

Corporate risk and external sourcing from foreign suppliers: A Scandinavian stock market approach

(Old title: Corporate risk and internationalization)

Tom Aabo^{a*}, Christos Pantzalis^b, Helle Sørensen^c, and Malene Teilmann Toustrup^d

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Highlights

- Generally, we find a strong, positive relationship between foreign sales and risk
- Data on external sourcing from foreign suppliers is not readily available
- External sourcing from foreign suppliers reduces risk for highly international firms

Abstract

External sourcing from foreign suppliers is an omitted variable in empirical studies on corporate internationalization because data is available neither from databases nor from annual reports. This omission implies that it is impossible to distinguish between firms that source externally from foreign as opposed to domestic suppliers and difficult to distinguish between firms that source externally from foreign suppliers as opposed to internally from production facilities abroad (or at home). Based on a survey of 147 Scandinavian non-financial firms we obtain information on foreign cost ratios and find that external sourcing from foreign suppliers reduces risk (as measured by stock return volatility) for highly international firms. The results suggest that using a network of foreign suppliers for external sourcing is superior in flexibility and environmental risk terms than sourcing from own production facilities abroad. The empirical risk implications of external sourcing from foreign suppliers have not been investigated previously.

Keywords: Corporate risk; Internationalization; Diversification; Operational flexibility; Environmental risk; Foreign costs; Foreign assets; External sourcing

^{a*} Corresponding author.

Aarhus University, Fuglesangs Allé 4, DK 8210 Aarhus V, Denmark.

Tel: +45 8716 4839. Fax: +45 8616 5394. E-mail: taa@asb.dk.

^b University of South Florida, 4202 E. Fowler Ave., Tampa, FL 33620-5500, US.

Tel: +1 813 974 3262. E-mail: cpantzal@coba.usf.edu.

^c Nykredit Realkredit A/S, Kalvebod Brygge 1-3, DK 1780 Copenhagen V, Denmark.

Tel: +45 4455 2017. E-mail: hsm@nykredit.dk.

^d Kids Retail of Denmark, Frederiksholms Kanal 4 st.th., DK 1220 Copenhagen K, Denmark.

Tel: +45 2349 3954. E-mail: mtoustrup@hamleys.dk

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1. Introduction

Empirical large-scale studies on internationalization¹ are generally restricted to the use of measures such as foreign sales ratios, foreign assets ratios, and foreign subsidiaries². However, this excludes a potentially important internationalization aspect: The external sourcing from foreign suppliers. Such information is available neither from databases nor from annual reports. This lack of information implies that it is not possible to distinguish between a firm that sources all its inputs from domestic suppliers and a firm that sources all its inputs from foreign suppliers although we would intuitively categorize the latter firm as being more internationally involved than the former firm³.

Based on a survey of 147 Scandinavian non-financial firms we obtain information on the foreign costs ratios which enable us to investigate the risk implications of external sourcing from foreign suppliers. We find – at least for firms with high levels of foreign sales – that external sourcing from foreign suppliers reduces risk. The results suggest that using a network of foreign

¹ The terms internationalization and multinationality are often used interchangeably. Dunning (1973) defines a multinational firm as a firm with production facilities in more than one country. We use the more broad term internationalization. Vahnle and Ivarsson (2014) distinguish between 1) firms that are in a state of internationalization with limited geographical spread and/or coordination and 2) firms that have passed this stage and have become “globalized” with wide geographical spread and coordination of activities. We use the term internationalization and encompass both “internationalized” and “globalized” firms.

² Aggarwal, Berril, Hutson, and Kearney (2011) examine 393 studies in which internationalization is conceptualized. They find that 264 studies employ single-attribute measures. Of these 163 studies use measures based on the number of foreign subsidiaries, and 62 studies employ measures based on sales. Other measures utilized include characteristics such as foreign assets, foreign production, foreign joint ventures, foreign profits, international transactions, foreign investments, foreign M&A activity, foreign employees, foreign exchange listings, foreign equity, foreign R&D, international marketing and patents.

³ Based on the foreign assets ratio and the relative size of the operating assets of the firm, it may be possible to guesstimate 1) the relative size of foreign production from own production facilities abroad versus domestic production from own production facilities at home and 2) the relative weights of own production versus external sourcing. However, it is impossible to guesstimate the relative size of external sourcing from domestic suppliers versus external sourcing from foreign suppliers.

suppliers for external sourcing is superior in flexibility and environmental risk terms than sourcing from own production facilities abroad.

Scandinavian firms are interesting objects for investigation because the Scandinavian economies are small and open which *ceteris paribus* forces Scandinavian firms to be highly international. Vahnle and Ivarsson (2014) find global external sourcing to be an important aspect in the internationalization of a sample of large multinational manufacturing firms based in Sweden. Kogut and Kulatilaka (1994) argue that an important area not investigated is the potential ability – as seen in the apparel industry - of firms “to write short-term contracts that allow the buying firms to switch suppliers based upon changes in costs and exchange rates”. To the best of our knowledge, the empirical risk implications of external sourcing from foreign suppliers have not been investigated previously in large scale format.

Our main focus is the risk implication of external sourcing from foreign suppliers. However, to address this question we initially have to address the more general question of the risk implications of internationalization as such. The answer is not straightforward neither theoretically nor empirically. On the one hand, a firm that is international reduces corporate risk through diversification. Shapiro (1978) argues that operating in a number of countries whose economic cycles are not perfectly in phase generates foreign cash flows that are not perfectly correlated with domestic cash flows. Furthermore, a firm that has production facilities in several countries may reduce risk through the ability to switch production in accordance with market developments (e.g. Allen and Pantzalis, 1996; Capel 1997). On the other hand, a firm that gets more international whether in terms of sales or production faces a set of new risks (termed

“environmental risks”) such as foreign exchange rate risk (e.g. Bartov, Bodnar and Kaul, 1996) and new political, regulatory, and/or social risks (e.g. Shaked, 1986). Thus, from a theoretical point of view the relationship between corporate risk and internationalization is ambiguous. Some empirical studies find a positive relationship between the firm’s degree of internationalization and its corporate risk (e.g. Goldberg and Heflin, 1995; Reeb, Kwok, and Baek, 1998) while other studies find a negative relationship (e.g. Hughes, Logue, and Sweeney, 1975; Fatemi, 1984; Michel and Shaked, 1986).

We use the stock market approach for measuring corporate risk. Specifically we measure corporate risk in terms of monthly stock return volatility⁴. We prefer such a measure to measures based on accounting numbers because stock prices are forward looking (as opposed to backward looking) and fixed often (as opposed to yearly on in best case quarterly data on accounting measures).

Generally, we find a strong, positive relationship between foreign sales and risk. A median firm with a median level of foreign sales is associated with a level of risk one third higher than a median non-international firm. Thus, the risk increasing environmental aspect more than outweighs the risk reducing diversification and flexibility aspects. More importantly and specifically, we find – at least for firms with high levels of foreign sales – that external sourcing from foreign suppliers reduces risk. A median firm with a median level of foreign costs but no foreign assets (= external sourcing from foreign suppliers) is associated with a risk level one third lower than a similar firm with a median level of foreign assets (= sourcing from own

⁴ Previously used by among others Guay (1999), Cassell, Huang, Sanchez, and Stuart (2012) and Kini and Williams (2012). Please refer to the next section for empirical studies on internationalization that have used stock return volatility as a risk measure.

production facilities abroad). Both our general results and our specific results are statistically significant and economically meaningful.

Our study has important policy implications for corporate managers and investors. First, all things equal, an international firm of today is more risky than a similar domestic firm. Second, the operating flexibility from having production facilities abroad may be inferior to the flexibility from external sourcing from a network of foreign suppliers. Note that our focus is solely on the risk implications and we do not attempt to make recommendations on the optimality of various actions in a risk / return framework.

We organize the paper as follows. Section 2 reviews relevant literature and states hypotheses. Section 3 describes the methodology and the data. Section 4 shows descriptive statistics. Section 5 performs a simple univariate analysis. Section 6 performs a multivariate regression analysis and discusses the findings. Section 7 concludes.

2. Related literature and hypotheses

Below we briefly describe three factors that affect the relationship between risk and internationalization, we relate our measure of firm risk to the literature, and we provide a short focused survey of the empirical literature.

According to the traditional portfolio framework (Markowitz, 1952) a multinational firm can be viewed as the grouping of several local firms. To the extent that foreign cash flows are

not perfectly correlated with those of domestic investments, the overall risk associated with variations in cash flows may be reduced (Shapiro, 1978). The portfolio framework is a “passive” framework where interactions between facilities in different locations are disregarded. This is a valid approach for an investment in a portfolio of shares in firms headquartered in multiple countries but it does not apply directly to a portfolio of real assets. According to real option theory a manager of a non-financial firm with activities in various countries will naturally try to exploit the inherent flexibility of such an international network of operations. Thus, internationalization potentially lowers exposure towards principal market risks such as adverse changes in factor costs, demand conditions or exchange rate movements (e.g. Allen and Pantzalis, 1996; Capel, 1997).

Environmental risks consist of political, cultural, economic, and financial risks (Goerzen, Sapp, and Delios, 2010). Burgman (1996) argues that political risks could more than offset potential diversification benefits from operating in a large portfolio of foreign countries. Thus, a multinational firm will encounter risks that a domestic firm is either isolated from or not as severely affected by. Multinational firms are faced with the challenge of adapting their managerial processes, legal contracts, and customer/supplier relationships to the local conditions and thus exposed to more risk than comparable domestic firms (Meyer, 2001; Roth and O'Donnell, 1996; Feinberg and Gupta, 2009; Pantzalis, Park, and Sutton, 2008; Shane, 1994). Industrial organization theory suggests that as firms grow they become more complex. This complicates operational and strategic decision making and reduces the firm's ability to adapt to disruptive changes in the external environment (Gavetti and Rivkin, 2007). As argued by e.g. Kim and Mathur (2008) such risks are further amplified when firms expand internationally due

to cultural differences, staffing complications, and the addition of hierarchical levels to their organizational structure. A survey by Dewhurst, Harris, and Heywood (2012) indicate that global organizations struggle to adapt to local conditions due to organizational rigidities.

The environmental risk argument favors a positive link between internationalization and corporate risk while the diversification and the flexibility argument favor a negative link internationalization and corporate risk. We have two opposing hypotheses:

Hypothesis 1. There is a positive link between internationalization and corporate risk.

Hypothesis 2. There is a negative link between internationalization and corporate risk.

We address the general relationship between internationalization and risk for our Scandinavian firm in the regression analysis. More importantly, we address to what extent external sourcing from foreign suppliers is likely to be risk reducing or risk increasing. Sourcing from foreign suppliers is likely to be more flexible and less committing than the establishment and use of own production facilities abroad. Aabo and Simkins (2005) find that firms are much more likely to change sourcing between suppliers in different countries than to shift production between production outlets in different countries or to establish production in a country because of the development of exchange rates. Furthermore, having a network of foreign suppliers involves less commitment than production facilities abroad and is therefore also associated with less environmental risk (e.g. political/country risk). However, if the firms in question are predominantly domestically oriented, external sourcing from foreign suppliers is likely to

increase net cash flows from abroad (=no counterweigh in form of foreign sales) and thus increase risk. We have two opposing hypotheses:

Hypothesis 3. External sourcing from foreign suppliers reduces risk.

Hypothesis 4. External sourcing from foreign suppliers increases risk.

We measure firm risk by stock return volatility. We use stock returns as opposed to accounting returns to measure risk because the former 1) is forward looking and 2) contains many observations. Stock return volatility is affected by general market developments (systematic risk)⁵ and firm-specific developments (idiosyncratic risk) with the latter outweighing the former. Goyal and Santa-Clara (2003) find that the effect of idiosyncratic risk constitutes almost 85% of the average stock variance measure. Thus, our measure of risk predominantly measures risk related to the specific firm (and its firm-specific internationalization). Guay (1999) notes that stock return volatility measures equity risk and not firm risk. Most debt in our sample firms is not listed on exchanges and we cannot observe the volatility of changes in the price of such debt. However, a stock is an option on firm value and its value is sensitive to the volatility of firm value. Thus, we use stock return volatility as a proxy for firm risk. We exclude firms with negative book equity values to avoid stocks that are likely to behave like out-of-the money options on firm value (i.e., correspondingly where the correlation between stock value and firm value is likely to be low).

⁵ We generally do not find significant results (for the sake of brevity not reported) if we narrow our investigation to systematic risk (beta). We attribute this finding to two opposing forces in line with the reasoning of Reeb, Kwok, and Baek (1998): A correlation between markets that is less than one but generally a higher volatility on foreign markets seen from the perspective of a developed country. An alternative explanation is the poor performance of the Capital Asset Pricing Model (CAPM) in quantifying systematic risk especially for firms with growth options (Grullon, Lyandres, and Zhdanov, 2012).

Previous work using stock return volatility as the measure for corporate risk do not show a uniform pattern. Hughes, Logue, and Sweeney (1975) compare 46 multinational US firms and 50 purely domestic US firms in the period 1970 – 1973 and find a negative relationship. Fatemi (1984) analyzes 84 US multinational firms and 52 US domestic firms in the period 1971 – 1980 and finds a negative relationship. Michel and Shaked (1986) analyze 58 US multinational firms and 43 domestic manufacturing firms in the period 1980 – 1982 and find a negative relationship. Goldberg and Heflin (1995) examine 187 US multinational firms in the period 1977-1987 and find a positive relationship. Kwok and Reeb (2000) investigate 1,921 multinational firms from 32 different countries and find a positive (negative) relationship for firms based in more developed (less developed) economies making investments in less (more) developed markets.

3. Data and methodology

This study is based on large and medium-sized (i.e., with at least 50 employees and an annual turnover and balance sheet total of minimum EUR 10 million), Scandinavian, listed, liquid (excluding stocks with thin trading), non-financial (excluding NACE Rev. 2, section K: Financial and insurance activities) firms. The population of 472 firms that meet these restrictions were approached in an online questionnaire survey in Spring 2012. We targeted the CFOs of the firms whenever possible and reached a response rate of 33% (158 firms). We furthermore eliminated 11 firms because we require our firms to have positive equity values, have international activities (foreign sales, foreign costs, foreign assets, and/or foreign debt), and have an annual turnover and balance sheet total of minimum EUR 10 million according to the recent

2011 annual reports. Thus, we reached our final sample of 147 Danish (36), Norwegian (32), Finnish (24), and Swedish (55) firms. 76 firms are manufacturing firms and 71 firms are non-manufacturing firms⁶. Information on our sample firms is drawn from the survey (internationalization variables) and the Orbis database (control variables).

No significant non-response bias is detected in relation to size, capital structure, industry diversification, economic sectors, or stock return volatility. There is some indication that the sample firms have on average a higher profitability (return on equity) and growth potential (Tobin's Q). Danish firms are more willing to respond (48% response rate) and Finnish firms less willing to respond (25% response rate) than the average. Apart from these differences, our sample seems to be representative for the population of firms.

The Scandinavian countries are all small (5-9 million inhabitants), wealthy (GDP per capita comparable to the U.S.), and open (export of good and services 41%-54% of GDP) economies. They are characterized by well-developed welfare models, low levels of corruption (Transparency International), and high rankings on "ease of doing business" (World Bank). They are all members of UN, WTO, and OECD. Their main export partners are northern European countries (especially Germany) with the addition of the US (all four countries), France (Norway), Russia, and China (Finland). There are, however, also differences between the four countries. Thus, Denmark, Finland, and Sweden are longtime members of EU while Norway is

⁶ The 147 firms are distributed as follows in terms of industrial sectors (NACE 2. Rev.): (A) Agriculture, forestry and fishing = 1; (B) Mining and quarrying = 6; (C) Manufacturing = 76; (D) Electricity, gas, steam and air conditioning supply = 2; (F) Construction = 3; (G) Wholesale and retail trade; repair of motor vehicles and motorcycles = 11; (H) Transportation and storage = 10; (J) Information and communication = 22; (L) Real estate activities = 2; (M) Professional, scientific and technical activities = 7; (N) Administrative and support service activities = 4; (R) Arts, entertainment and recreation = 2; and (S) Other service activities = 1.

not a member. Finland is the only country that has adopted the Euro. Denmark's currency (Danish krone) is pegged to the Euro while the Swedish (Swedish krona) and Norwegian (Norwegian krone) currencies float. We include country dummy variables in our regression analysis.

We use stock return volatility as our proxy for firm risk in line with our previous arguments. Specifically we measure stock return volatility as the standard deviation of monthly returns for the three year period from January 2010 till December 2012. Regression analysis is performed using ordinary least squares regression analysis. The independent variables are control variables (size, capital structure, current ratio, profitability, R&D, market-to-book, industrial diversification, sector dummies, and country dummies) plus measures of internationalization. The following equation is estimated:

$$\begin{aligned}
 STOCKVOL_i = & \\
 & C + \lambda_1 ASSETS_i + \lambda_2 EQUITYRATIO_i + \lambda_3 CURRENT_i + \lambda_4 EBITDA_i + \lambda_5 RD_i + \lambda_6 MB_i \quad (1) \\
 & + \lambda_7 INDDIV_i + \lambda_8 Sector_i + \lambda_9 Country_i + \lambda_{10+} Internationalization\ variables_i + \omega_i
 \end{aligned}$$

Internationalization variables refer to *FOREIGN SALES* (the percentage of consolidated operating revenue in foreign currency), *FOREIGN COSTS* (the percentage of consolidated operating costs in foreign currency), and *FOREIGN ASSETS* (the percentage of consolidated operating assets in foreign currency). Please refer to the Appendix for descriptions of all variables.

We use logarithmic versions of a range of variables in the equation above because the non-logarithmic version of the variables are positively skewed. The logarithmic version of the variables are closer to being normally distributed (for elaboration please refer to the descriptive statistics in Table 1). Our focus is on the relationship between risk (STOCKVOL) and internationalization. In line with previous literature we include various control variables.

We include size (ASSETS) and measure it as the log of total assets in line with previous literature (e.g. Goldberg and Heflin, 1995; Contractor, Kundu and Hsu, 2003). Larger firms are expected to have an enhanced opportunity to benefit from natural hedging (Chowdhry and Howe, 1999). Smaller firms face constraints in terms of human and capital resources. On the other hand, industrial organization theory suggests that as firms grow they become more complex which may reduce the ability to adapt to disruptive changes in the environment (Gavetti and Rivkin, 2007).

We include a measure of financial leverage - capital structure (EQUITYRATIO) – in line with previous literature (Fatemi, 1984; Goldberg and Heflin, 1995; Reeb, Kwok, and Baek, 1998). *Ceteris paribus*, risk increases as the amount of debt in the firm's capital structure increases. Following similar reasoning, we also include a measure of the firm's ability to honor its short term obligations (CURRENT) and to be profitable (EBITDA).

We include measures of growth options (RD and MB) in line with previous literature (e.g. Reeb, Kwok, and Baek, 1998; Kwok and Reeb, 2000). On the one hand, growth options are valuable and may provide the firm with a buffer in bad times. On the other hand, growth stocks

can be considered similar to holding a portfolio of out of the money call options on value stocks (Berk, Green, and Naik, 1999).

We include a measure of industrial diversification (INDDIV). Since both geographical and industrial diversification can imply risk reduction from diversification and the two forms of diversification may be correlated, it is important to include an explicit measure of product diversification to isolate the effect of geographic disperse activities (Kim and Mathur, 2008).

Finally, we include industrial sector dummies in line with previous literature. Firms in different sectors may face environments that have different risk characteristics (e.g. Kwok and Reeb, 2000; Contractor, Kundu and Hsu, 2003). In line with this reasoning, we also include country dummies.

4. Descriptive statistics

Table 1 reports descriptive statistics for the 147 sample firms. Variables used in subsequent regression analysis are in capital letters.

* Table 1 goes about here *

The mean (median) firm experiences a stock return volatility of 11% (10%) and has total assets of 1,858 million EUR (293 million EUR), an equity ratio of 46% (43%), a current ratio of 1.66 (1.44), EBITDA divided by total assets of 12% (11%), a market-to-book ratio of 2.21

(1.24), and 4.5 (4.0) registered NACE codes. The mean (median) firm has foreign sales of 65% (70%), foreign costs of 49% (50%), and foreign assets of 44% (50%). Thus, our sample of firms are in general very international and include no purely domestic firms. Only two firms have no foreign sales (but foreign costs).

Correlation coefficients in Table 2 show that firms that are highly international in terms of foreign sales (FOREIGN SALES) also tend to be highly international in terms of foreign costs (FOREIGN COSTS) and foreign assets (FOREIGN ASSETS). The risk measure (STOCKVOL) and the internationalization variables are not highly correlated.

* Table 2 goes about here *

5. Univariate results

Table 3 compares means and medians of control and internationalization variables of the 68 highly international firms (foreign sales more than 80% of total sales) with those of the 79 less international firms (foreign sales less than 80% of total sales). Table 3 shows that highly international firms are not significantly different from less international firms in terms of risk (STOCKVOL). However, highly international firms are significantly larger (ASSETS) and have a more conservative capital structure both in terms of equity ratio and current ratio. There are no significant differences in terms of R&D expenditures (RD), market-to-book ratio (MB), and industrial diversification (INDDIV). The bottom part of Table 3 shows that highly international firms tend to be more international than less international firms not only – per construction - in

terms of foreign sales (FOREIGN SALES) but also in terms of foreign costs (FOREIGN COSTS), and foreign assets (FOREIGN ASSETS). This is in line with the high correlation coefficients among the three internationalization variables in Table 2.

* Table 3 goes about here *

Table 3 shows that picking an arbitrary stock in a highly international firm is not likely to lead an investor to an investment that is different in terms of return volatility than picking an arbitrary stock in a less international firm. However, this is a result of a simple univariate comparison which may not hold in a multivariate regression analysis – e.g. Table 2 shows that highly international firms tend to have a more conservative capital structure which is hypothesized to decrease risk.

6. Multivariate results

Table 4 reports results of OLS regression analysis on risk measured as stock return volatility (STOCKVOL, dependent variable) and foreign sales, foreign costs, foreign assets, and control variables (independent variables). Model 1 in Table 3 excludes internationalization variables. Models 2 includes the foreign sales ratio. Models 3-4 only include the 68 high foreign sales firms and includes variables related to foreign costs and assets. Table 4 shows that risk is negatively related to a conservative capital structure (EQUITYRATIO) and a high profitability (EDITBA) – in line with a priori expectations.

* Table 4 goes about here *

Model 2 shows that foreign sales (FOREIGN SALES) are significantly (1% level) and positively related to risk. There is no indication that the relationship is non-linear. Thus, if we include the squared value of the foreign sales ratio in Model 2, the coefficients for both internationalization variables become insignificant (not tabulated). We also add (not tabulated) variables related to foreign exchange hedging (debt in foreign currencies, percent of operating cash flows in foreign currencies hedged, and/or percent of foreign assets hedged), but the coefficients of these variables are not significant and do not change our conclusions.

To be more precise, in Model 2 we measure the percentage of consolidated operating revenue in foreign currency for Danish, Norwegian, and Swedish firms and revenue outside Finland for Finnish firms. Thus, to the extent that the Danish, Norwegian, and Swedish firms invoice in their own currencies when selling abroad or invoice in foreign currencies when selling in their domestic markets, our results could be biased. However, the Danish, Norwegian, and Swedish currencies are “small” currencies compared to the currencies of their main export markets (EUR, GBP, USD). Thus, we consider it likely that the extent to which Danish, Norwegian and Swedish firms invoice in their own currencies abroad is limited. However, to test the robustness of the use of the responses to the questionnaire we use the geographical segment information in the annual reports and are able to calculate a foreign sales ratio for 113 of the 147 firms in our sample. The correlation between the two alternative foreign sales ratios (the one bases on the questionnaire and the one based on annual reports) is 0.88. When we use the foreign

sales ratio based on the annual reports in a regression like the one shown in Model 2 we obtain results (for the sake of brevity not tabulated) that are similar to the results of Model 2 in Table 3. The coefficient for the foreign sales ratio is similar (0.38 versus 0.37) and statistically significant (1% level). The similar results are comforting in relation to 1) our argumentation above and 2) the reliability of the survey responses.

If we extend Model 2 (not tabulated) to also include foreign assets (FOREIGN ASSETS) and foreign costs (FOREIGN COSTS), foreign sales (FOREIGN SALES) are still statistically significant (1% level) in explaining risk while the two other internationalization variables do not seem to affect risk. If we substitute foreign sales (FOREIGN SALES) with either foreign costs (FOREIGN COSTS) or foreign assets (FOREIGN ASSETS) in Model 2, the coefficients of both variables are positive and statistically significant at the 10% level. The results indicate that foreign sales is *the* most important internationalization variable and thus to some extent justifies the extensive use of the foreign sales ratio as the internationalization variable in previous literature.

The economic significance of being international in terms of risk is material. Thus, a median firm (i.e., median in all aspects apart from the foreign sales ratio) in our sample with 0% in foreign sales has a stock return volatility of 8.7% according to the coefficients of Model 2 in Table 3. This risk measure increases to 11.6% when the firm increases its foreign sales ratio to 70% which is the median foreign sales ratio - an increase in stock return volatility of 2.9% points or 33%.⁷

⁷ We insert the median values from Table 1 for ASSETS, EQUITYRATIO, CURRENT, EBITDA, RD, MB, INDIV into Model 2 in Table 4. We insert 0% for FOREIGN SALES. We assume that the firm is a manufacturing firm. We

The results of Model 2 confirm the hypothesis that there is a positive link between internationalization and corporate risk. However, the main purpose of this research is to investigate the link between external sourcing and corporate risk. Or more specifically, to investigate to which extent (if any) external sourcing from foreign suppliers reduces risk. We address this question in Models 3 and 4. Both models are restricted to only include the 68 firms with foreign sales exceeding 80% of total sales (thus effectively making foreign sales a constant). Models including the whole sample of firms did not report significant coefficients for the internationalization variables (not tabulated).

Model 3 shows that foreign assets (FOREIGN ASSETS) increase risk and that foreign costs (FOREIGN COSTS) reduce risk (both at the 10% level). The absolute magnitude of coefficients are similar (0.47 and 0.53). To further – we have already effectively made foreign sales a constant by only including the firms with more that 80% of their sales abroad – mitigate multicollinearity concerns, Model 4 introduces a variable (FOREIGN COSTS (residuals on FOREIGN ASSETS)) which is the foreign costs not explained by foreign assets. Specifically, it is the residuals of a regression where foreign costs are explained by a constant and foreign assets. This new variable is significant at the 10% level and the absolute value of the coefficient (0.56) is similar to the absolute values of the coefficients on foreign assets and foreign costs in Model 3. As a further robustness test (not tabulated), we take a simple difference between foreign costs and foreign assets. Such a variable is significant at the 10% level and has a coefficient (-0.49) with similar absolute value.

get a value for STOCKVOL of 2.27. We have $\text{STOCKVOL} = \ln(\text{stock return volatility} \times 100 + 1)$. We get a value for stock return volatility of 8.7%. When we insert 70% for FOREIGN SALES, we get a STOCKVOL of 2.53 and a stock return volatility of 11.6%.

The results of Models 3 and 4 imply that foreign assets are risk neutral in the sense that the risk increasing features of having production facilities abroad are neutralized (= similar magnitude of coefficients) by the accompanying increase in foreign costs. More importantly, the results of Models 3 and 4 suggest that external sourcing from foreign suppliers is risk reducing. External sourcing from foreign suppliers as compared to internal sourcing from own production facilities abroad seem to provide the same diversification benefits, enhanced flexibility (= easier to change supplier than to close down a production facility in one country and opening up in another country), and less exposure to environmental risk (no firm establishment in form of e.g. buildings, machinery, and long-term employee contracts).

The economic significance of external sourcing from foreign suppliers as opposed to sourcing from own production facilities abroad is material. The absolute magnitude of the coefficients for our internationalization variables in Models 3 and 4 are of the same magnitude (= 0.5). Thus, a firm associated with a foreign assets ratio of 70% corresponding to the median foreign assets ratio for the highly international firms and a corresponding foreign costs ratio of 70% is estimated to have more or less the same risk as a firm with 0% in foreign assets and foreign costs (= a stock return volatility of 12.2%). However, a firm that sources from external suppliers abroad reaching a foreign costs ratio of 70% without having own production facilities abroad (0% foreign assets ratio) has a stock return volatility of 8.1%. This is an decrease in stock return volatility of 4.1% points or 34%.⁸

⁸ We insert the median values for the 68 highly international firms from Table 3 for ASSETS, EQUITYRATIO, CURRENT, EBITDA, RD, MB, INDIV into Model 3 in Table 4. We insert 0% for FOREIGN ASSETS and 0% for FOREIGN COSTS. We assume that the firm is a manufacturing firm. We get a value for STOCKVOL of 2.58. We

The results of Models 3 and 4 are based on the subset of 68 firms that are highly international (foreign sales exceeding 80% of total sales). For less international firms we do not find significant results. We attribute this insignificance to the earlier mentioned point that more domestically oriented firms are more likely to increase net cash flows from abroad when sourcing from foreign suppliers than highly international firms because the former have less counterweight in the form of foreign sales.

We re-test our models in Tables 4 for robustness in relation to industry and size by dividing our sample into manufacturing firms (76 firms) and non-manufacturing firms (71 firms) and by dividing our sample into the 73 largest firms and the 74 smallest firms (as measured by total assets). Furthermore, we measure stock return volatility only for 2010, only for 2011, and only for 2012. These robustness tests show less significance but are in line with our main conclusions.

7. Conclusions

We examine 147 medium-sized and large non-financial firms from Scandinavia (Denmark, Finland, Norway, and Sweden). We obtain data from databases and responses to a questionnaire. We analyze the relationship between corporate risk as measured by stock return volatility and the internationalization of the firm. We specifically analyze the relationship between corporate risk and external sourcing from foreign suppliers.

have $STOCKVOL = \ln(\text{stock return volatility} * 100 + 1)$. We get a value for stock return volatility of 12.2%. When we insert 70% for FOREIGN COSTS, we get a STOCKVOL of 2.21 and a stock return volatility of 8.1%.

We generally find a strong, positive relationship between foreign sales and risk and more specifically we find that external sourcing from foreign suppliers is associated with less risk than sourcing from own production facilities abroad at least for highly international firms. Our findings are statistically significant and economically meaningful. Our study has important policy implications for corporate managers and investors. First, going abroad means more risk. Second, from a risk perspective do not focus too much on the flexibility of having production facilities abroad but consider using external sourcing from a network of foreign suppliers instead.

Appendix

Dependent variables

Stock return volatility is the standard deviation of the monthly returns for the period 2010-2012.

STOCKVOL is the logarithm of the sum of *stock return volatility* times 100 plus 1.

Control variables

Total assets are the total assets of the firm measured in million EUR.

ASSETS is the logarithm of *total assets*.

EQUITYRATIO is the equity of the firm divided by the total assets of the firm.

Current ratio is current assets divided by current liabilities.

CURRENT is the logarithm of the sum of *current ratio* plus 1.

EBITDA is EBITDA of the firm divided by the total assets of the firm.

R&D expenses are R&D expenses divided by the total sales of the firm.

RD is the logarithm of the sum *R&D expenses* times 100 plus 1.

Market-to-book ratio is the market value of equity divided by the book value of equity of the firm.

MB is the logarithm of the sum of *market-to-book ratio* plus 1.

Number of NACE is the number of NACE codes reported by the firm.

INDDIV is the logarithm of the *number of NACE* plus 1.

Sector_i is NACE classification codes A+B+D+F, G, H, J, and L+M+N+R+S respectively (Manufacturing, C, being default) coded as 1 if the firm belongs to the specific sector and 0 otherwise.

Country_i is Denmark, Finland, or Norway (Sweden being default) coded as 1 if the firm is headquartered in the specific country and 0 otherwise.

Internationalization variables (questionnaire)

FOREIGN SALES is the percentage of consolidated operating revenue in foreign currency

FOREIGN COSTS is the percentage of consolidated operating costs in foreign currency

FOREIGN ASSETS is the percentage of consolidated operating assets in foreign currency

FOREIGN SALES, *FOREIGN COSTS*, and *FOREIGN ASSETS* are based on responses to questions 2⁹ in the Questionnaire (midpoints of intervals used when calculating means, medians, etc.).

FOREIGN COSTS (residuals on FOREIGN ASSETS) is the residuals of a regression where *FOREIGN COSTS* are explained by a constant and by *FOREIGN ASSETS*

⁹ Q2. How many percent of the following are in foreign currency?

Consolidated operating revenue:

0%	1%-20%	21%-40%	41%-60%	61%-80%	81%-99%	100%
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Consolidated operating costs:

0%	1%-20%	21%-40%	41%-60%	61%-80%	81%-99%	100%
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Consolidated operating assets:

0%	1%-20%	21%-40%	41%-60%	61%-80%	81%-99%	100%
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If the respondent is from Finland, the questionnaire is designed to rephrase the question to “How many percent of the following are outside Finland?” because Finland has adopted the Euro.

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Table 1

Descriptive statistics.

	<u>Mean</u>	<u>Median</u>	<u>Max.</u>	<u>Min.</u>	<u>Std. Dev.</u>	<u>Jarque-Bera</u>	<u>Obs.</u>
<u>Dependent variables</u>							
Stock return volatility	0.11	0.10	0.38	0.03	0.05	278.4	147
STOCKVOL	2.40	2.38	3.67	1.28	0.38	8.6	147
<u>Control variables</u>							
Total assets (mill. EUR)	1,858	293	54,443	10	5,302	27,605	147
ASSETS	5.88	5.68	10.90	2.30	1.86	4.2	147
EQUITYRATIO	0.46	0.43	0.82	0.08	0.17	4.4	147
Current ratio	1.66	1.44	5.17	0.17	0.89	96.5	147
CURRENT	0.93	0.89	1.82	0.15	0.30	7.6	147
EBITDA	0.12	0.11	0.51	-0.32	0.11	53.0	147
R&D expenses	0.065	0.025	0.400	0.000	0.010	304.6	147
RD	1.43	1.25	3.71	0.00	1.01	10.4	147
Market-to-book ratio	2.21	1.24	26.19	0.12	3.36	5,094	147
MB	0.94	0.81	3.30	0.11	0.58	99.9	147
Number of NACE	4.54	4.00	16.00	1.00	2.55	78.9	147
INDDIV	1.37	1.39	2.78	0.00	0.55	0.51	147
<u>Internationalization variables (Questionnaire)</u>							
FOREIGN SALES	0.65	0.70	1.00	0.00	0.31	18.7	147
FOREIGN COSTS	0.49	0.50	1.00	0.00	0.28	8.1	147
FOREIGN ASSETS	0.44	0.50	1.00	0.00	0.30	10.8	147

Note: This table reports descriptive statistics for the 147 sample firms. Variables used in subsequent regression analysis are in capital letters. Variables are defined in the Appendix.

Table 2

Correlation coefficients (risk and internationalization variables)

	(1)	(2)	(3)	(4)
STOCKVOL (1)	1.00			
FOREIGN SALES (2)	0.18	1.00		
FOREIGN COSTS (3)	0.04	0.76	1.00	
FOREIGN ASSETS (4)	0.01	0.68	0.89	1.00

Note: Variables are defined in the Appendix.

Table 3 Univariate analysis

	Foreign sales>80% (68 firms)		Foreign sales<80% (79 firms)		Difference	
	<u>Mean</u>	<u>Median</u>	<u>Mean</u>	<u>Median</u>	<u>Mean</u>	<u>Median</u>
STOCKVOL	2.44	2.40	2.37	2.34	0.07	0.06
ASSETS	6.27	6.12	5.55	5.55	0.72**	0.57**
EQUITYRATIO	0.49	0.48	0.43	0.40	0.06**	0.08**
CURRENT	1.01	0.93	0.86	0.84	0.15***	0.07**
EBITDA	0.13	0.12	0.12	0.11	0.01	0.01
RD	1.76	1.25	1.15	1.25	0.61***	0.00
MB	1.03	0.84	0.86	0.78	0.17*	0.06
INDDIV	1.47	1.38	1.28	1.38	0.19**	0.00
FOREIGN SALES	0.92	0.90	0.43	0.50	0.49***	0.40***
FOREIGN COSTS	0.67	0.70	0.35	0.30	0.32***	0.40***
FOREIGN ASSETS	0.63	0.70	0.39	0.30	0.34***	0.40***

Note: This table reports univariate analysis of the differences in the mean and median values between the two subsamples of the 147 firms: 1) 68 firms with foreign sales exceeding 80% of total sales and 2) 79 firms with foreign sales less than 80% of total sales. Variables are defined in the Appendix. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 4

Regression analysis on risk implications of foreign sales, costs, and assets.

	<u>Model 1</u>	<u>Model 2</u>	<u>Model 3</u>	<u>Model 4</u>
Constant	2.87*** (0.000)	2.85*** (0.0000)	3.04*** (0.000)	3.01*** (0.000)
ASSETS	-0.01 (0.7199)	-0.02 (0.2702)	0.02 (0.4533)	0.02 (0.4511)
EQUITYRATIO	-0.74*** (0.0010)	-0.77*** (0.0004)	-0.46 (0.1487)	-0.46 (0.1499)
CURRENT	0.27** (0.0190)	0.18 (0.1138)	-0.01 (0.9391)	-0.02 (0.9042)
EBITDA	-1.08*** (0.0006)	-0.94*** (0.0022)	-1.51*** (0.0005)	-1.47*** (0.0004)
RD	0.06 (0.1059)	0.03 (0.3441)	-0.01 (0.8171)	-0.02 (0.7062)
MB	-0.13** (0.0422)	-0.16** (0.0100)	-0.01 (0.8964)	-0.01 (0.8729)
INDDIV	-0.05 (0.4423)	-0.07 (0.3021)	-0.11 (0.2636)	-0.11 (0.2725)
FOREIGN SALES		0.37*** (0.0006)		
FOREIGN ASSETS			0.47* (0.0655)	
FOREIGN COSTS			-0.53* (0.0794)	
FOREIGN COSTS (residuals on FOREIGN ASSETS)				-0.56* (0.0563)
Sector dummies	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes
N	147	147	68	68
R ²	0.38	0.43	0.51	0.53
Adjusted R ²	0.32	0.36	0.35	0.38
F-statistic	5.33	6.19	3.30	3.55
Prob(F-stat.)	0.0000	0.0000	0.0006	0.0003

Note: This table reports results of OLS regression analysis on stock return volatility (dependent variable) and foreign sales, foreign costs, foreign assets, etc. (independent variables). Models 3 and 4 only include the 68 firms with foreign sales exceeding 80% of total sales. The dependent variable is the stock return volatility (STOCKVOL). Variables are defined in the Appendix. Sector dummies are NACE classification codes A+B+D+F, G, H, J, and L+M+N+R+S respectively (Manufacturing, C, being default) coded as 1 if the firm belongs to the specific sector and 0 otherwise. Country dummies are Denmark, Finland, and Norway (Sweden being default) coded as 1 if the firm is headquartered in the specific country and 0 otherwise. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.