

Bitzer, Jürgen; Gören, Erkan; Hiller, Sanne

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**International Knowledge Spillovers:
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by

Jürgen Bitzer, Erkan Gören
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International Knowledge Spillovers: The Benefits from Employing Immigrants *

JÜRGEN BITZER[†]

Carl von Ossietzky University Oldenburg

ERKAN GÖREN[‡]

Carl von Ossietzky University Oldenburg and Aarhus University

SANNE HILLER[§]

Ruhr-University Bochum and Aarhus University

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Abstract

This paper explores the role of immigrant employees for a firm's capability to absorb international knowledge. Using matched employer-employee data from Denmark for the years 1999 to 2009, we are able to show that non-Danish employees contribute significantly to a firm's economic output through their ability to access international knowledge. The immigrants' impact increases if they come from technological advanced countries, have a high educational level, and are employed in high skilled positions. However, the latter does not hold for immigrant managers.

Keywords: R&D Spillovers, Absorptive Capacity, Firm-Level Analysis,
Foreign Workers, Immigrants

JEL Classification Numbers: D20, J82, L20, O30

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[†]Carl von Ossietzky University Oldenburg, Department of Economics, Campus Haarentor, Building A5, 26111 Oldenburg, Germany, Tel.: +49-441-798-4217, e-mail: juergen.bitzer@uni-oldenburg.de.

[‡]Carl von Ossietzky University Oldenburg, Department of Economics, Campus Haarentor, Building A5, 26111 Oldenburg, Germany and Department of Economics, Aarhus University, Denmark, Tel.: +49-441-798-4292, e-mail: erkan.goeren@uni-oldenburg.de.

[§]Ruhr-University Bochum, Department of Economics, Universitätsstr. 150, 44801 Bochum, Germany and Department of Economics, Aarhus University, Hermodsvej 22, 8230 Aabyhøj, Denmark, e-mail: sanne.hiller@rub.de.

1 Introduction

Following the seminal paper of Coe and Helpman (1995) a large body of literature has emerged devoted to identifying the channels through which international knowledge spillovers occur and their impact on output and productivity (for reviews of the literature, see Hall et al., 2010 or Keller, 2004). While there has been substantial progress in the identification and analysis of several diffusion channels, the role of employees as a potential diffusion channel for international knowledge spillovers has been vastly neglected. This is rather surprising, because employees are an obvious and crucial factor in the absorption of knowledge and form the absorptive capacity (Cohen and Levinthal, 1989) of economic entities, be it countries, sectors or firms. To absorb foreign knowledge successfully, it is necessary to "evaluate the technological and commercial potential of knowledge in a particular domain, assimilate it, and apply it" (Cohen and Levinthal 1994, p. 227). Thus, countries, industries, or firms have to incur efforts to accumulate a certain amount of technological capability, to be able to acquire technological knowledge from the external environment. Obviously, employees play an active role in the identification, assimilation and application of foreign knowledge and are therefore an important channel for knowledge spillovers.

The empirical approximation of an economic entity's absorptive capacity usually closely follows the notion of Cohen and Levinthal (1989) that the absorptive capacity refers to a firm's stock of prior knowledge, which positively depends on its human capital stock and R&D expenditures. The importance of the two latter factors rises as usual with the complexity of external knowledge. For example, Mancusi (2008) shows for a panel of OECD industries that absorptive capacity, approximated by cross-industry patent citations, contributes significantly to innovation activity in laggard countries. Griffith et al. (2004), approximate absorptive capacity by the level of R&D intensity and illustrate, for a panel of industries in twelve OECD countries, that it stimulates TFP growth indirectly through technology transfer, once again, pointing to the importance of absorptive capacity. At the firm level, Poldahl (2012) investigates the impact of various domestic and international R&D intensity measures on firms' TFP growth in a panel of Swedish manufacturing firms. Their results, in accordance to previous studies, uncover the importance of absorptive capacity for firms' TFP growth. The largest number of studies in this branch use human capital as a proxy of absorptive capacity, as analyzed in Fracasso and Marzetti (2014), Ang et al. (2011), Sena and Anon Higon (2014), Kneller (2005), Kneller and Stevens (2006), among others. They all arrive at the conclusion that firms' and sectors' absorptive capacity is essential to reap the gains from international knowledge spillovers.

We build upon this literature but follow a different path by taking up an idea in the less often cited part of Arrow's (1969) paper in which he states that transfer of knowledge takes place via different communication channels exhibiting different costs, "where these costs include the ability of the sender to "code" the information and the recipient to "decode" it." (see p. 33). Arrow later in his paper elucidates that the coding/decoding process includes not only prior technological knowledge but also language, culture and personal contacts.¹ These non-technical aspects of the process of knowledge absorption, which determine the absorptive capacity of countries, sectors or firms are at the center stage of our analysis. In line with the considerations of Arrow (1969), the authors Cohen and Levinthal (1990) also emphasize the importance of communication systems between organizational structures and the external environment for the firm's absorptive capacity. At the basic level, individual actors equipped with a particular language can act as a gatekeeper to transfer knowledge from the external environment to different subunits of the firm.

Arrows arguments are supported by the recent empirical study of Kerr (2008), who argues in favor of international ethnic scientific networks for the diffusion of knowledge across nations. A striking result of his study is that foreign researchers outside are found to cite U.S. researchers of their own ethnicity more frequently than researchers from other ethnic groups, contributing significantly to technology diffusion between developed and emerging countries. His results suggest that industrial output in less advanced economies rises with co-ethnic patent citations in the United States, highlighting the importance of technology diffusion along ethnic lines. Ethnic scientific networks increase awareness of recent technological developments and can aid trust in otherwise uncertain legal environments. They matter for more than pure language skills, which by themselves are of importance for international interactions (Melitz and Toubal, 2013; Isphording and Otten, 2013). For example, Rauch (2001) argues that ethnic communities outside a country can foster trade flows as they are considered trusted intermediaries with strong ties to their home country. The importance of social capital in co-ethnic networks that facilitate knowledge exchange between innovators through enhanced trustworthiness has been analysed by Coleman (1988) and Kalnins and Chung (2006). Their functioning of reputation intermediaries in industries where tacit knowledge is important has been shown by Kapur (2001). Furthermore, Peri and Requena-Silvente (2010) illustrate that migrant networks lower barriers

¹In this context he gives an example on jet engines: As British authorities decided to transfer the plans for the jet engine to the U.S. during the Second World War, it took U.S. researchers ten months for them to redraw the plans making it suitable for American usage.

to international trade in particular for differentiated products, where contracts are likely to be incomplete, i.e., when the need for communication is large, because full codification is difficult. In this vein, other studies have mentioned the specific attributes of knowledge for the process of diffusion and absorption. Specifically, Sorenson et al. (2006) emphasize the importance of social proximity when receiving and extending knowledge of moderate complexity. While simple knowledge diffuses equally strong among socially near and distant recipients due to factors of unaided recipients search, the diffusion of moderate knowledge is considerably enhanced by social proximity which requires a certain amount of interpersonal exchange between actors. Pertaining to the sources of technology transfers, Agrawal et al. (2008) have shown that social proximity (e.g., co-ethnic networks) within members of U.S. resident Indian diaspora substitutes for geographical proximity in their role for knowledge diffusion. Their result is particularly relevant for firms recruiting foreign workers to increase their innovation capacities through their access to international knowledge flows: hiring immigrants may – to some extent – remove the need of “incurring the cost of moving teacher and student into the same geographical location” (Keller, 2004, p.756) to pass on tacit knowledge. Firms’ hiring decisions matter for inter-firm knowledge transmission (Poole, 2013; Balsvik, 2011), in particular if moving workers are highly educated or technicians (Parotta and Pozzoli, 2012).²

Thus, Arrow’s (1969) considerations and the mentioned empirical evidence on co-ethnic networks suggest that immigrant employees might be an important channel for the diffusion of international knowledge spillovers.

Our paper therefore addresses the question whether immigrant employment improves firms’ absorptive capacity for foreign knowledge. The contribution of our paper is threefold. First, by using detailed employee data we are able to differentiate the immigrants by origin, educational level and occupational position enabling us to construct highly detailed proxies of firms’ absorptive capacity and with it, to identify the importance of the individual groups of immigrants for the diffusion of foreign knowledge. Thereby, we additionally contribute to the literature on the costs and benefits of ethnic diversity in firms. Second, by combining these proxies with international R&D capital stocks we are able to establish a direct link between foreign knowledge and a firm’s immigration-based absorptive capacity. Helping to differentiate between the impact of the immigrants’ personal skills on firms’ output/productivity from their impact via the absorption of foreign knowledge. Third, our estimations uncover if the immigrants are an important

²Other studies have investigated the impact of foreign experts on firm’s TFP growth, and value added per worker in domestic firms (Görg and Strobl, 2005; Markusen and Trefimenko, 2009; Malchow-Møller et al., 2011).

channel for the diffusion of foreign knowledge thereby extending the literature on international knowledge spillovers.

Based on Coe and Helpman (1995), and the subsequent literature, we apply a production function approach. For our econometric analysis, we combine a matched employer-employee data set from Denmark during the years 1999 to 2009 with data on international R&D capital stocks for OECD countries. This enables us to control for a broad range of firm-specific variables such as physical capital stock, intermediate goods, size of the labour stock, average firm tenure, ethnic diversity. In addition, we also account for industry-year, commuting, and time fixed effects to control for unobserved heterogeneity across industry affiliations, regions, and economy-wide effects.

Our empirical results show that employing immigrants increases firms' absorptive capacity, resulting in a significantly higher output elasticity with respect to foreign knowledge. However, this effect is identified only if we take the origin, educational level or occupational position of the immigrants into account. Hiring a larger share of immigrants from technological advanced countries increases the output elasticity with respect to international R&D knowledge stocks. Furthermore, we are able to show that foreign knowledge's output elasticity increases with the educational level of the employed immigrants. The same is true for the occupational positions of the immigrants. However, the output elasticity with respect to foreign knowledge of immigrant managers is lower than that of high skilled immigrants without executive functions and becomes insignificant in the fully specified model, controlling for the full range of occupational positions of the employed immigrants. Additionally, we confirm existing findings that workforce ethnic diversity is associated with a negative output elasticity (e.g., Parrotta et al., 2014a). Despite our negative impact of workforce ethnic diversity on firms' gross production, perhaps, through increased communication costs, our findings point to the economic importance of a diverse labour force for the firm's capability to access international knowledge. Finally, our results are robust to the inclusion of a broad range of additional control variables and variations in the estimation specification.

The remaining parts of the paper are organized as follows. In Section 2 we outline our empirical approach that constitutes the basis of the empirical analysis. Section 3 describes the data and methods behind the construction of firm-specific international R&D knowledge stocks. Section 4 presents the empirical results, and Section 5 checks the robustness of the results to various sample sizes and among different specifications. Finally, Section 6 concludes by summarizing the main results.

2 Empirical Approach

2.1 Estimation Set Up

As pointed out by Arrow (1969) the absorption of knowledge reaches beyond the pure technological prior knowledge but also includes aspects like language, culture, personal contacts and social-ethnic networks. The absorption of knowledge from foreign sources therefore requires the access to foreign language, foreign culture, foreign persons and foreign social networks. Obviously a simple strategy to acquire such an access is to hire foreigners. The employment of foreigners would therefore increase the absorptive capacity which in turn should increase the benefits from foreign knowledge. Following Coe and Helpman (1995), we estimate a production function to empirically uncover the impact of employing foreign workers on economic performance through the access of international knowledge. However, we refrain from estimating the reduced TFP form because of two econometric reasons. First, by regressing value added on labor and capital to obtain TFP, approximated by the residual of the estimation, it would be implicitly assumed that labor and capital are uncorrelated with technological progress, which is captured in the residuals. If this assumption does not hold, the estimated coefficients are biased and thus the residuals, and with it TFP, are miscalculated. Furthermore, using different measures to explain TFP in the second step of the regressions strengthens the doubts about the correct specification of the first stage of the regression to obtain TFP.³ Second, using value added as variable to preserve TFP also implicitly assumes that changes in value added are solely caused by changes in labor and capital. However, organisational changes in the production structure, e.g. caused by outsourcing, are not taken into account and blur the direct production link between value added and labor and capital. We therefore estimate a fully specified model, using gross production as dependent variable and control for intermediates. The classical set up on the country level is then given by the following regression equation:

$$\log Y_{ct} = \alpha + \beta_1 \log L_{ct} + \beta_2 \log K_{ct} + \beta_3 \log M_{ct} + \beta_4 \log S_{ct}^d + \beta_5 \log S_{ct}^f + \beta_6 \mathcal{X}_{ct} + \alpha_c + \alpha_t + \varepsilon_{ct}, \quad (1)$$

where $\log Y$ is the log of gross production, $\log L$, $\log K$, and $\log M$ are the logs of labour, capital, and materials, respectively. $\log S^d$ is the domestic R&D capital stock and $\log S^f$ is the R&D capital stock of foreign countries. The variable \mathcal{X}_{ct} captures the influence of the foreign R&D capital stock (S^f) via the absorptive capacity of a country. Subscripts c and t refer to the index for the corresponding country and time, respectively. Unfortunately, and somewhat

³For a review on the problems to determine TFP see Hulten (2001). For the problem of capital utilization for TFP calculation see Hulten (1986), Burnside et al. (1996), Berndt et al. (1986).

surprisingly, detailed data on employees (e.g., education level, work experience, age structure) are not available on the country level, even not for industrialized countries. Therefore, we have to come back to the firm level, where such detailed employee data is available. However, transferring the basic econometric set up in equation 1 to the firm level requires various adjustments. While the control for the traditional inputs can be taken over one to one, the mapping of the different types of knowledge is more sophisticated. Taking the R&D capital stock variable to the firm level would require to split the variable up into own and external domestic R&D capital, to capture the effects of a firm's own R&D efforts and those of other domestic firms via knowledge spillovers. However, the coverage of R&D expenditures in firm level data is usually very limited, preventing the construction of the required R&D capital stocks. For this reason, only a few studies for Danish firms and with a limited number of observations exist to uncover the influence of a firm's R&D capital stock on its economic performance (e.g., Dilling-Hansen et al., 2003; Smith et al., 2004). Therefore, we control for the aggregated Danish R&D capital stock, but refrain from using R&D capital stocks on firm level. This of course comes at the expense of being unable to distinguish between the effects of own R&D capital stock and the effects of domestic knowledge spillovers on output; however, our focus is on international rather than domestic spillovers. Since the total domestic R&D capital stock does not vary between the firms in a year, the effect is captured by the time-fixed effects. The same applies to the foreign R&D capital stock, which varies over time, but not between firms in a year. Thus, we properly control for both variables $\log S^d$ and $\log S^f$ in our basic set-up; however, their concrete elasticity can not be identified. Finally, our variable of interest is a function of the firm specific proxy of its absorptive capacity and the foreign R&D capital stock $\log S_{ct}^f$. Thus, \mathcal{X}_{ct} is a firm specific variable which can be included into the estimation equation without any further troubles.

Extending equation (1) to firm i , industry j , and time t along with additional firm-specific controls results in the following estimation equation:

$$\log Y_{it} = \alpha + \beta_1 \log L_{it} + \beta_2 \log K_{it} + \beta_3 \log M_{it} + \beta_4 \mathcal{X}_{it} + \mathbf{X}_{it} \beta + \alpha_{ct} + \alpha_{jt} + \alpha_t + \varepsilon_{it}, \quad (2)$$

where $\log Y_{it}$ is the the log of gross production (measured in total sales of goods and services) of firm i at time t . $\log L_{it}$, $\log K_{it}$, and $\log M_{it}$ are the logs of labour, capital, and materials, respectively. The variable of interest, \mathcal{X}_{it} , refers to our measure for the effect of international R&D capital stocks on a firm's gross production outcomes via increased absorptive capacity through the employment of foreign workers. A detailed discussion regarding the construction of this variable is provided in the next section. In addition, we also take into account a broad range of firm-specific control variables, summarized in the matrix \mathbf{X}_{it} . This includes a measure

of ethnic diversity, the log of average firm tenure in years, the share of men employees, the share of managers, and a dummy variable indicating whether the firm is foreign-owned or not. Furthermore, we also incorporate firm specific controls indicating the share of employees belonging to each age distribution quartile, the share of employees with low-, mid-, and high-skilled occupations, and the share of employees with basic, secondary, and tertiary education. Thus, we are able to capture differences in firms' absorptive capacity on the employment level and thus control for Cohen and Levinthal's (1989) notion of prior knowledge.

In addition, the variables α_{ct} , α_{jt} and α_t refer to commuting fixed effects, industry-year fixed effects, and country-wide year fixed effects, respectively, to control for unobserved heterogeneity across industries, regions, and years. These fixed effects specifications warrant some careful discussions. First, the industry-year fixed effects remove all trends specific to the industry under consideration but are common to the firms belonging to that industry. These common trends include such factors as demand shifts and price changes, as well as differences in management skills, and industry-specific technology opportunity conditions. Second, the time-fixed effects remove trends common to the firms within Denmark. This variable captures economy-wide influences on the firm level such as the Danish legal system, the general knowledge stock, firms' own R&D knowledge stock, which is incorporated in the Danish total R&D capital stock, and economy-wide measurement errors in deflators common to all firms or industries. Third, we also incorporate commuting fixed effects into our regression analysis to control for differences in labour market policies, infrastructure quality, and assistance to industrial sectors across economic regions (Andersen, 2002).

We forego the use of firm-fixed effects in the empirical analysis for two reasons: firstly, Griliches and Hausman (1986) highlight that the inclusion of many fixed effects may exacerbate problems that arise from measurement error, for instance attenuation bias. Secondly, Table 2 indicates that much greater variation of ethnic groups from OECD countries exists across firms than across time within firms. To the extent that this small variation within firms is what being captured by the firm fixed effects, this circumstance will make it difficult to disentangle the impact of the ethnic- and education-weighted foreign R&D capital stock variable from the general firm-specific effect. As an additional benefit, this makes our findings more easily comparable with a related study on the direct impact of diversity on firm productivity by Parotta et. al. (2014). Reassuringly, robustness checks with firm fixed effects comfortably corroborate our main result. Finally, ε_{it} is a firm-specific error term. Summary statistics and pairwise correlations for the samples used in the empirical analysis are provided in the appendix.

To a large extent, endogeneity concerns are ameliorated by inclusion of different sets of fixed

effects. In particular, our results are not driven by unobserved price or demand shocks at the industry level. Yet, even though the foreign R&D capital stock is likely to be exogenous to the individual Danish firm, it might be that some Danish MNEs conduct R&D activities abroad, thereby contributing to the foreign knowledge stock. Similar to Keller (2002), we address this concern by excluding MNEs in our robustness checks. A third important source of endogeneity is located at the firm-level: firms with substantial gross output are likely to be more successful in hiring qualified migrants, as they are likely to have more capacities for recruitment of workers. We tackle this problem from three sides: First, systematically better hires in large firms are likely to be driven by organizational advantages of the firm. These features rarely change over time and are consequently purged by firm fixed effects. Secondly, the quality of hires is likely to depend also on the composition of the management, which we control for in our specifications. Thirdly, we provide results where we include all regressors in their first lag. Neither of these modifications changes our main conclusions.

2.2 Approximation of Absorptive Capacity and Knowledge Spillovers

We follow the discussion in Coe and Helpman (1995) to establish a direct link between firms' absorptive capacity based on their immigrants and the international knowledge stock by constructing a weighted sum of foreign R&D capital stocks (s^f), where the weight is a measure of a firm's absorptive capacity provided by the employed immigrants.⁴ The robustness of the main results with respect to the used weights are assessed on behalf of three different specifications in the construction of the foreign R&D variable.

In a first step, we account for the origin of the immigrants. For that we follow the procedure of Coe and Helpman (1995) and construct an ethnic-weighted variable, where the weight is the share of immigrants from a certain country. Therefore, \mathcal{X}_{it} becomes then:

$$\log s_{it}^{f,ew} = \log \left(\sum_{c \in S_{it}} \left(\frac{L_{ict}^{For}}{L_{it}^{For}} s_{ct}^f \right) \right), \quad (3)$$

where S_{it} is the set of foreign workers in firm i for period t belonging to countries for which data on R&D capital stocks is available, L_{ict}^{For} is the number of immigrants engaged in firm i from country c and L_{it}^{For} is the total number of immigrants in firm i . Thus, the construction

⁴The trade-weighted R&D capital stock suggested by Coe and Helpman (1995) indeed reflect trade-related spillovers as discussed in Coe and Helpman (1999) after having been questioned by Keller (1998).

ensures that, *ceteris paribus*, firms with a higher share of immigrants from technological advanced countries (here approximated by size of the R&D capital stock) have a larger $\log s_{it}^{f,ew}$ and vice versa. Again, we also differentiate the immigrant workforce by educational level, this time by constructing three separate variables for immigrants with basic, secondary and tertiary education. As an example, the foreign R&D variable $s_{it}^{f,ew,B}$ then includes only immigrants with basic education.

In the next step, we further differentiate the educational aspect of the absorptive capacity by constructing an ethnic-education-weighted measure of foreign *R&D* capital stocks for each firm in year t as follows:

$$\log s_{it}^{f,ewedu} = \log \left(\sum_{c \in S_{it}} \left(\frac{L_{ict}^{For,B}}{L_{it}^{For}} s_{ct}^f H^B + \frac{L_{ict}^{For,S}}{L_{it}^{For}} s_{ct}^f H^S + \frac{L_{ict}^{For,T}}{L_{it}^{For}} s_{ct}^f H^T \right) \right), \quad (4)$$

where $L_{ict}^{For,\theta}$ is the number of immigrants engaged in firm i from country c with education level $\theta = (Basic, Secondary, Tertiary)$, respectively.⁵ H^θ is the theoretical cumulative duration in years for the education level θ . Information on the theoretical duration for each education type is taken from the International Standard Classification of Education (ISCED), as reported by the United Nations Educational, Scientific and Cultural Organization (UNESCO). This time, *ceteris paribus*, firms with a higher share of immigrants from technological advanced countries (here approximated by size of the R&D capital stock) and higher educational level have a larger $\log s_{it}^{f,ewedu}$ and vice versa. As for the ethnic-weighted measure, we also construct the ethnic-education-weighted measure for each educational level separately (e.g., for basic education then this would correspond to $\log s_{it}^{f,ewedu,B}$).

Finally, particularly for immigrants, the occupational position might not correspond to the educational level, e.g., due to problems with the approval of foreign education certificates. Therefore, we construct an ethnic-occupational-position-weighted measure for each single occupational level (low-skilled, mid-skilled, high-skilled, manager, others). It is again constructed according to the procedure of Coe and Helpman (1995), where the weight this time is the share of immigrants on a certain occupational position:

$$\log s_{it}^{f,ewoccu,\phi} = \log \left(\sum_{c \in S_{it}} \left(\frac{L_{ict}^{For,\phi}}{L_{it}^{For}} s_{ct}^f \right) \right), \quad (5)$$

where $L_{ict}^{For,\phi}$ is the number of persons engaged in firm i from country c with occupational level $\phi = (low, mid, high, manager, others)$.⁶ According to this definition, *ceteris paribus*, firms with

⁵Detailed information on the classification of the educational levels are provided in the appendix.

⁶Detailed information on the classification of occupational positions are provided in the appendix.

a higher share of immigrants from technological advanced countries (again approximated by size of the R&D capital stock) and employed in a higher occupational position have a larger $\log s_{it}^{f,ewoccu,\phi}$ and vice versa.

3 Data Description

3.1 Data Sources

In evaluating the impact of immigrants on firm's economic performance through their access to international R&D knowledge stocks, this study utilizes a longitudinal employer-employee data set provided from a variety of statistical registers by Statistics Denmark (henceforth DS). The starting point in data preparation is the Integrated Database for Labour Market Research (henceforth IDA). IDA integrates three databases on the personal, employee, and workplace level for any given year. It provides valuable information on a wide range of individual characteristics, containing, e.g., gender, age, country of origin, education level, labour market experience, earnings, and current occupation on each individual employed in Danish firms during the entire period 1995 to 2009. The link between individuals and workplaces are uniquely identified each year at the end of November. The extracted information on each individual is then aggregated to obtain firm-specific variables, such as the number of full-time employees, average firm tenure, age distribution, shares of males, managers, highly-skilled workers, and the shares of workers belonging to basic, secondary, tertiary, and university education. Furthermore, a variable is created that reflects the ethnic composition of each firm based on the data indicating the country of origin for each individual. In addition, business accounts data is provided by the statistical register REGNSKAB, from which we extract such variables as gross production (total sales of goods and services), intermediate goods (purchase as goods, helping materials, and packaging), and the capital stock (total assets). REGNSKAB covers the construction and retail trade industries at the firm level from 1994 onwards, manufacturing industries beginning in 1995, wholesale trade was included from 1998 onwards, and the remaining private industries beginning from 1999 onwards. Finally, we also establish a link to a firm's foreign trade statistics. This statistical register provides detailed information on bilateral import and export sales with information on destination markets, and traded products based on an 8-digit classification scheme. We use this additional data source to construct an import- and export-weighted international R&D knowledge stock, to test the robustness of our main results to trade-related knowledge spillovers.

For the construction of the ethnic-education-weighted measure we use the information on the

theoretical duration for each education type from the International Standard Classification of Education (ISCED), as reported by the United Nations Educational, Scientific and Cultural Organization (UNESCO). ISCED acts as an international framework for comparisons of various education statistics across countries. The last Revision of ISCED in the year 2011 is intended to capture recent developments in educational systems worldwide. The Danish education system categorizes each individual in accordance to this classification scheme, from which we derive the theoretical duration of each education level in Denmark as follows: pre-primary education (1 year), primary education (6 years), lower secondary education (3 years), upper secondary education (3 years), post-secondary/non-tertiary education (2 years), short-cycle tertiary education (3 years), Bachelor (3 years), Master (2 years), and Doctoral programmes (3 years).

Finally, the Data for the construction of R&D capital stocks in 27 countries⁷ is provided by the OECD's Analytical Business Enterprise Research and Development (ANBERD) database.

3.2 Descriptive Statistics

Table 1 provides descriptive statistics for the main variables utilized in the empirical analysis for firms employing at least ten workers. The last choice was set to ensure a certain degree of variability of foreign workers across firms when constructing firm-specific international R&D knowledge stocks. Table 3 lists the gross production deciles along with information according to the share of foreign workers with basic, secondary and tertiary education. This table visualizes the relationship between a firm's economic performance and its share of foreign employees. For example, firms belonging to the first gross production decile have on average 4.4799% foreign workers with basic education. It is worth mentioning that the share of foreign workers with basic education seems to be not related to higher gross production deciles. A somewhat different picture emerges when turning to the share of foreign employees with secondary education. Those firms belonging to the higher gross production deciles also employ on average more foreigners with secondary education. This tendency is further reinforced when focussing on the median values which is positively correlated with the gross production deciles. The same picture holds when looking at those foreign employees with tertiary education. These employees may be of particular interest to firms as they enhance the firm's production possibility frontier, perhaps, through their unique social capabilities to establish a link between different subunits of the firm with the external knowledge environment. Indeed, firms belonging to the top gross production decile employ on average 0.4713% foreign employees with tertiary education. In comparison,

⁷See Table 4 for a list of the countries included in the empirical analysis.

firms residing in the fifth gross production decile have on average 0.2860% foreign workers with tertiary education. A full list of descriptive statistics on the variables included in each of the model specifications is given in Tables 5 and 7, respectively.

4 Results

Table 9 provides first results on the relationship between firms' economic performance and international knowledge absorbed by the employed immigrants. The results presented in column (1) refer to the base specification and show the estimated elasticities for the three main input factors. The estimated coefficients associated with labour, capital, and materials are of the expected positive signs and jointly sum up to unity, establishing the assumption of constant returns to scale in production.

From the findings in Coe and Helpman (1995) and the subsequent literature, it is well known that it makes a significant difference from which country technology is sourced. Obviously, countries which are technologically advanced offer more knowledge to be absorbed than countries which are technological laggards. We therefore account for an immigrant's origin and thereby test if it matters for a firm's absorptive capacity improvement. As described above, we therefore follow the procedure of Coe and Helpman (1995) and construct an ethnic-weighted measure of international R&D capital stocks (see equation 3). In column (2) the ethnic-weighted measure of international R&D capital stocks is introduced. The coefficient is highly significant and confirms our assumptions that firms benefit from the employment of immigrants through the absorbed international knowledge. Our measure further suggests that employing immigrants from technologically advanced countries increases the benefits to be earned in terms of a higher output with respect to foreign R&D knowledge stocks.

In addition, we assess the impact of the immigrants' education for each educational level separately (columns 3-6). All immigrants from OECD countries, regardless of their educational level, offer a positive markup on the output elasticity of international knowledge vis-à-vis firms without and those with non-OECD immigrants. Again, OECD-immigrants with tertiary education offer the highest benefits. The latter result deserves further investigation, as it suggests, in line with Stoyanov and Zubanov (2012), that immigrants with higher education might play a prominent role in the absorption of knowledge. Our measures so far simply split the sample into groups with basic, secondary and tertiary immigrants, and are therefore a simple count-based weight. To emphasize the differences in accumulated human capital of the education level, we introduce the average duration of education into our measure (see equation 4 for further details).

Therefore, the following Table 10 shows the main results for our preferred measure indicating the extent of a firm's access to international R&D knowledge stocks when employing immigrants, as discussed above. The estimates in column (1) are shown for comparison purposes. Column (2) adds the ethnic-education-weighted foreign R&D capital stock measure ($\text{Log } s^{f,ewedu}$) into the base specification. The estimated coefficient associated with $\text{Log } s^{f,ewedu}$ is of the expected positive sign and statistically significant at the 1% level. The output elasticity with respect to this measure equals 0.0009. To assess the impact of the different educational level separately, we construct our measure for each of the educational level and introduce them first separately (columns 3-5) and finally together (column 6). Again our previous result that immigrants from all educational levels increase firms absorptive capacity but immigrants with tertiary education offer the highest benefits from absorbing foreign knowledge, is further confirmed.

Finally, employees might not work in an occupational position in accordance with their educational level. In particular, immigrants might suffer from problems with the approval of their foreign education certificates, resulting in lower occupational position (Pohl Nielsen, 2011). Also, the opposite mismatch may be the case. Furthermore, the educational level approximates the human capital at the beginning of one business career neglecting advances in human capital through training on the job. Additionally, the occupation position provides an accurate assessment of the actual employees' activities within the firm which might be a closer approximation of our convention of absorptive capacity. Thus, we construct an ethnic-occupation-position weighted measure (see equation 5). In each column (1) to (6) of table 11 we introduce one of the separate measures for the different occupational levels indicating low-skilled, mid-skilled, high-skilled, managers, and others. With exception of the positions not classified (others), all immigrants add to the output elasticity towards foreign knowledge. The highest contribution is generated by high skilled immigrants without executive functions (0.0016), followed by managers (0.0013), immigrants with low and medium positions (0.0009 and 0.0008, respectively). Interestingly, the impact of managers is rendered insignificant in the fully specified model (column 6). As the correlations between the different measures do not exceed 0.1838, multicollinearity seems not to be the reason for that result. This finding is in accordance with Parrotta and Pozzoli (2012) who emphasize that highly educated technicians are knowledge carriers, and does directly relate back to Arrow's (1969) original idea where both prior technical knowledge and non-technical skills are ingredients for knowledge transmission.

Another notable result of the analysis is the negative sign associated with the ethnic diversity measure which is in line with previous studies. Prior research has shown the negative effect of diversity on firms' economic performance (Parrotta et al., 2014a). The argument is that eth-

nic diversity comes along with costs and benefits for firms' productivity. The negative effect is transmitted through higher communication costs and lower interpersonal trust, whereas the positive effect is transmitted through enhanced innovation activity (Alesina and La Ferrara, 2005). We argue that firms benefit from their increased absorptive capacity to acquire international knowledge - which is in line with a positive impact of ethnic diversity on innovative activity as found by Parrotta et al. (2014b).

In sum, firms employing foreign workers have on average higher gross production levels through their increased absorptive capacity to acquire international R&D knowledge stocks. Furthermore, the higher the share of immigrants from technologically advanced countries and the higher the education or the occupational position of the employed immigrants, the higher their contribution is. This relativises the finding that ethnic diversity exhibits a negative impact in all tested specifications.

5 Robustness Analysis

This section establishes the robustness of the previous results to different sample sizes and among various specifications. The results are shown in Tables 12, 13 and 14. Column (1) of table 12 shows the main results using the definition in equation 4 for the foreign R&D capital stock variable. This specification corresponds to that in column (2), Table 10, and is shown for comparison purposes.

Although we already control through the diversity measure, the firms education and occupation characteristics for the direct impact of immigrants on output, we add in column (2) a dummy indicating if a firm employs immigrants. As expected, the dummy is insignificant and the coefficient of the ethnic-education-weighted foreign R&D capital stock variable does not change. The results reported in column (3) of Table 12 restrict the analysis to non-exporting firms. This results in the exclusion of 30,941 observations from the base sample. The exclusion of exporters from the base sample alleviates, to some extent, knowledge spillovers triggered for example by export sales. Reassuringly, the estimates are not sensitive to the exclusion of exporters from the estimation sample. In contrast, the estimated coefficient associated with the foreign R&D capital stock variable increases substantially to about 0.0017 and is statistically significant at the 1% level. This result suggests that non-exporters benefit more from foreign workers than exporting firms. One possible reason for the importance of foreigners for non-exporters could be their functioning as possible substitutes to international technology diffusion by export activity, for example, through co-ethnic networks. Furthermore, column (4) maintains the robustness of

the results to the exclusion of multinational firms which might be particularly good in absorbing international knowledge spillovers due to their international structure and could, therefore, drive the main results in our empirical analysis. The estimated coefficient associated with the foreign R&D capital stock variable retains its positive sign and still is highly significant. This suggests that our previous results are not driven by R&D investments of Danish multinational companies abroad. Case studies have shown the importance of technology diffusion for the high-tech pharmaceutical and computer industries and Keller (2004) argues that endogeneity concerns are more pronounced in R&D intense industries (p. 761). Column (5), therefore, assesses the robustness of the results excluding the high-tech chemical (which incorporates the pharmaceutical industry) and computer industry from the base sample. The estimated coefficient associated with $\text{Log } s^{f,ewedu}$ remains positive and is statistically significant at the 1% level. Thus, the results are not driven by these industries. As a further robustness check, the results shown in column (6) exclude firms employing foreign workers from non-OECD countries. Therefore, the estimated coefficient on the foreign R&D capital stock variable then indicates the impact on gross production for firms employing foreign workers from OECD countries in comparison to firms employing exclusively Danish workers. This criterion restricts the analysis to 30,497 observations. However, the estimated coefficient on the foreign R&D capital stock variable is positive and increases substantially to about 0.0014. This estimated impact is statistically significant at the 1% level.⁸

Furthermore, to rule out the possibility that our ethnic based R&D capital stock measure captures knowledge spillovers triggered by trade relationships, column (7) includes an import- and export-weighted foreign R&D capital stock variable into the regression equation. Specifically, the two latter variables are constructed according to $\sum_{c \in T_{it}} (\omega_{ict} s_{ct}^f)$, where ω_{ic} refers to the bilateral import- and export-share of a firm's i trading partner countries, respectively. In addition, T_{it} is the set of firm i 's trading partners in year t . This specification excludes 18,349 observations from the base sample. However, the qualitative results remain unchanged to the inclusion of trade-weighted foreign R&D capital stocks. Interestingly, the positive coefficient associated with the import-weighted R&D capital stock confirms the findings in Coe and Helpman (1995). Regarding the coefficient associated with the export-weighted foreign R&D capital stock measure, the contributions by Clerides et al. (1998) and Bernard and Jensen (1999), for example,

⁸Because data on R&D capital stocks are unequally available across countries, we also restricted the estimation sample to the 2002-2006 time period. The main conclusions of the paper regarding this additional robustness test remain unaffected. These results are available from the authors upon request.

triggered a number of empirical studies investigating the relationship between export-learning and a wide range of firm characteristics, particularly firm productivity. In general, numerous case studies point to a beneficial effect on firms' productivity when exporting (for a survey of the literature see Wagner, 2007). The learning-by-exporting hypothesis points to knowledge flows coming from foreign buyers when firms are engaged in international trade. However, our export-weighted R&D capital stock measure enters with a negative sign into the regression analysis, suggesting that firms' gross production decreases when they export into high-R&D partner countries. This result would be consistent with the notion that firms' technology diffuses to potential competitors abroad, thus, negatively affecting a firm's own economic success.

Potential endogeneity bias could arise from the fact that economically well-performing firms may respond by hiring foreign workers who are likely to be in the preferred position to absorb international knowledge more effectively, therefore, creating an empirical artifact between a firm's gross production and our education-weighted R&D knowledge stock measure. Therefore, we use one-year lagged variables of our R&D knowledge stocks, as they were predetermined, in a way that consistent estimators for the corresponding R&D elasticities can be derived when they appear as exogenous regressors in the regression equation. Table 13 presents results where foreign knowledge stocks are measured in year $t - 1$. Reassuringly, the positive association between firms' gross production and its international R&D knowledge stock measure is maintained and rather robust, as shown in column (1). The regression analysis shown in columns (2) to (5) is dedicated to maintaining our results to the inclusion of lagged international R&D knowledge stocks by education types. The qualitative results remain unaffected. Finally, the results remain robust when we further control for international knowledge spillovers triggered by imports and exports, as shown in column (6).

Yet, it may be that firms with a systematically better management or a superior organizational structure are more apt to hire better workers and at the same time benefit from a higher level of gross output. These firm characteristics are not likely to vary strongly over time. Thus, we address this other source of endogeneity by including firm-fixed effects in our model. The results are given in Table 14. In column (1), the base specification is re-estimated. While the coefficients of the traditional inputs remain positive and significant, two of the control variables (Ethnic diversity, Managers) turn insignificant and the coefficient of the Males dummy changes its sign. These changes remain stable throughout all further estimations in columns (2)-(7). The results of the estimation with our ethnic-education weighted measure are reported in column (2). The coefficient remains significant but is slightly lower than in the previous estimations. In our further estimations differentiating our measure with respect to education, only the variable

for the immigrants with tertiary education remains significant. As a final robustness test, the analysis shown in column (7) includes a recodification dummy which equals one for firms with zero foreign R&D knowledge stocks. Although, the estimated coefficient on this dummy variable is not significant, the estimated coefficient associated with $\text{Log } s^{f,ewedu}$ is rather unaffected in magnitude and statistical significance.

6 Conclusion

This paper investigates the question if immigrant employees are an important channel for international knowledge spillovers. Based on Danish firm-level data and aggregated R&D capital stock data for OECD countries, the estimations show that immigrant employees are indeed an important diffusion channel for international knowledge spillovers contributing significantly to firms' output elasticity with respect to foreign knowledge. However, the composition of the foreign staff with respect to origin, education and occupational position has an important impact on the size of the effect on output. The higher the share of immigrants from technologically advanced countries and the higher their educational level (or occupational position), the larger the impact on a firm's output elasticity of foreign knowledge is. However, the only exception are immigrant managers for whom we do not find such a significant effect. Through a large number of checks, the robustness of the results is confirmed. Among these checks, a measure of workforce ethnic diversity is included as a control variable and reveals a negative direct impact of workforce ethnic diversity on firms' gross production. Thus, the positive impact of an ethnic-diverse labour force for firms' capability to access international knowledge via culture, language and social networks might on the other hand increase communication costs and cause a lack of interpersonal trust resulting simultaneously in a negative impact on firms' output. However, an assessment of costs and benefits of ethnic diversity in an unified framework is beyond the scope of the paper and has to be left to future research.

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A Data Description

Table 1: Summary Statistics and Data Description for the Main Variables

| Variable | Description | Mean | S.D. | Min. | Max. |
|---------------------------------|---|---------|---------|---------|---------|
| Foreigners Pre-Primary | Foreign workers with pre-primary education, as a proportion of total workers employed. | 0.0374 | 0.0673 | 0.0000 | 1.0000 |
| Foreigners Primary | Foreign workers with primary education, as a proportion of total workers employed. | 0.0093 | 0.0297 | 0.0000 | 1.0000 |
| Foreigners Lower Secondary | Foreign workers with lower secondary education, as a proportion of total workers employed. | 0.0005 | 0.0042 | 0.0000 | 0.1250 |
| Foreigners Upper Secondary | Foreign workers with upper secondary education, as a proportion of total workers employed. | 0.0001 | 0.0016 | 0.0000 | 0.0909 |
| Foreigners Post-Secondary | Foreign workers with post-secondary/non-tertiary education, as a proportion of total workers employed. | 0.0078 | 0.0206 | 0.0000 | 0.5000 |
| Foreigners Short-Cycle Tertiary | Foreign workers with short-cycle tertiary education, as a proportion of total workers employed. | 0.0027 | 0.0127 | 0.0000 | 1.0000 |
| Foreigners Bachelor | Foreign workers with Bachelor degree education, as a proportion of total workers employed. | 0.0001 | 0.0018 | 0.0000 | 0.0909 |
| Foreigners Master | Foreign workers with Master degree education, as a proportion of total workers employed. | 0.0001 | 0.0020 | 0.0000 | 0.1250 |
| Foreigners Doctoral | Foreign workers with Doctoral degree education, as a proportion of total workers employed. | 0.0001 | 0.0017 | 0.0000 | 0.1250 |
| Males | Men, as a proportion of total workers employed. | 0.7347 | 0.2079 | 0.0000 | 1.0000 |
| Age15_28 | Workers aged between 15 and 28, as a proportion of total workers employed. | 0.1851 | 0.1430 | 0.0000 | 1.0000 |
| Age29_38 | Workers aged between 29 and 38, as a proportion of total workers employed. | 0.2565 | 0.1209 | 0.0000 | 1.0000 |
| Age39_48 | Workers aged between 39 and 48, as a proportion of total workers employed. | 0.2600 | 0.1172 | 0.0000 | 1.0000 |
| Age49_65 | Workers aged between 49 and 65, as a proportion of total workers employed. | 0.2773 | 0.1472 | 0.0000 | 1.0000 |
| Low-Skilled | Workers with low-skilled occupation according to the definition of ISCO, as a proportion of total workers employed. | 0.1505 | 0.1821 | 0.0000 | 1.0000 |
| Mid-Skilled | Workers with mid-skilled occupation according to the definition of ISCO, as a proportion of total workers employed. | 0.5997 | 0.2230 | 0.0000 | 1.0000 |
| High-Skilled | Workers with high-skilled occupation according to the definition of ISCO, as a proportion of total workers employed. | 0.1277 | 0.1392 | 0.0000 | 1.0000 |
| Managers | Managers, according to Statistics Denmark's definitions based on ISCO, as a proportion of total workers employed. | 0.0562 | 0.0720 | 0.0000 | 1.0000 |
| Log Tenure | The log of average firm tenure (in years). | 1.5006 | 0.4750 | 0.0000 | 2.7081 |
| Ethnic Diversity | Ethnic worker diversity index, averaged across work places. | 0.0990 | 0.1244 | 0.0000 | 0.8471 |
| Log FKR&D | Education-weighted firm's foreign R&D capital stock based on foreign workers from OECD member countries. | 9.4034 | 12.2213 | 0.0000 | 30.9934 |
| Log FKR&D Basic | Education-weighted firm's foreign R&D capital stock based on foreign workers with basic education from OECD member countries. | 7.3437 | 11.1182 | 0.0000 | 30.1667 |
| Log FKR&D Secondary | Education-weighted firm's foreign R&D capital stock based on foreign workers with secondary education from OECD member countries. | 3.3184 | 8.6936 | 0.0000 | 30.9288 |
| Log FKR&D Tertiary | Education-weighted firm's foreign R&D capital stock based on foreign workers with tertiary education from OECD member countries. | 1.6838 | 6.3270 | 0.0000 | 30.9934 |
| Log Gross Production | The log of firm's gross production as total sales of goods and services (in DKK). | 17.3068 | 1.2960 | 12.8186 | 24.0804 |
| Log Materials | The log of firm's intermediate goods (purchase of goods, helping materials, and packaging) used in the production process (in DKK). | 16.2975 | 1.5165 | 6.9078 | 23.7692 |
| Log Capital | The log of firm's total assets (in DKK). | 15.7992 | 1.6970 | 6.9078 | 24.0446 |
| Log Labour | The log of firm's fulltime equivalent workers. | 3.4633 | 1.0706 | 0.0000 | 9.4122 |
| Multinational | Takes value 1, if the firm is foreign owned. | 0.0022 | 0.0469 | 0.0000 | 1.0000 |
| Exporter | Takes value 1, if the firm exports and zero otherwise. | 0.7578 | 0.4284 | 0.0000 | 1.0000 |
| Observations | | | 40828 | | |

Notes: Summary statistics are constructed for all manufacturing firms for the time period 1999 to 2009. The industrial sectors utilized in the empirical analysis are as follows: basic metals; beverages; chemicals and chemical products; coke and refined petroleum products; electrical equipment; fabricated metal products, except machinery and equipment; food products; furniture; leather and related products; machinery and equipment n.e.c.; motor vehicles, trailers and semi-trailers; other non-metallic mineral products; other transport equipment; paper and paper products; rubber and plastic products; textiles; tobacco products; wearing apparel; wood products; other manufacturing; printing and reproduction of recorded media; repair and installation of machinery and equipment;

B Construction of the foreign R&D capital stock

Data for the construction of R&D capital stocks in 27 countries⁹ is provided by the OECD's Analytical Business Enterprise Research and Development (ANBERD) database. Data on R&D expenditures were first deflated by a country-specific value added price deflator (VALP) provided by the OECD Structural Analysis (STAN) database and then converted into constant 2000 US-Dollar.

The construction of the R&D capital stock for each country is then carried out following the Perpetual Inventory Method (PIM).¹⁰ Specifically, the R&D capital stock evolves according to the following equation:

$$KR\&D_{ct} = (1 - \delta)KR\&D_{ct-1} + R\&D_{ct}, \quad (6)$$

where $KR\&D_{ct}$ is the R&D capital stock of country c in period t and $R\&D_{ct}$ is the flow of real R&D expenditures of country c in period t . To apply this equation to data on real R&D expenditures, two crucial decisions with respect to the depreciation rate δ and the initial capital stock must be set, respectively. The depreciation rate is assumed to be 10%, the same across countries, and constant over time. Furthermore, assuming a constant country-specific growth rate of g_c for the R&D capital stock before period $t = 1$, the value for the initial R&D capital stock is computed according to the following expression:

$$\begin{aligned} KR\&D_{c1} &= (1 - \delta)R\&D_{c-1} + (1 - \delta)^2R\&D_{c-2} + \dots \\ &= \sum_{s=0}^{\infty} (1 - \delta)^s R\&D_{c-s} = R\&D_{c0} \sum_{s=0}^{\infty} \left[\frac{1 - \delta}{1 + g_c} \right]^s = \frac{R\&D_{c0}}{\delta + g_c}. \end{aligned} \quad (7)$$

In contrast to other studies, which assume a growth rate (e.g. Hall and Mairesse, 1995) in this study g_c is computed using an average geometric growth rate in years for which data on R&D expenditures is available. Summary statistics on the R&D capital stocks of the different countries is given in Table 4.

⁹See Table 4 for the countries employed in the empirical analysis.

¹⁰Hulten (1991) provides an extensive discussion of the PIM for the measurement and construction of physical and human capital stocks.

C Descriptive Statistics

Table 2: Summary Statistics for Foreign Workers according to Education Level

| Country Code | | Basic Education | | | | | | Secondary Education | | | | | | Tertiary Education | | | | | |
|--------------|---------|-----------------|-------|--------|-------|--------|-------|---------------------|-------|--------|-------|--------|-------|--------------------|-------|--------|-------|--------|-------|
| | | Obs. | Mean | Median | S.D. | Min. | Max. | Obs. | Mean | Median | S.D. | Min. | Max. | Obs. | Mean | Median | S.D. | Min. | Max. |
| AUS | overall | 41.000 | 0.005 | 0.002 | 0.011 | 0.000 | 0.056 | 80.000 | 0.018 | 0.007 | 0.026 | 0.000 | 0.100 | 37.000 | 0.005 | 0.002 | 0.007 | 0.000 | 0.033 |
| | between | 10.000 | | | 0.016 | 0.000 | 0.053 | 28.000 | | | 0.023 | 0.000 | 0.074 | 9.000 | | | 0.011 | 0.000 | 0.033 |
| | within | 4.100 | | | 0.001 | 0.002 | 0.010 | 2.857 | | | 0.005 | -0.001 | 0.044 | 4.111 | | | 0.000 | 0.004 | 0.006 |
| AUT | overall | 64.000 | 0.013 | 0.003 | 0.020 | 0.000 | 0.083 | 170.000 | 0.014 | 0.006 | 0.018 | 0.000 | 0.083 | 94.000 | 0.007 | 0.002 | 0.014 | 0.000 | 0.077 |
| | between | 18.000 | | | 0.017 | 0.000 | 0.074 | 39.000 | | | 0.018 | 0.000 | 0.083 | 26.000 | | | 0.020 | 0.000 | 0.077 |
| | within | 3.556 | | | 0.002 | 0.005 | 0.022 | 4.359 | | | 0.002 | 0.003 | 0.025 | 3.615 | | | 0.001 | 0.000 | 0.011 |
| BEL | overall | 16.000 | 0.007 | 0.001 | 0.018 | 0.000 | 0.071 | 57.000 | 0.009 | 0.008 | 0.008 | 0.000 | 0.029 | 11.000 | 0.008 | 0.007 | 0.009 | 0.000 | 0.030 |
| | between | 5.000 | | | 0.031 | 0.000 | 0.071 | 22.000 | | | 0.008 | 0.000 | 0.026 | 7.000 | | | 0.011 | 0.000 | 0.030 |
| | within | 3.200 | | | 0.000 | 0.006 | 0.007 | 2.591 | | | 0.002 | 0.004 | 0.016 | 1.571 | | | 0.000 | 0.007 | 0.009 |
| CAN | overall | 74.000 | 0.008 | 0.003 | 0.010 | 0.000 | 0.037 | 155.000 | 0.011 | 0.006 | 0.020 | 0.000 | 0.200 | 52.000 | 0.004 | 0.001 | 0.006 | 0.000 | 0.031 |
| | between | 24.000 | | | 0.011 | 0.000 | 0.037 | 41.000 | | | 0.026 | 0.000 | 0.114 | 16.000 | | | 0.009 | 0.000 | 0.031 |
| | within | 3.083 | | | 0.001 | 0.002 | 0.014 | 3.780 | | | 0.010 | -0.075 | 0.097 | 3.250 | | | 0.001 | 0.002 | 0.007 |
| CZE | overall | 3.000 | 0.005 | 0.005 | 0.001 | 0.004 | 0.005 | 7.000 | 0.030 | 0.002 | 0.036 | 0.002 | 0.083 | 18.000 | 0.003 | 0.001 | 0.004 | 0.000 | 0.015 |
| | between | 2.000 | | | 0.001 | 0.004 | 0.005 | 2.000 | | | 0.047 | 0.002 | 0.068 | 6.000 | | | 0.005 | 0.000 | 0.014 |
| | within | 1.500 | | | 0.000 | 0.004 | 0.005 | 3.500 | | | 0.008 | 0.021 | 0.046 | 3.000 | | | 0.000 | 0.002 | 0.003 |
| DEU | overall | 989.000 | 0.014 | 0.007 | 0.017 | 0.000 | 0.143 | 2628.000 | 0.021 | 0.010 | 0.030 | 0.000 | 0.500 | 1084.000 | 0.015 | 0.005 | 0.026 | 0.000 | 0.333 |
| | between | 285.000 | | | 0.021 | 0.000 | 0.134 | 634.000 | | | 0.025 | 0.000 | 0.161 | 265.000 | | | 0.021 | 0.000 | 0.125 |
| | within | 3.470 | | | 0.003 | -0.005 | 0.042 | 4.145 | | | 0.012 | -0.099 | 0.360 | 4.091 | | | 0.013 | -0.041 | 0.280 |
| DNK | overall | 39764.000 | 0.314 | 0.300 | 0.151 | 0.012 | 1.000 | 40629.000 | 0.543 | 0.538 | 0.171 | 0.028 | 1.000 | 31338.000 | 0.124 | 0.096 | 0.101 | 0.007 | 1.000 |
| | between | 4770.000 | | | 0.142 | 0.026 | 1.000 | 4778.000 | | | 0.161 | 0.063 | 1.000 | 4313.000 | | | 0.088 | 0.010 | 1.000 |
| | within | 8.336 | | | 0.067 | -0.140 | 1.005 | 8.503 | | | 0.070 | 0.117 | 1.265 | 7.266 | | | 0.048 | -0.374 | 0.971 |
| ESP | overall | 54.000 | 0.008 | 0.003 | 0.014 | 0.000 | 0.077 | 87.000 | 0.008 | 0.003 | 0.013 | 0.000 | 0.077 | 108.000 | 0.011 | 0.003 | 0.022 | 0.000 | 0.125 |
| | between | 21.000 | | | 0.020 | 0.000 | 0.077 | 25.000 | | | 0.017 | 0.000 | 0.077 | 33.000 | | | 0.021 | 0.000 | 0.084 |
| | within | 2.571 | | | 0.000 | 0.007 | 0.010 | 3.480 | | | 0.001 | 0.004 | 0.015 | 3.273 | | | 0.006 | -0.017 | 0.052 |
| EST | overall | 5.000 | 0.031 | 0.024 | 0.025 | 0.000 | 0.067 | 24.000 | 0.010 | 0.002 | 0.017 | 0.000 | 0.048 | 28.000 | 0.010 | 0.001 | 0.022 | 0.000 | 0.091 |
| | between | 3.000 | | | 0.027 | 0.000 | 0.053 | 9.000 | | | 0.018 | 0.000 | 0.044 | 11.000 | | | 0.025 | 0.000 | 0.084 |
| | within | 1.667 | | | 0.009 | 0.017 | 0.044 | 2.667 | | | 0.002 | 0.004 | 0.017 | 2.545 | | | 0.002 | 0.003 | 0.017 |
| FIN | overall | 116.000 | 0.006 | 0.001 | 0.013 | 0.000 | 0.077 | 225.000 | 0.008 | 0.004 | 0.013 | 0.000 | 0.077 | 153.000 | 0.010 | 0.003 | 0.015 | 0.000 | 0.077 |
| | between | 37.000 | | | 0.016 | 0.000 | 0.074 | 68.000 | | | 0.015 | 0.000 | 0.077 | 40.000 | | | 0.015 | 0.000 | 0.068 |
| | within | 3.135 | | | 0.001 | 0.003 | 0.013 | 3.309 | | | 0.002 | 0.000 | 0.024 | 3.825 | | | 0.004 | -0.007 | 0.033 |
| FRA | overall | 45.000 | 0.018 | 0.008 | 0.024 | 0.000 | 0.105 | 177.000 | 0.015 | 0.004 | 0.021 | 0.000 | 0.100 | 173.000 | 0.012 | 0.004 | 0.025 | 0.000 | 0.200 |
| | between | 18.000 | | | 0.019 | 0.000 | 0.069 | 59.000 | | | 0.021 | 0.000 | 0.091 | 50.000 | | | 0.022 | 0.000 | 0.133 |
| | within | 2.500 | | | 0.009 | -0.015 | 0.054 | 3.000 | | | 0.003 | 0.002 | 0.035 | 3.460 | | | 0.010 | -0.059 | 0.079 |
| GBR | overall | 239.000 | 0.012 | 0.003 | 0.019 | 0.000 | 0.167 | 702.000 | 0.015 | 0.007 | 0.020 | 0.000 | 0.167 | 316.000 | 0.013 | 0.003 | 0.022 | 0.000 | 0.143 |
| | between | 95.000 | | | 0.022 | 0.000 | 0.125 | 218.000 | | | 0.019 | 0.000 | 0.113 | 82.000 | | | 0.023 | 0.000 | 0.113 |
| | within | 2.516 | | | 0.005 | -0.038 | 0.062 | 3.220 | | | 0.005 | -0.014 | 0.090 | 3.854 | | | 0.008 | -0.036 | 0.083 |
| GRC | overall | 12.000 | 0.016 | 0.018 | 0.012 | 0.002 | 0.034 | 80.000 | 0.009 | 0.004 | 0.016 | 0.000 | 0.091 | 34.000 | 0.006 | 0.003 | 0.010 | 0.000 | 0.032 |
| | between | 4.000 | | | 0.011 | 0.002 | 0.025 | 18.000 | | | 0.024 | 0.000 | 0.087 | 9.000 | | | 0.010 | 0.000 | 0.031 |
| | within | 3.000 | | | 0.004 | 0.007 | 0.025 | 4.444 | | | 0.002 | 0.000 | 0.018 | 3.778 | | | 0.000 | 0.004 | 0.007 |
| HUN | overall | 96.000 | 0.014 | 0.005 | 0.017 | 0.000 | 0.053 | 216.000 | 0.011 | 0.004 | 0.019 | 0.000 | 0.091 | 88.000 | 0.011 | 0.003 | 0.017 | 0.000 | 0.100 |
| | between | 35.000 | | | 0.014 | 0.000 | 0.049 | 54.000 | | | 0.021 | 0.000 | 0.088 | 30.000 | | | 0.013 | 0.000 | 0.069 |
| | within | 2.743 | | | 0.001 | 0.010 | 0.019 | 4.000 | | | 0.003 | -0.009 | 0.033 | 2.933 | | | 0.004 | -0.006 | 0.042 |

Notes: Summary statistics are constructed for all manufacturing firms during the time period 1999 to 2009. Obs. refers to the number of observations across firms and years for each country of origin.

Table 2: *Continued*

| Country Code | | Basic Education | | | | | | Secondary Education | | | | | | Tertiary Education | | | | | |
|--------------|---------|-----------------|-------|--------|-------|--------|-------|---------------------|-------|--------|-------|--------|-------|--------------------|-------|--------|-------|--------|-------|
| | | Obs. | Mean | Median | S.D. | Min. | Max. | Obs. | Mean | Median | S.D. | Min. | Max. | Obs. | Mean | Median | S.D. | Min. | Max. |
| ISL | overall | 187.000 | 0.014 | 0.006 | 0.021 | 0.000 | 0.111 | 403.000 | 0.015 | 0.006 | 0.021 | 0.000 | 0.167 | 422.000 | 0.014 | 0.004 | 0.035 | 0.000 | 0.321 |
| | between | 85.000 | | | 0.021 | 0.000 | 0.100 | 127.000 | | | 0.021 | 0.000 | 0.102 | 138.000 | | | 0.027 | 0.000 | 0.268 |
| | within | 2.200 | | | 0.005 | -0.014 | 0.053 | 3.173 | | | 0.006 | -0.015 | 0.080 | 3.058 | | | 0.006 | -0.032 | 0.067 |
| ISR | overall | 29.000 | 0.018 | 0.014 | 0.020 | 0.001 | 0.077 | 97.000 | 0.009 | 0.004 | 0.013 | 0.000 | 0.067 | 74.000 | 0.012 | 0.006 | 0.012 | 0.000 | 0.043 |
| | between | 13.000 | | | 0.021 | 0.001 | 0.065 | 38.000 | | | 0.015 | 0.000 | 0.067 | 20.000 | | | 0.010 | 0.000 | 0.034 |
| | within | 2.231 | | | 0.004 | 0.003 | 0.030 | 2.553 | | | 0.003 | -0.009 | 0.032 | 3.700 | | | 0.003 | 0.005 | 0.022 |
| ITA | overall | 44.000 | 0.027 | 0.007 | 0.033 | 0.001 | 0.111 | 136.000 | 0.010 | 0.004 | 0.013 | 0.000 | 0.063 | 68.000 | 0.007 | 0.001 | 0.014 | 0.000 | 0.071 |
| | between | 24.000 | | | 0.027 | 0.001 | 0.081 | 34.000 | | | 0.012 | 0.000 | 0.047 | 29.000 | | | 0.015 | 0.000 | 0.069 |
| | within | 1.833 | | | 0.008 | 0.002 | 0.057 | 4.000 | | | 0.002 | 0.001 | 0.027 | 2.345 | | | 0.001 | 0.002 | 0.011 |
| JPN | overall | 17.000 | 0.015 | 0.009 | 0.015 | 0.000 | 0.050 | 46.000 | 0.010 | 0.009 | 0.010 | 0.000 | 0.056 | 39.000 | 0.010 | 0.011 | 0.010 | 0.000 | 0.043 |
| | between | 10.000 | | | 0.013 | 0.000 | 0.044 | 13.000 | | | 0.018 | 0.000 | 0.056 | 13.000 | | | 0.013 | 0.000 | 0.043 |
| | within | 1.700 | | | 0.002 | 0.009 | 0.021 | 3.538 | | | 0.003 | 0.004 | 0.020 | 3.000 | | | 0.001 | 0.007 | 0.013 |
| KOR | overall | 15.000 | 0.016 | 0.014 | 0.017 | 0.000 | 0.059 | 28.000 | 0.014 | 0.010 | 0.013 | 0.000 | 0.034 | 13.000 | 0.012 | 0.001 | 0.023 | 0.000 | 0.067 |
| | between | 7.000 | | | 0.019 | 0.000 | 0.052 | 9.000 | | | 0.012 | 0.000 | 0.029 | 5.000 | | | 0.026 | 0.000 | 0.061 |
| | within | 2.143 | | | 0.003 | 0.009 | 0.023 | 3.111 | | | 0.004 | 0.003 | 0.022 | 2.600 | | | 0.002 | 0.006 | 0.017 |
| MEX | overall | 3.000 | 0.013 | 0.014 | 0.002 | 0.010 | 0.014 | 19.000 | 0.021 | 0.019 | 0.019 | 0.000 | 0.059 | 25.000 | 0.005 | 0.003 | 0.006 | 0.000 | 0.019 |
| | between | 2.000 | | | 0.003 | 0.010 | 0.014 | 9.000 | | | 0.019 | 0.000 | 0.056 | 10.000 | | | 0.005 | 0.000 | 0.019 |
| | within | 1.500 | | | 0.000 | 0.012 | 0.013 | 2.111 | | | 0.002 | 0.018 | 0.024 | 2.500 | | | 0.000 | 0.004 | 0.005 |
| NLD | overall | 141.000 | 0.021 | 0.005 | 0.055 | 0.000 | 0.500 | 279.000 | 0.010 | 0.004 | 0.015 | 0.000 | 0.091 | 138.000 | 0.008 | 0.003 | 0.014 | 0.000 | 0.100 |
| | between | 62.000 | | | 0.038 | 0.000 | 0.265 | 75.000 | | | 0.018 | 0.000 | 0.081 | 42.000 | | | 0.021 | 0.000 | 0.100 |
| | within | 2.274 | | | 0.024 | -0.119 | 0.256 | 3.720 | | | 0.003 | -0.007 | 0.026 | 3.286 | | | 0.001 | 0.005 | 0.012 |
| NOR | overall | 436.000 | 0.017 | 0.006 | 0.024 | 0.000 | 0.125 | 860.000 | 0.016 | 0.008 | 0.020 | 0.000 | 0.167 | 582.000 | 0.013 | 0.005 | 0.016 | 0.000 | 0.083 |
| | between | 151.000 | | | 0.025 | 0.000 | 0.125 | 243.000 | | | 0.020 | 0.000 | 0.122 | 169.000 | | | 0.017 | 0.000 | 0.071 |
| | within | 2.887 | | | 0.004 | -0.001 | 0.055 | 3.539 | | | 0.005 | -0.029 | 0.062 | 3.444 | | | 0.004 | -0.008 | 0.053 |
| POL | overall | 720.000 | 0.018 | 0.007 | 0.026 | 0.000 | 0.214 | 1053.000 | 0.016 | 0.006 | 0.024 | 0.000 | 0.167 | 670.000 | 0.016 | 0.006 | 0.043 | 0.000 | 1.000 |
| | between | 273.000 | | | 0.026 | 0.000 | 0.171 | 286.000 | | | 0.024 | 0.000 | 0.159 | 204.000 | | | 0.042 | 0.000 | 0.516 |
| | within | 2.637 | | | 0.007 | -0.053 | 0.111 | 3.682 | | | 0.004 | -0.006 | 0.079 | 3.284 | | | 0.027 | -0.468 | 0.500 |
| PRT | overall | 27.000 | 0.013 | 0.001 | 0.017 | 0.000 | 0.059 | 84.000 | 0.010 | 0.002 | 0.020 | 0.000 | 0.111 | 33.000 | 0.003 | 0.002 | 0.005 | 0.000 | 0.018 |
| | between | 4.000 | | | 0.016 | 0.000 | 0.032 | 21.000 | | | 0.028 | 0.000 | 0.111 | 7.000 | | | 0.006 | 0.000 | 0.016 |
| | within | 6.750 | | | 0.006 | 0.004 | 0.040 | 4.000 | | | 0.002 | 0.005 | 0.019 | 4.714 | | | 0.001 | 0.001 | 0.005 |
| SVK | overall | | | | | | | 1.000 | 0.001 | 0.001 | | 0.001 | 0.001 | 9.000 | 0.006 | 0.001 | 0.015 | 0.000 | 0.045 |
| | between | | | | | | | 1.000 | | | | 0.001 | 0.001 | 5.000 | | | 0.020 | 0.000 | 0.045 |
| | within | | | | | | | 1.000 | | | | 0.001 | 0.001 | 1.800 | | | 0.000 | 0.005 | 0.006 |
| SVN | overall | 1.000 | 0.040 | 0.040 | | 0.040 | 0.040 | 6.000 | 0.007 | 0.004 | 0.008 | 0.003 | 0.023 | 7.000 | 0.004 | 0.004 | 0.001 | 0.002 | 0.005 |
| | between | 1.000 | | | | 0.040 | 0.040 | 2.000 | | | 0.013 | 0.004 | 0.023 | 2.000 | | | 0.002 | 0.002 | 0.005 |
| | within | 1.000 | | | | 0.040 | 0.040 | 3.000 | | | 0.001 | 0.006 | 0.009 | 3.500 | | | 0.000 | 0.003 | 0.004 |
| USA | overall | 95.000 | 0.009 | 0.004 | 0.015 | 0.000 | 0.100 | 207.000 | 0.013 | 0.002 | 0.021 | 0.000 | 0.111 | 218.000 | 0.012 | 0.002 | 0.022 | 0.000 | 0.111 |
| | between | 38.000 | | | 0.019 | 0.000 | 0.100 | 73.000 | | | 0.020 | 0.000 | 0.096 | 64.000 | | | 0.018 | 0.000 | 0.090 |
| | within | 2.500 | | | 0.002 | 0.004 | 0.016 | 2.836 | | | 0.004 | -0.003 | 0.036 | 3.406 | | | 0.004 | -0.007 | 0.032 |

Notes: Summary statistics are constructed for all manufacturing firms during the time period 1999 to 2009. Obs. refers to the number of observations across firms and years for each country of origin.

Table 3: Summary Statistics for Firms Employing Foreign Workers According to their Economic Performance

| Gross Production Deciles | Labour Size | Basic Education | | | | | Secondary Education | | | | | Tertiary Education | | | | |
|--------------------------|-------------|-----------------|--------|--------|------|---------|---------------------|--------|--------|------|---------|--------------------|--------|--------|------|---------|
| | | Mean | Median | S.D. | Min. | Max. | Mean | Median | S.D. | Min. | Max. | Mean | Median | S.D. | Min. | Max. |
| First | 12.4541 | 4.4799 | 0.7407 | 8.8201 | 0 | 79.3355 | 0.6685 | 0.0000 | 2.2207 | 0 | 24.5671 | 0.1601 | 0.0000 | 0.9994 | 0 | 11.9683 |
| Second | 14.3312 | 4.4422 | 1.2527 | 7.3119 | 0 | 71.9569 | 0.8795 | 0.0000 | 2.4311 | 0 | 19.9893 | 0.1349 | 0.0000 | 0.7080 | 0 | 8.6915 |
| Third | 16.2110 | 4.0450 | 1.1873 | 8.1019 | 0 | 92.0068 | 0.8771 | 0.0000 | 1.9616 | 0 | 13.2558 | 0.2911 | 0.0000 | 1.3746 | 0 | 16.1089 |
| Fourth | 20.0726 | 3.9961 | 1.5152 | 6.6142 | 0 | 64.2520 | 0.9034 | 0.0000 | 2.0957 | 0 | 15.3437 | 0.2095 | 0.0000 | 0.7574 | 0 | 8.2748 |
| Fifth | 23.5248 | 4.4134 | 1.6306 | 7.9799 | 0 | 93.5152 | 0.6717 | 0.0000 | 1.3636 | 0 | 10.9276 | 0.2860 | 0.0000 | 1.3095 | 0 | 19.2055 |
| Sixth | 29.2331 | 4.9171 | 2.2479 | 7.6863 | 0 | 64.5614 | 0.8431 | 0.0000 | 1.5006 | 0 | 11.9653 | 0.3121 | 0.0000 | 0.9291 | 0 | 9.3750 |
| Seventh | 40.9758 | 5.0211 | 2.9524 | 6.9545 | 0 | 66.4562 | 0.8071 | 0.1749 | 1.3084 | 0 | 9.0115 | 0.3532 | 0.0000 | 0.9030 | 0 | 9.8321 |
| Eighth | 56.0916 | 5.3908 | 2.9309 | 7.9095 | 0 | 57.7179 | 0.8382 | 0.3251 | 1.2228 | 0 | 8.1445 | 0.3200 | 0.0000 | 0.9662 | 0 | 17.1875 |
| Ninth | 93.9273 | 5.1965 | 3.0016 | 7.1715 | 0 | 54.6899 | 0.8009 | 0.4366 | 1.0218 | 0 | 6.8783 | 0.3584 | 0.0749 | 0.7454 | 0 | 8.0458 |
| Tenth | 412.8351 | 4.5899 | 3.0325 | 5.2289 | 0 | 46.0161 | 0.8849 | 0.6547 | 0.8674 | 0 | 5.6925 | 0.4713 | 0.2512 | 0.7330 | 0 | 8.5619 |

Notes: Summary statistics are constructed for all manufacturing firms for the time period 1999 to 2009. Labour Size corresponds to the average number of fulltime-equivalent employees. The mean and median values are expressed in %, respectively.

Table 4: Descriptive Statistics for the Sampled *R&D* Countries

| Country Code | Country | Obs. | Coverage | Mean | Median | S.D. | Min. | Max. |
|--------------|----------------|------|-----------|-------------|-------------|------------|------------|-------------|
| AUS | Australia | 18 | 1989-2006 | 17201.496 | 16536.043 | 7143.181 | 7627.369 | 31489.420 |
| AUT | Austria | 8 | 2002-2009 | 22913.260 | 22699.828 | 3613.437 | 18204.256 | 28197.736 |
| BEL | Belgium | 12 | 1998-2009 | 28853.129 | 28973.688 | 1575.196 | 26200.441 | 31248.355 |
| CAN | Canada | 20 | 1987-2006 | 45117.004 | 41924.473 | 14394.748 | 26949.480 | 70907.125 |
| CZE | Czech Republic | 17 | 1993-2009 | 3489.423 | 3274.040 | 794.038 | 2567.471 | 5084.386 |
| DEU | Germany | 18 | 1991-2008 | 255013.719 | 248473.781 | 30972.646 | 215808.141 | 312100.344 |
| DNK | Denmark | 6 | 2001-2006 | 24575.367 | 24631.211 | 767.462 | 23498.283 | 25563.172 |
| ESP | Spain | 30 | 1980-2009 | 14500.596 | 13074.151 | 8934.097 | 3410.860 | 34061.348 |
| EST | Estonia | 12 | 1998-2009 | 105.881 | 78.737 | 77.010 | 26.196 | 248.403 |
| FIN | Finland | 37 | 1973-2009 | 9401.680 | 6771.818 | 7921.644 | 1384.660 | 27438.457 |
| FRA | France | 35 | 1973-2007 | 108090.961 | 106073.328 | 37593.590 | 55305.691 | 169559.266 |
| GBR | United Kingdom | 22 | 1987-2008 | 151379.797 | 147885.969 | 9290.854 | 138059.500 | 169844.109 |
| GRC | Greece | 20 | 1988-2007 | 1016.673 | 885.278 | 514.151 | 381.227 | 1953.248 |
| HUN | Hungary | 16 | 1994-2009 | 1166.288 | 1079.830 | 400.754 | 689.227 | 1991.053 |
| ISL | Iceland | 23 | 1987-2009 | 418.984 | 240.409 | 381.488 | 43.975 | 1159.778 |
| ISR | Israel | 9 | 2000-2008 | 34480.141 | 33819.258 | 3460.149 | 29825.244 | 40453.988 |
| ITA | Italy | 37 | 1973-2009 | 39275.785 | 44330.148 | 13996.295 | 17809.988 | 60354.758 |
| JPN | Japan | 23 | 1987-2009 | 790902.188 | 772097.125 | 163205.984 | 546084.188 | 1083235.375 |
| KOR | South Korea | 15 | 1995-2009 | 72619.531 | 67124.102 | 24041.914 | 42983.758 | 118903.773 |
| MEX | Mexico | 13 | 1995-2007 | 3682.963 | 3269.329 | 1983.757 | 1319.377 | 7288.594 |
| NLD | Netherlands | 35 | 1973-2007 | 24377.344 | 24415.133 | 6706.725 | 15412.286 | 36682.840 |
| NOR | Norway | 14 | 1995-2008 | 13775.466 | 13844.434 | 841.686 | 12433.524 | 14964.194 |
| POL | Poland | 14 | 1995-2008 | 3383.130 | 3376.470 | 139.420 | 3106.814 | 3580.878 |
| PRT | Portugal | 20 | 1987-2006 | 995.597 | 805.097 | 573.275 | 324.639 | 2348.847 |
| SVK | Slovakia | 16 | 1994-2009 | 946.094 | 981.808 | 83.785 | 793.463 | 1045.345 |
| SVN | Slovenia | 15 | 1995-2009 | 1138.584 | 1102.479 | 371.920 | 647.619 | 1827.205 |
| USA | United States | 22 | 1987-2008 | 1348665.500 | 1300002.250 | 253918.906 | 993174.063 | 1803543.625 |

Notes: The construction of the R&D capital stocks is based on the Perpetual Inventory Method (PIM) applied to data for R&D expenditures from the OECD's Analytical Business Enterprise Research and Development (ANBERD) database, as outlined in the main text. R&D expenditures by country are first deflated with a country-specific valued added price deflator (VALP) from the OECD Structural Analysis (STAN) database and then converted into constant 2000 US-Dollar. The values in this table are expressed in millions of US-Dollars.

Table 5: Summary Statistics for Regression Analysis in Table (3).

| | Obs. | Mean | S. D. | Min. | Max. |
|--------------------------------------|-------|---------|---------|---------|---------|
| Log Gross Production | 40828 | 17.3068 | 1.2960 | 12.8186 | 24.0804 |
| Log Labour | 40828 | 3.4633 | 1.0706 | 0.0000 | 9.4122 |
| Log Capital | 40828 | 15.7992 | 1.6970 | 6.9078 | 24.0446 |
| Log Materials | 40828 | 16.2975 | 1.5165 | 6.9078 | 23.7692 |
| $Dummy_{For} \times \text{Log } s^f$ | 40828 | 18.0973 | 13.9242 | 0.0000 | 28.9659 |
| $Dummy_B \times \text{Log } s^f$ | 40828 | 16.0348 | 14.3137 | 0.0000 | 28.9659 |
| $Dummy_S \times \text{Log } s^f$ | 40828 | 7.6702 | 12.7342 | 0.0000 | 28.9659 |
| $Dummy_T \times \text{Log } s^f$ | 40828 | 3.7272 | 9.6686 | 0.0000 | 28.9659 |
| $\text{Log } s^{f,ew}$ | 40828 | 9.0006 | 11.6812 | 0.0000 | 28.2208 |
| $\text{Log } s^{f,ew,B}$ | 40828 | 7.2688 | 11.0025 | 0.0000 | 28.2208 |
| $\text{Log } s^{f,ew,S}$ | 40828 | 2.9755 | 7.8031 | 0.0000 | 28.2208 |
| $\text{Log } s^{f,ew,T}$ | 40828 | 1.4977 | 5.6351 | 0.0000 | 28.2208 |
| $\text{Log } s^{f,ewedu}$ | 40828 | 9.4034 | 12.2213 | 0.0000 | 30.9934 |
| $\text{Log } s^{f,ewedu,B}$ | 40828 | 7.3437 | 11.1182 | 0.0000 | 30.1667 |
| $\text{Log } s^{f,ewedu,S}$ | 40828 | 3.3184 | 8.6936 | 0.0000 | 30.9288 |
| $\text{Log } s^{f,ewedu,T}$ | 40828 | 1.6838 | 6.3270 | 0.0000 | 30.9934 |
| $\text{Log } s^{f,ewoccu,other}$ | 40828 | 0.8584 | 4.3881 | 0.0000 | 28.1568 |
| $\text{Log } s^{f,ewoccu,low}$ | 40828 | 2.1429 | 6.6914 | 0.0000 | 28.2208 |
| $\text{Log } s^{f,ewoccu,mid}$ | 40828 | 6.1494 | 10.4158 | 0.0000 | 28.2208 |
| $\text{Log } s^{f,ewoccu,high}$ | 40828 | 2.5244 | 7.2703 | 0.0000 | 28.2208 |
| $\text{Log } s^{f,ewoccu,managers}$ | 40828 | 0.8228 | 4.3028 | 0.0000 | 27.9528 |
| Ethnic Diversity | 40828 | 0.0990 | 0.1244 | 0.0000 | 0.8471 |
| Log Tenure | 40828 | 1.5006 | 0.4750 | 0.0000 | 2.7081 |
| Males | 40828 | 0.7347 | 0.2079 | 0.0000 | 1.0000 |
| Age15_28 | 40828 | 0.1851 | 0.1430 | 0.0000 | 1.0000 |
| Age29_38 | 40828 | 0.2565 | 0.1209 | 0.0000 | 1.0000 |
| Age39_48 | 40828 | 0.2600 | 0.1172 | 0.0000 | 1.0000 |
| Age49_65 | 40828 | 0.2773 | 0.1472 | 0.0000 | 1.0000 |
| Low-Skilled | 40828 | 0.1505 | 0.1821 | 0.0000 | 1.0000 |
| Mid-Skilled | 40828 | 0.5997 | 0.2230 | 0.0000 | 1.0000 |
| High-Skilled | 40828 | 0.1277 | 0.1392 | 0.0000 | 1.0000 |
| Managers | 40828 | 0.0562 | 0.0720 | 0.0000 | 1.0000 |
| Basic Education | 40828 | 0.3529 | 0.1745 | 0.0000 | 1.0000 |
| Secondary Education | 40828 | 0.5489 | 0.1751 | 0.0000 | 1.0000 |
| Tertiary Education | 40828 | 0.0982 | 0.1059 | 0.0000 | 1.0000 |
| Multinational | 40828 | 0.0022 | 0.0469 | 0.0000 | 1.0000 |
| Exporter | 40828 | 0.7578 | 0.4284 | 0.0000 | 1.0000 |

Table 7: Summary Statistics for Robustness Analysis (Export/Import Spillover Sample).

| | Obs. | Mean | S. D. | Min. | Max. |
|---------------------------|-------|---------|---------|---------|---------|
| Log Gross Production | 22479 | 17.8886 | 1.2721 | 13.2708 | 24.0804 |
| Log Labour | 22479 | 3.8745 | 1.1268 | 0.0000 | 9.4122 |
| Log Capital | 22479 | 16.3580 | 1.7384 | 7.6009 | 24.0446 |
| Log Materials | 22479 | 16.9574 | 1.4470 | 6.9078 | 23.7692 |
| Log $s^{f,ewedu}$ | 22479 | 12.6091 | 12.6537 | 0.0000 | 30.9294 |
| Ethnic Diversity | 22479 | 0.1137 | 0.1244 | 0.0000 | 0.8471 |
| Log Tenure | 22479 | 1.5491 | 0.4244 | 0.0000 | 2.7081 |
| Males | 22479 | 0.7035 | 0.1989 | 0.0000 | 1.0000 |
| Age15_28 | 22479 | 0.1545 | 0.1081 | 0.0000 | 1.0000 |
| Age29_38 | 22479 | 0.2665 | 0.1081 | 0.0000 | 1.0000 |
| Age39_48 | 22479 | 0.2782 | 0.1026 | 0.0000 | 1.0000 |
| Age49_65 | 22479 | 0.2826 | 0.1305 | 0.0000 | 1.0000 |
| Low-Skilled | 22479 | 0.1438 | 0.1680 | 0.0000 | 1.0000 |
| Mid-Skilled | 22479 | 0.5720 | 0.2131 | 0.0000 | 1.0000 |
| High-Skilled | 22479 | 0.1639 | 0.1436 | 0.0000 | 1.0000 |
| Managers | 22479 | 0.0590 | 0.0670 | 0.0000 | 1.0000 |
| Basic Education | 22479 | 0.3536 | 0.1611 | 0.0000 | 1.0000 |
| Secondary Education | 22479 | 0.5224 | 0.1538 | 0.0000 | 1.0000 |
| Tertiary Education | 22479 | 0.1240 | 0.1076 | 0.0000 | 1.0000 |
| Multinational | 22479 | 0.0032 | 0.0561 | 0.0000 | 1.0000 |
| Exporter | 22479 | 0.9605 | 0.1947 | 0.0000 | 1.0000 |
| Log import-weighted FKR&D | 22479 | 23.7007 | 5.6950 | 0.0000 | 28.2208 |
| Log export-weighted FKR&D | 22479 | 24.5936 | 2.0235 | 6.3804 | 28.2208 |

Table 8: Pairwise Correlations for Robustness Analysis (Export/Import Spillover Sample).

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) | (20) | (21) | (22) | (23) | | |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|--------|--|--|
| (1) Log Gross Production | 1.0000 | | | | | | | | | | | | | | | | | | | | | | | | |
| (2) Log Labour | 0.8981 | 1.0000 | | | | | | | | | | | | | | | | | | | | | | | |
| (3) Log Capital | 0.8020 | 0.7804 | 1.0000 | | | | | | | | | | | | | | | | | | | | | | |
| (4) Log Materials | 0.9105 | 0.7991 | 0.7046 | 1.0000 | | | | | | | | | | | | | | | | | | | | | |
| (5) Log <i>FKR&D</i> | 0.4394 | 0.4897 | 0.3645 | 0.3966 | 1.0000 | | | | | | | | | | | | | | | | | | | | |
| (6) Ethnic Diversity | 0.0129 | 0.0299 | 0.0283 | 0.0116 | 0.2653 | 1.0000 | | | | | | | | | | | | | | | | | | | |
| (7) Log Tenure | 0.0617 | -0.0093 | 0.0539 | 0.0094 | -0.0529 | -0.0617 | 1.0000 | | | | | | | | | | | | | | | | | | |
| (8) Males | -0.0367 | -0.0409 | -0.0521 | -0.0159 | -0.0375 | -0.1071 | 0.0371 | 1.0000 | | | | | | | | | | | | | | | | | |
| (9) Age15_28 | -0.1096 | 0.0055 | -0.0905 | -0.0767 | -0.0166 | 0.0756 | -0.3545 | 0.0716 | 1.0000 | | | | | | | | | | | | | | | | |
| (10) Age29_38 | 0.0940 | 0.1043 | 0.0734 | 0.1001 | 0.0640 | 0.0150 | -0.2408 | -0.0045 | 0.0057 | 1.0000 | | | | | | | | | | | | | | | |
| (11) Age39_48 | 0.1597 | 0.0851 | 0.1333 | 0.1288 | 0.0414 | -0.0032 | 0.1950 | -0.0411 | -0.4271 | -0.2923 | 1.0000 | | | | | | | | | | | | | | |
| (12) Age49_65 | -0.0535 | -0.1028 | -0.0428 | -0.0646 | -0.0429 | -0.0708 | 0.3281 | -0.0074 | -0.4965 | -0.5479 | -0.1602 | 1.0000 | | | | | | | | | | | | | |
| (13) Low-Skilled | -0.0568 | -0.0639 | -0.0372 | -0.0522 | -0.0293 | 0.1360 | -0.0756 | -0.1669 | 0.1396 | -0.0757 | -0.0361 | -0.0612 | 1.0000 | | | | | | | | | | | | |
| (14) Mid-Skilled | 0.0447 | 0.1456 | 0.0668 | 0.0680 | 0.0268 | -0.0690 | -0.0100 | 0.1834 | 0.0755 | 0.0127 | -0.0726 | 0.0205 | -0.4843 | 1.0000 | | | | | | | | | | | |
| (15) High-Skilled | 0.1919 | 0.0964 | 0.0948 | 0.1478 | 0.0814 | -0.0945 | 0.0567 | -0.0102 | -0.2217 | 0.1150 | 0.1485 | -0.0083 | -0.1765 | -0.4622 | 1.0000 | | | | | | | | | | |
| (16) Managers | -0.1547 | -0.2285 | -0.1303 | -0.1550 | -0.1171 | -0.0460 | 0.0931 | -0.0232 | -0.1270 | -0.0382 | -0.0002 | 0.1227 | -0.1083 | -0.1258 | 0.0196 | 1.0000 | | | | | | | | | |
| (17) Basic Education | -0.0268 | 0.0372 | 0.0555 | 0.0018 | 0.0556 | 0.3978 | -0.1027 | -0.3501 | 0.1575 | -0.1765 | -0.0765 | 0.0492 | 0.2618 | 0.0527 | -0.4445 | -0.0650 | 1.0000 | | | | | | | | |
| (18) Secondary Education | -0.0665 | -0.0611 | -0.0961 | -0.0696 | -0.1024 | -0.3878 | 0.1049 | 0.4437 | -0.0582 | 0.0925 | 0.0112 | -0.0169 | -0.2239 | 0.2236 | 0.0105 | 0.0080 | -0.7676 | 1.0000 | | | | | | | |
| (19) Tertiary Education | 0.1353 | 0.0317 | 0.0542 | 0.0968 | 0.0633 | -0.0411 | 0.0038 | -0.1102 | -0.1527 | 0.1320 | 0.0985 | -0.0494 | -0.0718 | -0.3987 | 0.6506 | 0.0859 | -0.3998 | -0.2806 | 1.0000 | | | | | | |
| (20) Multinational | 0.0043 | -0.0206 | -0.0263 | 0.0130 | 0.0287 | -0.0013 | -0.0206 | 0.0256 | -0.0216 | 0.0294 | 0.0037 | -0.0050 | -0.0182 | 0.0136 | 0.0116 | -0.0100 | -0.0409 | 0.0553 | -0.0178 | 1.0000 | | | | | |
| (21) Exporter | 0.0675 | 0.0538 | 0.0575 | 0.0758 | 0.0392 | 0.0075 | 0.0482 | -0.0258 | -0.0135 | 0.0075 | 0.0146 | -0.0023 | -0.0265 | 0.0001 | 0.0609 | 0.0219 | -0.0278 | -0.0198 | 0.0700 | 0.0073 | 1.0000 | | | | |
| (22) Log import-weighted <i>FKR&D</i> | 0.1822 | 0.1833 | 0.1216 | 0.1753 | 0.1612 | 0.0104 | -0.0501 | -0.0277 | -0.0449 | 0.0849 | 0.0218 | -0.0253 | -0.0435 | 0.0022 | 0.0804 | -0.0577 | -0.0190 | -0.0358 | 0.0796 | 0.0221 | 0.0333 | 1.0000 | | | |
| (23) Log export-weighted <i>FKR&D</i> | 0.0977 | 0.1381 | 0.0759 | 0.1100 | 0.1693 | 0.0485 | -0.0732 | -0.0562 | 0.0167 | 0.0661 | 0.0037 | -0.0631 | -0.0264 | 0.0068 | 0.0328 | -0.0493 | 0.0282 | -0.0881 | 0.0837 | 0.0153 | 0.1026 | 0.2270 | 1.0000 | | |

D Summary Tables

Table 9: Firm's Economic Performance and Access to International Knowledge (Assessing Immigrants Structure)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------------------------------|--|------------------------|-----------------------|-----------------------|-----------------------|------------------------|
| | Dependent Variable: Log of Firm's Gross Production | | | | | |
| Log Labour | 0.5135*** (0.0123) | 0.5091*** (0.0124) | 0.5094*** (0.0125) | 0.5116*** (0.0123) | 0.5110*** (0.0124) | 0.5050*** (0.0125) |
| Log Capital | 0.0814*** (0.0037) | 0.0813*** (0.0037) | 0.0812*** (0.0037) | 0.0813*** (0.0037) | 0.0810*** (0.0037) | 0.0808*** (0.0037) |
| Log Materials | 0.3995*** (0.0119) | 0.3992*** (0.0119) | 0.3993*** (0.0119) | 0.3993*** (0.0119) | 0.3992*** (0.0119) | 0.3989*** (0.0119) |
| Log $s^{f,ew}$ | | 0.0010*** (0.0003) | | | | |
| Log $s^{f,ew,B}$ | | | 0.0010*** (0.0003) | | | 0.0010*** (0.0003) |
| Log $s^{f,ew,S}$ | | | | 0.0007* (0.0004) | | 0.0007* (0.0004) |
| Log $s^{f,ew,T}$ | | | | | 0.0018*** (0.0006) | 0.0017*** (0.0006) |
| Ethnic Diversity | -0.0480* (0.0265) | -0.0773*** (0.0282) | -0.0709** (0.0278) | -0.0545** (0.0268) | -0.0555** (0.0267) | -0.0847*** (0.0283) |
| Log Tenure | 0.0532*** (0.0074) | 0.0533*** (0.0074) | 0.0532*** (0.0074) | 0.0534*** (0.0074) | 0.0536*** (0.0074) | 0.0537*** (0.0074) |
| Males | 0.1032*** (0.0261) | 0.1039*** (0.0261) | 0.1038*** (0.0261) | 0.1032*** (0.0261) | 0.1061*** (0.0262) | 0.1065*** (0.0261) |
| Managers | 0.2081*** (0.0690) | 0.2082*** (0.0688) | 0.2097*** (0.0689) | 0.2068*** (0.0688) | 0.2077*** (0.0688) | 0.2080*** (0.0685) |
| Multinational | 0.2582*** (0.0928) | 0.2515*** (0.0916) | 0.2500*** (0.0915) | 0.2578*** (0.0933) | 0.2589*** (0.0927) | 0.2503*** (0.0917) |
| Exporter | 0.0385*** (0.0076) | 0.0383*** (0.0076) | 0.0385*** (0.0076) | 0.0387*** (0.0076) | 0.0395*** (0.0076) | 0.0398*** (0.0076) |
| Constant | 6.9908*** (0.1551) | 7.0044*** (0.1552) | 7.0032*** (0.1550) | 6.9987*** (0.1555) | 7.0028*** (0.1550) | 7.0226*** (0.1554) |
| Observations | 40,828 | 40,828 | 40,828 | 40,828 | 40,828 | 40,828 |
| R-squared | 0.945 | 0.945 | 0.945 | 0.945 | 0.945 | 0.945 |
| Industry-Year Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Commuting Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm's Age Characteristics | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm's Occupation Characteristics | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm's Education Characteristics | Yes | Yes | Yes | Yes | Yes | Yes |

Notes: The dependent variable is the log of firm's gross production as total sales of goods and services (in DKK).

Independent variables: *Log Labour* refers to full-time equivalent employees. *Log Capital* is the log of total assets (in DKK). *Log Materials* is the log of intermediate goods (purchase of goods, helping materials, and packaging) used in the production process (in DKK). *Log FKR&D_{ew}* is the log of a firm's ethnic-weighted sum of foreign R&D capital stocks of non-Danish employees. *Log FKR&D_{ew}^B* is the log of a firm's ethnic-weighted sum of foreign R&D capital stocks of non-Danish employees with basic education. *Log FKR&D_{ew}^S* is the log of a firm's ethnic-weighted sum of foreign R&D capital stocks of non-Danish employees with secondary education. *Log FKR&D_{ew}^T* is the log of a firm's ethnic-weighted sum of foreign R&D capital stocks of non-Danish employees with tertiary education. *Ethnic Diversity* refers to a Herfindahl-based measure of diversity averaged across work places. *Log Tenure* is the log of average firm tenure (in years). *Males* is the fraction of men employees engaged in production. *Managers* refers to the fraction of managers employed, according to Statistics Denmark's definitions of occupations for employment based on ISCO. *Multinational* takes value 1 if the firm is foreign-owned and zero otherwise. *Exporter* takes value 1 if the firm exports and zero otherwise. *Firm's Age Characteristics* refers to a full set of shares of employees belonging to each age distribution quartile. *Firm's Occupation Characteristics* refers to a full set of shares of employees belonging to low-skilled, mid-skilled, and high-skilled occupations. *Firm's Education Characteristics* refers to a full set of shares of employees with basic, secondary, and tertiary education.

Standard errors, clustered at the firm-level, are reported in parenthesis.

*: Significant at the 10% level. **: Significant at the 5% level. ***: Significant at the 1% level.

Table 10: Firm's Economic Performance and Access to International Knowledge (Assessing Education Structure)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|--|-----------------------|------------------------|-----------------------|-----------------------|-----------------------|------------------------|
| Dependent Variable: Log of Firm's Gross Production | | | | | | |
| Log Labour | 0.5135*** (0.0123) | 0.5090*** (0.0124) | 0.5094*** (0.0125) | 0.5116*** (0.0123) | 0.5110*** (0.0124) | 0.5050*** (0.0125) |
| Log Capital | 0.0814*** (0.0037) | 0.0813*** (0.0037) | 0.0812*** (0.0037) | 0.0813*** (0.0037) | 0.0810*** (0.0037) | 0.0808*** (0.0037) |
| Log Materials | 0.3995*** (0.0119) | 0.3992*** (0.0119) | 0.3993*** (0.0119) | 0.3993*** (0.0119) | 0.3992*** (0.0119) | 0.3989*** (0.0119) |
| Log $s^{f,ewedu}$ | | 0.0009*** (0.0003) | | | | |
| Log $s^{f,ewedu,B}$ | | | 0.0010*** (0.0003) | | | 0.0010*** (0.0003) |
| Log $s^{f,ewedu,S}$ | | | | 0.0007* (0.0003) | | 0.0006* (0.0003) |
| Log $s^{f,ewedu,T}$ | | | | | 0.0016*** (0.0005) | 0.0016*** (0.0005) |
| Ethnic Diversity | -0.0480* (0.0265) | -0.0772*** (0.0282) | -0.0705** (0.0278) | -0.0546** (0.0268) | -0.0556** (0.0267) | -0.0844*** (0.0283) |
| Log Tenure | 0.0532*** (0.0074) | 0.0533*** (0.0074) | 0.0532*** (0.0074) | 0.0534*** (0.0074) | 0.0536*** (0.0074) | 0.0537*** (0.0074) |
| Males | 0.1032*** (0.0261) | 0.1040*** (0.0261) | 0.1038*** (0.0261) | 0.1032*** (0.0261) | 0.1061*** (0.0262) | 0.1065*** (0.0261) |
| Managers | 0.2081*** (0.0690) | 0.2080*** (0.0688) | 0.2097*** (0.0689) | 0.2068*** (0.0688) | 0.2077*** (0.0688) | 0.2080*** (0.0685) |
| Multinational | 0.2582*** (0.0928) | 0.2519*** (0.0917) | 0.2503*** (0.0915) | 0.2578*** (0.0933) | 0.2589*** (0.0927) | 0.2506*** (0.0918) |
| Exporter | 0.0385*** (0.0076) | 0.0383*** (0.0076) | 0.0385*** (0.0076) | 0.0388*** (0.0076) | 0.0395*** (0.0076) | 0.0398*** (0.0076) |
| Constant | 6.9908*** (0.1551) | 7.0046*** (0.1553) | 7.0030*** (0.1550) | 6.9988*** (0.1555) | 7.0030*** (0.1550) | 7.0227*** (0.1554) |
| Observations | 40,828 | 40,828 | 40,828 | 40,828 | 40,828 | 40,828 |
| R-squared | 0.945 | 0.945 | 0.945 | 0.945 | 0.945 | 0.945 |
| Industry-Year Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Commuting Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm's Age Characteristics | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm's Occupation Characteristics | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm's Education Characteristics | Yes | Yes | Yes | Yes | Yes | Yes |

Notes: The dependent variable is the log of firm's gross production as total sales of goods and services (in DKK).

Independent variables: *Log Labour* refers to full-time equivalent employees. *Log Capital* is the log of total assets (in DKK). *Log Materials* is the log of intermediate goods (purchase of goods, helping materials, and packaging) used in the production process (in DKK). $\text{Log } FKR\&D_{ew}$ is the log of a firm's education-weighted sum of foreign R&D capital stocks of non-Danish employees. $\text{Log } FKR\&D_{ew}^B$ is the log of a firm's education-weighted sum of foreign R&D capital stocks of non-Danish employees with basic education. $\text{Log } FKR\&D_{ew}^S$ is the log of a firm's education-weighted sum of foreign R&D capital stocks of non-Danish employees with secondary education. $\text{Log } FKR\&D_{ew}^T$ is the log of a firm's education-weighted sum of foreign R&D capital stocks of non-Danish employees with tertiary education. *Ethnic Diversity* refers to a Herfindahl-based measure of diversity averaged across work places. *Log Tenure* is the log of average firm tenure (in years). *Males* is the fraction of men employees engaged in production. *Managers* refers to the fraction of managers employed, according to Statistics Denmark's definitions of occupations for employment based on ISCO. *Multinational* takes value 1 if the firm is foreign-owned and zero otherwise. *Exporter* takes value 1 if the firm exports and zero otherwise. *Firm's Age Characteristics* refers to a full set of shares of employees belonging to each age distribution quartile. *Firm's Occupation Characteristics* refers to a full set of shares of employees belonging to low-skilled, mid-skilled, and high-skilled occupations. *Firm's Education Characteristics* refers to a full set of shares of employees with basic, secondary, and tertiary education. Standard errors, clustered at the firm-level, are reported in parenthesis.

*: Significant at the 10% level. **: Significant at the 5% level. ***: Significant at the 1% level.

Table 11: Firm's Economic Performance and Access to International Knowledge (Assessing Occupation Structure)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------------------------------|--|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|
| | Dependent Variable: Log of Firm's Gross Production | | | | | |
| Log Labour | 0.5120*** (0.0124) | 0.5102*** (0.0124) | 0.5101*** (0.0124) | 0.5123*** (0.0124) | 0.5133*** (0.0124) | 0.5044*** (0.0125) |
| Log Capital | 0.0812*** (0.0037) | 0.0813*** (0.0037) | 0.0808*** (0.0037) | 0.0813*** (0.0037) | 0.0814*** (0.0037) | 0.0806*** (0.0037) |
| Log Materials | 0.3994*** (0.0119) | 0.3993*** (0.0119) | 0.3991*** (0.0119) | 0.3995*** (0.0119) | 0.3994*** (0.0119) | 0.3990*** (0.0119) |
| Log $s^{f,ewoccu,low}$ | 0.0009** (0.0004) | | | | | 0.0008** (0.0004) |
| Log $s^{f,ewoccu,mid}$ | | 0.0008*** (0.0003) | | | | 0.0008*** (0.0003) |
| Log $s^{f,ewoccu,high}$ | | | 0.0016*** (0.0004) | | | 0.0016*** (0.0004) |
| Log $s^{f,ewoccu,managers}$ | | | | 0.0013* (0.0007) | | 0.0011 (0.0007) |
| Log $s^{f,ewoccu,other}$ | | | | | 0.0003 (0.0005) | 0.0003 (0.0005) |
| Ethnic Diversity | -0.0545** (0.0267) | -0.0649** (0.0273) | -0.0573** (0.0268) | -0.0509* (0.0267) | -0.0491* (0.0265) | -0.0833*** (0.0281) |
| Log Tenure | 0.0532*** (0.0074) | 0.0535*** (0.0074) | 0.0532*** (0.0074) | 0.0533*** (0.0074) | 0.0532*** (0.0074) | 0.0535*** (0.0074) |
| Males | 0.1038*** (0.0261) | 0.1034*** (0.0261) | 0.1054*** (0.0262) | 0.1041*** (0.0261) | 0.1033*** (0.0261) | 0.1068*** (0.0261) |
| Managers | 0.2077*** (0.0689) | 0.2070*** (0.0688) | 0.2053*** (0.0688) | 0.1992*** (0.0697) | 0.2110*** (0.0696) | 0.1992*** (0.0698) |
| Multinational | 0.2547*** (0.0933) | 0.2547*** (0.0924) | 0.2546*** (0.0916) | 0.2581*** (0.0925) | 0.2580*** (0.0929) | 0.2479*** (0.0913) |
| Exporter | 0.0387*** (0.0076) | 0.0385*** (0.0076) | 0.0394*** (0.0076) | 0.0386*** (0.0076) | 0.0385*** (0.0076) | 0.0399*** (0.0076) |
| Constant | 7.0005*** (0.1551) | 7.0014*** (0.1552) | 7.0099*** (0.1550) | 6.9950*** (0.1550) | 6.9890*** (0.1553) | 7.0299*** (0.1552) |
| Observations | 40,828 | 40,828 | 40,828 | 40,828 | 40,828 | 40,828 |
| R-squared | 0.945 | 0.945 | 0.945 | 0.945 | 0.945 | 0.945 |
| Industry-Year Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Commuting Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm's Age Characteristics | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm's Occupation Characteristics | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm's Education Characteristics | Yes | Yes | Yes | Yes | Yes | Yes |

Notes: The dependent variable is the log of firm's gross production as total sales of goods and services (in DKK).

Independent variables: *Log Labour* refers to full-time equivalent employees. *Log Capital* is the log of total assets (in DKK). *Log Materials* is the log of intermediate goods (purchase of goods, helping materials, and packaging) used in the production process (in DKK). *Log FKR&D* is the log of a firm's education-weighted sum of foreign R&D capital stocks of non-Danish employees (see the main text for further details in the construction of R&D capital stocks). *Log FKR&D_{low}* is the log of a firm's sum of foreign R&D capital stocks of non-Danish employees with low-skilled occupation. *Log FKR&D_{mid}* is the log of a firm's sum of foreign R&D capital stocks of non-Danish employees with mid-skilled occupation. *Log FKR&D_{high}* is the log of a firm's sum of foreign R&D capital stocks of non-Danish employees with high-skilled occupation. *Log FKR&D_{managers}* is the log of a firm's sum of foreign R&D capital stocks of non-Danish employees with a managers position. *Log FKR&D_{other}* is the log of a firm's sum of foreign R&D capital stocks of non-Danish employees with other-skilled occupation. *Ethnic Diversity* refers to a Herfindahl-based measure of diversity averaged across work places. *Log Tenure* is the log of average firm tenure (in years). *Males* is the fraction of men employees engaged in production. *Managers* refers to the fraction of managers employed, according to Statistics Denmark's definitions of occupations for employment based on ISCO. *Multinational* takes value 1 if the firm is foreign-owned and zero otherwise. *Exporter* takes value 1 if the firm exports and zero otherwise. *Firm's Age Characteristics* refers to a full set of shares of employees belonging to each age distribution quartile. *Firm's Occupation Characteristics* refers to a full set of shares of employees belonging to low-skilled, mid-skilled, and high-skilled occupations. *Firm's Education Characteristics* refers to a full set of shares of employees with basic, secondary, and tertiary education.

Standard errors, clustered at the firm-level, are reported in parenthesis.

*: Significant at the 10% level. **: Significant at the 5% level. ***: Significant at the 1% level.

Table 12: Firm's Economic Performance and Access to International Knowledge (Robustness Analysis)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|--|------------------------|------------------------|-----------------------|------------------------|----------------------------------|----------------------------------|-----------------------------|
| | Full Sample | Foreigner Dummy | Non- Exporters | Non- Multinationals | Excl. Chemicals and Computers | Control Group: Firms w/o For. | Export/Import Spillovers |
| Dependent Variable: Log of Firm's Gross Production | | | | | | | |
| Log Labour | 0.5090*** (0.0124) | 0.5091*** (0.0124) | 0.5103*** (0.0189) | 0.5103*** (0.0124) | 0.5106*** (0.0127) | 0.4973*** (0.0117) | 0.5204*** (0.0186) |
| Log Capital | 0.0813*** (0.0037) | 0.0813*** (0.0037) | 0.0813*** (0.0062) | 0.0812*** (0.0037) | 0.0802*** (0.0037) | 0.0844*** (0.0042) | 0.0775*** (0.0051) |
| Log Materials | 0.3992*** (0.0119) | 0.3992*** (0.0119) | 0.3791*** (0.0166) | 0.3983*** (0.0119) | 0.3983*** (0.0122) | 0.4040*** (0.0117) | 0.3839*** (0.0179) |
| Log $s^{f,ewedu}$ | 0.0009*** (0.0003) | 0.0009*** (0.0003) | 0.0017*** (0.0005) | 0.0009*** (0.0003) | 0.0009*** (0.0003) | 0.0014*** (0.0004) | 0.0007** (0.0003) |
| Ethnic Diversity | -0.0772*** (0.0282) | -0.0759*** (0.0321) | -0.0545 (0.0452) | -0.0773*** (0.0282) | -0.0725** (0.0282) | -0.1245*** (0.0377) | -0.1309*** (0.0412) |
| Log Tenure | 0.0533*** (0.0074) | 0.0533*** (0.0074) | 0.0703*** (0.0122) | 0.0527*** (0.0074) | 0.0516*** (0.0075) | 0.0492*** (0.0084) | 0.0438*** (0.0117) |
| Males | 0.1040*** (0.0261) | 0.1040*** (0.0261) | 0.1422*** (0.0478) | 0.1040*** (0.0262) | 0.0954*** (0.0267) | 0.0856*** (0.0301) | 0.1280*** (0.0363) |
| Managers | 0.2080*** (0.0688) | 0.2080*** (0.0688) | 0.0550 (0.0831) | 0.2104*** (0.0689) | 0.2056*** (0.0720) | 0.1850** (0.0814) | 0.3002*** (0.1146) |
| Multinational | 0.2519*** (0.0917) | 0.2519*** (0.0917) | 0.3698 (0.2515) | | 0.2987*** (0.0882) | 0.2494*** (0.0955) | 0.2607*** (0.1002) |
| Exporter | 0.0383*** (0.0076) | 0.0383*** (0.0076) | | 0.0386*** (0.0076) | 0.0384*** (0.0076) | 0.0347*** (0.0083) | -0.0030 (0.0208) |
| Foreigner | | -0.0007 (0.0075) | | | | | |
| Log import-weighted s^f | | | | | | | 0.0029*** (0.0006) |
| Log export-weighted s^f | | | | | | | -0.0076*** (0.0021) |
| Constant | 7.0046*** (0.1553) | 7.0046*** (0.1553) | 7.1341*** (0.2046) | 7.0168*** (0.1556) | 7.0397*** (0.1592) | 6.8886*** (0.1575) | 7.3556*** (0.2579) |
| Observations | 40,828 | 40,828 | 9,887 | 40,738 | 39,682 | 30,497 | 22,479 |
| R-squared | 0.945 | 0.945 | 0.916 | 0.945 | 0.945 | 0.950 | 0.942 |
| Industry-Year Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Commuting Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm's Age Characteristics | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm's Occupation Characteristics | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm's Education Characteristics | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Notes: The dependent variable is the log of firm's gross production as total sales of goods and services (in DKK).

Independent variables: *Log Labour* refers to full-time equivalent employees. *Log Capital* is the log of total assets (in DKK). *Log Materials* is the log of intermediate goods (purchase of goods, helping materials, and packaging) used in the production process (in DKK). *Log FKR&D* is the log of a firm's education-weighted sum of foreign R&D capital stocks (see the main text for further details in the construction of R&D capital stocks). *Ethnic Diversity* refers to a Herfindahl-based measure of diversity averaged across work places. *Log Tenure* is the log of average firm tenure (in years). *Males* is the fraction of men employees engaged in production. *Managers* refers to the fraction of managers employed, according to Statistics Denmark's definitions of occupations for employment based on ISCO. *Multinational* takes value 1 if the firm is foreign-owned and zero otherwise. *Exporter* takes value 1 if the firm exports and zero otherwise. *Foreigner* takes value 1 if the firm employs foreigners and zero otherwise. *Log import-weighted FKR&D* is the log of the bilateral import-share weighted R&D capital stocks of a firm's trading partner countries. *Log export-weighted FKR&D* is the log of the bilateral export-share weighted R&D capital stocks of a firm's trading partner countries. *Firm's Age Characteristics* refers to a full set of shares of employees belonging to each age distribution quartile. *Firm's Occupation Characteristics* refers to a full set of shares of employees belonging to low-skilled, mid-skilled, and high-skilled occupations. *Firm's Education Characteristics* refers to a full set of shares of employees with basic, secondary, and tertiary education.

Standard errors, clustered at the firm-level, are reported in parenthesis.
*: Significant at the 10% level. **: Significant at the 5% level. ***: Significant at the 1% level.

Table 13: Firm's Economic Performance and Access to International Knowledge (Robustness to First Lag)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|--|------------------------|------------------------|-----------------------|-----------------------|------------------------|------------------------|
| Dependent Variable: Log of Firm's Gross Production | | | | | | |
| Log Labour | 0.5142*** (0.0122) | 0.5149*** (0.0124) | 0.5178*** (0.0122) | 0.5178*** (0.0123) | 0.5094*** (0.0123) | 0.5084*** (0.0181) |
| Log Capital | 0.0792*** (0.0037) | 0.0790*** (0.0037) | 0.0794*** (0.0037) | 0.0791*** (0.0037) | 0.0785*** (0.0037) | 0.0750*** (0.0050) |
| Log Materials | 0.3936*** (0.0117) | 0.3937*** (0.0117) | 0.3939*** (0.0117) | 0.3939*** (0.0117) | 0.3932*** (0.0117) | 0.3872*** (0.0172) |
| Log $s_{t-1}^{f,ewedu}$ | 0.0014*** (0.0003) | | | | | |
| Log $s_{t-1}^{f,ewedu,B}$ | | 0.0015*** (0.0003) | | | 0.0014*** (0.0003) | 0.0013*** (0.0004) |
| Log $s_{t-1}^{f,ewedu,S}$ | | | 0.0010*** (0.0004) | | 0.0009*** (0.0004) | 0.0011*** (0.0004) |
| Log $s_{t-1}^{f,ewedu,T}$ | | | | 0.0017*** (0.0005) | 0.0017*** (0.0005) | 0.0017*** (0.0005) |
| Ethnic Diversity | -0.0855*** (0.0279) | -0.0769*** (0.0279) | -0.0541** (0.0273) | -0.0539** (0.0273) | -0.0911*** (0.0280) | -0.1566*** (0.0406) |
| Log Tenure | 0.0367*** (0.0090) | 0.0365*** (0.0090) | 0.0374*** (0.0090) | 0.0376*** (0.0090) | 0.0364*** (0.0089) | 0.0412*** (0.0132) |
| Males | 0.1118*** (0.0273) | 0.1117*** (0.0273) | 0.1100*** (0.0273) | 0.1130*** (0.0274) | 0.1148*** (0.0273) | 0.1278*** (0.0369) |
| Managers | 0.1804** (0.0705) | 0.1826*** (0.0707) | 0.1793** (0.0706) | 0.1808** (0.0706) | 0.1816*** (0.0702) | 0.2521** (0.1142) |
| Multinational | 0.2743*** (0.0946) | 0.2721*** (0.0942) | 0.2844*** (0.0974) | 0.2863*** (0.0962) | 0.2719*** (0.0949) | 0.2436** (0.0991) |
| Exporter | 0.0371*** (0.0079) | 0.0376*** (0.0079) | 0.0381*** (0.0080) | 0.0387*** (0.0080) | 0.0390*** (0.0080) | -0.0043 (0.0217) |
| Log import-weighted FKR&D | | | | | | 0.0030*** (0.0006) |
| Log export-weighted FKR&D | | | | | | -0.0072*** (0.0022) |
| Constant | 7.1223*** (0.1569) | 7.1200*** (0.1565) | 7.1080*** (0.1570) | 7.1086*** (0.1565) | 7.1464*** (0.1571) | 7.3933*** (0.2568) |
| Observations | 35,835 | 35,835 | 35,835 | 35,835 | 35,835 | 20,075 |
| R-squared | 0.946 | 0.946 | 0.946 | 0.946 | 0.946 | 0.944 |
| Industry-Year Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Commuting Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm's Age Characteristics | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm's Occupation Characteristics | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm's Education Characteristics | Yes | Yes | Yes | Yes | Yes | Yes |

Notes: The dependent variable is the log of firm's gross production as total sales of goods and services (in DKK).

Independent variables: *Log Labour* refers to full-time equivalent employees. *Log Capital* is the log of total assets (in DKK). *Log Materials* is the log of intermediate goods (purchase of goods, helping materials, and packaging) used in the production process (in DKK). *Log FKR&D* is the log of a firm's education-weighted sum of foreign R&D capital stocks (see the main text for further details in the construction of R&D capital stocks). *Log FKR&D_B* is the log of a firm's education-weighted sum of foreign R&D capital stocks of non-Danish employees with basic education. *Log FKR&D_S* is the log of a firm's education-weighted sum of foreign R&D capital stocks of non-Danish employees with secondary education. *Log FKR&D_T* is the log of a firm's education-weighted sum of foreign R&D capital stocks of non-Danish employees with tertiary education. *Ethnic Diversity* refers to a Herfindahl-based measure of diversity averaged across work places. *Log Tenure* is the log of average firm tenure (in years). *Males* is the fraction of men employees engaged in production. *Managers* refers to the fraction of managers employed, according to Statistics Denmark's definitions of occupations for employment based on ISCO. *Multinational* takes value 1 if the firm is foreign-owned and zero otherwise. *Exporter* takes value 1 if the firm exports and zero otherwise. *Firm's Age Characteristics* refers to a full set of shares of employees belonging to each age distribution quartile. *Firm's Occupation Characteristics* refers to a full set of shares of employees belonging to low-skilled, mid-skilled, and high-skilled occupations. *Firm's Education Characteristics* refers to a full set of shares of employees with basic, secondary, and tertiary education.

Standard errors, clustered at the firm-level, are reported in parenthesis.

*: Significant at the 10% level. **: Significant at the 5% level. ***: Significant at the 1% level.

Table 14: Firm's Economic Performance and Access to International Knowledge (Robustness to FE Regression)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|-----------------------------------|--|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| | Dependent Variable: Log of Firm's Gross Production | | | | | | |
| Log Labour | 0.4105*** (0.0113) | 0.4092*** (0.0114) | 0.4098*** (0.0114) | 0.4103*** (0.0113) | 0.4099*** (0.0113) | 0.4089*** (0.0113) | 0.4089*** (0.0113) |
| Log Capital | 0.0797*** (0.0041) | 0.0796*** (0.0040) | 0.0797*** (0.0041) | 0.0797*** (0.0041) | 0.0796*** (0.0040) | 0.0796*** (0.0040) | 0.0796*** (0.0040) |
| Log Materials | 0.2672*** (0.0105) | 0.2672*** (0.0105) | 0.2672*** (0.0105) | 0.2672*** (0.0105) | 0.2672*** (0.0105) | 0.2671*** (0.0105) | 0.2671*** (0.0105) |
| Log $s^{f,ewedu}$ | | 0.0004** (0.0002) | | | | | |
| Log $s^{f,ewedu,B}$ | | | 0.0003 (0.0002) | | | 0.0003 (0.0002) | 0.0000 (0.0004) |
| Log $s^{f,ewedu,S}$ | | | | 0.0002 (0.0003) | | 0.0002 (0.0003) | 0.0000 (0.0003) |
| Log $s^{f,ewedu,T}$ | | | | | 0.0009*** (0.0003) | 0.0009*** (0.0003) | 0.0008** (0.0004) |
| Ethnic Diversity | 0.0168 (0.0324) | -0.0003 (0.0344) | 0.0085 (0.0333) | 0.0145 (0.0331) | 0.0111 (0.0327) | 0.0001 (0.0342) | -0.0026 (0.0345) |
| Log Tenure | 0.0741*** (0.0117) | 0.0741*** (0.0117) | 0.0742*** (0.0117) | 0.0741*** (0.0117) | 0.0742*** (0.0117) | 0.0743*** (0.0117) | 0.0742*** (0.0117) |
| Males | -0.1276*** (0.0407) | -0.1275*** (0.0407) | -0.1276*** (0.0407) | -0.1275*** (0.0407) | -0.1269*** (0.0406) | -0.1268*** (0.0407) | -0.1269*** (0.0407) |
| Managers | 0.0325 (0.0518) | 0.0316 (0.0517) | 0.0324 (0.0518) | 0.0321 (0.0517) | 0.0317 (0.0517) | 0.0311 (0.0516) | 0.0311 (0.0516) |
| Exporter | 0.0398*** (0.0068) | 0.0399*** (0.0068) | 0.0398*** (0.0068) | 0.0398*** (0.0068) | 0.0398*** (0.0068) | 0.0398*** (0.0068) | 0.0398*** (0.0068) |
| Recode Dummy | | | | | | | -0.0074 (0.0094) |
| Observations | 40,828 | 40,828 | 40,828 | 40,828 | 40,828 | 40,828 | 40,828 |
| R-squared | 0.686 | 0.686 | 0.686 | 0.686 | 0.686 | 0.686 | 0.686 |
| Numbers of Firms | 4,784 | 4,784 | 4,784 | 4,784 | 4,784 | 4,784 | 4,784 |
| Industry-Year Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Commuting Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm's Age Characteristics | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm's Occupation Characteristics | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm's Education Characteristics | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Notes: The dependent variable is the log of firm's gross production as total sales of goods and services (in DKK).

Independent variables: *Log Labour* refers to full-time equivalent employees. *Log Capital* is the log of total assets (in DKK). *Log Materials* is the log of intermediate goods (purchase of goods, helping materials, and packaging) used in the production process (in DKK). *Log FKR&D* is the log of a firm's education-weighted sum of foreign R&D capital stocks (see the main text for further details in the construction of R&D capital stocks). *Log FKR&D_B* is the log of a firm's education-weighted sum of foreign R&D capital stocks of non-Danish employees with basic education. *Log FKR&D_S* is the log of a firm's education-weighted sum of foreign R&D capital stocks of non-Danish employees with secondary education. *Log FKR&D_T* is the log of a firm's education-weighted sum of foreign R&D capital stocks of non-Danish employees with tertiary education. *Ethnic Diversity* refers to a Herfindahl-based measure of diversity averaged across work places. *Log Tenure* is the log of average firm tenure (in years). *Males* is the fraction of men employees engaged in production. *Managers* refers to the fraction of managers employed, according to Statistics Denmark's definitions of occupations for employment based on ISCO. *Exporter* takes value 1 if the firm exports and zero otherwise. *Recode Dummy* takes value 1 if *FKR&D* = 0, and zero otherwise. *Firm's Age Characteristics* refers to a full set of shares of employees belonging to each age distribution quartile. *Firm's Occupation Characteristics* refers to a full set of shares of employees belonging to low-skilled, mid-skilled, and high-skilled occupations. *Firm's Education Characteristics* refers to a full set of shares of employees with basic, secondary, and tertiary education.

Standard errors, clustered at the firm-level, are reported in parenthesis.

*: Significant at the 10% level. **: Significant at the 5% level. ***: Significant at the 1% level.

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Leuphana Universität Lüneburg
Institut für Volkswirtschaftslehre
Postfach 2440
D-21314 Lüneburg
Tel.: ++49 4131 677 2321
email: brodt@leuphana.de

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