strategies and firm performance. The relationship between how or whether firms choose to internationalize and their financial performance is one of the defining questions in IB research. Research investigating the relationship has stalled in recent years because of challenges with empirical identification. Second, the paper helps researchers in modelling how environmental circumstances affect internationalization behaviour. IB research has discussed this substantially in the context of emerging market MNEs, which potentially behave differently from developed market MNEs because of differences in their home country environment. Third, this paper allows establishing on a theoretical basis what the net effects of several co-existing influences are on global diversification strategies. This is particularly important for the analysis of dynamic competitive strategy when firms are confronted with competition that enters foreign markets following particular global diversification strategies. Fourth, this paper is arguably the first to introduce a formal description of how important IB concepts could play out to connect firm strategy to performance. Naturally, such a formalized model is a strong abstraction of reality. Nevertheless, the abstraction allows a clear specification of assumptions and to distinguish between necessary and sufficient conditions that (individually or jointly) lead to phenomena relevant to the theory and practice of IB. Finally, the paper also may help practitioners to compare different internationalization strategies. An advanced version of the simulation calibrated to a specific firm's environment and competitive position may help in playing through scenarios that are difficult to compare without a computer.

Notes

[1]The mode of entry is not specifically investigated here. The logic suggested may apply to all forms of entry, from exporting to wholly-owned subsidiary

[2]A keyword search for papers on the topic of "global diversification strategy" in the FT50 and prominent IB journals reveals that 8 of the 10 most cited papers on the topic are concerned with this relationship

[3]The competing firm's home country is assumed to be the same as the focal firm's home country.

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Figure 1: Boxplot of cumulative (i.e., summed over all periods) returns (left) and risk-return plot (right) for the four global diversification strategies (random, distance-minimizing, sales-maximizing, and risk-optimizing).

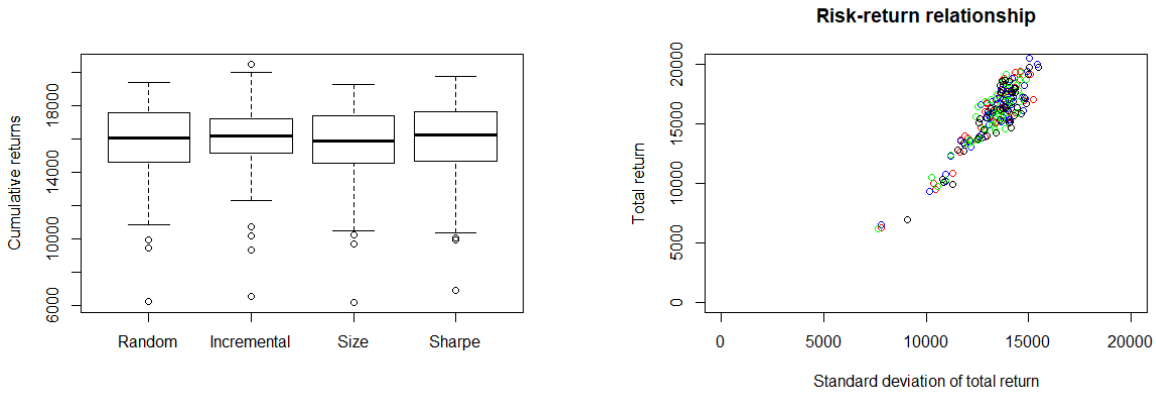


Figure 2: Boxplot of cumulative (i.e., summed over all periods) returns (left) and risk-return plot (right) for the four global diversification strategies (random, distance-minimizing, sales-maximizing, and risk-optimizing).

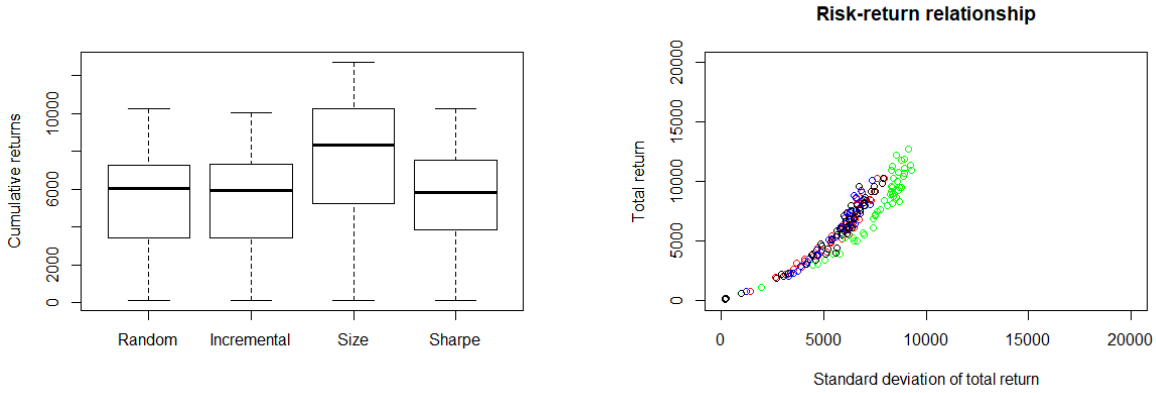


Figure 3: Boxplot of cumulative (i.e., summed over all periods) returns (left) and risk-return plot (right) for the four global diversification strategies (random, distance-minimizing, sales-maximizing, and risk-optimizing).

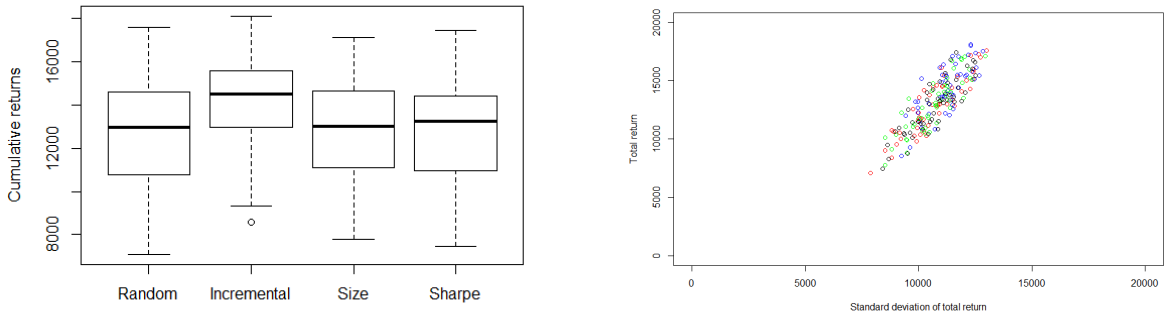


Figure 4: Boxplot of cumulative (i.e., summed over all periods) returns (left) and risk-return plot (right) for the four global diversification strategies (random, distance-minimizing, sales-maximizing, and risk-optimizing).

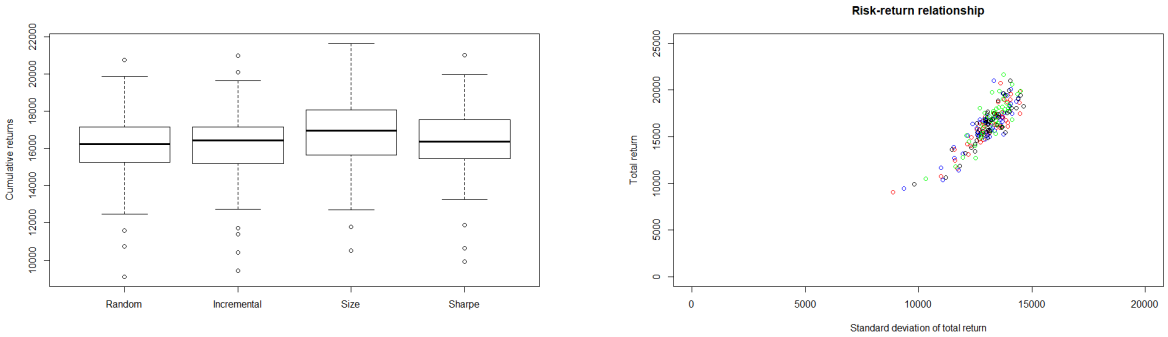
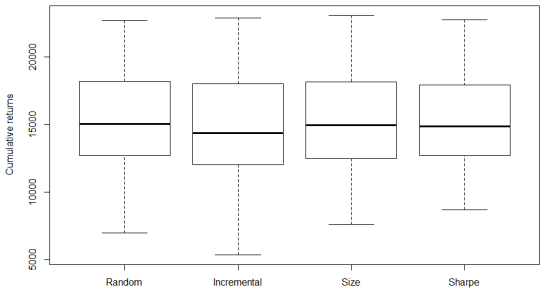


Figure 5: Boxplot of cumulative (i.e., summed over all periods) returns (left) and risk-return plot (right) for the four global diversification strategies (random, distance-minimizing, sales-maximizing, and risk-optimizing).



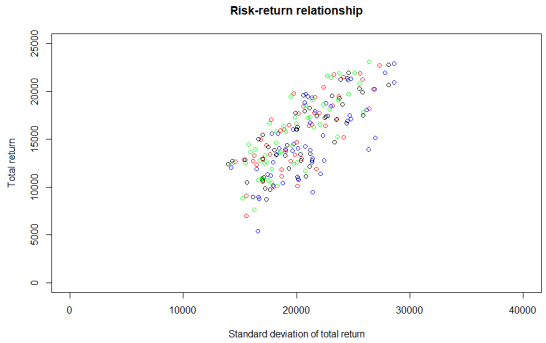


Figure 6: Boxplot of cumulative (i.e., summed over all periods) returns (left) and risk-return plot (right) for the four global diversification strategies (random, distance-minimizing, sales-maximizing, and risk-optimizing).

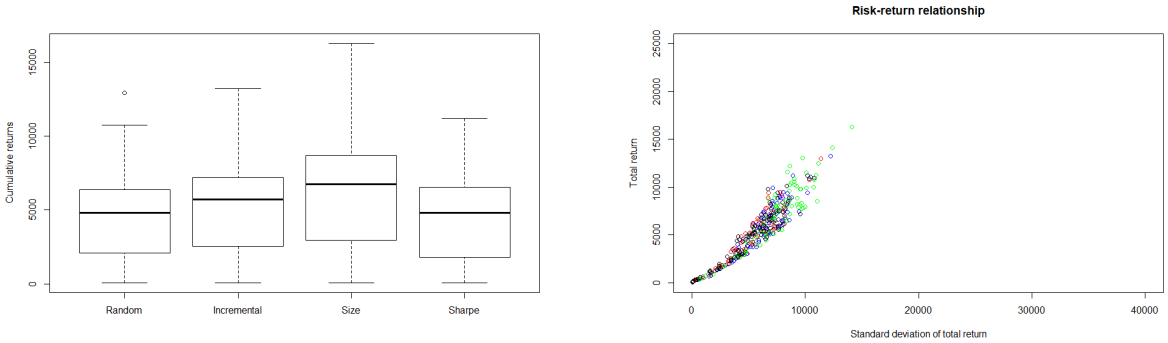


Figure 7: Boxplot of cumulative (i.e., summed over all periods) returns (left) for the four global diversification strategies under a competing firm that chooses its country market depending on the respective global diversification strategies (random (top-left), distance-minimizing (top-right), sales-maximizing (bottom-left), and risk-optimizing (bottom-right).

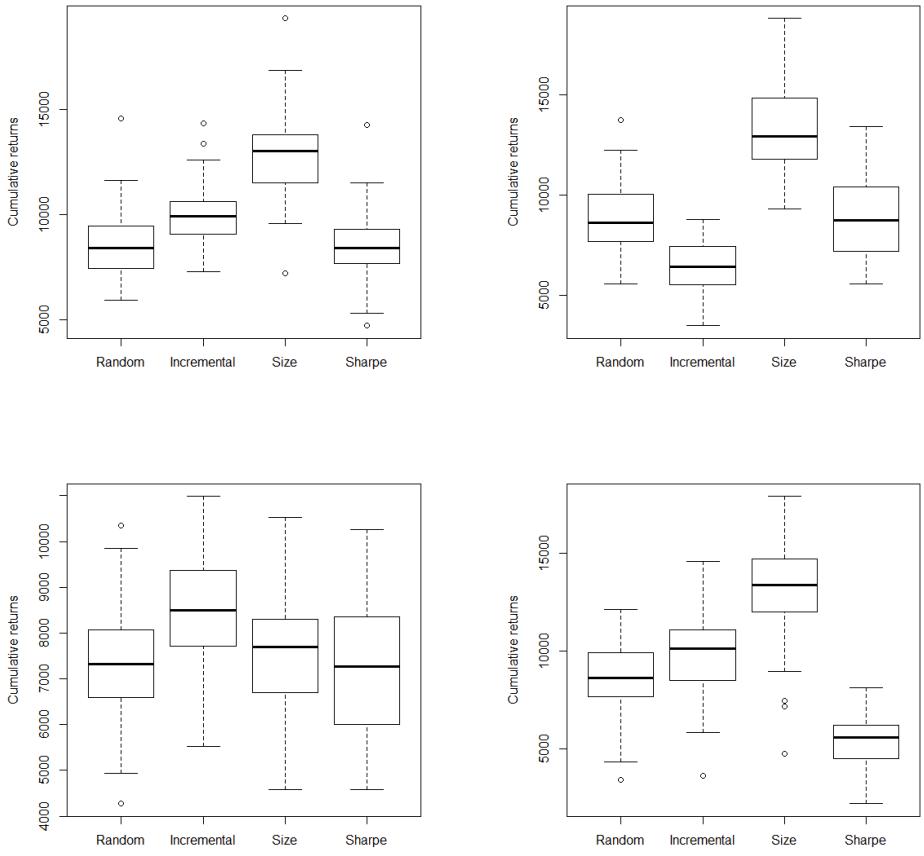


Figure 8: Boxplot of cumulative (i.e., summed over all periods) returns for the four global diversification strategies under a competing firm that chooses its country market depending on the size of untapped markets.

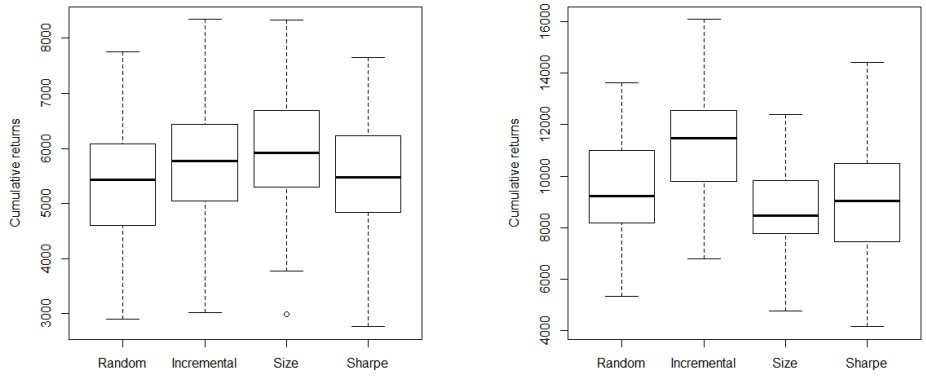


Table 1: Example for the liability of foreignness that firms from countries indicated by the column headers will face in countries represented by line headers. Example for 10 countries.

	1	2	3	4	5	6	7	8	9	10
1	1	0.889	0.778	0.667	0.556	0.444	0.333	0.222	0.111	0
2	0.889	1	0.889	0.778	0.667	0.556	0.444	0.333	0.222	0.111
3	0.778	0.889	1	0.889	0.778	0.667	0.556	0.444	0.333	0.222
4	0.667	0.778	0.889	1	0.889	0.778	0.667	0.556	0.444	0.333
5	0.556	0.667	0.778	0.889	1	0.889	0.778	0.667	0.556	0.444
6	0.444	0.556	0.667	0.778	0.889	1	0.889	0.778	0.667	0.556
7	0.333	0.444	0.556	0.667	0.778	0.889	1	0.889	0.778	0.667
8	0.222	0.333	0.444	0.556	0.667	0.778	0.889	1	0.889	0.778
9	0.111	0.222	0.333	0.444	0.556	0.667	0.778	0.889	1	0.889
10	0	0.111	0.222	0.333	0.444	0.556	0.667	0.778	0.889	1

Table 2: Regression results for the relationship between internationalization and performance.

	Random	Distance min	Sales max	Risk opt
	(1)	(2)	(3)	(4)
Intercept	796.19	263.08	1,248.94*	1,446.30**
	(500.88)	(535.05)	(564.92)	(518.53)
DoI (Random)	456.50***			
	(38.67)			
DoI (Incremental)		501.48***		
		(40.58)		
DoI (Size)			623.92***	
			(45.89)	
DoI (Sharpe)				529.16***
				(36.99)
Distance	−3,655.80**	−1,543.77	−5,200.05***	−5,361.25***
	(1,355.75)	(1,446.30)	(1,531.57)	(1,398.97)
Size	86.70	−20.53	3.29	−1,276.17
	(870.26)	(913.96)	(1,024.91)	(846.79)
Observations	100	100	100	100
Log Likelihood	−801.26	−806.61	−818.12	−798.06
Akaike Inf. Crit.	1,614.51	1,625.23	1,648.25	1,608.12
Bayesian Inf. Crit.	1,630.14	1,640.86	1,663.88	1,623.75
Note:				*p<0.05; **p<0.01; ***p<0.001