Are Networks always Beneficial?

An Empirical Analysis on the Relationship between Knowledge Intensity and International New Venturing

Abstract

Knowledge intensity is a specific asset requiring protection during international new venturing. Drawing on a framework of Transaction Cost Economics and Structural Embeddedness, we study how the impact of knowledge intensity on international scale and scope is moderated by international network strength and size. Findings suggest that the impact of knowledge intensity on international scale and scope increases with international network strength and decreases with international network size. Hence, we contribute to the extant literature by showing that international network strength has a beneficial effect whereas international network size has a liability effect for the internationalization of new ventures.

Keywords: International Networks, Knowledge Intensity, Transaction Cost Economics, Structural Embeddedness, International New Venturing

1. Introduction

According to International Entrepreneurship (IE) literature, knowledge intensity is a pivotal factor of international new venturing (Autio et al., 2000; Bell, McNaughton et al., 2003; Coviello and McAuley, 1999; Jones, 1999). On one hand knowledge intensive International New Ventures (INVs) have to expand internationally in order to amortize high initial R&D expenditures and to find sufficient demand for their products to survive and grow (Autio et al., 2000). On the other hand, the risk of losing the firm's most valuable asset – its knowledge – may grow significantly with increasing scale and scope of internationalization (Li et al., 2008).

Arguing from an economic perspective, knowledge is an important specific asset for INVs which requires protection. However, for INVs – mostly suffering from limited resources and facing liabilities of newness, size, and foreignness (Hymer, 1960; Singh et al., 1986; Zaheer, 1995) – internalizing their specific knowledge as suggested by economic theories (Williamson, 1985, 1996) is hard to achieve. Research has shown that INVs have to rely on alternative governance structures such as networks to overcome their resource constraints (Oviatt and McDougall, 1994). As such, international network contacts have been shown to enable access to foreign markets (Weerawardena et al., 2007) and to develop knowledge in trustworthy relationships (Yli-Renko et al., 2002). Moreover, researchers found that management teams with access to foreign market networks are better able to overcome the liabilities of foreignness (Zaheer, 1995) and to secure a firm´s proprietary knowledge in foreign environments (Yli-Renko et al., 2002). Hence, international network contacts allow young and internationally operating firms to compensate their liabilities of newness, size, and foreignness. International networks may provide a firm the opportunity to achieve fast international coverage while at the same time securing the firm´s proprietary knowledge.

However, recent studies argue that networks may have a liability side as well (Chetty and Agndal, 2007). For instance, Woolcock and Narayan (2000) incorporate both the benefits and the costs of social capital in their research. Accordingly, a differentiated analysis is required with regard to networks and international new venturing. Different characteristics of networks, such as size and interaction strength, may impact knowledge exploitation in international markets differently.

However, a systematic analysis taking both positive and negative aspects of networks into account are largely missing to date.

The present study contributes to extant research in two ways: First, we contribute to IE theory by integrating Transaction Cost Economics (TCE) with Structural Embeddedness reasoning. We draw on TCE (Williamson, 1985, 1996) combined with Structural Embeddedness reasoning (Granovetter, 1985) to provide a more contingent view on the role of knowledge intensity, international network contacts, and international new venturing. We argue that strong international network contacts provide a beneficial governance structure for INVs securing a firm's specific knowledge and making it exploitable for means of international expansion. On the contrary, network size may cause liabilities for International New Ventures, because a large network is harder to control and increases the risk of opportunistic behavior and unintended knowledge diffusion. Knowledge diffusion is particularly severe for small and young firms for which knowledge is the most important asset.

Second, based on our theoretical framework we empirically contribute to the role of networks in international new venturing by investigating how international network strength (frequency of contact with network partners) and size (number of network contacts) moderate the impact of knowledge intensity on the scale and scope of international new venturing. Hence, the detailed economic and structural perspective taken in this paper allows identifying a beneficial and liability side of international network contacts, which is novel and important to the extant literature on INVs.

The remainder of the paper is structured as follows: The next section defines INVs and discusses the two dimensions of their internationalization behavior which are employed in this study as dependent variables: scale and scope of internationalization. In the theory and hypotheses section we link TCE with Structural Embeddedness and outline the impact of knowledge intensity on international scale and scope in dependence of international network strength and size. Thereafter we present our INV sample as well as results from moderated OLS regression. Finally, we discuss the results and show implications for research and practice as well as limitations of our study.

2. Theory

We apply transaction cost reasoning supplemented with elements of Structural Embeddedness to examine how international network strength and size moderate the relationship between knowledge intensity and the international scale and scope of INVs.

TCE considers economic activities in the light of efficiency. Three basic assumptions characterize the behavior of the actors: bounded rationality, opportunism, and foresight (Williamson, 1985). Transactions seem to be efficient if they have the, comparatively, lowest accumulated production and transaction costs. Besides uncertainty and frequency, asset specificity is the central element in TCE. "Asset specificity is the big locomotive to which transaction cost economics owes much of its predictive content" (Williamson, 1985: 56). According to TCE, specific assets need protection. They are most efficiently governed in hierarchical structures designed to reduce behavioral and environmental uncertainty (Williamson, 1996).

TCE found widespread acceptance in the internationalization literature and has been highly appreciated as a tool to study economic factors of internationalization. However, the role of opportunism, the isolated unit of analysis, and a static set-up inherent in economic approaches have been criticized for not facilitating the study of environmental issues (Calof and Beamish 1995; Gulati et al., 2000; Ramanathan et al., 1997; Zafarullah et al., 1998; Zajac and Olsen, 1993). "Like most influential theories, transaction cost theory was not fully developed at the outset. It has been and continues to be refined and reformulated, corrected and expanded, in response to new theoretical and empirical developments" (Geyskens et al., 2006: 519).

The concept of embeddedness forwarded by new economic sociology (e.g. Granovetter, 1985) refers to the criticism of TCE. In contrast to TCE, the concept of embeddedness assumes economic actors as „being socially constructed – shaped and constrained by the groups to which they belong" (Pressman and Montecinos, 1996: 878). Networks enable long-term relationships between two or more transaction partners and can additionally produce learning effects (Richter, 2002). This way, relationships of mutual dependence develop which are less prone for opportunistic behavior. In

addition, restrictions can be overcome and information asymmetries and uncertainties can be reduced (Brouthers and Brouthers, 2003; Rooks et al., 2000). Supplementing TCE with elements of Structural Embeddedness creates an integrative perspective from which we can study the relationships between knowledge intensity, networks, and international scale and scope of INVs.

Referred to our research context, knowledge is a specific asset which needs protection (Amara et al., 2008; de Faria and Sofka, 2010; Park, 2008). However, for INVs – suffering from limited resources and experiences – it is hard to protect their specific assets through internalization. Internalization is often cost and resource intensive and INVs are mostly not able to stem these resource requirements. Hence, INVs have to rely on alternative governance structures such as networks in order to achieve fast internationalization without losing their specific knowledge.

Networks have proven to play an important role in new venture internationalization as an alternative governance mechanism (Coviello, 2006). A wealth of studies emphasize the impact of international networks on the intensity and scope of international new venturing (Weerawardena et al., 2007; Young et al., 2003; Zahra et al., 2003). Networks facilitate foreign market entry (Nerkar and Paruchuri, 2005), reduce uncertainty (Freeman et al., 2006), provide financial backup (Shane and Cable, 2002), and support learning in and about foreign markets (Schwens and Kabst, 2009; Yli-Renko et al., 2002). Regarding networks, especially two aspects are highlighted in extant network and IE studies: The size of a network (Baum et al., 2000; Reuber and Fischer, 1997) and the strength of interpersonal network contact (Dyer and Singh, 1998; Kale et al., 2000). Both aspects may encourage international new venturing, even though their effectiveness results from different mechanisms.

Strong contact with foreign network partners "contributes to lowering risk and uncertainty inherent in international operations" (Weerawardena et al., 2007: 301). Hence, strong relations are a powerful tool to facilitate international new venturing (Oviatt and McDougall, 2005; Selnes and Sallis, 2003) by yielding security and financial back-up (Shane and Cable, 2002). This is why new ventures with strong networks are more likely to benefit from innovation (Rao et al., 2008) compared to new ventures lacking these relations. By providing information and reducing the threat of opportunism

(Uzzi, 1997), intensive inter-organizational contact reduces transaction costs and environmental uncertainty, and thus fosters the distribution of knowledge-intensive products and services abroad.

The number of network contacts, on the other hand, may provide a vehicle for young firms to gain initial access to foreign markets (Coviello, 2006). A big network supports internationalization in general by providing visibility and legitimacy (Choi and Shepherd, 2005; Gulati, 1995; Suchman, 1995) as well as innovative capabilities (Chetty and Agndal, 2007; Nahapiet and Goshal, 1998). Moreover a large international network facilitates foreign market entry by providing contact to potential customers or other stakeholders and by helping to spot opportunities for market development (Weerawardena et al., 2007). However, even though international network size may forward international new venturing in the first place (Oviatt and McDougall, 1994) it may also limit the exploitation of knowledge intensive products abroad, because large networks provide ground for increased opportunistic behavior as control becomes more difficult.

We propose that knowledge intensity fosters international new venturing (Autio et al., 2000; Sapienza et al., 2006), but also bears the risk of opportunistic behavior and sunk costs (Miller and Shamsie, 1996). Although knowledge intensity provides an opportunity for international growth (Yli-Renko et al., 2002) its impact may be restricted if risks of patent infringement or product piracy arise. The strength of international networks has an impact on the power to exploit knowledge intensive resources at an international level (Dyer and Singh, 1998; Levinson and Asahi, 1995; Powell, 1996). Thus, knowledge intensive firms are particularly in need of a secure environment to minimize risks and to exploit their knowledge and abilities on a full scale.

A large network may be facilitating internationalization in the first place but also leaves room for opportunistic acting, since monitoring of specific network partners becomes more difficult. Under these circumstances, specific knowledge is much harder to protect. In contrast, strong international networks are characterized by mutual commitment and less prone to opportunistic behavior encouraging an effective international firm expansion. Based on these argumentations, we assume the relationship between knowledge intensity and the scale and scope of new ventures' internationalization to be moderated differently by international network strength and size. Figure 1

summarizes our theoretical reasoning and research model. In the following we develop our research model´s underlying hypotheses.

Insert Figure 1 about here

3. Hypotheses

We assume international network strength to positively moderate the relationship between knowledge intensity and the scale and scope of international operations. Strong networks foster the transition of knowledge-intensive products and services into international markets. Strong networks imply a high intensity of interaction and the information exchange is "more proprietary and tacit than the price and quantity data […] traded in" loosely connected networks (Uzzi, 1997: 45). A strong international network provides rich chunks of information that strengthen internationalization and security better than sequential bits of dissimilar price and quantity data.

The high interaction rate, inherent to strong networks, hampers opportunistic behavior (Ahuja, 2000; Kogut et al., 1992) since the close interaction enhances the "ability to recognize and effectively evaluate information" (Atuahene-Gima and Murray, 2007: 7) and it is essential for the sharing of vital information (Cowan and Jonard, 2009). Managers, for example, more comfortably exchange their knowledge with other organizations if they are connected by strong relationships (Kelley et al., 2009; Perry-Smith and Shalley, 2003). This is particularly true when knowledge involves a high level of complexity (Hansen, 1999). Therefore, a constant interaction "between partners is often cited as a critical [network] element that in turn enhances the quality of the resource flows" (Hoang and Antoncic, 2003: 166).

International network strength fosters the exploitation of knowledge intensive products in multiple countries since strong contact with foreign network partners "contributes to lowering risk and uncertainty inherent in international operations" (Weerawardena et al., 2007: 301). Strong network contacts reduce the complexity of international market development and facilitate international new

venturing into a multitude of countries right from inception (Oviatt and McDougall, 2005; Selnes and Sallis, 2003) by yielding information and financial security (Shane and Cable, 2002). Therefore, intensive inter-organizational contact reduces transaction costs and environmental uncertainty, and thus fosters the distribution of knowledge-intensive products and services abroad.

Strong international networks increase the impact of knowledge intensity on international scale. Strong network contacts promote opportunities for market development and help to identify international business opportunities (Oviatt and McDougall, 1995) as well as economies of time (Uzzi, 1997). With close international partners INVs may more easily identify and contact key customers. Therefore, knowledge intensive firms with strong networks can efficiently penetrate a foreign market and increase their international sales. Moreover, close partners are less capable to pursue opportunistic behavior and free riding as their activity can be monitored. This increases the efficiency of cooperation as risks of unintended knowledge dissemination are reduced. Oviatt and McDougall (1994: 57) support this view, stating that “using network governance structures may limit the expropriation of venture knowledge. To a certain extent, the network structure tends to control the risk of knowledge dissemination and intellectual property violence.”

Thus, strong international networks help to exploit knowledge intensity on an international level by providing increased market knowledge and higher transaction security (Filaster and Spiess, 2008). Strong international networks help firms to overcome obstacles to internationalization and to increase both international scale and international scope.

Hypothesis 1a: The strength of a firm's international network moderates the impact of knowledge intensity on international scale in such that the stronger the network, the stronger the relation between knowledge intensity and international scale.

Hypothesis 1b: The strength of a firm's international network moderates the impact of knowledge intensity on international scope in such that the stronger the network, the stronger the relation between knowledge intensity and international scope.

In contrast to the effect of international network strength, we argue that the size of an international network negatively moderates the relationship between knowledge intensity and scale and scope of internationalization. Although a big network supports internationalization in general by providing visibility and legitimacy (Choi and Shepherd, 2005; Gulati, 1995; Suchman, 1995) as well as innovative capabilities (Chetty and Agndal, 2007; Nahapiet and Goshal, 1998), it may also cause severe problems which outweigh the benefits, particularly for knowledge intensive firms (Adler and Kwon 2002; Athuane-Gima and Murray 2006). Extant literature emphasizes the positive effect of big networks by referring to the internal network visibility and information dissemination (Nahapiet and Goshal, 1998), which is meant to increase innovative capabilities. In some cases, however, an INV does not aim for full visibility, especially with regard to its technological base, because knowledge dissemination and product piracy become more likely as a company's visibility increases (Carayannopoulos, 2009). Moreover, as networks grow its members become more disperse and connections between network partners become weaker. The manageability of the individual network companies may diminish with weakening bonds. This effect is further enforced by the remoteness of international network partners. Compared to physical firm clusters, international cooperation suffers from lower face-to-face interaction. Former research has already shown that face-to-face interaction is a prerequisite for enhanced innovation and information exchange (Carayannopoulus, 2009; von Hippel, 1998).

A big network offers more room for opportunistic behavior since network partners do not interact as closely with each other as in a strongly integrated network making monitoring more difficult. Relationships are more likely to be quickly established, and equally quickly dissolved, while rigorous behavioral control is difficult (Williamson, 1996). Accordingly, proprietary knowledge cannot be safeguarded efficiently via this conduit and knowledge dissemination becomes more likely. This is why networks of a large size may "help to speed up projects when knowledge complexity is low, but slow down projects when knowledge complexity is high" (Hansen, 1999: 82). Following a TCE rationale, knowledge intensive INVs may be hindered from further internationalization if they have a

wealth of international contacts, since knowledge cannot be safeguarded in a loose network due to increased monitoring costs. Therefore, an INV will benefit less from its knowledge intensity during its internationalization if it holds numerous international network contacts.

Hypothesis 2a: The size of a firm's international network moderates the impact of knowledge intensity on international scale in such that the bigger the network, the weaker the relation between knowledge intensity and international scale.

Hypothesis 2b: The size of a firm's international network moderates the impact of knowledge intensity on international scope in such that the bigger the network, the weaker the relation between knowledge intensity and international scope.

4. Methods

4.1. Sample

We test our hypotheses on a dataset of German firms from four different technology areas: Nanotechnology, Biotechnology, Microsystems, and Renewable Energies. Although the phenomenon of international new venturing is not restricted to technology firms, a large number of studies in this area focus on this type of firm (Bell et al., 2003; Bloodgood et al., 1996; Boter and Holmquist, 1996; Crick and Spence, 2005; Preece et al., 1998).

We collected data from multiple sources to establish the validity of our measures and reduce common method variance. First, we used secondary data to identify the relevant firms from the four technology areas. In close cooperation with industry experts from the Association of German Engineers (VDI) (for the populations of Nanotechnology, Biotechnology, and Microsystems) and industry experts from the German Energy Agency (for the Renewable Energy population), we identified a sample with a total number of 1,944 firms. We used different databases ("Hoppenstedt" and "The Creditreform Markus Database") to gather quantitative firm information such as, for

instance, the number of employees or the year of foundation of the relevant firms. Moreover, we used the "Factiva" database to gain qualitative information about, for instance, the internationalization actions taken by the firms. Furthermore, in line with Cloninger and Oviatt (2007), we checked the firms' website information and collected other available firm information and company brochures. Second, we conducted twelve informant interviews (with three firms from each technology area) as input for our questionnaire construction. Third, we tested the questionnaire on another twelve representative firms (again, three firms from each technology area) prior to the survey.

We collected the primary data of our study in 2007. To limit common method bias, we sent two questionnaires to collect data of the independent, moderator, and dependent variables from two informants. The first questionnaire was sent to the firm's CEO as he is perceived to have the most profound knowledge of the firm strategy as well as internationalization decisions taken by the firm. The second questionnaire - depending on the firm´s organizational structure - was sent to an informant with expert knowledge about a firm's internationalization, such as the head of strategy, sales, or export. To maximize our response rate, we undertook several measures as suggested by Dillman (2000). Firms received a letter stating the purpose and importance of the research project and subsequently a phone call in which they were requested to participate. We received 335 questionnaires (17.2%) of which 44 firms had two respondents. As we surveyed the total populations of German Nanotechnology, Biotechnology, Microsystems, and Renewable Energy firms, our sample included both international firms and firms with activities exclusively in the domestic market. Our sample includes n = 248 firms with international activities and n = 87 firms with explicit activities only on the domestic market. This is a percentage of 74% internationally acting and 26% domestically acting firms, which is consistent with the secondary information that we collected in databases and on the firms' websites prior to the questionnaire-based survey.

In order to define INVs we refer on existing literature. The most dominant threshold applied to define INVs is internationalization within six years after company foundation (e.g. Shrader, 1996; Zahra et al., 2000). This time span is largely regarded as appropriate, because it balances between validity of available firm data and distinguishing power from SME internationalization. Therefore,

"the operational definition of a new venture within the entrepreneurship literature is up to 6 […] years of age (Fernhaber et al., 2008: 272)". Accordingly, we follow this stream of research and apply the same reasoning to define INVs as independent firms, which enter foreign markets within the first six years after inception. We included only those firms into our analyses which complied with this definition resulting in a final sample of n = 138. The average firm age of the companies in our sample was about nine years and the average age at first internationalization was two years, realizing on average 39.6% of their annual sales abroad. On average, the firms in our sample internationalized into nine foreign markets. These statistics show a very proactive internationalization behavior among the firms in our sample.

We controlled the returned questionnaires for non-response bias according to Armstrong and Overton (1977). We compared early and late respondents in terms of selected constructs, such as size and age. A t-test showed no significant differences ($p < 0.05$). Thus, results indicate that differences between respondents were not related to non-response bias.

4.2. Measurement

International scale and international scope. In addition to the pace of internationalization two aspects of new ventures' internationalization have attracted particular attention: the scale of internationalization and the scope of international activities (Preece et al., 1998). International scale is mostly classified as the percentage of foreign sales to total sales in INV research and provides information about the importance of international business compared to domestic business. The scope of internationalization is mostly defined as the number of foreign markets a firm has international activities with. It "denotes a firm´s increased reliance on foreign markets as a means of growth and financial performance" (Hitt et al., 1997: 780). Prior studies often confounded both dimensions into one index to measure the degree of internationalization (e.g. Hitt et al., 1997; Tallman and Li, 1996). This might be reasonable when observing large multinational enterprises´ (MNEs) internationalization (Sullivan, 1994) but has shortfalls with regard to INVs. Studies argued that merging international scale

and scope measurement is problematic regarding INVs since international acting firms are not necessarily global acting firms (Hordes et al., 1995). INVs may venture in multiple countries at a high scale, but also might restrict their activities on just a few markets. Scope and scale of international activities also have different implications for INVs´ resource commitment and risk diversification. Acting in numerous foreign markets on a low scale usually binds more resources than focusing internationalization on few markets on a high scale (Brouthers et al., 2009). International scope increases managerial complexity and transaction costs (Hitt et al., 1994). Moreover, cross-national differences in government regulations, trade policies, and currency fluctuations create additional risks (Brouthers et al., 2009). On the contrary, high international scope makes a venture less vulnerable to demand fluctuations or structural changes in single foreign markets. Because of those differences between international scale and international scope we follow recent IE studies (e.g. Hordes et al., 1995; Preece et al., 1998) and decided not to merge the two dimensions into one index but to observe them separately to study INV internationalization.

Our dependent variables are measured with established indicators. For international scale we applied the percentage of foreign market sales to total sales as proposed by various scholars (Brouthers et al., 2009; Preece et al., 1998). To measure international scope we used the number of foreign countries served (Shrader et al., 2000). We decided for this measurement since it provides more fine grained information than only measuring the number of continents as proxy for international scope (Preece et al., 1998). As some studies combined both dimensions into one index to measure the degree of internationalization (Hitt et al., 1997; Tallman and Li, 1996), we checked zero-order correlation between both variables. The intermediate correlation of 0.42 underpins our decision to separately evaluate international intensity and scope for our sample of INVs even though the two variables might be interconnected to a certain degree.

Knowledge intensity. To measure knowledge intensity, we adapted a three-item scale developed by Yli-Renko et al. (2002). Questions yielded the technological excellence of the firm such as “we are known for our excellent technological expertise and knowledge” (Likert scale from “1=do not agree” to “5=strongly agree”). We applied multi-item measurement covering the different aspects of

knowledge intensity. Factor analysis shows the items loading on one factor delivering a scale with a Cronbach´s alpha of 0.78.

International network contacts. We measure international network contacts in terms of two aspects: the size as well as the strength of international network contacts. The *size* is measured by combining two questions about the number of partnerships or network ties a new venture has with foreign companies (SMEs, or MNEs respectively), as suggested by various authors (Baum et al., 2000; Reuber and Fischer, 1997). To determine the total number of partnerships a new venture holds abroad, the two measurements are merged into one index. The *strength* is measured by asking for the frequency of contact with the most important international cooperation partner (Dyer and Singh, 1998; Kale et al., 2000). This is also in line with the findings by Uzzi (1997) stating that constant communication is an indicator for strong networks.

Control variables. We included **firm age, age at internationalization,** the **team size at foundation, prior founding experience, prior international experience, international growth orientation** and **learning orientation** as control variables since these covariates have proven their explanatory value for the phenomenon of INVs. Firm age and team size at foundation have high importance in prior entrepreneurship research (Chandler and Hanks, 1994). Both can be seen as proxies for the firm's resource endowment, which is of particular interest when focusing on the internationalization of new ventures. Firm age is measured by subtracting the year of firm foundation from the year of data collection (2007). Team size at foundation is directly measured by asking about how many persons constituted the founding team of the firm. Age at internationalization has been shown to impact international expansion and growth (Sapienza et al., 2006). Hence, it is important to include this variable into our model. Age at internationalization is measured by subtracting the year of company foundation from the year of first internationalization of the firm. Prior founding experience potentially influences the capability to cope with the complexity of international operations (McDougall et al., 2003). We applied a dichotomous measurement asking whether prior founding experience existed or not. In order to measure prior international experience we adapted two questions from Bloodgood et al. (1996). One example is whether or not the person with the most international

experience has already worked in an internationally operating company. Both items are merged and binary coded ("0" if no international experience exists and "1" if at least one aspect was answered positively). This type of coding is applied, since "the relationship between international experience and organizational outcomes is unlikely to be linear across time or across individuals and strategic management literature suggests that exposure to a particular type of experience, regardless of its length, is likely to be consequential (Reuber and Fischer, 1997: 816)". International growth orientation was measured with a three items scale (Autio et al., 2000; Nummela et al., 2004; Yli-Renko et al., 2002) with a Cronbach´s alpha of 0.75. An example item is "The growth we are aiming at can be achieved mainly through internationalization". Learning orientation was also measured with three items (Emden et al., 2005; Hult and Ferrell, 1997; Sinkula et al., 1997), resulting in a scale with a Cronbach´s alpha of 0.85. One example item is "Learning in this organization is viewed as key to organizational survival". International growth orientation and learning orientation have both been shown to play an important role for international new venturing and this is why we decided to control for these variables in our models (Tuppura et al., 2008).

4.3. Assessing common method variance

We undertook several procedures recommended by Podsakoff et al. (2003) to reduce and evaluate the magnitude of common method bias. First, we assessed the interrater reliabilities for the 44 firms in which we obtained data from two respondents. Intraclass correlation coefficients (ICC) for our scales exhibited high interrater reliability (Shrout and Fleiss, 1979), all at the 0.000 level: for instance, network strength (ICC = 0.71) and international experience (ICC = 0.74).

Second, following Podsakoff and Organ (1986), we used the Harman's one-factor test to assess the influence of common method bias. Principle component factor analysis based on the dependent, independent, moderator, and control variables of our model revealed three factors with an eigenvalue above 1. These three factors accounted for 49.0% of the total variance; the first factor accounted for 19%, the second factor for 16% and the third factor for 14% of the total variance. Thus, no single factor emerged, nor did one factor account for most of the variance. A substantial amount of common

method variance is present either if a single factor will emerge from the factor analysis or if one general factor will account for the majority of the covariance among the variables (Podsakoff and Organ, 1986; Podsakoff et al., 2003).

Third, we checked the firm's website information, brochures, and other available firm information (Cloninger and Oviatt, 2007) to verify the information from our survey. Furthermore, we used available secondary information on the number of employees worldwide and the year of foundation for the firms in our sample from the Markus database. We performed statistical tests to compare our primary data with these pieces of secondary source information. Paired-sample t-tests showed that the differences in means between the information collected by survey and the Markus data were insignificant. Overall, these results suggested little threat of common method bias and provided support for the validity of our measures.

4.4. Analytical approach

In advance of conducting regression analysis, we tested the independent variables for multicollinearity by calculating zero order correlations as well as variance inflation factors (VIF) for all independent variables (table 1). The results show no significant risk for multicollinearity since no correlation exceeds 0.7 (Anderson et al., 1996). Moreover, all VIF values stay below 4.0 (Neter et al., 1983) and even below 2.5 (Allison, 1999).

Insert Table 1 about here

To test our set of hypotheses, we applied hierarchical regression analysis (Cohen et al., 2003). As proposed by Aiken and West (1991), establishing different models allows for a comparison between alternative models with or without interaction terms by showing changes in R^2 and, therefore, delivers an indicator for the explanatory power of the moderator effects. To analyze the hypothesized

moderator effects, we mean-centered the variables before creating interaction terms in order to avoid multicollinearity (Aiken and West, 1991).

In order to provide richer information about the interaction terms, we plotted the significant interactions and calculated simple slope analysis (Cohen et al., 2003). As suggested, we selected a low and a high score on the moderator variable to illustrate the curves. The low level condition was defined as a standard deviation below the mean of the moderator, and the high level condition as a standard deviation above the mean of the moderator.

Insert Table 2 about here

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5. Results

Table 2 shows the results of the hierarchical regression analysis. Model 1 provides the results for the dependent variable international scale, model 2 for international scope. In Model 1a and 2a, we included the control and predictor variables, which together explain a significant proportion of the variance in the dependent variable (Model 1a: $R^2 = 0.39$, $p < 0.001$; Model 2a: $R^2 = 0.24$, $p < 0.001$). In Model 1b and 2b, we entered the interaction terms to test our moderator hypotheses. The model leads to higher variance explanation compared to the models without interaction terms (Model 1b: $\Delta R^2 = 0.04$, $p < 0.05$; Model 2b: $\Delta R^2 = 0.03$, $p < 0.10$) supporting our assumption that the interaction effects have a significant impact on the scale and scope of new ventures' internationalization. To better understand the interaction effects we plotted them according to the procedure proposed by Cohen et al. (2003). Figures 2 and 3 show the two-way interaction plots.

In Hypothesis 1 we argued that international network strength will positively moderate the impact of knowledge intensity on the international scale and scope. As shown in Models 1b and 2b the interaction terms have a significant positive value supporting our hypotheses 1a and 1b. The plots shown in Figure 2 as well as simple slope analysis supplement the numerical information. As outlined, knowledge intensity only positively impacts international scale and international scope if accompanied

by high network strength. The slope of knowledge intensity is significantly positive for international scale ($b = 22.36$, $p < 0.05$) and international scope ($b = 6.99$, $p < 0.05$). At low levels of international network strength, knowledge intensity does not impact international scale ($b = -1.88$, n.s.) and international scope ($b = -0.69$, n.s.).

Insert Figure 2 about here

Next, Hypotheses 2a and 2b stipulate that international network size negatively influences the relationship between knowledge intensity and international scale and scope. Supporting hypothesis 2a, the results in Model 1b show that the interaction between knowledge intensity and international network size has a negative effect on international scale. Hypothesis 2b has to be rejected. Although the interaction term between network size and knowledge intensity has a negative influence on international scope, the effect is not significant. Figure 3 provides a more detailed perspective on the relationship between knowledge intensity, network size, and international scale. As illustrated knowledge intensity impacts international scale only if the international network has a restrained size. This is underlined by simple slope analysis. The slope at a low level of international network size is significantly positive ($b = 28.06$, $p < 0.05$) while the slope for high network size is not significantly different from zero ($b = 3.18$, n.s.). Hence, when the size of the network becomes too big and consequently too loosely connected such a network has a counterproductive influence on the scale of a firm's internationalization.

Insert Figure 3 about here

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6. Discussion

The aim of our study was to investigate the moderating effects of international network strength and size on the relationship between knowledge intensity and international new venturing. We found that several significant effects could be attributed to the moderating role of international networks, enriching the theoretical as well as practical discussions about INVs. International network strength increases the positive impact of knowledge intensity on the scale and scope of international activities. If an INV fosters close relationships with international partners it can better exploit its inherent knowledge. High-tech products can be distributed more easily and with lower transaction costs, since a close international network provides security. "[D]ensity (or 'closure') facilitates the role of social capital that allows for reputation effects, trust, social norms and social control (Gilsing et al., 2007: 230)". Risks of patent infringement and product piracy are reduced by a strong international network, which allows a higher degree of international activity from early on. Not only the international scale increases this way, but also the number of countries served, and thus international scope as well.

Strong international networks appear to provide both greater protection against failure and a better chance to distribute a firm´s products on a higher international scale and scope. Thus, an intensive contact to foreign partners fosters the expansion of knowledge intensive products and services on international markets. This underscores theoretical arguments concerning the role of social capital. According to extant literature in this research field, intensive cooperation and communication among network partners is fundamental for the creation of knowledge and innovation (Nahapiet and Goshal, 1998). Intensive contact prevents intra-network opportunism and fosters the diffusion of relevant knowledge, such as market knowledge. A strong network provides both security for market operation, which is especially important for high-technology firms (Chetty and Agndal, 2007) and opportunities for market development initiating international growth (Selnes and Sallis, 2003). Thus, knowledge-intensive firms profit from strong international networks and may expand their international activity close to inception. Concerning the impact of network strength, our results further show that INVs which fail to establish a strong international network have a comparative disadvantage in terms of knowledge exploitation. As figure 2 and simple slope analyses illustrate, INVs with low

network strength do not profit from knowledge intensive products. This may have fatal consequences for INVs survival, since the initial R&D expenses are less efficiently recouped.

Interestingly, the size of the international network works conversely. While international network strength positively moderates the impact of knowledge intensity on scale and scope of internationalization, the international network size negatively moderates the impact of knowledge intensity on international scale. Thus, in such case, knowledge intensity will be rather a deterrent to internationalization than a facilitator.

We add to the previous literature, because our results suggest that international networks also have a liability side for international new venturing. Nourishing a big international network does not provide the same level of security than a closely related network and even increases the propensity for opportunistic behavior. In a loose network, large size could more easily cause diffusion of the knowledge base, eroding an INV's competitive advantage. Previous researchers already mentioned that alliance scope aggravates the protection of technological assets as mutual exposure of core technologies increases (Khanna, 1998; Li et al., 2008; Oxley and Sampson, 2004; Sampson, 2007). The same rationale seems to apply to international network size: As the network grows, technologies can more easily disseminate as more contact points to external firms exist. An INV will recognize this threat and restrain international activity to avoid this disadvantageous outcome.

As to the liability side of international networks we enrich prior findings from the social capital literature suggesting partial negative effects of networks. According to recent studies, some network characteristics are meant to potentially increase organizational inertia (Maurer and Ebers, 2006) and restrain innovative capabilities (Leonard-Barton, 1992). However, most studies that mention a liability side of networks conclude that these mainly occur to closely held ties and less open networks. These studies assert that a big and loosely connected network supplies firms with more information and a higher information diversity providing a fruitful ground for innovative ideas (Maurer and Ebers, 2006). Moreover, a close network may foster undesired obligations and normative pressure reducing a firm’s flexibility (Knoke, 2009).

Our results show, that in particular strong networks and close interactions help knowledge intensive firms to expand international activities, and thus to quicker amortize R&D spending and to better reduce risk by diversifying internationalization. We add to previous literature and based on our empirical findings we suggest that different rules apply to INVs than for other firms. The studies cited above mainly draw on traditionally internationalizing firms and MNEs, which pursue different internationalization patterns and face less resource limitations (Tuppura et al., 2008). Hence, our study offers new insights which earlier works were unable to provide due to their empirical focus.

We state that for INVs having a considerable knowledge base which needs protection a close international network better helps to benefit from internationalization. Having close partners in international markets provides security and prevents problems that "arise from transaction-cost opportunism" (Knoke, 2009: 1695). A higher degree of interaction lowers monitoring costs and prevents unintended knowledge appropriation among the international network.

A big network is harder to monitor, especially for INVs. A profound monitoring of network partners binds financial as well as managerial resources. INVs lack these resources, making it eventually impossible to have an eye on every network partner in big, loosely connected networks. MNEs on the other hand may have the required resource base to monitor a big network and thus avoid its shortfalls while profiting from its innovative benefits. Moreover, MNEs have better capacities to cope with patent infringements. While an INV may face bankruptcy, an MNE may still have enough resources to initiate legal countermeasures and to survive the costs due to product piracy and legal charges. Therefore, INVs may better pursue small, but closely related networks to protect their inherent knowledge.

Our paper makes theoretical contributions as well. To theoretically ground our assumptions about the relationships between knowledge intensity, networks, and internationalization we augmented traditional economic reasoning from TCE with elements of Structural Embeddedness. Despite multiple attempts to extend TCE towards a more holistic view (e.g. Brouthers, 2002; Delios and Beamish, 1999; Erramilli and Rao, 1993; Makino and Neupert, 2000), only few studies have applied sufficient theoretical rigor and foundation. Developing a holistic framework based on TCE as well as Structural

Embeddedness, the present paper offers a valuable contribution to the pertinent literature. The framework developed has proven worthwhile for studying the relationship between knowledge intensity, networks, and internationalization.

7. Limitations and Implications for Further Research

As is the case for most empirical studies, several limitations apply to our study. First, as internationalization is more a process than a state, a lack of longitudinal data for the INV phenomenon created measurement problems. Longitudinal research designs could delineate changes over time, and show if INVs develop gradually in terms of international scale and international scope. Changes in the international scale and scope or management cognition can only be analyzed in depth when powerful longitudinal data is available. This would help to clarify if changes in the variables used really result in a change of international scale and scope.

Second, even though multiple technologies were included, this study only focused on German technology-based companies, and therefore lacks comparative value on an international level. We cannot state if influential factors vary across different countries or cultural regions. Third, an observation of the cultural distance between an INV's country of origin and the focal markets could provide further information. Companies acting in a very restricted geographical area (e.g., Europe) do not have to cope with such psychically distant cultures, laws, and business practices as firms acting in geographically as well as culturally distant markets. Such firms may be more dependent on the prior experience of their founders or strong networks than INVs which mainly act in culturally close areas.

One could also criticize the high level of knowledge intensity in our sample, eroding its direct effect on international scale and scope due to limited variance. It is true that our sample mostly consists of high technology firms which is also depicted by the high mean value of knowledge intensity in our sample. However, we did not intend to observe the direct effect of knowledge intensity or international network strength and size on international scale and scope but the interaction of these effects. Measuring the direct impact of our core variables certainly would require a more comprehensive sample including traditional manufacturing industries or even service firms. The direct

effects of knowledge intensity and international networks on INVs' internationalization have been asserted and found by many studies (e.g. Autio et al., 2000; Weerawardena et al., 2007). The present study set an emphasis on the interaction between knowledge intensity and international networks. More specifically, we observed how knowledge intensive firms can best exploit their inherent knowledge base for internationalization and if the network size or the network strength provide the ground for effective international knowledge exploitation. Accordingly, focusing on high technology firms is rather a strength than a limitation of this study since we need firms with both, inherent knowledge and international activities at a young age to make suggestions about the interactive impact of knowledge intensity and international networks on new ventures' internationalization.

Our paper has some implications for management practice. The results show that it is important for managers of technology firms to foster strong and closely interrelated network contacts if they aim at international expansion and a high international diversification. A loosely connected big network may even lead to counterproductive results and may negatively influence the internationalization activities of the firm. This is of particular importance for technology firms, since they might lose their unique assets if they are operating in international networks which are hardly to monitor. Management practice may want to pay particular attention to this issue.

Furthermore, we provide insights into liability aspects of networks which still require further investigation. A growing body of literature (Chetty and Agndale, 2007; Nahapiet and Ghoshal, 1998) mentions concerns regarding a too positive view on the effects of firm networks, omitting the potential problems arising from network embeddedness. Instead, most research addresses the problem of being over-embedded and less open for new input and innovation capabilities (Maurer and Ebers, 2006). More research is needed to show which network characteristics may be potential risks for firms, at what levels and under which circumstances.

Our contribution to IE research is a more differentiated view of the effect of networks on internationalization. Networks are meant to be an integral part of INVs, as already proposed by the seminal framework developed by Oviatt and McDougall (1994). Alternative governance structures such as networks facilitate internationalization by enabling opportunity spotting, reducing liabilities of

foreignness, and generating learning advantages. Against the largely dominating positive view of networks in IE research (e.g. Coviello, 2006), we show that networks may also be problematic for internationalization and may hamper the exploitation of knowledge intensity in foreign markets. In particular, knowledge intensive firms require international expansion in order to amortize R&D expenditures (Knight and Cavusgil, 2004). It is worthwhile to know about influential factors which deter the exploitation of knowledge intensity in foreign markets, as they may have direct implications for INV growth and subsequent survival. Thus, more research is needed on the interplay between networks and international new venturing to recognize which network characteristics provide opportunities for internationalization and which may be problematic under some conditions. Accordingly, research should increasingly be devoted to the liabilities of networks, and how these liabilities might be overcome.

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TABLES AND FIGURES

FIGURE 1
Research Model

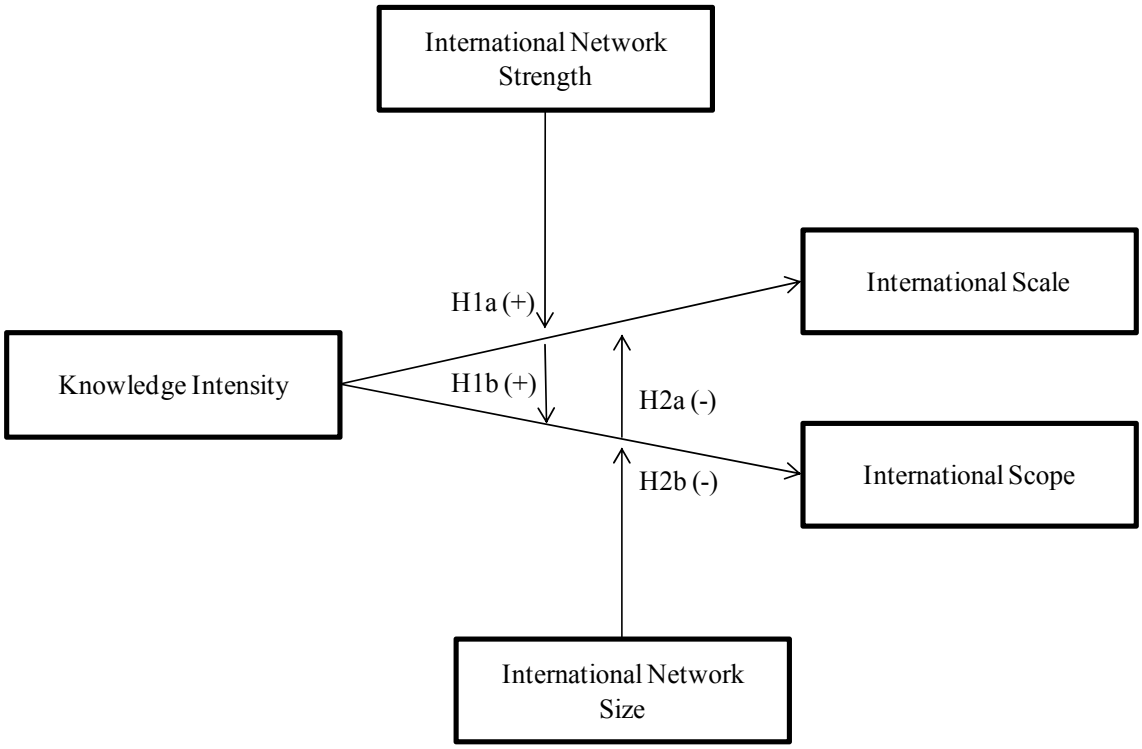
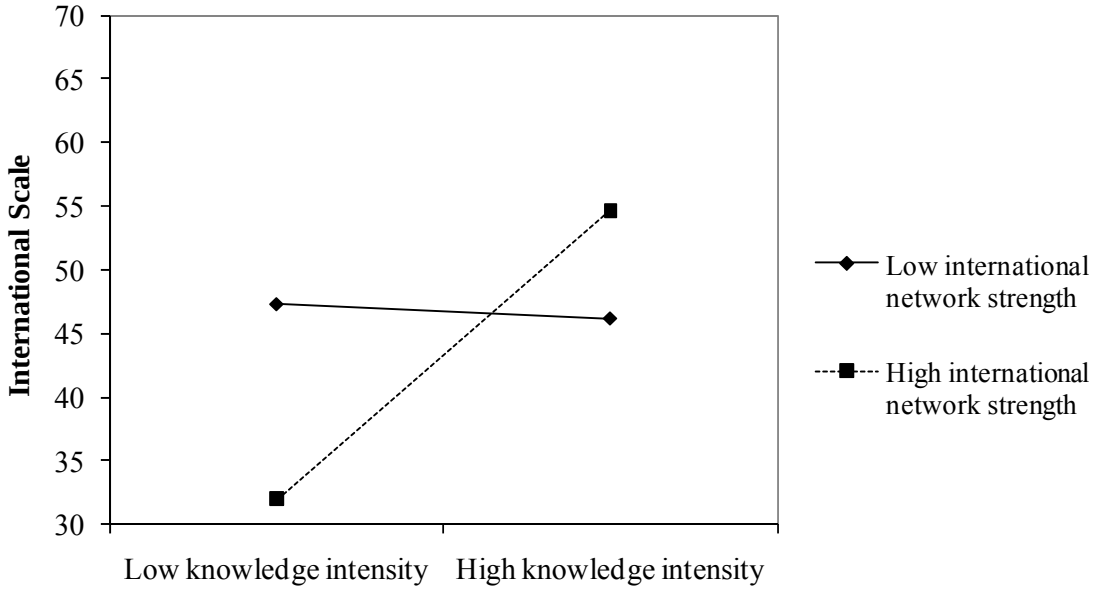


FIGURE 2

Significant Interaction Effects between International Network Strength and Knowledge Intensity



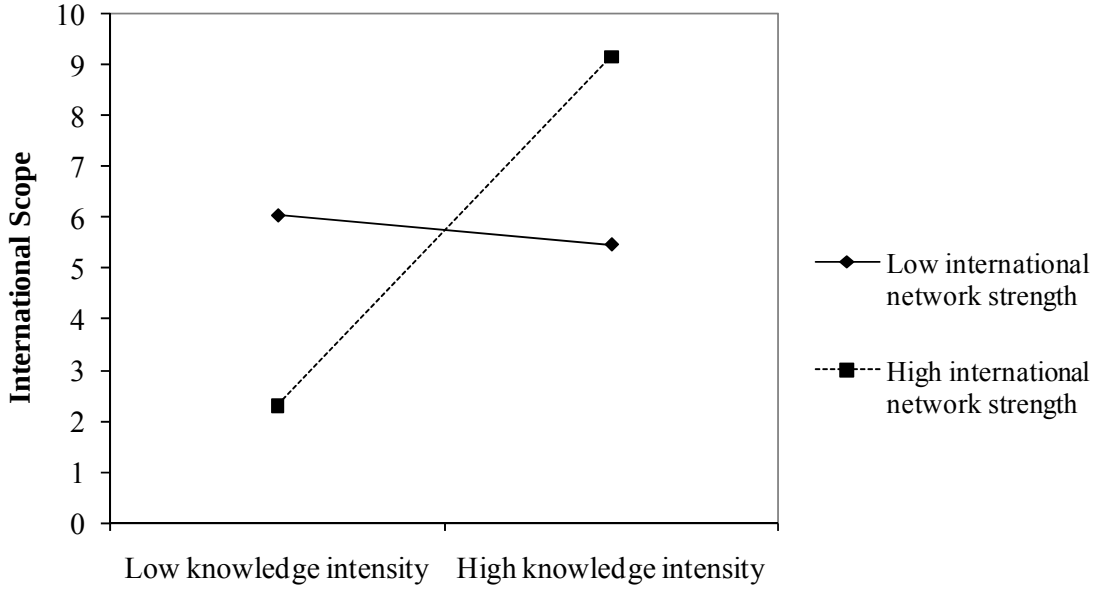


FIGURE 3

Significant Interaction Effect between International Network Size and Knowledge Intensity

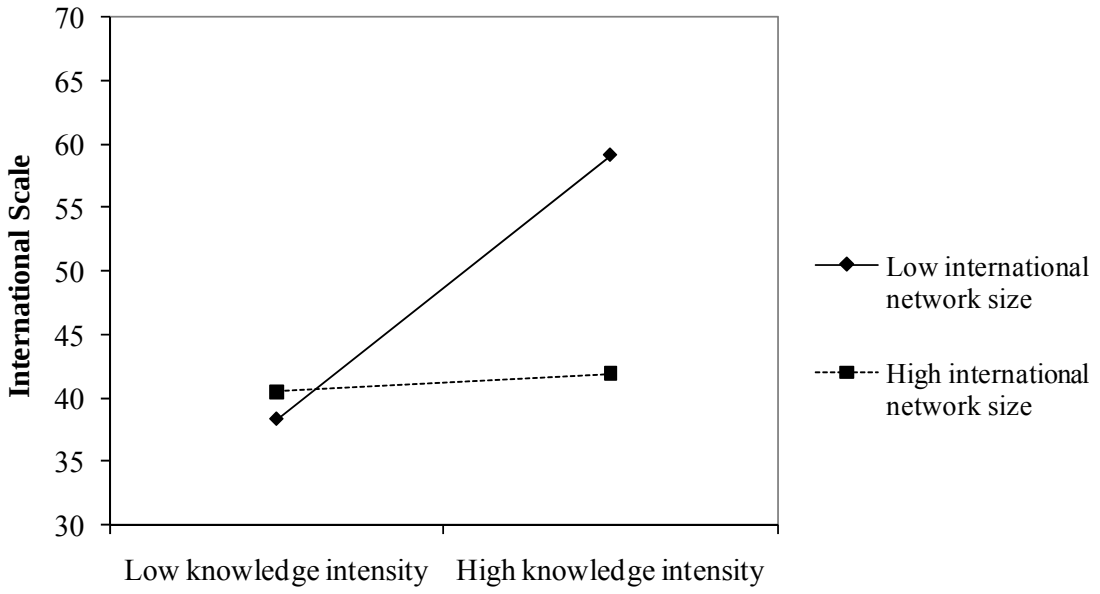


TABLE 1

Means, Standard Deviations and Correlations

Variables	Mean	S.D.	International Scale	International Scope	Knowledge intensity	International network strength	International network size	Firm age	Age at inter-nationali-zation	Teamsize	Prior founding experience	Prior inter-national experience	International growth orientation
International Scale	39.60	28.89	1										
International Scope	9.23	10.30	0.42 **	1									
Knowledge intensity	4.36	0.65	0.14 †	0.11	1								
International network strength	2.27	1.04	0.02	0.02	-0.11	1							
International network size	4.81	7.21	0.00	0.01	-0.11	0.25 **	1						
Firm age	9.17	6.21	0.12	0.34 **	0.04	-0.06	-0.09	1					
Age at internationalization	2.00	1.74	-0.34 **	-0.17 *	-0.08	-0.07	-0.12	0.26 **	1				
Teamsize	3.01	1.71	-0.07	0.02	0.06	0.20 *	0.22 **	-0.12	0.10	1			
Prior founding experience	0.41	0.49	-0.08	-0.04	-0.03	0.01	0.17 *	-0.23 **	-0.03	0.14 †	1		
Prior international experience	0.52	0.50	0.12	0.18 *	0.00	-0.08	-0.03	0.05	-0.28 **	-0.03	0.05	1	
International growth orientation	3.39	1.05	0.46 **	0.17 *	0.11	0.17 *	0.18 *	0.11	-0.08	-0.01	0.00	-0.04	1
Learning orientation	4.38	0.72	-0.10	-0.22 **	0.31 **	-0.04	0.05	-0.05	-0.13 †	0.06	-0.11	0.08	0.02

Note: ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed). † Correlation is significant at the 0.10 level (2-tailed).

TABLE 2

Results of the Hierarchical Linear Regression Analysis

		Dependent Variable: International Scale			Dependent Variable: International Scope	
		Model 1a	Model 1b		Model 2a	Model 2b
Step 1: Control, Independent and Moderator Variables	Firm age	0.18 *	0.21 **	Firm age	0.40 ***	0.42 ***
	Age at internationalization	-0.38 ***	-0.42 ***	Age at internationalization	-0.24 *	-0.26 **
	Teamsize	0.04	0.05	Teamsize	0.14	0.15 †
	Prior founding experience	-0.07	-0.06	Prior founding experience	-0.04	-0.04
	Prior international experience	-0.01	-0.02	Prior international experience	0.13	0.12
	International growth orientation	0.42 ***	0.42 ***	International growth orientation	0.03	0.02
	Learning orientation	-0.20 *	-0.26 **	Learning orientation	-0.24 **	-0.28 **
	Knowledge intensity (KI)	0.10	0.21 *	Knowledge intensity (KI)	0.13	0.19 †
	International network strength (STR)	-0.06	-0.10	International network strength (STR)	0.03	0.00
	International network size (SIZE)	-0.09	-0.13	International network size (SIZE)	0.03	0.02
Step 2: Interaction Variables	KIxSTR		0.22 *	KIxSTR		0.18 *
	KIxSIZE		-0.26 *	KIxSIZE		-0.13
R^2		0.39 ***	0.43 ***		0.24 ***	0.27 ***
Change in R^2			0.04 *			0.03 †

Note: Standardized coefficients are reported; *** Coefficient is significant at the 0.001 level (2-tailed). ** Coefficient is significant at the 0.01 level (2-tailed). * Coefficient is significant at the 0.05 level (2-tailed). † Coefficient is significant at the 0.10 level (2-tailed).