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Board of directors and export-spillovers: What is the impact on extensive margins of trade?

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Board of directors and export-spillovers: What is the impact on extensive margins of trade?

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Abstract

Increased export experience on the board of non-exporting firms has a causal effect on their propensity to enter foreign markets in later periods. Using a universal set of Swedish employer-employee panel data for the period 2000-2014, this paper finds evidence on spillover from exporters to non-exporters through outside board directors. The identification strategy to account for endogenous selection of external board members relies on external instruments and applications of different instrumental variable approaches, capturing also unobserved heterogeneity. Our findings are robust to controlling for export background among managers and employees, as well as firm size, human capital, total factor productivity, productivity spillovers, firm location and industry classification.[1]

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Keywords: Export spillovers, extensive margins of trade, outside directors, employer-employee data, endogeneity

JEL classification: C26, F14, L2, M2, O33

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1 Introduction

What hinders corporate involvement in international markets? This issue has received large attention among scholars from various research areas over past decades. Core insights include weak productivity performance, and high sunk costs including factors such as retrieval of information on market opportunities, competition, legal aspects, business practices and distribution channels. More productive firms are found to be better equipped to face the sunk costs associated with exporting.

More recently, exploiting employer-employee (EE) data, some studies have investigated whether young, small and other non-exporting firms may learn to export from firms currently serving foreign markets, and thereby reducing sunk costs as an entry barrier. Existing research on export-spillovers, using EE-data on possible information links, has examined the role of managers and workers. Our paper contributes to the literature by providing evidence on the impact of external ties to the board of directors (BoD).

Our data is a panel of universal administrative register statistics on firms and individuals in Sweden. This employer-employee data is matched with data on trade and the board of directors. The focal firms of the study are initially non-exporting limited companies (Ltd). We restrict the analysis to small firms defined as the size class 10-50 employees. The focal firms are observed over the period 2006-2014, whereas the other firms linked to a focal firm through its managers, employees, inside and outside directors of the board, are traced in the data over the period 2000-2013.

The measure on export spillover in this paper is constructed by information on the export performance of the firm where outside directors are employed as managers or workers, or appointed directors on the board (interlocked). The spillover-measure is calculated in three steps. First, we calculate the relative export intensity of all firms by their export to sales ratio normalized by the median for their industry, at the 2-digit level. Second, we link every external board member in Sweden to this export intensity

measure. In the case where the external board member is linked to several firms, we use the largest intensity value. Third, for each board we calculate the external export expertise measure as the sum of the normalized export intensity embodied in the outside directors divided by total number of internal and external directors.

In order to identify the separate effect of the outside directors on the BoD, this paper relies on two strategies. The first is to control for factors that previous literature has found to be associated with propensity to export, as well as some new factors. These are the productivity of the focal firm, which we measure as total factor productivity (TFP), the productivity of the other firms where the outside directors are employed as managers or workers or serving the board, and prior export experience of the focal firm's management and workers, including also inside board members. We use one lagged period for these variables.

The second identification strategy is to apply exogenous instruments that are highly correlated with the outside board members, but not directly with the focal firm's propensity to export. To do so, we construct two binary instrumental variables identifying whether any of the focal firms' directors, who had no connections to any exporting firms when appointed to the board, got employed in or joined the board of an exporter other than the focal firm during the previous year. Changes in the outside directors' employment and/or other board assignments, ex-post joining the focal firm's board could thus be argued to be exogenous to the focal firm.

Existing literature suggests self-selection of the more productive firms into export, and that non-exporting firms may learn to export from other firms' export experience through mobility of management and workers. Our study, controlling for these factors, shows that outside members of the board of directors from export intensive companies are an important channel for export spillovers. The empirical results reveal that an increase in the board's export expertise has a causal positive effect on non-exporting firms' propensity to source foreign markets in later periods. The results are robust to different estimation methods and specifications.

Estimating marginal effects, we find that the magnitude of the outside director-estimates is within the same range as TFP, and managers and workers with export background, though only the former is instrumented. The results on export spillovers transmitted by firm employees corroborates what previously has been found true for different countries: Brazil (Molina & Muendler 2013), Portugal (Mion & Opromolla 2014), Denmark (Sala & Yalcin 2015) and (Choquette & Meinen 2015), and the U.K (Love et al. 2016).

In the next section we show how our paper is linked to international trade and business literature. Section 3 presents data and descriptive statistics. The methodological approach is introduced in Section 4. Section 5 evaluates the empirical models and reports the main results. We conclude with a summary discussion in Section 6 and provide directions for further research.

2 Literature review

The systematic pattern that only a small proportion of firms in most countries is able to enter into foreign markets, has received large attention in international business and economics literature.

A number of studies examine factors that may explain the selection mechanism. These factors include productivity and sunk costs (Melitz 2003, Wagner 2007), financial constraints (Greenaway et al. 2007, Berman & Héricourt 2010, Manova 2012), R&D, patents and innovations (Cassiman & Golovko 2007, Castellani & Zanfei 2007, Damijan et al. 2010, Becker & Egger 2013, Lööf et al. 2015), corporate ownership (Zahra & Filatotchev 2004, Oesterle et al. 2013, Raff & Wagner 2014), governmental interventions (Leonidou et al. 2011, Martincus et al. 2011), and export-spillovers (Aitken et al. 1997).

Several explanatory factors for exporting are overlapping, such as firm size, financial resources, innovation and productivity, while others may have a more separate role. Bernard & Jensen (2004) use a panel of U.S. manufacturing plants to examine four

factors, each one associated with increased probability of entering into export. In line with theoretical predictions from the Melitz (2003) model, the authors show that entry cost and other plant characteristics are significant determinants. In contrast, governmental interventions and spillovers from other plants are found to be less important or negligible.

The spillover result by Bernard & Jensen (2004) is confirmed by some studies, however, counterbalanced by many more. Increased access to firm-level data on factors such as spatial and technological proximity improve conditions for the researcher to trace channels of knowledge diffusion. Some of these conduits are spillover within and between industries, knowledge transfer within company groups, as well as diffusion of know-how between foreign-owned and domestic companies and to some extent between buyers and sellers in various stages of global value chains.

With better data, more and more studies have also been able to indicate the presence of export spillovers, although causality is not always established and the results are sometimes not comparable. There is a significant geographical spread of these studies, and the positive results apply, for example, to exploitation of data from Belgium (Dumont et al. 2010), China (Hu & Tan 2016), France (Koenig et al. 2010), Hungary (Harasztosi 2016) India (Franco & Sasidharan 2010), Indonesia (Narjoko et al. 2009) Ireland (Ruane et al. 2005), Poland (Cieślik & Hagemejer 2014), Sweden (Karpaty & Kneller 2011), U.K. (Kneller & Pisu 2007) and Vietnam(Anwar & Nguyen 2011).

However, even though a growing number of studies provide evidence on export spillovers, the literature using micro econometric approaches is largely silent on how knowledge, information and experience are transmitted from one firm to another.

Recently, an emerging line of research, attempts to fill this gap by exploiting some of the potential provided by matched employer-employee (EE) data. Register data, revealing details of single firms and individuals at national level, offer unprecedented possibilities to disentangle links between firms, so far mainly hidden for the researcher.

The EE-data allows the researcher to look into people's past, and for instance, study

their mobility between exporting and non-exporting firms. This kind of information has been exploited to study whether workers and managers may be carriers of knowledge, skills and experience between companies. One example isMolina & Muendler (2013), which use Brazilian EE-data to examine the workers' labour market history, and find that hiring former export workers is an important predictor of a firm's export-market entry. The paper suggests that these workers may transfer special skills from passive learning or active training, knowledge on individual customers or specific markets characteristics, or signal a screened but unobserved ability.

Exploiting Danish EE-data, Choquette & Meinen (2015) confirm the main finding by Molina & Muendler (2013), though only the former investigates whether hiring a person that has previously worked for a firm exporting to a specific market increases the likelihood that the new firm starts to export to this market. The results in the Danish study is also in agreement with Kneller & Pisu (2007) and Albornoz et al. (2012), which show that conditions for export-spillovers are facilitated if they occur in industries with similar knowledge platforms, or if exports are destination-specific.

Manager mobility provides another channel for spillovers suitable to be analyzed by EE-data. Previous studies using survey-information suggest that the export background of a CEO is particularly important for a small firm's involvement in international markets. Reuber & Fischer (1997), investigate why some SMEs in the Canadian software industry are more successful in selling outside their domestic markets than other SMEs in the same industry. The study shows that internationally experienced management teams have a greater propensity to obtain foreign sales after start-up. Similar findings are reported in studies on European firms. Love et al. (2016) examine determinants of SME's exporting performance using a survey of internationally engaged SMEs in the UK and find positive effects from the recruitment of managers with prior international experience.

Some recent papers use EE-data to study export experience of managers and internationalisation of firms without limitations associated with survey data. Mion &

Opromolla (2014), focus on Portugal to quantify the importance of manager's international experience in previous firms on the current firm's export performance. Results show a positive effect, and value of the export spillovers increases when it is market-specific. While both Choquette & Meinen (2015) and Mion & Opromolla (2014) report the importance of export experience related to markets served by both the previous and the current firm, Sala & Yalcin (2015) find that managers with export experiences as such, contribute to the sorting of firms into international activity. In their study, based on Danish EE-data, a chief executive officer (CEO) is considered to have qualified international experience if he or she has previously held a similar position in an exporting company.

Our paper investigates the presence of export-spillovers on extensive margins, using EE-data on Swedish firms including trade data, matched with data on BoD. We examine whether non-exporting firms are influenced in their future export orientation by the recruitment of outside directors with export experience.

The firms in our sample are within the size-class 10-50 employees before starting to export. In accordance with the corporate governance literature on the resource dependency theory, Zahra & Filatotchev (2004) and Zhang et al. (2011) show that, in practice, boards of SMEs act as extensions to the top management teams rather than they monitor the firm. One way for these firms, which are unable to employ full-time professional managers, is to engage part time non-executive directors for the board who may possess more experience and specific knowledge than the founders of the firm (Zhang et al. 2011). The corporate governance literature has also identified outside directors as an important governance mechanism for managements in small firms with export strategies. Filatotchev et al. (2007) report that their knowledge and international vision may help firms to deal with managerial challenges associated with internationalisation. Empirical support for this view is provided by, for instance, Calabrò et al. (2009). Analyzing a sample of small and medium sized Norwegian family businesses, they report that the board is an important strategic resource contributing to

their international expansion.

Our paper shares the challenge with other studies on spillovers to quantify expertise or knowledge transferred from one firm to another. Another difficulty is to establish whether a change in expertise has a causal impact on the performance of the firm. The first problem is related to how the expertise or competence can be observed. Some papers within corporate governance literature consider the board as reflection of social network ties between internal and external factors (Carpenter & Westphal 2001). Other studies proxy director expertise in terms of formal financial, corporate and academic knowledge (Duchin et al. 2010). This literature reports mixed results (Garg 2013).

The second problem, reverse causality, is applicable on all empirical spillover studies. The four EE-studies discussed above experiment with various identification approaches to mitigate potential endogeneity. Since the researchers cannot observe the firm's intention regarding future international market involvement, the reliability of the estimated results depends crucially on the validity of the chosen instruments. The construction of our instruments for addressing the endogeneity problem is presented in Section 4, which also defines the measures we use as proxies for export-spillovers. Before that, we present data and define variables in Section 3.

Finally, reviewing the literature on export spillovers, to the best of our knowledge, we find no previous papers that have conducted a systematic analysis of the board of directors as a transmitter of strategic competence for entering the export market.

3 Data and summary statistics

The primary data in our analysis is matched Swedish employer-employee (EE) data provided by Statistics Sweden (SCB) containing observations on the realm of firms and employees in Sweden over the period 2000-2014. The employer data were originally constructed from audited register information on firm characteristics based on annual reports. The employee data is constructed from several register sources. The total

number of observations is about 5 million firms and 50 million employees. To this data we match information on the boards of directors retrieved from the Swedish Companies Registration Office. From the primary data we selected a sample of *focal firms* consisting of 1,261 firms observed over the period 2006-2014.

The selection is based on the following criteria: First, all firms in the sample are independent, non-exporting limited companies (Ltd) in the Swedish manufacturing sector, with at least 10 but not more than 50 employees in the first year of observation. Second, each firm is observed until data is censored or the firm enters a foreign market. Third, the firms were active for at least two years prior to the first year of observation. For all firms in the sample we are able to exploit the EE-data to track the background of outside directors, and managers as well as inside directors and other employees.
Table 3.1 defines key variables in the study. Definitions of additional control variables are presented in Table 7.1. Our dependent binary variable $Exporting$ indicates if the focal firm is exporting in year t. The main variable of interest is the export expertise of the board of directors, EEB. To calculate its value, we start by normalizing the export intensity of each firm in Sweden (export value to sales ratio) by the median for its two-digit industry, formally expressed as:

For firm i in industry j and time t, the export intensity,EI_{it} is given by

$$EI_{it} = log\left(1 + \frac{ES_{it}}{\widetilde{ES_{jt}}}\right)$$

where $\widetilde{ES_{jt}}$ is the median export to sales ratio of the exporting firm in the firm's two digit industry j.

In a second step, each board member's export expertise is calculated as the maximum of the normalized export intensity of all the firms to which the board member is connected through either employment or board appointment. We then construct the EEB variable for each focal firm by the average export expertise among the board members in the following way: For firm i in time t, the export expertise in the board of

directors, EEB_{it}, with A directors is given by

$$EEB_{it} = \frac{\sum_{a=1}^{A} EE_{at}}{A_{it}}$$

where $a = 1, ..., A$. A is the number of board members that are connected to other firms either through employment or board membership. The export intensity, EE is calculated as

$$EE_{at} = \max_{c=1}^{C} EI_{ct} \quad \forall \quad c \neq i$$

where $c = 1, ..., C$. C is the number of firms to which a board member is connected through employment or board membership.

The next two variables presented in Table 3.1 are our instruments for the possible endogenous EBB-variable. As there might be a concern for reverse causality where the owners of the focal firm might search for and appoint directors with certain qualities, such as valuable connections to exporting firms, as a strategy to facilitate an upcoming export entry, we create two instrumental variables to mitigate potential endogeneity. We construct two instruments that identify changes in the connections between the focal firm's directors and other firms that were established after they were appointed to the board.

Although all directors are appointed one-year spells, we make the assumption that once appointed the probability of re-election is high[2]. Therefore, changes in employment and connections to other boards that occur after the initial appointment to the focal board could be argued to be exogenous to the focal firm.

[2]In Table 7.5 in the appendix results from a proportional hazards survival model using complementary log-log estimation on the probability of an individual director leaving a board spell. The first column reports the results from using the full sample of directors on the focal firms' board and the second column reports the results from using a sub-sample of directors who serve on the board of the firms in the sample that enter a foreign market. Z is an indicator variable that indicates whether the director received any export experience after being appointed director to the focal firm's board. This is found to have no significant effect on the probability of not being re-elected to the board, which provides some support to the assumption that once a director is appointed to the board the probability of re-election is high. Also, changes in employment and connections to other boards that occur after the initial appointment to the focal board could be argued to be exogenous.

The first instrument, *New employer*, takes the value 1 for firms where at least one of the outside directors was newly hired by an exporting firm and had at the time when joining the focal firm's board no connection to an exporting firm. We restrict this to outside directors who have been on the focal firm's board for at least the past two years (appointed in year $t-2$ or earlier) and were newly employed with the exporting firm in year $t-1$. The second instrument, *New interlock*, is constructed in a similar way and identifies firms in which any of the interlocking directors were newly appointed to the board of an exporting firm (in year $t-1$) and have served on the focal firm's board since year $t-2$ or longer.

Other variables in Table 3.1 are discussed in connection with the presentation of the empirical strategy in section 4.

Table 3.2 shows the summary statistics for the sample of manufacturing firms during the last year of observation. Each firm is followed until it enters a foreign market or data is censored. The complete summary statistics for the panel over the period 2006-2014 is reported in Table 7.2 in the appendix.

The upper part of the table reveals that 30% of the initially non-exporting 1,261 firms in the sample entered the export market during the period of our study. The EEB-measure is a weight average of the relative export intensity in the firms where the outside directors work or serve as board member. On average, a director is connected to a firm with a relative export intensity of $exp(0.17) - 1 = 0.19$.

On average, 8% of the employees have at least 3 years of university education, a quarter of the firms are located in metro areas and 80% of the firms are classified as medium low tech or low tech manufacturing. Approximately 19% of the employees in the average firm have worked at an exporting company during any of the previous years and 5% of the firms have recruited a CEO who earlier has held a similar position in an exporting firm.

Table 3.1: Variables

Variable	Description
Exporting$_t$	Indicator (0/1): focal firm is exporting in year t.
EEB$_{t-1}$	Average of the log(maximum Export intensity$_{t-1}$) of the firms where the focal firm's outside and/or interlocking directors were employed/interlocked in year (t-1).
New employer$_{t-1}$	=1 if any of the focal firm's outside directors were newly hired in a firm which had the highest relative export intensity amongst the firms the director is connected to in year (t-1) and were employed elsewhere in year (t-2), and served on the focal firm's board during (at least) both years.
New interlock$_{t-1}$	=1 if any of the focal firm's interlocking directors were newly appointed director on the board of an additional firm which had the highest relative export intensity amongst the firms the director is connected to in year (t-1) and served on the focal firm's board during (at least) both years
OBP$_{t-1}$	Average of the log(maximum relative productivity$_{t-1}$) of the firms where the focal firm's outside and/or interlocking directors were employed/interlocked in year (t-1).
OBP New employer$_{t-1}$	=1 if any of the focal firm's outside directors were newly hired in a firm which had the highest relative productivity amongst the firms the director is connected to in year (t-1) and were employed elsewhere in year (t-2), and served on the focal firm's board during (at least) both years.
OBP New interlock$_{t-1}$	=1 if any of the focal firm's interlocking directors were newly appointed director on the board of an additional firm which had the highest relative productivity amongst the firms the director is connected to in year (t-1) and served on the focal firm's board during (at least) both years.
OBFF$_{t-1}$	Share of directors on the board who are employed or interlocked in foreign owned firms (t-1).
Board size$_{t-1}$	Number of directors on the focal firm's board.
Board size $^2_{t-1}$	Square of number of directors on the focal firm's board.
EEE$_{t-1}$	Share of employees who were employed in an exporting firm in any of the previous years.
CEO EE$_{t-1}$	=1 if newly externally recruited CEO has experience of being CEO in exporting firms
CEO no EE$_{t-1}$	=1 if a newly externally recruited CEO has no experience of being CEO in exporting firms
Int CEO$_{t-1}$	=1 if newly hired CEO was internally recruited (was already employed in the non-exporting focal firm)
Productivity$_{t-1}$	log((TFP$_{t-1}$)/(Industry median TFP$_{t-1}$)+1)

Table 3.2: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.
Exporting$_t$	0.301	0.459	0	1
EEB$_{t-1}$	0.17	0.521	0	3.73
New employer$_{t-1}$	0.012	0.071	0	1
New interlock$_{t-1}$	0.008	0.063	0	1
Board size$_{t-1}$	2.102	1.412	1	10
Firm size$_{t-1}$	0.155	0.362	0	1
Human capital$_{t-1}$	0.079	0.13	0	1
EEE$_{t-1}$	0.188	0.192	0	1
TFP$_{t-1}$	1.169	0.503	0.024	3.727
CEO EE	0.053	0.224	0	1
CEO INT$_{t-1}$	0.332	0.471	0	1
CEO NEE$_{t-1}$	0.354	0.478	0	1
CEO age$_{t-1}$	46.572	9.880	21	76
CEO education$_{t-1}$				
Primary	0.032	0.175	0	1
Secondary	0.158	0.365	0	1
Upper secondary	0.608	0.488	0	1
Uni $<$3 years	0.082	0.275	0	1
Uni $\geq$	0.114	0.318	0	1
Metro	0.268	0.443	0	1
Industry				
High tech	0.048	0.213	0	1
Medium high tech	0.113	0.316	0	1
Medium low tech	0.431	0.495	0	1
Low tech	0.379	0.485	0	1
Firm age$_{t-1}$	19.005	13.089	1	85
N		1261		

4 Empirical approach

Empirical modeling strategy

Our empirical models analyze the influence of directors on firms' propensity to export, accounting for endogeneity. We evaluate the reduced form of a structural equation system to mitigate endogeneity, applying an instrumental variables approach. In the regressions, the variables *New Employer* and *New Interlock* are used as instruments for the potentially endogenous measure of export expertise in the board, EEB.
The empirical analysis employs a probit model to study firms' export propensity. For firm i in industry j and time t, the probit model is

$$Pr[Y_{it} = 1] = \alpha EEB_{it-1} + X'_{it-1}\beta + \epsilon'_{it}\gamma + t'_t\theta + e_i \tag{1}$$

where Y_{it} is an indicator of whether the focal firm exported during year t, EEB_{it-1} is the log average of the export intensity measures of the firms where the outside directors are employed and where the interlocking directors are board members, X_{it-1} is a vector of firm specific control variables including firm age, total assets, human capital, location and board size, and ϵ_{it} and t_t denotes industry technology level and year fixed effects, respectively. We employ equation (1) to calculate the new firms' propensity to export.

To handle potential endogeneity we specify first stage equation 2 that is used in the structural equation 1 as:

$$EEB_{it-1} = X'_{it-1}\pi_0 + \epsilon'_{it}\pi_1 + t'_t\pi_2 + Z'_{it-1}\pi_3 + \mu_i \tag{2}$$

where Z_{it-1} is a vector of the two instrumental variables. We estimate (1) using a pooled probit model and a random effects probit model. In addition, we use predictions from the first stage equation residuals (2) in the instrumental variables pooled probit model of equation (1), applying the Newey (1987) two-step estimator.

Finally, we estimate equation (2) and (1) in STATA applying Roodman's conditional

mixed process (Roodman 2011) accounting for unobserved heterogeneity using random effects estimator. The CMP is a seemingly unrelated regression estimator that allows several equations to be estimated simultaneously using a system approach in which the errors are allowed to be correlated. We also apply a correlated random effects approach (CRE) by adding firm specific time averages of all time varying covariates following procedures suggested by, e.g, Wooldridge (n.d.), Papke & Wooldridge (2008) and Semykina (2018). As we have an unbalanced panel we also include averages of year dummies as proposed by Wooldridge (2019).

As suggested by previous studies (e.g, Sala & Yalcin (2015) and Mion & Opromolla (2014)) the employment background of top management teams could be a determinant of firms' export entry. Therefore, we include controls of the firms' CEOs. First, we define a newly recruited CEO as internally (from within the focal firm) or externally recruited (from another firm). Next, we distinguish between an externally recruited CEO who previously was the CEO of an exporting firm (CEO EE) and an externally recruited CEO without managerial export experience (CEO no EE). We also control for the CEO's age and educational level. We identify the CEOs as the employee at the firm with the highest salary in a given year. In case more than one "CEO" is identified, *CEO EE* identifies whether any of the employees with maximum salary were CEOs in an exporting firm before joining the focal firm. In that case CEO age is calculated as the average age, and for the CEO educational level, the maximum level among the "CEOs" is used.

Furthermore, we add a control for employees export experience, EEE_{t-1}, to control for spillovers through employees and inside directors (who per definition are employees of the focal firm). EEE_{t-1} is defined as the share of employees who in any of the five previous years were employed in an exporting firm. Two recent studies using EE-data report that firms hiring workers with previous export experience are more likely to enter export markets (Molina & Muendler 2013, Choquette & Meinen 2015).

If exporting firms also are more productive than non-exporting firms one might be

concerned about whether the effect of spillovers from exporting firms to non-exporters also captures the effect of spillovers from more productive to less productive firms. Using the above mentioned methods we examine the robustness of our results by adding controls for the productivity of the firms to which the directors are connected. We create a variable OBP_{it-1},outside board productivity, which alike EEB_{it-1} is calculated in several steps. First, we measure each firm's relative productivity by normalizing the firm's TFP by the two-digit industry median TFP.

Next, we determine each directors productivity measure as the maximum relative productivity among the other firms the director is connected to through employment or board appointment. Then, for each of the firms in our sample, we calculate the average productivity measure among the directors on the board. Similar to EEB_{it-1}, OBP_{it-1} is likely to be endogenous. Thus, we need to specify an other first stage equation with additional instruments. The instruments indicate whether any of the directors on the focal firm's board were newly appointed to the board of, or employed in, another firm that has the highest relative productivity among the firms to which the director is connected.

5 Results

Main results estimating the impact of increased export experience of the board of directors are reported in Tables 5.1 - 5.4. Table 5.1 estimates the propensity that currently non-exporting firms start to export in later periods using pooled probit, random effects probit and IV-probit models. Table 5.2 reports results from the probit random effects model, pooled IV-probit and random effects IV-probit model estimated with the Correlated Mixed Process approach (CMP). Table 5.3 shows results from the correlated random effects model using CMP. In order to assess the relative importance of the three export spillover variables as well as, total factor productivity , 5.4 estimates their marginal productivity. For the sake of comparability, none of the four variables is

instrumented.

Robustness test are conducted in Table 5.5 and 5.6. Table 7.3 presents results when also controlling for the share of directors with connections to foreign owned firms and Table 7.4 provide values from our main specification but applying a linear probability model instead.

5.1 Probit estimates

The first column of Table 5.1 reports the probability coefficient estimating equation 1 by the pooled probit model. Dummies for year, cohort, firm age fixed and CEO characteristics are included in the estimation but not reported in the table in order to save space.

Our main interest is the estimated effect of export experience among the board of directors. The lagged external export expertise variable, EEB_{t-1} enters highly significant in the upper row of the table, suggesting that outside and interlocked directors who are linked to export intensive firms are an important channel for transferring export competence to non-exporting firms.

The results also corroborate the existing research using EE-data in that we find robust evidence for export spillover by the employees (EEE_{t-1}) and the chief executive officer ($CEO\ EE_{t-1}$). Both are positively related to the non-exporting firms propensity to start exporting. It is worth pointing out that the $CEO\ EE_{t-1}$ variable is a dummy variable, while EEE_{t-1} measures the share of employees with export experience and the EEB_{t-1} is an intensity measure. The magnitude of the three categories of spillover estimates are therefore not comparable in the table.

As could be expected, the total factor productivity variable positively affects the likelihood that a firm will start exporting. The estimated impact of board size and human capital are not significant.

We can then draw three conclusions from our initial estimation results. The first, and least surprising is that the evidence of productivity and self-selection into exports

from two decades of productivity research is valid even with studies based on EE data. This is also in accordance with the four EE-studies discussed in Section 2. The second, and more important, is that both productivity and spillover via managers, workers and outside directors of the board are four separate explanatory factors when they are estimated in the same model. Finally, since we do not account for endogeneity, the results can only be interpreted as correlation.

The second column of Table 5.1 estimates the same model as column 1 but applies a random effects probit model to account for time-invariant unobserved heterogeneity. The results are not deviating from column (1).

While the two probit models in column 1 and 2 provide evidence that external board members with export experience increase the probability of exporting, the results might suffer from bias caused by simultaneity. To account for this problem, column 3 and 4 introduce our identification strategy, and present results from the two stage IV-probit model. The 1st stage of the model is reported in column 3 and includes two external instruments, for mitigating the endogenous bias, identified as a chronic problem in previous spillover studies (Hermalin & Weisbach 2001, Adams et al. 2010).

Inspecting the reduced form estimates, we first consider the two instruments in column 3, $New\ employer_{t-1}$ and $New\ interlock_{t-1}$, in the lower part of the table. Both are positive and highly significant and sizable in magnitude, which indicates their validity as instruments.

Considering the results from the structural equation estimation (column 4), we see that the three spillover estimates, EEB_{t-1}, EEE_{t-1} and $CEO\ EE_{t-1}$ all are positive and highly significant. However, only the estimate on export expertise in the board is instrumented by the two external instruments. It should be noted that the magnitude of the instrumented EEB_{t-1} variable increases substantially in column (4), compared to the coefficient estimates reported in column 1 and 2. The magnitude of the coefficients of the two non-instrumented variables is about the same in the IV-probit models compared to the probit and RE-probit models.

The bottom part of Table 5.1 reports the statistical test for the IV-probit model. Both the Amemiya–Lee–Newey test on overidentifying restrictions, and the Anderson-Rubin test of weak instruments, produce satisfactory results. The null hypothesis when testing for the validity of the overidentifying restriction cannot be rejected which suggests that the additional instrument is valid under the assumption that at least one of our instruments is also valid. Furthermore, the Wald test statistic is significant, which means that the null hypothesis of exogeneity is rejected suggesting that the point estimates from the probit model is not consistent with point estimates from the IV probit models.

Marginal effects from estimations presented in column 1 (probit) and 2 (RE probit) of Table 5.1 are shown in Table 5.4. Column 3 (probit) and column 4 (RE probit) repeat the same models, but replace the continuous intensity measure (EEB_{t-1}) for export expertise in the board with the binary variable $Any\ EEB_{t-1}$, that indicates whether any of the directors of the focal firm's board are connected to an exporting firm, and replace the continuous variable for export experience among the workers (EEE_{t-1}) with the binary variable $EEE10_{t-1}$, that indicates whether at least 10% of the employees of the focal firm have work experience from exporting firms. Across all four columns, $CEO\ EE_{t-1}$ is a binary variable that takes the value 1 if a newly externally recruited CEO has experience as a CEO in exporting firms.

Column 1 and 2 shows positive marginal effects for all three spillover-estimates as well as, for the TFP variable. In both columns, the magnitude of the estimates is largest for workers (0.063) and smallest for directors (0.015). Column 3 and 4 report what we suggest are the most comparable results for the three channels of knowledge diffusion in the analysis. Our preferred model is RE-probit (column 4) which accounts for unobserved heterogeneity but does not control for endogeneity.

We can see that the marginal effects in column 4 are quantitatively almost similar for the two binary variables outside board of directors ($Any\ EEB_{t-1}$), and managers ($CEO\ EE_{t-1}$), and somewhat smaller for workers (EEE_{t-1}). To put the column 4-figures into perspective, the results are as follows: To have at least one director with export

expertise is associated with a 5.1 percentage point increase in probability of export entry. Firms that recruit an external CEO with export experience increase the likelihood of export entry by 4.6 percentage points and firms in which at least one out of ten employees has export experience have a 3.0 percentage point higher probability of export entry compared to firms with fewer export experienced employees. Doubling TFP, corresponds to a 4.9 percent points increase in probability to serve a foreign market [3].

One concern with the results presented above is that the IV-estimates on the EEB_{t-1} variable are systematically larger than in the non-instrumented probit models. This finding is similar to results reported by Mion & Opromolla (2014), and in line with their interpretation our tentative explanation is the presence of substitutability between electing outside board members associated to exporting firms and other strategies in preparation for going abroad. One example could be that the focal firm plans to start exporting to a particular market or customer. Then the owners of the firm could choose between electing a director with experience of this market or customer, undertake a market analysis, or both of them. If the distribution of this unobservable other strategy across firms and time is positively correlated to electing directors with export expertise to the board (complements), the estimated EEB_{t-1} coefficient would be upward biased. In contrast, a negative correlation implies that they are substitutes, such that the firm elects a director with export skills, instead of, for example, conducting a costly market analysis and the coefficient on EEB_{t-1} would be downward biased. Thus, the larger estimates in our instrumented IV-models suggests that recruiting a director with specific expert experience is a substitute to an other possible costly export preparing strategy and that the coefficient on EEB_{t-1} in the non-instrumented models are underestimated.

[3]Note that doubling TFP requires quite a substantial effort.

5.2 CMP Probit and IV Correlated random effects

Table 5.2 reports the results from the CMP approach using random effects (column 1), pooled IV (column 2 and 3) and an IV-approach applying firm random effects in the structural equation (column 5).

The CMP probit estimates for EEB_{t-1} are all in line with the results presented in Table 5.1. The variable positively and significantly influences firms propensity to be exporter in the next time period. The estimated impact of this export-spillover is strongest when applying our preferable Limited Information Maximum Likelihood (LIML) CMP approach and accounting for both unobserved heterogeneity and endogeneity in column 5 (RE IV). Column 2 and column 4 indicate that the instruments used in the pooled IV and the RE IV models are valid.

The results in 5.2 also confirm the sorting effect of productivity. The presumably endogeneity biased estimates for employers are positive and significant in all three models, while the point estimate is positive but outside the 10% degree of significance for the managers in column 5.

In Table 5.3, we apply a correlated random effects approach (CRE) on the CMP RE IV-probit model presented in column 5 of 5.2. To do this, we add to the estimations of the last two columns of 5.2, firm specific time averages of all time varying covariates. The coefficient on EEB_{t-1} is smaller compared to in Table 5.2 and only significant on a 10% significance level. Coefficients on EEE_{t-1} and TFP_{t-1} remain highly significant and increase substantially in magnitude.

5.3 Robustness test

Tables 5.1, 5.2 and 5.3 produce very clear results on the importance of knowledge transfer from exporting to non-exporting firms. The likelihood that they will start to export is increased significantly. Our results for outside board members are a novelty contribution to the literature. But is there any reason to question the strong and causal

relationship?

One potential concern is that the estimated spillover effect could be driven not by the export intensity of the exporting firms to which the directors are connected but rather by their productivity.

In table 5.5, we therefore re-estimate the IV probit used in Table 5.1 and control for outside board productivity OBP.

The OBP measure is constructed in a similar manner as the EEB, but instead of summing the relative export intensity we sum the relative productivity of the other firms in which the directors of the focal firms are either employed or serve as a director on the board. Correspondingly, we also re-define the instruments, see appendix Table 7.1 for details.

The results from the estimations in 5.5 should be compared with the pooled probit, random effects probit and IV-probit presented in 5.1.

Columns 1, 2 and 5 of the table presents results for the EEB_{t-1} variable that are very close the estimates reported in Table 5.1. We find no significant effect on the focal firm's propensity to export from the productive expertise among the outside directors of the board, measured by the OBP variable, and the estimated effect of EEB_{t-1} remains highly significant in all specifications.

For comparability we also include results from CMP estimations controlling for OBP_{t-1} in Table 5.6. Column (3) presents the results from the structural equation including firm random effects and column (6) reports the results from including firm specific time averages of time varying covariates. The coefficient on EEB_{t-1} remains highly significant. The coefficients on EEE_{t-1} and TFP_{t-1} more than double in sizes when controlling for firm specific time averages.

As a second test of robustness, we examine possible spillover from foreign owned firms to the domestic firms. The results are shown in appendix Table 7.3 where the variable $OBFF$ measures the share of directors on the focal firm's board who are employed in, or serve on the board of, foreign owned firms. No spillover link between

foreign firms and the focal firm can be found.

Our final robustness test concerns possible industry- and firm specific variables not accounted for in the results presented above. In Table 7.4 we therefore estimate a linear probability model with appropriate fixed effects. One concern, however when applying fixed effects is that our panel is unbalanced and some of the firms are only observed once. Since the sample only includes never-exporters observed until they enter export our data is censored. Due to this, many of the singleton observations are observations of export entries. Excluding the singletons may cause a selection bias of the sample since we would only keep firms that remain non-exporting for at least one additional year.

Nevertheless, we include a table reporting the fixed effects linear probability estimations in the appendix Table 7.4 where the first column reports the results from a fixed effects OLS (including the singleton observations) and the second column presents the results from a two-stage least squares fixed effects second stage. The results show positive and significant estimates for connections to exporting firms through the board of directors and employees as well as productivity.

What then are the common observations in the tables reported in this section? We present significant evidence that an increase in export expertise on the board of small firms increases the probability that non-exporters will enter into foreign markets. This finding is robust across different model specifications and estimation approaches. Most importantly, we are able to show that our results are not driven by endogeneity bias.

6 Summary and conclusions

This paper investigates the link between export intensive firms and small non-exporting firms through outside and interlocked directors to the board of the company. The primary data in our analysis is matched Swedish employer-employee (EE) data containing observations on the realm of firms and employees in Sweden over the period 2000-2014. The total number observations is about 5 million firms and 50 million employees.

Based on this comprehensive data set, we identify 1,261 companies that meet the required conditions: They belong to the manufacturing sector, are independent non-exporting limited companies with between 10 and 50 employees when first observed, and can be followed in data for at least 3 years.

By exploiting detailed information on outside board members and the other firms that they are connected to, we are able to construct a normalized measure on the export expertise of the board of directors for each of the studied firms. We are then examining whether an increase in this export expertise measure affects the focal firms probability of entering foreign markets.

Applying a structural modeling instrumental variable approach including external instruments from the extensive EE-data to account for endogeneity, we find that outside directors may have a causal influence on entries into export markets. We conduct several sensitivity procedures to identify the isolated spillover effect from outside board members. First, we control for firm productivity, which in previous studies is found to be a main sorting mechanism into exports. We then consider that the non-exporting firm may have received export knowledge due to mobility of management and workers. Finally, in addition to our export-intensity measure for the outside board members, we control for a similarly constructed productivity measure. The results are robust to all these controls.

The contribution of the paper is that we identified a previously not well documented mechanism behind firms' decision to start to export. This is the first paper that applies

Table 5.1: Probit

	(1) Probit	(2) RE Probit	(3) IV probit 1st stage	(4) IV probit 2nd stage
	Exporting_t	Exporting_t	EEB_{t-1}	Exporting_t
EEE_{t-1}	0.125***	0.169**		0.663***
	(0.048)	(0.072)		(0.195)
Board size_{t-1}	0.017	0.046	0.075***	-0.039
	(0.062)	(0.090)	(0.015)	(0.065)
$\text{Board size}^2_{t-1}$	-0.005	-0.009	-0.003	-0.002
	(0.009)	(0.013)	(0.002)	(0.009)
EEE_{t-1}	0.723***	1.135***	0.069	0.674***
	(0.209)	(0.385)	(0.052)	(0.212)
CEO EE_{t-1}	0.286**	0.298*	0.037	0.262**
	(0.129)	(0.163)	(0.035)	(0.131)
TFP_{t-1}	0.262***	0.427***	0.075***	0.219***
	(0.064)	(0.137)	(0.015)	(0.066)
$\text{New employer}_{t-1}$			1.104***	
			(0.107)	
$\text{New interlock}_{t-1}$			1.648***	
			(0.123)	
Industry, Metro, Firm size, Human capital controls	Yes	Yes	Yes	Yes
Year, cohort,firm age fixed effects	Yes	Yes	Yes	Yes
CEO controls[1]	Yes	Yes	Yes	Yes
Constant	-1.560***	-3.131***	-0.162	-1.437***
	(0.475)	(1.203)	(0.113)	(0.481)
$\ln\sigma_u^2$		-0.241		
		(0.787)		
Wald test of exogeneity χ^2 statistic			8.246	
p-value			0.004	
Amemiya-Lee-Newey minimum χ^2 statistic			0.117	
p-value			0.732	
Anderson-Rubin χ^2statistic			12.01	
p-value			0.003	
Observations	4969	4969	4969	4969

[1] All specifications include controls of CEO characteristics including CEO age, CEO education, Internal CEO and External CEO without EE

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5.2: CMP probit

	(1)	(2)	(3)	(4)	(5)
	RE	Pooled IV		RE IV[2]	
	$Exporting_t$	EEB_{t-1}	$Exporting_t$	EEB_{t-1}	$Exporting_t$
EEB_{t-1}	0.169**		0.642***		0.843***
	(0.068)		(0.194)		(0.276)
New $employer_{t-1}$		1.099***		1.102***	
		(0.311)		(0.311)	
New $interlock_{t-1}$		1.653***		1.650***	
		(0.379)		(0.380)	
Board $size_{t-1}$	0.046	0.076***	-0.037	0.075***	-0.027
	(0.100)	(0.024)	(0.065)	(0.024)	(0.097)
Board $size^2_{t-1}$	-0.009	-0.003	-0.002	-0.003	-0.004
	(0.014)	(0.004)	(0.009)	(0.004)	(0.014)
EEE_{t-1}	1.137**	0.069	0.652***	0.069	1.040**
	(0.455)	(0.081)	(0.224)	(0.081)	(0.428)
CEO EE_{t-1}	0.298*	0.037	0.254**	0.037	0.255
	(0.160)	(0.038)	(0.124)	(0.038)	(0.155)
TFP_{t-1}	0.428***	0.075**	0.212***	0.075**	0.361**
	(0.155)	(0.029)	(0.029)	(0.029)	(0.144)
Industry, Metro, Firm size, Human capital controls	Yes	Yes	Yes	Yes	Yes
Year, cohort, firm age fixed effects	Yes	Yes	Yes	Yes	Yes
CEO controls[1]	Yes	Yes	Yes	Yes	Yes
Constant	-3.138**	-0.163	-1.391***	-0.162	-2.911**
	(1.525)	(0.109)	(0.479)	(0.109)	(1.428)
σ_{11}	0.889				
	(0.460)				
σ_1			0.453***		0.453***
			(0.032)		(0.032)
ρ_{12}			-0.251***		-0.327**
			(0.091)		(0.125)
σ_{12}					0.876
					(0.428)
Observations	4969	4969	4969	4969	4969

[1] All specifications include controls of CEO characteristics including CEO age, CEO education, Internal CEO and External CEO without EE. [2] Firm random effects only included in Exporting-equation. Clustered standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5.3: CMP probit - CRE IV

	(1) EEB_{t-1}	(2) $Exporting_t$
EEB_{t-1}		0.576*
		(0.312)
New $employer_{t-1}$	1.090***	
	(0.302)	
New $interlock_{t-1}$	1.594***	
	(0.372)	
Board $size_{t-1}$	0.005	0.338
	(0.039)	(0.216)
Board $size^2_{t-1}$	0.004	-0.037
	(0.006)	(0.025)
EEE_{t-1}	0.013	2.300***
	(0.090)	(0.700)
CEO EE_{t-1}	-0.011	0.230
	(0.035)	(0.237)
TFP_{t-1}	-0.049	0.994***
	(0.06)	(0.323)
Firm-specific time averages[2]	Yes	Yes
Industry, Metro, Firm size, Human capital controls	Yes	Yes
Year, cohort, firm age fixed effects	Yes	Yes
CEO controls[1]	Yes	Yes
Constant	12.255***	-0.030
	(1.497)	(0.176)
σ_1		0.449***
		(0.031)
ρ_{12}		-0.274*
		(0.145)
Observations	4969	4969

[1] All specifications include controls of CEO characteristics including CEO age, CEO education, Internal CEO and External CEO without EE. [2] Firm specific time averages of all time varying covariates included in both specifications. Clustered standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5.4: Marginal Effects

	(1) Probit	(2) RE Probit	(3) Probit	(4) RE Probit
	Exporting$_t$			
EEB$_{t-1}$	0.015***	0 .019**		
	(0.005)	(0.008)		
Any EEB$_{t-1}$			0.039***	0.051***
			(0.010)	(0.015)
Board size$_{t-1}$	0.009	0 .015	0.000	0.002
	(0.007)	(0.011)	(0.008)	(0.011)
Board size$^2_{t-1}$	-0.001	-0 .002	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.002)
EEE$_{t-1}$	0.063***	0 .097***		
	(0.022)	(0.038)		
EEE10$_{t-1}$			0.025**	0.030***
			(0.010)	(0.012)
CEO EE$_{t-1}$	0.035**	0 .036*	0.042**	0.046**
	(0.015)	(0.019)	(0.017)	(0.020)
TFP$_{t-1}$	0.029***	0 .046***	0.034***	0.049***
	(0.007)	(0.015)	(0.008)	(0.015)
Industry, Metro, Firm size,				
Human capital controls	Yes	Yes	Yes	Yes
Year and firm age fixed effects	Yes	Yes	Yes	Yes
CEO controls[1]	Yes	Yes	Yes	Yes
Observations	4969	4969	4969	4969

[1] All specifications include controls of CEO characteristics including CEO age, CEO education, Internal CEO and External CEO without EE

Clustered standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5.5: Probit

	(1) Probit	(2) RE Probit	(3) IV probit 1st stage	(4) IV probit 1st stage	(5) IV probit 2nd stage
	Exporting_t	Exporting_t	EEB_{t-1}	OBP_{t-1}	Exporting_t
EEB_{t-1}	0.152***	0.198***			1.116***
	(0.052)	(0.075)			(0.480)
OBP_{t-1}	-0.053	-0.068			-0.254
	(0.040)	(0.056)			(0.232)
Board size_{t-1}	0.026	0.057	0.076***	0.160***	-0.028
	(0.062)	(0.090)	(0.015)	(0.022)	(0.067)
Board size^2_{t-1}	-0.005	-0.009	-0.003*	0.001	0.000
	(0.009)	(0.013)	(0.002)	(0.003)	(0.009)
EEE_{t-1}	0.733***	1.134***	0.068	0.192**	0.695***
	(0.210)	(0.382)	(0.052)	(0.078)	(0.217)
CEO EE_{t-1}	0.286**	0.296*	0.038	0.046	0.254*
	(0.129)	(0.162)	(0.035)	(0.052)	(0.134)
TFP_{t-1}	0.272***	0.431***	0.075***	0.221***	0.241***
	(0.064)	(0.135)	(0.015)	(0.023)	(0.070)
New employer_{t-1}			1.101***	2.724***	
			(0.110)	(0.165)	
New interlock_{t-1}			1.601***	2.023***	
			(0.127)	(0.192)	
OBP New employer_{t-1}			0.001	0.583***	
			(0.047)	(0.071)	
OBP New interlock_{t-1}			0.118	0.766***	
			(0.080)	(0.121)	
Industry, Metro, Firm size, Human capital controls	Yes	Yes	Yes	Yes	Yes
Year, cohort,firm age-industry fixed effects	Yes	Yes	Yes	Yes	Yes
CEO controls[1]	Yes	Yes	Yes	Yes	Yes
Constant	-1.575***	-3.092***	-0.164	-0.363**	-1.453***
	(0.474)	(0.188)	(0.113)	(0.170)	(0.488)
$\ln\sigma_u^2$		-0.290			
		(0.800)			
Wald test of exogeneity χ^2 statistic			11.051		
p-value			0.004		
Amemiya-Lee-Newey minimum χ^2 statistic			0.300		
p-value			0.861		
Anderson-Rubin χ^2 statistic			12.54		
p-value			0.014		
Observations	4969	4969	4969	4969	4969

[1] All specifications include controls of CEO characteristics including CEO age, CEO education, Internal CEO and External CEO without EE

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5.6: CMP probit

	(1)	(2)	(3)	(4)	(5)	(6)
		RE IV [1]			CRE IV	
	EEB_{t-1}	OBP_{t-1}	$Exporting_t$	EEB_{t-1}	OBP_{t-1}	$Exporting_t$
EEB_{t-1}			1.262***			1.142***
			(0.374)			(0.423)
OBP_{t-1}			-0.283			-0.287
			(0.236)			(0.266)
OBP New $employer_{t-1}$		0.850***			0.832***	
		(0.098)			(0.099)	
OBP New $interlock_{t-1}$		1.063***			1.039***	
		(0.181)			(0.178)	
New $employer_{t-1}$	0.597**			0.590**		
	(0.275)			(0.267)		
New $interlock_{t-1}$	1.264***			1.222***		
	(0.344)			(0.337)		
EEE_{t-1}	0.078	0.235*	0.969**	0.009	0.306**	2.122***
	(0.082)	(0.133)	(0.412)	(0.090)	(0.141)	(0.684)
CEO EE_{t-1}	0.039	0.058	0.226	-0.010	0.014	0.230
	(0.038)	(0.065)	(0.150)	(0.035)	(0.048)	(0.218)
TFP_{t-1}	0.078***	0.236***	0.351**	-0.049	-0.048	0.988***
	(0.030)	(0.057)	(0.154)	(0.060)	(0.083)	(0.306)
Firm-specific time averages[2]	No	No	No	Yes	Yes	Yes
Industry, Metro, Firm size, Human capital controls	Yes	Yes	Yes	Yes	Yes	Yes
Year, cohort,firm age fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
CEO controls[3]	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.179	-0.453**	-2.654**	-0.060	-0.465	11.199***
	(0.109)	(0.184)	(1.314)	(0.178)	(0.324)	(1.805)
σ_{13}			0.788			
			(0.382)			
σ_1			0.455***			0.450***
			(0.32)			(0.032)
σ_2			0.710***			0.706***
			(0.029)			(0.029)
ρ_{12}			0.314***			0.313***
			(0.033)			(0.033)
ρ_{13}			-0.463**			-0.464**
			(0.164)			(0.189)
ρ_{23}			-0.017			-0.072
			(0.156)			(0.185)
Observations	4969	4969	4969	4969	4969	4969

[1] Firm random effects only included in Exporting-equations. [2] Firm specific time averages of all time varying covariates included in all specifications. [3] All specifications include controls of CEO characteristics including CEO age, CEO education, Internal CEO and External CEO without EE.
Clustered standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

a systematic analysis of export expertise spillovers through the board of directors. For this analysis we were able to rely on a data set that made it possible to link all unique managers, workers and board directors to unique companies. While providing detailed individual- and firm characteristics, it also observes the units across the economy and over time.

We also corroborate findings from the still limited EE-literature on spillovers from exporting firms to non-exporters by presenting robust evidence on employment and managers with export experience.

There are several limitations of this study. One limitation is that we don't observe presence of consultants, that may be an omitted channel for export spillovers in the analysis that might not be properly captured by our random effects estimates. Another limitation is that we don't identify the particular skills of the outside directors, which is a direction that deserves further analysis following the research conducted in this paper. Using the richness of the EE-data, an interesting research could be to investigate if the most effective expertise of outside directors is specific in terms of technology, products or regions, i.e. if the focal firm tends to resemble the company where the board members have their employment or serve as interlocked directors. A second area for further research is to follow up on how the new exporters succeed in the international market. Does the expertise of the board have any impact on the intensive margin or sustainability of exports?

From the policy perspective, the results of our analysis provide evidence on the role of the board of directors in small firms aiming to be involved in international markets. Many of these firms have board of directors just to fulfill legal requirements. Our paper sheds light on the importance of strategic election of a professional board with links to firms already serving customers abroad.

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7 Appendix

Table 7.1: Variables

Variable	**Description**
Firm size$_{t-1}$	=1 if number of employees>25
Human capital$_{t-1}$	Share of employees with 3 or more years of university education.
CEO age$_{t-1}$	CEO age in years
CEO education$_{t-1}$	CEO's highest educational level.5 categories Primary, Secondary, High school, Short-, Long university.
Metro	Indicator (0/1): focal firm is located in metro area (Stockholm, Gothenburg or Malmö).
Firm age	Firm age in years
Industry technology level	
HT	High tech manufacturing
MHT	Medium High tech manufacturing
MLT	Medium Low tech manufacturing
LT	Low tech manufacturing

Table 7.2: Summary statistics - Panel of firms

Variable	Mean	Std. Dev.	Min.	Max.
Exporting$_t$	0.076	0.266	0	1
EEB$_{t-1}$	0.133	0.494	0	8.184
New employer$_{t-1}$	0.009	0.062	0	1
New interlock$_{t-1}$	0.006	0.053	0	1
Board size$_{t-1}$	2.107	1.402	1	10
Firm size$_{t-1}$	0.188	0.391	0	1
Human capital$_{t-1}$	0.071	0.119	0	1
EEE$_{t-1}$	0.147	0.168	0	1
TFP$_{t-1}$	1.222	0.494	0	3.727
CEO EE$_{t-1}$	0.039	0.195	0	1
CEO INT$_{t-1}$	0.339	0.473	0	1
CEO NEE$_{t-1}$	0.36	0.48	0	1
CEO age$_{t-1}$	46.292	9.666	20	76
CEO education$_{t-1}$				
Primary	0.038	0.19	0	1
Secondary	0.161	0.367	0	1
Upper secondary	0.616	0.486	0	1
Uni $<$3 years	0.078	0.269	0	1
Uni $\geq$	0.105	0.306	0	1
Industry				
High tech	0.047	0.212	0	1
Medium high tech	0.105	0.306	0	1
Medium low tech	0.414	0.493	0	1
Low tech	0.401	0.49	0	1
Year				
2006	0.661	0.473	0	1
2007	0.114	0.318	0	1
2008	0.105	0.306	0	1
2009	0.035	0.185	0	1
2010	0.029	0.168	0	1
2011	0.027	0.161	0	1
2012	0.012	0.109	0	1
2013	0.012	0.107	0	1
2014	0.005	0.071	0	1
Firm age$_{t-1}$	18.13	12.553	0	99
Cohort				
2006	0.141	0.348	0	1
2007	0.143	0.35	0	1
2008	0.135	0.342	0	1
2009	0.107	0.309	0	1
2010	0.106	0.308	0	1
2011	0.103	0.304	0	1
2012	0.096	0.294	0	1
2013	0.087	0.281	0	1
2014	0.083	0.275	0	1
N	4969			

Table 7.3: RE Probit

	Exporting_t
EEB_{t-1}	0.204***
	(0.075)
OBP_{t-1}	-0.079
	(0.057)
OBFF_{t-1}	0.095
	(0.457)
Board size_{t-1}	0.087
	(0.091)
$\text{Board size}^2_{t-1}$	-0.014
	(0.013)
EEE_{t-1}	1.095***
	(0.357)
CEO EE_{t-1}	1.570**
	(0.668)
TFP_{t-1}	0.451***
	(0.139)
Industry, Metro, Firm size, Human capital controls	Yes
Year, cohort,firm age fixed effects	Yes
CEO controls[1]	Yes
Constant	-3.039**
	(1.202)
$\ln\sigma_u^2$	-0.387
	(0.874)
Observations	4969
Wald test of exogeneity	
χ^2 statistic	
p-value	

[1] Include controls of CEO characteristics including
CEO age, CEO education, Internal CEO and External CEO without EE
Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7.4: Linear probability

	(1)	(2)
	Fixed effects	Fixed effects IV, 2nd stage
	Exporting$_t$	Exporting$_t$
EEB$_{t-1}$	0.018	0.469*
	(0.012)	(0.261)
Board size$_{t-1}$	0.021	0.008
	(0.017)	(0.028)
Board size$^2_{t-1}$	-0.002	-0.003
	(0.002)	(0.004)
EEE$_{t-1}$	0.174***	0.164***
	(0.046)	(0.061)
CEO EE$_{t-1}$	0.012	0.019
	(0.021)	(0.025)
TFP$_{t-1}$	0.049*	0.080**
	(0.026)	(0.038)
Firm size and Human capital controls	Yes	Yes
Year and firm age fixed effects	Yes	Yes
CEO controls[1]	Yes	Yes
Constant	-0.259***	
	(0.077)	
Cragg-Donald Wald F statistic		12.180
Kleinbergen-Paap rk Wald F statistic		3.385
Hansen J statistic		0.247
χ^2p-value		0.619
Observations	4969	4638

[1] All specifications include controls of CEO characteristics including CEO age, CEO education, Internal CEO and External CEO without EE

Clustered standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7.5: Proportional hazard - board exit

	(1)	(2)
	Complementary log-log	
	Full sample	Only exporters
	$Exit_t$	
$Tenure_{t-1}$	-0.172***	-0.137*
	(0.033)	(0.079)
$Tenure^2_{t-1}$	0.014***	0.012*
	(0.002)	(0.007)
Z_{t-1}	0.074	0.362
	(0.253)	(0.345)
Constant	-2.095***	-1.944***
	(0.098)	(0.196)
Observations	11554	2138

Clustered standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$