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Productivity Gains From Exporting: Do Export Destinations Matter?

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Productivity Gains From Exporting: Do Export Destinations Matter?

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Abstract:

In this paper, I have examined whether exporters benefit by exporting more, and also whether the productivity benefits from exporting more are heterogeneous across export destinations. I have conducted my own data collection field work and built a unique firm-level panel database of Czech manufacturing firms that includes data on the destinations of exports. I have found that firms do benefit from exporting more. However, my results also show that it is necessary to take into account export markets' heterogeneity. I have found that it is only exporting more to developed countries that brings productivity gains.

Keywords: exporting, productivity, spillovers

JEL: F14

INTRODUCTION

One of the most important questions in international business is whether productivity spillovers take place between firms. Foreign direct investment and exporting are considered to be the major channels for productivity spillovers. The literature tends to indicate positive and also, in some cases, economically significant spillovers associated with foreign direct investment (Javorcik 2004; Wei and Liu 2007; Blalock 2008). However, the empirical evidence on whether participation in export markets increases firm-level productivity has been quite mixed and so far inconclusive. There is discordance between the existing econometric and case-study literatures on learning-by-exporting. Many case studies provide examples about how domestic firms benefit from exporting. However, there is very limited econometric evidence to support a hypothesis that exporting makes firms more productive.

The main aim of this paper is to test whether continuing exporters benefit by exporting more and whether productivity benefits from exporting more are heterogeneous across export destinations. It is crucial to distinguish between export destinations when analyzing productivity spillovers from exporting. The major reason is that only by disaggregating total exports into individual markets, which permits examination of the link between exporting to these individual markets and firms' productivities, can one

uncover the true effects of exporting. As long as exporting solely to certain specific markets leads to productivity gains, it is possible that the results of studies which do not distinguish between export markets mask the real effect of exporting activities on firms' productivities.

The thought behind the idea of possible productivity gains from exporting more is that exporting with greater intensity could potentially cause exporters to create more personal contacts with foreign partners, and these contacts could lead to an exchange of information on technical and managerial problems, which would increase the exporters' productivity. Learning-by-exporting could take place via a direct transfer of knowledge from foreign customers to their domestic suppliers. Exporters would be able to obtain locally embedded knowledge inputs not available to them in their domestic market. It is also possible that customers from advanced countries would set higher quality standards and more stringent requirements for shipment timing, which would then force their suppliers to improve their productivity.

I have hypothesized that productivity gains from exporting more differ according to the export destination and that exporting to more developed regions brings higher productivity gains. It would also be possible that exporting to some markets could lead to a decline in a firm's performance. The reasoning is that customers in more advanced countries would be more demanding with respect to product quality and shipment timing, which would continually force firms to improve their performance. There would be a greater learning potential in advanced countries on account of sophisticated production techniques, marketing and management strategies, and production inputs and designs. On the other hand, exporting to less mature markets could result in productivity declining, since an environment with lower requirements for product quality and soft timing constraints would permit exporters to become less efficient.

I have contributed to the existing literature in several ways.

First, I have tested the role of foreign markets' heterogeneity in productivity spillovers. To my knowledge, this is the first paper that tests whether continuing exporters benefit from exporting more by using panel data that allows for disaggregating total exports into several export destinations. I have conducted my own field work and built a unique firm-level panel data database of manufacturing firms. I have surveyed 258 firms over the course of 12 months. Each firm was visited personally, which enabled

me to obtain high-quality data. My database contains balance sheet and profit-and-loss statement data and reveals how much each firm exported to various destinations each year.

Second, the existing literature compares the performances of exporters and non-exporters to test whether firms benefit from starting export activities. In my paper, instead of studying firms that start exporting (starters), I have focused exclusively on firms that have been exporting continuously. These are firms that have already entered foreign markets and that continue to export during the entire period they are observed in data. Little attention has been given to continuing exporters. These firms are typically dropped from analyses, since, without information about when they started to export, it is impossible to identify the effect of their entry into export markets. However, although continuing exporters have been neglected in the literature, it is an important question as to whether they benefit from their continued exporting activities and whether these benefits are dependent on the export destinations.

Third, I have enriched my econometric evidence by providing unique qualitative evidence based on interviews with managers of Czech manufacturing firms during my field work. The majority of econometric studies try to find a statistical link between variables of interest without providing any qualitative evidence illustrating the studied phenomenon. The phenomenon thus remains a black box. In my paper, I have supplemented my econometric evidence with firm-level qualitative evidence which reveals the relationships between firms in the Czech Republic and their foreign customers.

I have concentrated on examining the role of export *intensity* on firms' productivity. In other words, I have analyzed whether variance in export intensity impacts learning within exporting firms. To examine the impact of exporting more on firms' productivities, I have used and compared two alternative measures of export intensity which have been identified in the literature – real export volume and real export share. Differences as to the effect of export share versus volume, ceteris paribus, are revealed. If I use real export share in my estimations, I do not find any statistically significant positive effects of exporting more on firms' performances. However, if I use real export volume as the export measure in my specifications, I find that exporting more leads to productivity gains. Grossman and Helpman (1991b) have argued that the volume of trade positively correlates with the intensity of interaction with foreign agents. The more exporters interact with their foreign customers, the more knowledge they are able to

acquire. As a measure of exporting, real export volume captures this mechanism in a better way than real export share. My findings imply that researchers studying productivity spillovers from exporting should not base their models on one particular measure of exporting, but, instead, the differences between alternative measures should be examined.

My results also show that it is necessary to take into account export markets' heterogeneity. I have found that it is only exporting more to developed countries (i.e. the core countries of the European Union) that brings productivity gains. My findings support the view of Salomon (2006) who considers exporting as a business strategy-oriented activity important for learning which increases a firm's productivity and leads to establishing a competitive advantage in international business.

More research is needed to uncover the role of exporting on firms' performances. The ultimate goal of research in international productivity spillovers is to understand how the firm, industry, and country dimensions together affect how knowledge moves between countries. This paper contributes to this goal by providing new firm-level quantitative and qualitative evidence for several industries in the manufacturing sector in the Czech Republic.

This paper is organized as follows. In the next section, I provide an overview of the existing literature. Subsequently, I build and motivate two research hypotheses. Next, I briefly describe my field work and the data that I have collected. Subsequently, I present qualitative evidence from surveys about the relationships between firms in the Czech Republic and their customers abroad. In the following section, I explain my estimation strategy and present my findings. Then, I discuss the sensitivity and robustness of my results. The final section concludes this paper. All tables and figures are presented in Appendix A. Appendix B contains details about the construction of variables. Appendix C provides details about estimating total factor productivity.

LITERATURE REVIEW

The empirical evidence on whether participation in export markets increases firm-level productivity has been quite mixed and so far inconclusive. The extant literature on this subject can be divided into five groups. First, there are several case studies which provide qualitative evidence demonstrating that firms learn about foreign technology through their exporting experience. These case studies present many examples in which firms have benefited from their interaction with foreign customers. These benefits include being supplied with blueprints and technical specifications for competing products, technical assistance, visits to the production plants by engineers from the importing countries, annual reviews of production methods, feedback on the products' design, quality and technical performance, and advice on how to minimize production costs and expand production capacities. Foreign customers may also make their suppliers invest in new, more precise, and more sophisticated machinery. See, for example, Rhee, Ross-Larson, and Pursell (1984) for examples from East Asian countries or Blalock and Gertler (2004) for examples from Indonesia. The qualitative evidence I collected during my field research also shows that Czech firms in a non-trivial number of cases benefit from their interactions with their customers abroad.

Second, there are several econometric studies comparing the performances of exporters and non-exporters. These studies typically find that exporters are, on average, more productive than non-exporters, and this finding has already become a stylized fact. The main goal is then to test whether firms become more efficient after becoming exporters or whether exporters' superior performance reflects the mere self-selection of ex ante more productive firms into exporting. Disentangling the learning-by-exporting effects from the mere self-selection of ex ante more productive firms into exporting is econometrically a challenging task, since the decision to export is endogenous. For this, researchers have used various, more-or-less sophisticated econometric techniques. The majority of studies have concluded that the positive association between exporting and efficiency is explained by the more efficient firms' self-selection into the export market. This conclusion is consistent with the prediction of a model by Melitz (2003), who showed that if there are sunk costs associated with an entry into export markets, firms with ex ante higher productivity self-select into exporting. Exporters' superior performance compared to non-

exporters' just reflects this self-selection. This strand of literature is represented, for example, by Clerides, Lach, and Tybout (1998), who studied manufacturing plants in Columbia, Morocco, and Mexico during the 1980s to test the learning-by-exporting hypothesis. They concluded that the positive association between exporting and efficiency is explained by the more efficient firms' self-selection into the export market. Bernard and Jensen (1999) studied manufacturing plants in the United States during the 1980s and early 1990s to explain the sources of exceptional exporter performance. They found that "the lack of productivity gains suggests that firms entering the export market are unlikely to substantially raise their productivity (1999: 24)." Delgrado, Farinas, and Ruano (2002) examined the role of exporting in the productivity of Spanish manufacturing firms. They concluded that the evidence in favor of learning-by-exporting is rather weak and is limited to younger exporters. Aw, Chung, and Roberts (2000) came to a similar conclusion when studying the case of the Republic of Korea and Taiwan. Wei and Liu (2006) examined productivity spillovers in China's manufacturing sector. They found a close relationship between the firm's own export activities and productivity. Their empirical methodology was based on examining how the lagged values of the share of firm's exports in its sales influence the firm's value added. However, they used the OLS estimator and a sample that contained both exporters and non-exporters. Therefore, their results could be biased due to export endogeneity. It is not clear whether their results capture learning-by-exporting effects or just the more productive firms' self-selection into exporting. Compared to this strand of the literature, I have posited a different research question. I have not analyzed the differences between exporters and non-exporters. I have explored the impact of exporting intensity and heterogeneity across export destinations on productivity spillovers for continuing exporters.

Third, two recent papers – Damijan, Polanec and Prasnikar (2004) and De Loecker (2007) – have examined whether "learning effects" depend on the export destinations. Both papers examine Slovenian manufacturing firms using the same data source. Damijan et al. (2004) concluded that exporting per se does not warranty productivity improvements. However, significant productivity improvements occur only when serving advanced, high-wage foreign markets. De Loecker (2007) also found evidence in favor of the learning-by-exporting hypothesis and concluded that the productivity gains are higher for firms exporting to high-income regions. There are two major differences between their papers and my study,

besides the fact that they examine firms in a different country. Their database contains only *cross-sectional*, i.e., time-invariant, information about export destinations, and, therefore, these authors were not able to identify separate parameters by destination. In my paper, I am able to use unique firm-level *panel* data that also contain *longitudinal* information about export destinations. Moreover, these papers examine whether firms *benefit from starting to export* whereas, in my paper, I study whether *continuing exporters benefit from exporting more.* To my knowledge, this is the first paper that looks at productivity gains from exporting more that exploits longitudinal information about several export destinations.

Fourth, there is existing literature which examines the learning-by-exporting hypothesis indirectly. Salomon and Shaver (2005) concluded that exporting is related to ex post increases in product innovation and patent application counts in Spanish manufacturing firms. This is consistent with learning-by-exporting. Salomon and Jin (2007) confirmed this finding using the same data but a different econometric technique. Salomon (2006) studied the impact of export strategies on innovative productivity in Spain. He was able to distinguish exports into OECD and non-OECD countries in his data. His findings did not let him conclude that exporting to developed (OECD) countries aids in the realization of innovations. Specifically, Salomon (2006: 154) found that though "a preference for developed as opposed to developing countries positively affected patent applications, it negatively influenced product innovation." Alvarez, Faruq and Lopez (2007) studied Chilean firms and concluded that previous experience exporting to a certain market or with a certain product increases the probability of exporting the same product to a different market or a different product to the same market. In my paper, I have studied whether exporting more and specific export destinations influence firms' productivity *directly*. This means that I have examined whether exporting more can lead to gains in revenue efficiency and in total factor productivity. That is important, since these two measures are much broader in scope than, for example, the number of product innovation or patent application counts. They capture improvements in marketing and management, advancements in methods of production, pricing, the introduction of new products, and the implementation of many other productivity-enhancing measures, techniques, and strategies.

Fifth, there is related literature which examines the link between exporting decisions and financial factors. In a recent article, Greenaway, Guariglia, and Kneller (2007) asked whether financial health is a

determinant for export market participation or its outcome. They found that participation in export markets improves firms' financial health using a sample of UK manufacturing firms. These authors emphasized the importance of also studying continuing exporters. However, they examined a different research question than that in my paper – i.e., the relationship between financial health and exporting.

THEORY AND HYPOTHESES

International trade theory analyzes the relationship between trade and economic growth and stresses the potential gains from trade. Scholars of international trade have argued that trade plays a crucial role in the exchange of knowledge across borders (for example, Grossman and Helpman 1991a, 1991b; Aw and Hwang, 1995; Bernard and Jensen, 1999b). These researchers pointed out that a country that interacts with the outside world may gain access to a large body of knowledge. Estimates of the magnitude of knowledge sourced from abroad are quite high. For example, Keller (2004: 752) states that "for most countries, foreign sources of technology account for 90 percent or more of domestic productivity growth." It is believed that export-led development strategies improve technical efficiency. One oft-cited reason is that exporters may benefit from the technical expertise of their buyers (Clerides, 1998).

However, it is not just access to a foreign market that may be important for productivity growth. Grossman and Helpman (1991a: 166) have argued that "the larger the volume of international trade, the greater presumably will be the number of personal contacts between domestic and foreign individuals. These contacts may give rise to an exchange of information and may cause the agents from the small country to acquire novel (for them) perspectives on technical problems." This means that the intensity of trade, i.e., the magnitude of exporting, may be decisive for potential productivity gains - the higher the intensity of exports, the higher productivity. This motivates my first hypothesis.

Hypothesis I: - All else equal, exporters that export more will achieve higher productivity than those that export less.

My second hypothesis concerns heterogeneity in export destinations. In his review of the literature on technology diffusion, Wolfgang Keller claims, "The conventional wisdom today is that learning-by-exporting effects are non-existent (2004: 767)." However, he adds that there are still many issues worthy of further research before a learning-by-exporting hypothesis can be considered settled. According to Keller, the existing econometric analyses could be improved if "we knew more on both the export destination and the exporter, instead of simply an indicator variable (exporting yes/no). For instance, to which firms, in which countries do the exports go? (2004: 769)." If spillovers from exporting exist, it could be possible that there will be heterogeneity between export destinations. Econometric studies that work with information about exporting status or about aggregate exports might not find any learning-by-exporting effects due to ignoring this heterogeneity. I hypothesize that productivity gains differ according to export market destinations. I have illustrated three scenarios in Figure 1. The productivity trajectory denoted by (A) corresponds with the case when a firm exports to a market that fosters learning, contains a lot of local knowledge inputs, and sets more and more stringent quality and timing requirements. This leads to productivity improvement. The trajectory denoted by (B) illustrates the case when a firm exports to a market that is not rich in knowledge content, has lower quality, and softer timing requirements. This leads to productivity declining. The trajectory denoted by (C) depicts the case when exporting does not have any impact on a firm's productivity.

Which markets can foster learning? It has been recognized that the availability of information varies across national markets (Dicken, 2003). Scholars have argued that knowledge is concentrated in a few countries. "The G-7 countries accounted for about 84 percent of the world's research and development spending in 1995." (Keller 2004: 752). Likely, more can be learned in developed countries that are pushing the world technological frontier forward than in countries that are just trying to catch up with the more advanced countries. Hill (2007) discussed the impact of knowledge concentration and

heterogeneity in availability of information across markets on location choice of foreign direct investment. Foreign technology firms open their branches in the Silicon Valley to exploit locally embedded knowledge. Salomon (2006), when studying firms' innovative productivity, argued that the locations to which a firm exports can affect the type of knowledge that firms access and absorb due to the diversity of knowledge inputs available across geographic markets. Referring to Grossman and Helpman (1991b), Salomon stated that (2006: 140-141) "if firms export to regions that are rich with knowledge, and knowledge spills back to those firms that export, then firms that export to well-endowed regions should benefit disproportionally."

Exporters are successful firms that have superior performance compared to non-exporters (Clerides et al., 1998). Scholars of organizational behavior have argued that success will lead firms to "organizational slack" unless there is a continued challenge (March and Simon 1958, Cyert and March 1963). Researchers have recognized that slack leads to undisciplined project management and to inefficient use of corporate resources (Herold et al, 2006). This implies that exporting to markets that do not challenge firms could lead to productivity worsening.

For these reasons, I hypothesize that all markets are not equally valuable for learning. I expect that firms benefit more from exporting more to developed markets. Otherwise stated:

- **Productivity gains from exporting more differ according to the export destination. Exporting to more developed regions brings higher productivity gains.**

DATA AND FIELD RESEARCH

I conducted my own field work in the Czech Republic from January 2005 to December 2005 to collect unique firm-level panel data revealing export volumes and their destinations. I focused on firms in the following NACE[1] industries: 21 - Pulp, paper, and paper products; 29 - Machinery and equipment; 31

- Electrical equipment and apparatus; and 34 - Motor vehicles. I chose these industries because they represent Czech manufacturing well in the sense that they have a long tradition and a wide presence in the area. Within these industries, I have focused on mid-sized and large firms - firms having more than 99 employees. Based on information from the Business Register of the Czech Statistical Office, there were 691 such firms on December 31, 2004. I excluded 20 firms either because they were cooperatives which employed primarily handicapped workers or because they were state military companies. Such firms are not governed by standard market conditions. I ended up with 671 firms. These firms form the population of firms for my research.

I constructed a survey, personally visited each randomly chosen firm, and introduced my project to the CEOs. The surveys were then filled out by accountants, who retrieved the data from the firms' information systems. Since the surveys were very comprehensive, I allowed the firms a few weeks to fill them out. If the completed survey was not returned within the agreed-upon time period, I contacted the firms again to ensure the highest possible rate of return. Overall, I achieved a 35 percent rate of return. I also followed up to complete missing information, to verify data in some cases, and to correct any logical inconsistencies I noticed. This allowed me to acquire high-quality data. I obtained data for 103 manufacturing firms in four industries for the period 1995 - 2004. The data form an unbalanced panel data set. On average, I have data for seven years for each firm.

In any analysis based on surveys, there is the possibility of response bias. During my field work, I encountered firms that did not wish to participate in my research when I contacted them and firms that allowed me to visit their firms and interview them but did not return completed surveys. Table 1 provides a detailed summary of the firms contacted.

[TABLE 1]

I contacted 295 firms, which amount to 44 percent of the firm population. Thirty-seven firms, which amount to 12.6 percent of the firms contacted, refused to be visited and interviewed. Two hundred

fifty-eight firms (38.5 percent of the population) were personally visited and interviewed. Out of 258 visited firms, 155 firms either never sent back the survey or filled it out incompletely. These firms amount to 52.5% of all firms contacted. The major reason firms mentioned for not completing the survey was its complexity. Although firms know their export destinations, they do not often have readily available information about exports that is disaggregated according to export destination. It is demanding to extract this data from their information systems, especially data for several years back. One hundred three firms returned the survey filled out in such a way that I was able to use it in my econometric analysis. These firms amount to 34.9 percent of the firms contacted and 15.35 percent of the population. Are the firms that provided data systematically different from those that did not provide data? I was able to compile data about sales, tangible assets, and profits for 129 of the firms that declined to be interviewed or did not return filled surveys. This data is available for various years between 1995 and 2003, and it comes from the Data Monitor database from the year 2003. Firms that did not provide data have higher mean sales and stocks of tangible assets and smaller mean profits. However, a t-test shows that there is no statistically significant difference in mean sales, mean stocks of tangible assets, and mean profits between the firms in my sample and the firms that did not provide data. The testing statistics are presented in Table 2. These test statistics have given me at least some evidence that the presence of a bias is less likely.

[TABLE 2]

I collected balance-sheet data, loss and profit statements data, and data about exports and their destinations. I am able to distinguish exports to five geographical locations: (1) the countries of the former fifteen-member European Union (EU15)[2], (2) the ten countries of the European Union admitted on May 1, 2004,[3] (3) the rest of Europe,[4] (4) Asia, and (5) North America (the USA and Canada). I chose to distinguish these 5 regions in my survey for two reasons. First, this breakdown of the world's countries made filling out the surveys manageable for the firms. Second, and more importantly, these geographical groups are relatively homogeneous. They are formed by countries that have similar quality requirements,

wage level, and R&D intensity. Especially, the core 15 countries of the European Union, the group of 10 countries admitted to the EU on 1 May 2004, and the countries of North America form homogeneous groups. Asia appears to be the least homogeneous group. It is very heterogeneous where economic development is concerned, consisting of both very developed countries like Japan and less developed ones. It is therefore informative to note to which specific Asian countries firms from my sample export. Table 3 reveals the Asian countries to which the Czech firms export. This table is compiled from information obtained in the follow-up survey conducted in 2006.

[TABLE 3]

These data show that 18 out of 45 firms export to Asia. The most frequent export destinations are China and Vietnam. This group of countries is rather homogeneous. In other words, Table 3 shows that Czech exports into Asia flow into developing countries rather than into developed countries.

My dataset is well suited to examining whether firms benefit from exporting more. It is important to note that, out of the 103 firms in my database, only 3 firms have never exported. One hundred firms (97% of my sample) exported in at least one of the periods recorded in my database. Table 4 provides detailed information about the structure of my sample and definitions of individual firm categories. This classification of firms has been used by Clerides et al. (1998).

[TABLE 4]

Four firms started to export during the sample period; only one firm stopped exporting. Ninety-three firms were exporting continuously during the sample period. It is not surprising that so many of the firms in my random sample are exporters, given that my field research focused on mid-sized and large firms and given that the Czech Republic is a very small, extremely open economy located within the

European Union. The share of exports in GDP has been rapidly growing. In 1995, the share of exports in GDP was 44 percent; in 2006 the share of exports in GDP reached 96 percent.[5]

Selected sample summary statistics are provided in Table 5. I have calculated these statistics only for continuing exporters, because these are the firms that were entered in my estimations (93 firms).

[TABLE 5]

Continuing exporters located in the Czech Republic on average export a total of CZK 332.2 million. More than half of their output is exported. The greatest share of exports flows to the core countries of the European Union (EU15) and to the ten countries of the EU admitted on 1 May 2004 (EU10). Relatively low shares go to the rest of Europe, North America, and Asia.

I have provided a correlation matrix in Table 6. Correlations among the variables are generally as expected. With regard to the hypotheses, the positive correlation of output on both real export share and real export volume is consistent with H1. The correlations between output and region-specific measures of exporting suggest that there is heterogeneity in learning across destination markets. It is not possible, however, to conclude that such relationships support or disconfirm the hypotheses. Correlations do not control for factors that influence both the independent and dependent variables.

QUALITATIVE EVIDENCE FROM SURVEYS

This section presents firm-level information about the interaction of firms in the Czech Republic with their customers from abroad. This qualitative evidence is based on a follow-up survey of the exporting firms that participated in my survey in 2005.[6] The follow-up survey was conducted in 2006 and resulted in 45 responses from exporters located in the Czech Republic.

I asked firms whether their foreign customers had provided them with some form of assistance. Twenty-four out of 45 firms acknowledged that they received assistance from their customers from abroad. What form of assistance did they receive? Table 7 summarizes these forms. In my survey, each firm could choose from several forms of assistance, thus, the presented percentages add up to more than

100%. Blueprints were provided by customers from abroad to 54.2% of suppliers in the Czech Republic. Half the firms (50%) report help with production technology, and the same percent of firms report help with quality control. Assistance with machinery maintenance was provided to 33.3% of firms. Help with financing, training employees, and advice on improving existing products was provided to 29.2% of firms. The remaining forms of assistance were provided to a lesser degree. Apart from the above-mentioned forms of assistance, a few firms reported help with logistics and with the provision of computer technology and software.

[TABLE 7]

I asked the firms whether they change or adjust the quality of their products based on the quality demanded by individual markets. Sixteen out of 45 firms (35.5%) said yes. However, this does not mean that higher quality products are exported and inferior products are sold in the Czech Republic. Only 3 out of 45 firms claimed that the goods they export are of higher quality than goods they sell to domestic (Czech) consumers. Also, only 4 out of 45 firms acknowledge that they sell a basic version of their product in the Czech market and an upgraded version in foreign markets. By saying that they adjust the quality of their products according to export destination, firms mean that they respond flexibly to the specific needs of their customers. Thirty-nine out of 45 firms (86.7%) developed a product for foreign customers according to their specific demands. Firms report that in 34 out of 39 cases (87.2%), the knowledge and experience gained during their cooperation with foreign customers were used in production for other customers. What is especially interesting is that, in 19 out of 39 cases (48.7%), foreign customers helped with product development. This qualitative evidence indicates that exporting might be, certainly for some firms, a source of productivity advancement.

Clearly, concerning the existence and extent of learning, the type of firms from abroad with which the Czech firms interact does matter. Therefore, I asked firms whether their foreign customers have R&D and, if so, how advanced their R&D is. Table 8 below summarizes their answers.

[TABLE 8]

The distribution of R&D intensity has two peaks. Foreign customers have either "substantive" R&D (24.4%) or they do not have any R&D at all (22.2%). In a non-trivial number of cases (15.6%), firms from the Czech Republic interact with industry leaders in R&D.

Although the focus of my paper is to examine whether continuing exporters benefit from exporting more, I have included a question regarding the difficulty in starting to export. I asked firms how they would describe the degree of difficulty and the cost of entering foreign markets. Table 9 presents their responses.

[TABLE 9]

Firms in the Czech Republic primarily consider the cost of entry into foreign markets as moderately difficult/moderately costly (42.2%). The entry was considered to be rather difficult/rather costly for 37.8% of firms.

METHODOLOGY

In this section, I have described the models proposed to test hypotheses I and II and the statistical methods that I used to estimate the models. My goal is to test the link between exporting and firms' performances. I have followed an approach similar to that taken by the previous productivity literature (for example Blalock and Gertler 2004 and 2008; Wei and Liu 2006; Javorcik 2004) and have based my methodology on the estimation of production functions.

Hypothesis I: Econometric Model

I asked whether continuing exporters benefit by exporting more. To answer this question, I have used a sample of Czech continuing exporters and I have tested whether, all else equal, exporters that sell more abroad produce more. In this approach, productivity gains are identified by an extra output produced using a given level of production inputs.

Specifically, I have estimated the model in this form:

$$(1)\ \ln(Y_{i,t}) = \alpha_0 + \alpha_1 \cdot \ln(M_{i,t}) + \alpha_2 \cdot \ln(E_{i,t}) + \alpha_3 \cdot \ln(WIP_{i,t}) + \alpha_4 \cdot \ln(WOP_{i,t}) + \alpha_5 \cdot \ln(K_{i,t}) + \alpha_6 \cdot EXP_{i,t-3} + \alpha_t + \beta_i + \varepsilon_{it},$$

where Y, M E, WIP, WOP, and K denote output, material consumption, energy consumption, the number of workers in production, the number of workers out of production, and tangible capital, respectively. In Appendix B, I have presented precise definitions of these variables.

Fixed effects for years are denoted by α. They account for changes between time periods. The term β represents a fixed firm-specific effect influencing a firm's productivity. The term ε is an error term reflecting the effects of unknown factors and other disturbances. Subscripts i and t indicate the firm and time period under consideration.

The model (1) is a standard production function that is augmented by an export measure (EXP). The export measure, which aims to capture the influence of exporting on firms' performances, is a variable of particular interest. Several export measures can be defined. I have summarized the measures that have been commonly used in the extant literature in Table 10.

[TABLE 10]

The majority of studies have simply used binary zero/one data – the exporting measure equals one if the firm exported in a given period and otherwise equals zero. This measure is just an indicator of export status, distinguishing exporters from non-exporters. This is not a suitable measure for my purposes, since I have been examining the role of exporting intensity on the productivity of continuing exporters and not differences between exporters and non-exporters. I have used two measures of exporting intensity in my estimations – real export share defined as the ratio of a firm's real export to its real output:

$$\text{Real Export Share}_{it} = \frac{\text{Real Export}_{it}}{\text{Real Output}_{it}}$$

and real export volume defined as the real value of exported products:

$$\text{Real Export Volume}_{it} = \frac{\text{Export}_{it}}{\text{Export Deflator}_{jt}}.$$

In Appendix B, I have described how exports were deflated.

Both these measures have been used in the literature. Recently, Wei and Liu (2006) used export share when testing productivity spillovers from R&D, exports, and FDI. In this paper, I use export share as one of the measures in my estimations, since it is a standard measure of the degree of a firm's internalization – see, e.g., Reuber and Fisher (1997), Sullivan (1994), and Ramaswamy, Kroeck and Renforth (1996). Moreover, one could argue that, with a higher export share, the exporting firm is more likely to put extra effort into making exporting a success.[7]

On the other hand, Salomon and Shaver (2005b) used export volume (apart from export status) when studying the interrelationship between exporting and innovation outcomes. They used this measure, since "the volume of trade is likely to covary with the intensity of interaction with destination markets" (2005b, p. 440) as suggested by Grossman and Helpman (1991b). It is possible that, with a higher volume, the clients might well be more committed to investing in the exporting firm.[8] Clearly, the choice of export measure is not self-evident. One of the purposes of my article is to examine the differences in the effect of export share versus volume, ceteris paribus. It is quite possible that the choice of export measure will have a significant effect on the conclusions.

Since I am only interested in continuing exporters, I have dropped non-exporters (3 firms), the one firm that stopped exporting, starters (4 firms), and switchers (2 firms) from my database and have estimated all my specifications exclusively using the data for continuing exporters.

Hypothesis I: Statistical Method I

There are several econometric issues that have to be addressed when estimating model (1). First, it is important to check for unobserved time-invariant firm characteristics that influence firm productivity (the term β in the model 1). Such characteristics may include, but are not limited to, either talented or poor managers, an advantageous geographical location, and access to better infrastructure. Having several years of data for each firm allows me to use the fixed effects estimator to check for these unobserved time-invariant firm characteristics that influence firm productivities.

Second, another important econometric issue is the possibility of endogeneity in exporting. Note that in model (1), the usual type of endogeneity does not exist – the endogeneity of the decision to start exporting. The reason is that I am exclusively examining continuing exporters instead of starters. All the firms that I have studied have already overcome the sunk costs necessary to start exporting. They have already reached a certain minimal productivity threshold. Since I will not compare the productivity trajectories of exporters and non-exporters, my results will not capture the mere self-selection of ex ante more productive firms into exporting. However, there is another similar, and by no means less serious, endogeneity issue: endogeneity in the decision to export more. This means that an increase in the share or the volume of exporting could well be influenced by productivity. The direction of causality could be from productivity to exporting: Exporting=F(Productivity) instead of the hypothesized relationship where productivity is a function of exporting: Productivity=F(Exporting). To keep the possible endogeneity problem to a minimum, I have included measures of exporting activity into the estimations with a lag of three years. Wei and Liu (2006) addressed a similar reverse causality issue in their analysis by including possibly endogenous variables with a lag of only one year. There is a considerable advantage to my data in that I have a relatively long panel, which allows me to include a three-year lag in my model. The three-year lagged measures of exporting activity give me at least some comfort that the alternative explanation of increased productivity leading to more continuing exporting is less plausible. Moreover, by including exporting measures with a lag, I have taken into account that it may take time before productivity gains from exporting manifest themselves.

Third, it is necessary to check for heteroskedasticity and autocorrelation. I have used the fixed effects estimator with correction for heteroskedasticity and autocorrelation to estimate the model (1).

Hypothesis I: Statistical Method II

Despite controlling for fixed firm-specific effects, the fixed effects estimator with correction for heteroskedasticity and autocorrelation may produce inconsistent results due to potential simultaneity between inputs and productivity shocks that vary within firms over time. The statistical methodology

described above assumed that in model (1), all right-hand side variables, with the exception of the exporting measure, were exogenous. At least as early as Marschak and Andrews (1944), researchers have been concerned about the possible correlation between input levels and unobserved firm-specific productivity shocks when estimating production function parameters. The OLS method is not appropriate for estimating coefficients of the production function if inputs cannot be treated as exogenous. If a firm chooses its production inputs based on its productivity, which is observed by the firm but not by the econometrician, the inputs are endogenous, and the fixed effects estimates will be biased.[9]

Therefore, I have taken the possible simultaneity between inputs and the shocks that vary within firms over time into account by applying the Levinsohn-Petrin (2003) estimator in the following way: first, I estimated the production function by the Levinsohn-Petrin (henceforth LP) method. Second, I recovered residuals from the estimation of the production function and used them as a (consistently estimated) measure of the total factor productivity of firm i at time t. See Appendix C for estimation details. The total factor productivity (TFP) becomes a dependent variable in the basic model. I have tested hypothesis I by estimating a specification in the form:

$$(2)\quad \ln TFP_{it} = \alpha_0 + \alpha_1 \cdot \ln TFP_{i,t-1} + \alpha_2 \cdot \ln TFP_{i,t-2} + \alpha_3 \cdot EXP_{i,t-3} + \alpha_t + \beta_i + \varepsilon_{it},$$

where TFP_{it} stands for the total factor productivity of firm i at time t. Regressors include a one-period and a two-period lagged TFP to capture the persistence in total factor productivity. This is a dynamic panel model, since current realizations of the dependent variable are influenced by past ones. To test whether continuing exporting activity influences a firm's productivity, I have included an export measure in model (2). I used real export share, and alternatively, real export volume defined above as export measures. To reduce the reverse causality problem discussed previously and to take into account the lag between knowledge spillovers and productivity gains, I have included an export measure with a lag of three periods. Time dummies are included and denoted as α_t. The term β denotes the fixed firm-specific effect.

When estimating model (2), an instrumental variables approach is required. Therefore, I have applied the system GMM estimator proposed by Blundell and Bond (1998, 1999) to estimate model (2).

This estimator takes into account not only fixed firm-specific effects but also the potential endogeneity of regressors and generates heteroscedastic-consistent estimates. The system GMM estimator is based on two sets of moment conditions. The first set of moment conditions comes from the first differenced equations (to remove the firm-specific effect) with lagged levels of the variables as instruments (cf. Arellano and Bond, 1991). A problem with the original Arellano-Bond estimator is that lagged levels are often poor instruments for first differences. Arellano and Bover (1995) described how, if the original equations in levels were added to the system, additional moment conditions could be used to increase efficiency. These additional moment conditions are based on the level equations with lagged differences of the variable as instruments. Blundell and Bond (1998, 1999) precisely characterized the necessary assumptions for this augmented estimator and tested it with Monte Carlo simulations. The main assumption is that E[α_i *D ε_{it}]=0, which means that the unobserved firm-specific effects are not correlated with changes in the error term.

I assume that there is no serial dependence in ε_{it}, i.e., for all i, $E[\varepsilon_{it} \cdot \varepsilon_{is}] = 0$ for s≠t. I have used the following instruments: in the first-difference equations, I instrument for $\Delta \ln TFP_{i,t-1}$, $\Delta \ln TFP_{i,t-2}$, $\Delta Exports_{i,t-2}$ and $\Delta Exports_{i,t-3}$ with lags of variables in levels, i.e., with $\ln TFP_{i,t-2}$, $\ln TFP_{i,t-3}$, $Exports_{i,t-3}$, $Exports_{i,t-4}$ and their higher lags, respectively. In the levels equations, I instrument for $\ln TFP_{i,t-1}$, $\ln TFP_{i,t-2}$, $Exports_{i,t-2}$, $Exports_{i,t-3}$ with the first differences, specifically with $\Delta \ln TFP_{i,t-1}$, $\Delta \ln TFP_{i,t-2}$, $\Delta Exports_{i,t-2}$, and $\Delta Exports_{i,t-3}$.

Hypothesis II: Econometric Model

I have hypothesized that productivity gains from exporting more would differ according to the geographical destination of exports. Exporting to more developed countries would be more beneficial than exporting to less developed countries. To test hypothesis II, I have estimated a dynamic panel model in the form:

$$(3)\quad \ln TFP_{it} = \alpha_0 + \alpha_1 \cdot \ln TFP_{i,t-1} + \alpha_2 \cdot \ln TFP_{i,t-2} + \alpha_3 \cdot EU15_{i,t-3} + \alpha_4 \cdot EU10_{i,t-3} + \alpha_5 \cdot Europe - rest_{i,t-3} + \alpha_6 \cdot America_{i,t-3} + \alpha_7 \cdot Asia_{i,t-3} + \alpha_t + \beta_i + \varepsilon_{it}.$$

The dependent variable is the same as in model (2) - the total factor productivity of firm i at time t (TFP_{it}) obtained using the Levinsohn-Petrin method. Regressors include a one-period and a two-period lagged TFP to capture the persistence in total factor productivity. To test whether exporting more leads to productivity gains, ceteris paribus, I have included real export share, and alternatively, real export volume as the export measures. I have made use of unique information about the geographical composition of firms' exports. I have distinguished five geographical regions. For each region, I have defined a specific export measure.

The real export share for a specific region is defined as the ratio of real exports into the region to the total real output. The real export volume for a specific region is defined as the volume of real exports to a given region. These export measures are constructed for the following regions: the EU15 denotes the export measure capturing exporting to the former fifteen-member European Union; the EU10 to the ten countries that became members of the European Union on May 1, 2004; the Europe-rest to the rest of Europe; the Asia to Asia; and the America to the USA and Canada. Year dummies α_t are included in the model. The term β_i denotes a fixed effect for firm i.

Hypothesis II - Statistical Method

Using export measures disaggregated according to export destinations in model (3) raises potential econometric issues. An important issue is the potential endogeneity of the decision to export to a specific market. I would predict that better exporters select into developed markets ex ante. However, if firms self-select into export markets based on their ex ante productivity, their superior performance will reflect self-selection instead of learning effects. Another issue is the potential endogeneity of exporting more to a specific export market. If firms export more to a specific market only if their productivity improves, then productivity will be positively correlated with exporting, and again the direction of causality will be from productivity to exporting more and not as I hypothesized.

Salomon (2006) faced analogous endogeneity issues when he used export destinations (exporting to OECD and non-OECD countries) as measures of access to technological knowledge. He addressed potential endogeneity concerns by incorporating export measures with a time lag in his econometric specifications. I have used the same econometric strategy. I have included all measures of exporting with a lag of three years to reduce the endogeneity problems and also to take into account that it may take time before productivity gains manifest themselves. Moreover, I can see in my raw data that the majority of firms do not change their export markets, i.e., they do not leave their existing markets, nor do they enter new export markets. Even if firms match endogenously into export markets based on their ex ante productivity, they already matched before I entered them into my database. This suggests that the first type of endogeneity might not be much of an issue in my sample.

Model (3) is a dynamic panel model. I have used the system GMM estimator proposed by Blundell and Bond (1998, 1999) to estimate model (3), since this estimator takes into account both fixed firm-specific effects (β_i) and the regressors' endogeneity. I have assumed that there is no serial dependence in ε_{it}, i.e., for all i, $E[\varepsilon_{it} \cdot \varepsilon_{is}] = 0$ for s≠t. I have used the following set of instruments. In the first-difference equations, I instrument for $\Delta \ln TFP_{i,t-1}$, $\Delta \ln TFP_{i,t-2}$, $\Delta EU15_{i,t-3}$, $\Delta EU10_{i,t-3}$, $\Delta Europe-rest_{t-3}$, , $\Delta America_{i,t-3}$, and $\Delta Asia_{i,t-3}$ with $\ln TFP_{i,t-2}$, $\ln TFP_{i,t-3}$, $EU15_{i,t-4}$, $EU10_{i,t-4}$, $Europe-rest_{t-4}$, , $America_{i,t-4}$, and $Asia_{i,t-4}$ and their higher lags, respectively. In the levels equations, I instrument for $\ln TFP_{i,t-1}$, $\ln TFP_{i,t-2}$, , $EU15_{i,t-3}$, , $EU10_{i,t-3}$, $Europe-rest_{i,t-3}$, , $America_{i,t-3}$ and $Asia_{i,t-3}$ with the first differences, specifically with $\Delta \ln TFP_{i,t-1}$, $\Delta \ln TFP_{i,t-2}$, , $\Delta EU15_{i,t-3}$, $\Delta EU10_{i,t-3}$, $\Delta Europe-rest_{i,t-3}$, , $\Delta America_{i,t-3}$, and $\Delta Asia_{i,t-3}$, respectively.

RESULTS

Hypothesis I: Results

The fixed effects estimates with correction for heteroskedasticity and autocorrelation of the model (1) are presented in Table 11 below.

[TABLE 11]

Coefficients on material, energy, and workers in production have positive signs in both specifications as expected, and they are also highly statistically significant. The estimates of coefficients on capital and workers out of production are not significant. The poor estimate of the capital coefficient is likely caused by the nature of the measure of capital used; stock of capital is an accounting entry that does not well capture the services of capital used in production. Moreover, the stock of capital and the number of workers out of production do not change much over time, which leads to poor coefficient estimates, since the fixed effect estimator exploits within-firm variation.

More important for the purpose of this study are the coefficients on the export measures. One interesting fact is revealed: the real export share coefficient is not statistically different from zero, but the real export volume is significant at 5%. Clearly, the choice of the export measure is important. My finding shows that the volume of trade is decisive for productivity gains, not the share of exports in total production. I also examine if my findings are robust with respect to the potential simultaneity between inputs and the productivity shocks that vary within firms over time. The system GMM estimates of model (2) are presented in Table 12.

Table 12 shows robust, one-step GMM results estimated using a sample of continuing exporters.

[TABLE 12]

I have checked the validity of the model. The Hansen test of overidentifying restrictions confirms that the instruments are jointly exogenous. The Arellano-Bond test confirms that there is no second-order autocorrelation in the first differenced equations. The total factor productivity is persistent over time as expected: the first lags of the TFP are positive and statistically significant in both columns. Consistently with results of the model (1), the coefficient on real export share is not statistically different from zero. On

the other hand, the coefficient of real export volume is positive and statistically significant at 10%. I conclude that, ceteris paribus, the higher real export volume leads to productivity gains.

Hypothesis II: Results

If exporting more influences firms' productivity, does the export destination matter? The results of estimating model (3) are shown in Table 13. These are robust one-step system GMM results.[10]

[TABLE 13]

The Hansen J test confirms the validity of the instruments used, and the Arellano-Bond test indicates that there is no second-order autocorrelation in the first differenced equations. The results show that the total factor productivity is persistent for one period; the second lag of the TFP no longer influences the current TFP. It shows that the choice of the export measure is again important. If I use real export share as the measure of exporting, I do not find any positive impact of exporting more on a firm's productivity. The coefficients on real export shares are not statistically different from zero with the exception of the coefficient on exporting to the rest of Europe. This coefficient is negative, although it is only marginally statistically significant. Exporting to the rest of Europe has a negative effect on productivity. This is not the first study in the literature that has found negative learning effects from exporting. For example, Clerides et al. (1998) found such effects when they studied manufacturing plants in Columbia, Morocco, and Mexico during the 1980s. A possible explanation for the negative learning effects is that the group of countries classified as "the rest of Europe" are from less developed countries. These are less mature markets that might permit the decline of the Czech exporters' production discipline. Weaker standards and soft requirements on product quality and delivery terms would allow Czech exporters to decrease their performance.

SENSITIVITY AND ROBUSTNESS

I now describe several robustness tests. Results of these alternative specifications are not reported for brevity, but are available upon request. First, it is possible that productivity gains from exporting are industry specific. In my analysis, I estimated each specification using all continuing exporters due to the relatively small sample size. Thus, I imposed the condition of the same slope for firms in each industry. However, if the production functions are industry specific, then the simple inclusion of an industry dummy variable in the estimation would not be sufficient. Therefore, I re-estimated each specification for the industry for which I have the most observations (machinery and equipment). I obtained results similar to those reported in the paper.

Next, I estimated five alternative models similar to model (3) with total factor productivity as a dependent variable and with exporting measures to various export destinations lagged three periods and year dummies as independent variables. The difference between these five models and model (3) reported in the text is that I did not include the lagged value of the total factor productivity as a regressor, and, thus, these models were static. The rationale for examining these alternative static models is that estimations of dynamic models are demanding concerning the number of observations needed.

These five alternative specifications differ by assuming a different structure of the error term and by the assumption about the nature of the firm effects. However, my conclusions do not change qualitatively. I used the following combinations of assumptions: A) I assumed that the firm effects (β_i) were fixed parameters and that the error term was not serially correlated. I used the fixed effects estimator. B) I assumed that firm effects (β_i) were fixed parameters but the error term was first-order autoregressive, i.e. $\varepsilon_{it} = \rho \cdot \varepsilon_{i,t-1} + \eta_{it}$ where $|\rho| < 1$. I estimated this model using the fixed effects estimator with AR(1) disturbances. C) I assumed that firm specific effects (β_i) were realizations of an independent and identically distributed (i.i.d.) process with mean 0 and variance σ_η^2 and that the error term was not serially correlated. I used the random effects estimator. D) I assumed that firm specific effects

(β_i) were realizations of an i.i.d. process with mean 0 and variance σ_η^2 and that the error term was first-order autoregressive, i.e. $\varepsilon_{it} = \rho \cdot \varepsilon_{i,t-1} + \eta_{it}$ where $|\rho| < 1$. I used the random effects estimator with AR(1) disturbances. E) I estimated a model in first differences. Note that when there are more than two time periods, the choice between first differencing and fixed effects hinges on the assumptions about the idiosyncratic errors. The fixed effects estimator is more efficient for i.i.d. and serially uncorrelated errors, while the first difference estimator is more efficient when the errors follow a random walk, see Wooldridge (2002: 284) for more details.

Lastly, I examined whether there are any outliers that could drive my results. The summary statistics in Table 5 show that there are some large standard deviations in the data. I conducted the Grubbs' test for outliers. I dropped 6 observations that were identified as potential outliers and repeated my estimations using the reduced sample. I obtained results very similar to the ones reported in the paper.[11]

CONCLUSION

I conducted my own field work over the course of a year to collect unique panel data revealing firms' export destinations. Using a sample of Czech continuing exporters, I examined whether firms benefit from exporting more and whether productivity gains from exporting more differ across destination markets.

I have contributed to the existing literature in several ways. First, unlike existing literature that focuses on comparing the performances of exporters and non-exporters, I examined continuing exporters. It is important to know whether firms that have already managed to enter foreign markets benefit from their interactions with foreign customers and competitors.

Second, I tested whether there are differences in learning-by-exporting between various export markets using firm-level panel data about export destinations. To my knowledge, this is the first paper that looks at productivity gains from exporting more that distinguishes between several export destinations.

Third, I conducted my own field work and built a unique database that contains, apart from balance-sheet data and firm-level panel data about exports and their destinations, qualitative evidence revealing relationships between exporters located in the Czech Republic and their foreign customers.

My main findings are as follows. My results show that firms do benefit from exporting more. It is crucial to employ the volume of exports as a measure of exporting, which is consistent with the theoretical model of Grossman and Helpman (1991b). I have found significant heterogeneity in productivity spillovers across destination markets. This confirms that Keller's (2004) call for the necessity of exploiting destination market heterogeneity in empirical works on learning-by-exporting was warranted (Keller 2004). Specifically, I have found that exporting to developed countries (i.e. the core countries of the European Union) leads to productivity gains for Czech exporters.

At this point, I must make several caveats. First, my sample of firms is relatively constrained. It includes only manufacturing firms in four selected industries located in the Czech Republic. Although the Czech Republic is a particularly interesting environment for studying productivity spillovers, since it is a transitional developing country catching up with the more advanced countries of the European Union, future research should answer whether similar results can be obtained in other environments. Second, my sample does not include small firms, since I have surveyed only medium and large firms. Without empirical evidence, it is not possible to determine whether small firms benefit more from exporting than larger firms. This is another research question worth further investigation.

These caveats notwithstanding, my findings have important implications for managers and policy makers, for research on exporting, and for research on productivity spillovers. My results provide managers with the information that exporting to advanced countries is an important business strategy. It is a way to increase a firm's productivity by learning and exploiting foreign locally embedded knowledge. As long as exporting generates productivity spillovers to local firms and thus increases the pool of knowledge in a country, policy makers should design their policies to facilitate firms exporting. The ultimate goal of research in international productivity spillovers is to understand how the firm, industry, and country dimensions together affect how technological knowledge moves between countries. This

paper takes a step towards this goal by providing new firm-level quantitative and qualitative evidence for several industries in the Czech Republic's manufacturing sector.

More research is certainly needed before a definite conclusion about the role of exporting in firms' performances can be made. In particular, it would be useful to confirm the findings of this paper using data that allow for a more detailed distinction between export markets. My classification of export markets may be still too aggregate and may mask learning effects. It would be optimal to use micro-data that allow for the identification of individual foreign firms as customers to Czech exporters. It would be interesting to know the characteristics of these trading partners, since their characteristics could influence the extent of learning-by-exporting effects. For example, if the trading partner is engaged in research and development, the learning potential for its suppliers from abroad might be greater. The learning potential could also vary with the distance between firms. The trading partner that is closer may provide greater learning possibilities. It is necessary to improve the existing empirical analyses before definite conclusions about learning-by-exporting can be made. Hopefully, improved data availability will allow researchers to study these questions in the future.

NOTES

[1] NACE denotes the General Industrial Classification of Economic Activities in the European Communities, (Nomenclature générale des activités économiques dans les Communautés européennes).

[2] The EU15 includes: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Luxembourg, Italy, Ireland, the Netherlands, Spain, Sweden, Portugal, and the United Kingdom.

[3] Ten countries joined the European Union on May 1, 2004: the Czech Republic, the Slovak Republic, Slovenia, Poland, Hungary, Malta, Estonia, Lithuania, Latvia, and Cyprus. Note that my survey covered period from January 1, 1995 to December 31, 2004. These countries joined the EU within the period under study.

[4] The rest of Europe includes: Russia, Belarus, Ukraine, Moldova, Romania, Bulgaria, Albania, Croatia, Serbia, Bosnia and Herzegovina, Montenegro, Macedonia, Iceland, Norway, and Switzerland.

[5] Own calculations based on data from the Czech National Bank, available at www.cnb.cz.

[6] The questionnaires from the main survey and from the follow-up survey are available upon request.

[7] I am grateful for this suggestion by one referee.

[8] I thank one referee for suggesting this.

[9] See Griliches and Mairesse (1995).

[10] When estimating model (3), I used the xtabond2 command in Stata by Roodman (2005). I applied the collapse option to avoid a potential bias resulting from too many instruments, see Roodman (2005) for more details. As a robustness check, I did not apply this option and confirmed that the results do not qualitatively change.

[11] These results are available upon request.

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APPENDIX A

Figure 1 – Influence of Heterogeneity of Foreign Markets on Firms' Productivities

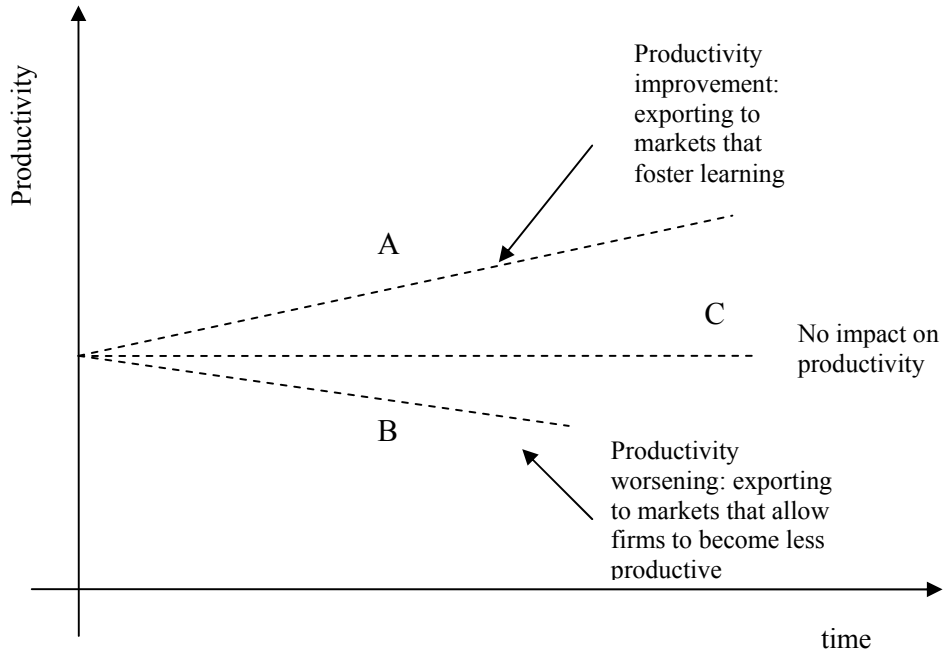

Table 1 – Summary of Firms Surveyed

Firm Category	Number of Firms	% Share if [A] = 100%	% Share if [B] = 100%

Total number of firms in population [A]	671	100.00	---
Total number of firms contacted [B]	295	43.96	100.00
Contacted firms that refused to be visited and interviewed	37	---	12.54
Visited firms that did not return surveys or returned them incomplete	155	---	52.54
Total number of complete surveys	**103**	**15.35**	**34.92**

Table 2 – Testing Sample Bias: Ho: difference in mean = 0

Variable	Firms that Provided Data	Firms that did not Provided Data	Difference in Mean	Ha: diff < 0	Ha: diff $\neq$ 0	Ha: diff > 0

	No. of Obs.	Mean	No. of Obs.	Mean				
Sales	814	532.00	230	581.37	-49.37	P(T < t)=0.25	P(|T| > |t|)=0.50	P(T > t)=0.75
Profit	789	32.52	664	25.10	7.43	P(T < t)=0.88	P(|T| > |t|)=0.23	P(T > t)=0.12
Tangible Assets	802	244.00	666	254.63	-10.67	P(T < t)=0.37	P(|T| > |t|)=0.73	P(T > t)=0.63

Table 3 – The Asian Countries that the Czech Firms Export to.

Country	Number of Exporting Firms

China	14
Vietnam	5
South Korea	4
Malaysia	3
Iran	3
Indonesia	3
India	3
Singapore	3
Taiwan	2
Thailand	2
Turkey	2
The Philippines	2
Russia (Asian part)	1
Mongolia	1
Tajikistan	1
Japan	1
Syria	1
Israel	1

Table 4 – Structure of My Database

Category	Definition	Number of Firms
Continuing Exporters	Firms that always exported during the sample period.	93
Non-Exporters	Firms that never exported during the sample period.	3
Starters	Firms that began the period as non-exporters, but started exporting during the sample period and never stopped.	4
Quitters	Firms that began the period as exporters, but stopped during the sample period and never resumed exporting.	1
Switchers	Firms that switched exporting status more than once during the sample period.	2
Total all firms		103

Table 5 – Selected Summary Statistics for Continuing Exporters

In millions of Czech crowns (CZK) unless otherwise indicated.

	Continuing Exporters		
Variable	Number of Obs.	Mean	Std. Dev.
Sales	726	580.59	1281.3
Change in Inventories	726	2.03	35.64
Output	726	582.63	1290.32
Profit	701	35.48	138.89
Profitability=Profit/Output in %	701	4.08%	11.69%
Total Exports	671	332.21	1132.01
Real Exports into EU15	661	246.58	1118.91
Real Exports into EU10	661	47.25	141.41
Real Exports to the Rest of Europe	661	19.56	71.30
Real Exports to the North America	661	7.75	31.13
Real Exports to Asia	660	10.32	48.57
Real Export Share EU15	652	35.64%	34.07%
Real Export Share EU10	652	8.1%	10.08%
Real Export Share Rest of Europe	652	3.15%	7.23%
Real Export Share North America	652	1.42%	5.17%
Real Export Share Asia	651	3.60%	24.58%
Number of Workers out of Production	714	120	128
Number of Workers in Production	714	311	441
Wages	711	75.66	118.94
Average Hourly Wage in US $[1]	711	4.52	1.50
Material Consumption	711	321.78	810.01
Energy	699	14.80	22.22
Tangible Capital	718	269.38	827.42
Intangible Capital	704	5.53	13.96
Investment in Tangible Capital	663	65.52	334.93
Investment in Intangible Capital	641	2.54	10.70

[1] 22.358 CZK/USD exchange rate as of December 31, 2004. See: www.oanda.com .

Table 6 - Correlation Matrix (N=636)

	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	ln Output																	
2	ln Material	0.91																
3	ln Energy	0.80	0.72															
4	ln Workers in Production	0.80	0.65	0.73														
5	ln Workers out of Production	0.74	0.68	0.74	0.70													
6	ln Capital	0.80	0.78	0.72	0.76	0.68												
7	Real Export Share	0.03	-0.03	-0.02	0.11	-0.15	0.08											
8	Real Export Share EU15	0.06	-0.04	-0.00	0.18	-0.06	0.03	0.70										
9	Real Export Share EU10	0.13	0.14	0.22	0.06	0.19	0.19	-0.03	-0.31									
10	Real Export Share Rest of E.	0.11	0.09	0.14	0.05	0.13	0.11	0.10	-0.12	0.10								
11	Real Export Share North A.	0.06	0.06	-0.00	0.09	0.02	0.07	0.18	0.05	-0.04	0.08							
12	Real Export Share Asia	-0.15	-0.10	-0.17	-0.14	-0.28	-0.05	0.52	-0.11	-0.03	-0.02	-0.01						
13	Real Export Volume	0.46	0.39	0.32	0.42	0.29	0.39	0.23	0.27	-0.01	0.02	0.03	-0.01					
14	Real Export Volume EU15	0.38	0.33	0.25	0.35	0.24	0.33	0.21	0.30	-0.09	-0.03	0.00	-0.02	0.98				
15	Real Export Volume EU10	0.39	0.35	0.33	0.34	0.25	0.28	0.01	-0.14	0.55	0.03	-0.01	-0.01	0.15	0.00			
16	Real Export Volume Rest of E.	0.30	0.21	0.26	0.27	0.22	0.22	0.10	-0.07	0.05	0.72	0.12	-0.00	0.12	0.01	0.16		
17	Real Export Volume North A.	0.24	0.21	0.11	0.22	0.15	0.22	0.20	0.09	-0.02	0.20	0.68	-0.00	0.10	0.04	0.04	0.31	
18	Real Export Volume Asia	0.24	0.19	0.17	0.22	0.13	0.17	0.12	-0.06	0.07	0.11	0.06	0.20	0.13	0.03	0.22	0.40	.14

Table 7 - Forms of Assistance Received from Customers from Abroad

Forms of Assistance Received from Customers Abroad	Percent of Firms
Provision of blueprints	54.2
Help with quality control	50.0
Technology improvement	50.0
Machinery maintenance	33.3
Training of employees	29.2
Advice how to improve existing products	29.2
Help with financing	29.2
Inspiration for new products	16.7
Leasing of technology	16.7
Finding new customers	12.5
Storage of material	8.3

Table 8 - Research and Development Intensity of Foreign Customers

R&D Intensity of Customers from Abroad	Percent of Firms
No, they do not have any R&D	22.2
Minimal	11.1
Medium	15.6
Substantive	24.4
They are industry leaders in R&D	15.6
No information	11.1

Table 9 - Cost of Entry into the Foreign Markets

Cost of Entry into the Foreign Markets	Percent of Firms
Rather easy/less costly	2.2
Moderately difficult/costly	42.2
Rather difficult/costly	37.8
Very difficult/costly	4.4
No information	13.3

Table 10 – Measures of Exporting Intensity in the Extant Literature

Author, Year, Journal	Export Measure	Main Research Question
1. Wei and Liu, 2006, JIBS	Export Share	Productivity spillovers from R&D, exports and FDI
2. Salomon and Shaver, 2005a, SMJ	Export Volume	Interrelationship between export and domestic sales
3. Salomon and Shaver, 2005b, JEMS	Export status (0/1) Export Volume	Learning by exporting, examining firm innovations
4. Salomon, 2006, SO	Percentage of total exports that go to OECD countries	Impact of export strategies on innovative productivity
5. Salomon and Jin, 2007, JIBS	Export Status (0/1)	Industry heterogeneity in learning by exporting
6. Blalock and Gertler, 2004, JDE	Export Status (0/1)	Learning from exporting
7. De Loecker, 2007, JIE	Export Status (0/1)	Learning by exporting, focus on export entrants
8. Greenaway, Guariglia and Kneller, 2007, JIE	Export Status (0/1)	Financial health as a determinant of exporting decision
9. Damijan, Polanec and Prasnikar, 2004, Licos Discussion Paper	Export Status (0/1)	Productivity improvements, export market heterogeneity
10. Bernard and Jensen, 1999a, JIE	Export Status (0/1)	Exceptional exporter performance: cause, effect, or both?
11. Biesebroeck, 2005, JIE	Export Status (0/1)	Learning by exporting

Notes:
Export Share is defined as the ratio of a firm's exports to its sales.
Export Status (0/1) is defined as a binary variable that equals 1 if a firm exported in a given period and 0 otherwise.

Table 11 – Exporting and Productivity

	Continuing Exporters	
ln (Material)	0.622 (12.82)****	0.626 (12.96)****
ln (Energy)	0.123 (2.68)***	0.114 (2.49)**
ln (Workers in Production)	0.227 (3.12)***	0.215 (3.06)***
ln (Workers out of Production)	0.024 (0.46)	0.025 (0.50)
ln (Capital)	-0.011 (-0.43)	-0.012 (-0.50)
Real Export Share (t-3)	0.030 (1.29)	
Real Export Volume (t-3)		0.000012 (2.12)**
Constant	1.158 (4.95)****	1.238 (5.48)****
N R^2 (within)	389 0.87	389 0.87

Notes:
Dependent variable is $\ln(Y_{it})$
Fixed effects estimator with correction for heteroskedasticity and autocorrelation.
All specifications include year fixed effects.
Figures in parentheses are t-statistics (two-tailed tests).
* significant at 10%; ** significant at 5%; *** significant at 1%; **** significant at 0.1%.

Table 12 – Exporting and Productivity, System GMM Estimator

Variable	Continuing Exporters	
ln TFP (t-1)	0.301 (2.92)***	0.311 (2.59)**
ln TFP (t-2)	-0.213 (-1.34)	-0.236 (-1.62)
Real Export Share (t-3)	0.032 (0.06)	
Real Export Volume (t-3)		0.00004 (1.98)*
Constant	0.258 (1.40)	0.260 (2.89)***
Arellano-Bond test for AR(2) in first differences, P-value	0.54	0.98
Hansen test of overidentifying restrictions, P-value	0.79	0.81
Number of Observations	376	376

Notes:
Dependent variable is ln TFP (t)
Figures in parentheses are t-statistics (two-tailed tests).
Year fixed effects included.
Robust one-step system GMM results.
* significant at 10%; ** significant at 5%; *** significant at 1%; **** significant at 0.1%.

Table 13 – Destination of Exports, System GMM Estimation

Variable	Continuing Exporters	
Measure of Exporting	Real Export Share	Real Export Volume
ln TFP (t-1)	0.321 (2.83)***	0.345 (2.95)****
ln TFP (t-2)	-0.150 (-1.38)	-0.132 (-0.95)
EU15 (t-3)	-0.116 (-0.34)	0.00004 (2.52)**
EU10 (t-3)	0.188 (0.32)	0.0003 (1.29)
Rest of Europe (t-3)	-2.726 (-1.93)*	-0.001 (-1.23)
North America (t-3)	0.025 (0.06)	0.001 (1.20)
Asia (t-3)	-0.061 (-1.13)	-0.001 (-1.57)
Constant	0.377 (2.29)**	0.274 (4.05)****
Arellano-Bond test for AR(2) in 1st differences, P-value	0.53	0.35
Hansen test of overidentifying restrictions, P-value	0.48	0.56
Number of Observations	369	369

Notes:
Dependent variable is ln TFP (t)
Figures in parentheses are t-statistics (two-tailed tests).
Year fixed effects included.
Robust one-step system GMM results.
* significant at 10%; ** significant at 5%; *** significant at 1%; **** significant at 0.1%.

APPENDIX B: DESCRIPTION OF VARIABLES AND DEFLATING

Y_{it} stands for a real output of firm i at time t. Output is calculated as a sum of sales and a change in inventories of the firm's own products. It is deflated by the producer price index for the proper 2-digit NACE sector obtained from the Czech Statistical Office.

M_{it} denotes real consumption of material. A deflator for material was constructed for each sector using a 1999 input-output matrix and producer price indices for the relevant 2-digit NACE sectors.

E_{it} is real energy consumption. Energy consumption was deflated by a producer price index for energy.

WIP denotes the number of people in production (WIP –Workers in Production)

WOP denotes the number of people out of production (WOP – Workers out of Production).

K_{it} stands for real net tangible capital at the beginning of the year. Net tangible capital was deflated by a simple average of producer price indices for the following 2-digit NACE sectors: machinery and equipment, motor vehicles and electrical equipment and apparatus. I use the net capital instead of gross capital because it takes into account the vintage of capital.

Real Exports

The Czech Statistical Office provides export deflators for nine groups of products. These do not correspond to the NACE sectors. Therefore, I deflate the exports of firms in NACE 21: Pulp, paper and paper products and NACE 31: Electrical Equipment and apparatus by a deflator for "Various Industrial Products." I deflate exports of firms in NACE 29: Machinery and equipment and NACE 34: Motor vehicles by a deflator for "Machines and Means of Transport."

APPENDIX C: ESTIMATION OF TOTAL FACTOR PRODUCTIVITY (TFP)

Olley and Pakes (1996) show the conditions under which an investment proxy controls for correlation between input levels and the unobserved productivity shock. Levinsohn-Petrin (2003) show how intermediate inputs, such as material and energy, can also be used to solve the simultaneity problem.

I apply the Levinsohn-Petrin (LP) procedure where I use consumption of material as a proxy variable. The LP procedure can be applied both for production functions in value-added form and revenue (output) form. Given my relatively limited sample size, I estimate the production function in value-added form, as there are fewer coefficients to be estimated compared to the revenue case. Value-added (VA) is defined as the difference between real output and real material and energy consumption. I estimate (i) using the nonlinear semi-parametric LP procedure using the full sample of firms.

$(i)\quad va_{it} = \alpha_0 + \alpha_{wop} \cdot wop_{it} + \alpha_{wip} \cdot wip_{it} + \alpha_k \cdot k_{it} + \omega_{it} + \varepsilon_{it}$,

where $va_{it} = \ln VA_{it}$, $\text{wop}_{it} = \ln WOP_{it}$, $\text{wip}_{it} = \ln WIP_{it}$ and $k_{it} = \ln K_{it}$.

The error term has two components: ω_{it}, the transmitted productivity component, and ε_{it}, an error term that is uncorrelated with input choices. The transmitted productivity component ω_{it} is a state variable that impacts the firm's decision rules. It is not observed by the econometrician, but it may impact the choice of inputs, which leads to a simultaneity problem in production function estimation. Demand for the material $m_{it} = \ln M_{it}$ is assumed to depend on the firm's state variables, capital k_{it} and ω_{it}, i.e. $m_{it} = m_{it}(k_{it}, \omega_{it})$.

LP (2003, Appendix C) showed that under mild assumptions about the firm's production technology, the demand function is monotonically increasing in ω_{it} and can be thus inverted: $\omega_{it} = \omega_{it}(k_{it}, m_{it})$.

A final identification restriction concerns the development of productivity. LP (2003) follow OP (1996) in assuming that productivity is governed by a first-order Markov process: $\omega_{it} = E(\omega_{it} \mid \omega_{i,t-1}) + \xi_{it}$, where ξ_{it} is an innovation to productivity that is uncorrelated with k_{it}. The production function (i) can be written as

$va_{it} = \alpha_{wop} \cdot wop_{it} + \alpha_{wip} \cdot wip_{it} + \phi_{it}(k_{it}, m_{it}) + \varepsilon_{it}$,

where $\phi_{it}(k_{it}, m_{it}) = \alpha_0 + \alpha_k \cdot k_t + \omega_{it}(k_{it}, m_{it})$. I follow Petrin, Levinsohn and Poi (2004) in substituting a third-order polynomial approximation in k_{it} and m_{it} in place of $\phi_{it}(k_{it}, m_{it})$ and consistently estimate coefficients on Workers in and out of Production by OLS. In the second stage, the coefficient on capital is identified. The estimated value for ϕ_{it} can be calculated as:

$\hat{\phi}_{it} = \hat{va}_{it} - \hat{\alpha}_{wop} \cdot wop_{it} - \hat{\alpha}_{wip} \cdot wip_{it}$. For any candidate value α_k^*, one can compute (up to a scalar constant) a prediction for ω_{it} for all periods using $\hat{\omega}_{it} = \hat{\phi}_{it} - \alpha_k^* \cdot k_{it}$. These values are used to estimate a consistent non-parametric approximation to $E(\omega_{it} \mid \omega_{i,t-1})$. It is given by the predicted values from the regression $\hat{\omega}_{it} = \gamma_0 + \gamma_1 \cdot \omega_{i,t-1} + \gamma_2 \cdot \omega_{i,t-1}^2 + \gamma_3 \cdot \omega_{i,t-1}^3 + \varepsilon_{it}$ and denoted as $\hat{E}(\omega_{it} \mid \omega_{i,t-1})$.

Given $\hat{\alpha}_s$, $\hat{\alpha}_u$, α_k^* and $\hat{E}(\omega_{it} \mid \omega_{i,t-1})$, the sample residual of the production function is given as:

$$\hat{\varepsilon}_{it} + \hat{\xi}_{it} = va_{it} - \hat{\alpha}_{wop} \cdot wop_{it} - \hat{\alpha}_{wip} \cdot wip_{it} - \alpha_k^* \cdot k_{it} - \hat{E}(\omega_{it} \mid \omega_{i,t-1})$$

The estimate of $\hat{\alpha}_k$ for α_k is defined as an argument minimizing the sum of squared residuals:

$$\min_{(\alpha_k^*)} = \sum_i \sum_t \left(va_{it} - \hat{\alpha}_{wop} \cdot wop_{it} - \hat{\alpha}_{wip} \cdot wip_{it} - \alpha_k^* \cdot k_{it} - \hat{E}(\omega_{it} \mid \omega_{i,t-1}) \right)^2.$$

Residuals from model (i) become a measure of total factor productivity:

$$TFP_{it} = e^{va_{it} - \hat{\alpha}_{wop} \cdot wop_{it} - \hat{\alpha}_{wip} \cdot wip_{it} - \hat{\alpha}_k \cdot k_{it}}.$$

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