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## Decomposing Service Exports Adjustments along the Intensive and Extensive Margin at the Firm-Level\*

Elisabeth Christen<sup>†</sup>, Yvonne Wolfmayr<sup>‡</sup>, Michael Pfaffermayr<sup>§</sup>

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### Abstract

Using a comprehensive and unique data set of Austrian service exporting firms provided by the Austrian central bank (OeNB) this paper empirically examines the determinants of service exports at the firm/destination country level. Based on a Heckman sample selection gravity model, the paper introduces a new approach to decompose expected firm-level service exports into changes at the intensive and the extensive margins of adjustment as a response to counterfactual changes in exogenous variables. Specifically, we consider several counterfactual scenarios including the (hypothetical) reduction of trade costs, changes in destination market size and enhanced firm productivity. Our results suggest that export market growth and a reduction in distance related trade costs exerts the relative strongest impact on the entry into new markets. Policies aiming at promoting firm productivity also have the potential to broaden the exporter base and play an important role for trade deepening.

**Keywords:** Service trade, Firm-level evidence, Firm heterogeneity, Gravity model, Sample selection, Intensive and extensive margin of trade.

**JEL Codes:** C15, C21, D21, F14, L20, L80

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<sup>†</sup>Corresponding author: Austrian Institute of Economic Research, Arsenal, Object 20, A-1030 Vienna, Austria.  
Email: Elisabeth.Christen@wifo.ac.at.

<sup>‡</sup>Austrian Institute of Economic Research, Arsenal, Object 20, A-1030 Vienna, Austria.

<sup>§</sup>Department of Economics, University of Innsbruck, Universitaetsstrasse 15, A-6020 Innsbruck, Austria.

# 1 Introduction

The (new) new trade theory literature pioneered by Melitz (2003) and further developed by Chaney (2008), Helpman et al. (2008) and Crozet and Koenig (2010) emphasizes the self-selection of the more productive firms into export destination markets. As firms exhibit heterogeneity in their productivity, only the more productive and larger firms are able to earn sufficient positive operating profits in a destination market to cover the associated fixed costs and thus serve this market by exports. At the firm level, adjustments in trade flows due to changes in exogenous determinants occur along two margins. On the one hand firms entering (exiting) a specific destination market contribute to an increase (decrease) in exports to that market (the extensive margin). On the other hand firms that already export to a destination may increase or decrease their export activities (the intensive margin). Both margins of adjustment, and especially their relative contributions to overall export growth, seem to be highly relevant to economic policy as different policy instruments are relevant to promote firms to enter new foreign markets and to deepen existing export relations.

Despite the prominent role gravity models have had in explaining aggregate trade flows, their adoption to firm level data has not yet gained widespread attention in the empirical literature, even less so for service trade.

Greenaway et al. (2009) apply a Heckman sample selection gravity model to control for the possible self-selection into exporting using firm level data on the Swedish food and beverage sector. Their findings are consistent with the predictions from the theory and confirm that more productive and larger firms are more likely to serve large and relatively close foreign markets. Additionally, also the export volumes are positively influenced by the size of the destination market and negatively by the distance between the trading partners. In a related paper, Crozet and Koenig (2010) examine the impact of distance on the probability of exporting and the export levels using French manufacturing firm level data. Their results show that distance has a significant negative impact on both the propensity to export and the export volume in the majority of the industries.<sup>1</sup>

In contrast to the research on goods trade, the empirical literature on services trade is developing only recently and so far mainly relies on aggregate data.<sup>2</sup> Recent contributions on services trade using firm-level data include Breinlich and Criscuolo (2011) who are among the first to study firm-level services trade with a focus on trade participation and trade patterns of UK firms. In line with the evidence for manufacturing firms they find important differences between service traders and non-traders with respect to firm size and productivity. A major conclusion of their study is that firm-heterogeneity is also a key feature of services trade, thereby pointing to the relevance of heterogeneous firm models for modeling service activities. In related papers Kelle and Kleinert (2010), Ariu (2011, 2012) and Federico and Tosti (2012) report similar stylized facts and provide firm-level evidence on services trade for Germany, Belgium and Italy, respectively. All these contributions distinguish between the adjustment at the intensive and extensive margin at the *aggregate levels* of destinations or industries. Accordingly, variations in aggregated firm-level services trade are mainly explained by the intensive margin, while contributions of the extensive margin only account for 20 to 30% of total variation. This

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<sup>1</sup>A detailed survey on the export productivity nexus at the firm-level is provided by Wagner (2007) but the survey does not include gravity models.

<sup>2</sup>Francois and Hoekman (2010) provide a comprehensive survey on service trade.

dominance of the intensive margin can be partly explained by the large fraction of firms which trade with only one foreign destination market and in one service type.

In these contributions the preferred measure of the extensive margin is the number of destination countries and/or services types per firm within an industry, while the intensive margin refers to the average trade volume per destination country and/or services type, again within an industry. However, this measure of the intensive margin leaves out variation across destinations and/or service types, while the number of firms as measure of the extensive margin fails to account for the heterogeneity of firms. In contrast, a firm-level Heckman sample selection gravity model is able to account for both aspects defining the extensive margin as the probability to export to a destination market and the intensive margin as the expected volume of service trade conditional on exporting to a specific destination. Based on the predictions of the Heckman sample selection model it is possible to assess the expected reaction of trade flows for specific groups of firms in response to changes in key exogenous determinants. In particular, this approach enables us to elaborate on the composition of trade flows in counterfactual scenarios along the extensive and intensive margin.

Using the formal results on the conditional expectation of log-normal random variables provided by Yen and Rosinski (2008) and the estimated parameters of the Heckman sample selection gravity model, we calculate the firm-specific probability of exporting to a specific destination and the expected trade volume conditional on exporting for each firm. Thereby, we decompose the expected change in exports into the contribution of continuing exporters holding the probability of exporting constant (intensive margin) and changes in the probability of exporting given the conditional expectations of positive exports (extensive margin).

The main contribution of this paper is to apply this framework in an analysis of services exports using a unique firm-level data set covering service exports by Austrian firms from both the manufacturing and service sector, by destination over the period 2006 to 2009. The distinction between manufacturing and service sector traders seems to be important not only because manufacturing firms differ from service firms in a number of ways (e.g., in terms of average size, export participation and average destination specific export flows per firm, see Breinlich and Criscuolo, 2011 and Ariu, 2012), but most importantly because the nature of service trade is likely to differ between service and manufacturing firms.

The estimation results suggest that export market growth and a reduction in distance related costs produce the relatively strongest impact on the entry into new destination markets. However, the adjustment at the intensive margin dominates and contributes with more than 70 percent to the overall change in export flows. IMF projections suggesting an expected increase in market size of 20.3% on average across destinations between 2012 and 2017 result in a pronounced increase in Austrian service exports to Extra-EU destinations. Counterfactually increasing firm productivity broadens the exporter base and both for the group of high and low productivity firms the largest adjustment at the extensive margin are found in the most distant markets. Again, in this scenario the adjustment of exports mainly occurs by trade deepening. Comparing manufacturing firms to services firms all counterfactual scenarios reveal a greater importance of the extensive margin for the manufacturing sector. Moreover, it is interesting that the overall change in exports is more pronounced for firms in the manufacturing sector. Only the impact of a reduction in distance related costs forms an exception to this pattern.

The remainder of the paper is organized as follows: Section 2 discusses the theoretical model and motivates the application of the Heckman sample selection model. Based on the model with heterogeneous firms we present the empirical specification and derive the functional composition

of the comparative static analysis. In Section 3 we present the data, descriptive statistics and the regression and robustness analysis. Section 4 contains the counterfactual analysis and Section 5 concludes.

## 2 A Simple Firm-Level Gravity Model

To motivate the empirical specification of the firm level gravity model estimated below, we envisage a standard monopolistic competition model of bilateral service trade with CES-preferences and heterogeneous firms as introduced by Melitz (2003). We consider a single exporter country, where each firm  $i$  produces a variety of a service and may export it to  $j = 1, \dots, J$  destination countries. As our sample of firms refers to a single country, we set out the model for a single exporter country and skip the corresponding index. Firms are assumed to differ in their (labour) productivity so that the more productive firms exhibit lower marginal costs.

In this monopolistic competition framework profit maximization implies that in each market firms price a mark-up over its firm and destination market specific marginal costs,

$$p_{ij} = \frac{\sigma a_i \tau_j}{\sigma - 1}, \quad (1)$$

where  $p_{ij}$  denotes the price of variety  $i$  in destination market  $j$  and  $\sigma > 1$  is the elasticity of substitution.  $a_i$  refers to firm specific marginal costs that are inversely related to its productivity.  $\tau_j \geq 1$  captures destination specific trade costs for service trade flows to country  $j$ . Following the literature (see e.g. Helpman et al., 2008; Crozet and Koenig, 2010), profits of firms are assumed to be separable across markets and are given by

$$\pi_{ij} = \frac{1}{\sigma} \left( \frac{\sigma}{\sigma - 1} \frac{a_i \tau_j}{P_j} \right)^{1 - \sigma} E_j - f_j. \quad (2)$$

$f_j$  captures destination specific fixed costs of serving market  $j$ .  $P_j$  denotes the CES-price index in importer country  $j$  and  $E_j$  income share in country  $j$  that is spent on services, which is interpreted as destination market size. Exports of firm  $i$  to country  $j$  will be observed if market specific profits are positive, or, when taking logs, a latent variable  $z_{ij}^*$  describing the propensity of firm  $i$  to export to destination market  $j$  that is defined as

$$z_{ij}^* = -\ln \sigma + (1 - \sigma) \ln \left( \frac{\sigma}{\sigma - 1} \right) + (1 - \sigma) \ln a_i + (1 - \sigma) \ln \tau_j + \ln \frac{E_j}{P_j^{1 - \sigma}} - \ln f_j \quad (3)$$

is positive. We assume that  $\pi_{ii}(a_i) > 0$ , i.e., that the home market is always served. The value of firm  $i$ 's exports to country  $j$ , if positive, can be shown to amount to

$$X_{ij} = \left( \frac{p_{ij}}{P_j} \right)^{1 - \sigma} E_j = \left( \frac{\sigma}{\sigma - 1} \frac{a_i \tau_j}{P_j} \right)^{1 - \sigma} E_j \text{ if } z_{ij}^* \geq 0 \quad (4)$$

or rewriting it in logs

$$x_{ij} = (1 - \sigma) \ln \frac{\sigma}{\sigma - 1} + (1 - \sigma) \ln a_i + (1 - \sigma) \ln \tau_j + \ln \left( \frac{E_j}{P_j^{1 - \sigma}} \right) \text{ if } z_{ij}^* \geq 0. \quad (5)$$

Firm  $i$  only exports its services to destination market  $j$  if it is profitable to do so. Hence, firms select themselves systematically into the group of service traders to destination  $j$  based on the potential operating profits they are able to achieve in these markets relative to the corresponding

fixed costs of serving that market (see Helpman et al., 2008). Specifically, the model implies that the decision of firm  $i$  to serve the foreign market  $j$  depends on its productivity, the associated variable and fixed trade costs of exporting services to the respective destination market and, lastly, on the size of the destination markets.

Given the distribution of the firms' productivity, only a fraction of firms – the most productive ones – will be able to achieve high enough operating profits and decide to export to a specific destination market (extensive margin). Firms with a productivity level below the threshold only serve the domestic market, where trade barriers are assumed to be absent or low. Service exports of firm  $i$  to destination market  $j$  are more likely to be observed the lower are the bilateral trade barriers,  $\tau_j$ , and the lower are the fixed costs,  $f_j$ , of exporting to the respective market. Foreign market size exerts a positive impact on the propensity to export as one would expect. With the exception of fixed trading costs the model suggests that essentially the same set of variables determine the value of a firm's service export to a specific destination market (intensive margin). The observed trade flows will be higher the more productive firms are, the lower the variable trade costs and the larger the destination markets are.

## 2.1 Empirical Specification and Comparative Static Analysis

Under normality of the unobserved stochastic disturbances, one can use a standard Heckman sample selection model based on the latent propensity to export,  $z_{ij}^*$ , for the selection equation and the nominal export volume,  $x_{ij}$ , for the outcome equation. While the Heckman sample selection model seems restrictive for estimation, it has also important advantages. Under the assumption of a bivariate normal distribution, it is possible to derive theory consistent comparative statics and to disentangle the reactions of firms at the intensive and extensive margins as a response to changes in exogenous determinants. A non-parametric estimation framework would not allow such a decomposition.<sup>3</sup>

To set up the econometric specification we subsume the set of explanatory variables of the outcome equation into the vector  $w_{ij}$  with corresponding parameter vector  $\beta$ . The right hand side variables of the selection equation are collected in  $v_{ij}$  with parameter vector  $\gamma$  and include those of the outcome equation,  $w_{ij}$ , plus additional proxies of destination-specific and firm-specific fixed costs. Hence, identification not only relies on the functional form of the likelihood, but also on exclusion restrictions. Cameron and Trivedi (2006) show that the sample selection model, since it is non-linear, is formally identified without any exclusion restriction and precise estimation will be possible if the variation of  $v_{ij}\gamma$  is large enough. However, adding an exclusion restriction is recommended, if the mills ratio turns out highly collinear to the explanatory variables in the outcome equation, especially when two-step estimators are used.

Denoting the iid disturbances by  $(\varepsilon_{ij}, \eta_{ij})$ , for each service firm the empirical specification of the sample selection model may be written as:

$$z_{ij}^* = v_{ij}\gamma + \varepsilon_{ij} \quad (6)$$

$$x_{ij} = \begin{cases} w_{ij}\beta + \eta_{ij}, & \text{if } z_{ij}^* \geq 0 \\ \text{unobserved}, & \text{if } z_{ij}^* < 0 \end{cases} \quad (7)$$

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<sup>3</sup>So far, as outlined in the introduction, the common practice in estimating gravity models distinguishing between the intensive and extensive margins seem to be mainly based on aggregate figures at the industry and/or destination country level and the number of firms in an industry and/or destination is considered to reflect reactions at the extensive margin.

$$\varepsilon_{ij}, \eta_{ij} \sim N(0, (1, \sigma_\varepsilon^2, \rho\sigma_\varepsilon)). \quad (8)$$

The comparative static analysis has to refer to both the extensive margin (selection into exporting to a specific destination market) and the intensive margin (change in service exports given they are positive). For firms, which decided to export, the conditional expectation of their service exports can be derived as:

$$E[x_{ij}|z_{ij}^* \geq 0] = w_{ij}\beta + \rho\sigma_\varepsilon\lambda(v_{ij}\gamma), \quad \lambda(v_{ij}\gamma) = \frac{\phi(v_{ij}\gamma)}{\Phi(v_{ij}\gamma)}. \quad (9)$$

Marginal effects conditional on positive service exports can thus be calculated as (see Cameron and Trivedi, 2006; Greene, 2008):

$$\frac{\partial E[x_{ij}|z_{ij}^* \geq 0]}{\partial x_{ij,k}} = \beta_k - \rho\sigma_\varepsilon\gamma_k(\lambda_{ij}^2 + v_{ij}\gamma\lambda_{ij}). \quad (10)$$

To quantify the impact of a change in exogenous determinants on the extensive and intensive margin of service trade, we compare the expected export flows in the counterfactual and the baseline scenario. Thereby we aggregate the implied percentage changes of each firm to weighted averages of groups of firms and report aggregate group specific figures. Hence, changes at the extensive margin can be analyzed in terms of the probabilities of the firms' export status in a particular destination. It is not necessary to derive predicted individual changes in the firm's actual export status. Actually, this latter approach involves the prediction of a dummy variable based on estimated probabilities and risks erroneously classifying exporters as non-exporters and viz versa. Here, we follow Yen and Rosinski (2008, p. 5) and first calculate the estimated expectation of the positive trade flows in levels as:

$$E[e^{x_{ij}}|z_{ij}^* \geq 0] = e^{x_{ij}\beta + \sigma_\varepsilon^2/2} \frac{\Phi(v_{ij}\gamma + \rho\sigma_\varepsilon)}{\Phi(v_{ij}\gamma)}. \quad (11)$$

The corresponding unconditional expectation is therefore given by:

$$E[e^{x_{ij}}] = E[e^{x_{ij}}|z_{ij}^* \geq 0]P(z_{ij}^* \geq 0) = e^{x_{ij}\beta + \sigma_\varepsilon^2/2}\Phi(v_{ij}\gamma + \rho\sigma_\varepsilon). \quad (12)$$

Aggregating over a set of  $N$  firms yields  $\sum_{i=1}^N E[e^{x_{ij}}]$  as a measure of the expected aggregate nominal service trade flow of this firm group to country  $j$ . Note, this measure considers both exporting and non-exporting firms, but sets exports in case of non-exporter status to zero, which occurs with probability  $1 - P(z_{ij}^* \geq 0)$ .

Moreover, one can decompose the expected aggregate export volume into two components in order to analyze the reaction of the intensive and the extensive margin of adjustment as response to changes in exogenous variables. The first component refers to continuing exporters holding the probability of exporting constant (intensive margin). Second, the probability of exporting to a specific destination may change at given conditional expectations of positive exports (extensive margin). In particular, the expected percent change ( $G_{ij}$ ) for firm  $i$  exporting to destination

country  $j$  can be decomposed as:

$$\begin{aligned}
G_{ij} &= \frac{E[e^{x_{ij}^C}] - E[e^{x_{ij}}]}{E[e^{x_{ij}}]} & (13) \\
&= \frac{E[e^{x_{ij}^C} | z_{ij}^{*C} \geq 0]P(z_{ij}^{*C} \geq 0) - E[e^{x_{ij}} | z_{ij}^{*C} \geq 0]P(z_{ij}^{*C} \geq 0)}{E[e^{x_{ij}} | z_{ij}^* \geq 0]P(z_{ij}^* \geq 0)} \\
&\quad \text{(intensive margin at constant probability to export)} \\
&+ \frac{E[e^{x_{ij}} | z_{ij}^{*C} \geq 0]P(z_{ij}^{*C} \geq 0) - E[e^{x_{ij}} | z_{ij}^* \geq 0]P(z_{ij}^* \geq 0)}{E[e^{x_{ij}} | z_{ij}^* \geq 0]P(z_{ij}^* \geq 0)} \\
&\quad \text{(extensive margin at constant positive export flows)}.
\end{aligned}$$

Thereby, superscript  $C$  refers to the counterfactually changed situation. Inserting the conditional expectations and the probabilities to export from above yields the decomposition:

$$\begin{aligned}
G_{ij} &= \frac{\Phi(v_{ij}^C \gamma + \rho \sigma_\epsilon) \left[ e^{x_{ij}^C \beta + \sigma_\epsilon^2/2} - e^{x_{ij} \beta + \sigma_\epsilon^2/2} \right]}{e^{x_{ij} \beta + \sigma_\epsilon^2/2} \Phi(v_{ij} \gamma + \rho \sigma_\epsilon)} & (14) \\
&+ \frac{\left( \Phi(v_{ij}^C \gamma + \rho \sigma_\epsilon) - \Phi(v_{ij} \gamma + \rho \sigma_\epsilon) \right) \left[ e^{x_{ij} \beta + \sigma_\epsilon^2/2} \right]}{e^{x_{ij} \beta + \sigma_\epsilon^2/2} \Phi(v_{ij} \gamma + \rho \sigma_\epsilon)} \\
&= \frac{\Phi(v_{ij}^C \gamma + \rho \sigma_\epsilon)}{\Phi(v_{ij} \gamma + \rho \sigma_\epsilon)} \left[ e^{(x_{ij}^C - x_{ij}) \beta} - 1 \right] + \left( \frac{\Phi(v_{ij}^C \gamma + \rho \sigma_\epsilon)}{\Phi(v_{ij} \gamma + \rho \sigma_\epsilon)} - 1 \right).
\end{aligned}$$

The contribution to the intensive margin of firm  $i$  is therefore given as:

$$int_{ij} = \frac{\Phi(v_{ij}^C \gamma + \rho \sigma_\epsilon)}{\Phi(v_{ij} \gamma + \rho \sigma_\epsilon)} \left[ e^{(x_{ij}^C - x_{ij}) \beta} - 1 \right], \quad (15)$$

while contribution of the extensive margin reads:

$$ext_{ij} = \left( \frac{\Phi(v_{ij}^C \gamma + \rho \sigma_\epsilon)}{\Phi(v_{ij} \gamma + \rho \sigma_\epsilon)} - 1 \right). \quad (16)$$

Adding these two components yields the corresponding overall change:

$$tot_{ij} = int_{ij} + ext_{ij}. \quad (17)$$

In order to obtain the aggregate percentage change for a group of firms of size  $N$ , we use the following weighting scheme:

$$\frac{\sum_{i=1}^N E[x_{ij}^C] - E[x_{ij}]}{\sum_{i=1}^N E[x_{ij}]} = \sum_{i=1}^N tot_i \frac{E[e^{x_{ij}}]}{\sum_{k=1}^N E[e^{x_{kj}}]} \quad (18)$$

and similarly for the extensive an intensive margin. In our empirical exercise, these weights will be based on the predictions of the baseline model. The counterfactual experiments first focus on the overall response in trade flows comparing the predictions from the baseline and

counterfactual scenario using (17) and (18). In a second step, we decompose the overall percentage change in exports into its contribution at the extensive (16) and intensive margin (15) applying the same aggregation as in (18). Thereby, we first consider continuing exporters (intensive margin) holding the probability of exporting constant, and second, we calculate changes in the probability of exporting at given conditional expectations of positive exports (extensive margin).

## 3 Data and Estimation Results

### 3.1 Data Description

The empirical analysis makes use of the Austrian Trade in Services Survey of non-financial corporations, which is conducted by Statistics Austria on behalf of the Austrian Nationalbank (OeNB) since 2006. The survey is mandatory and based on a stratified sample with the following threshold levels: export values above 50,000 € or 200,000 € depending on the industry affiliation of the firm, covering at least 90 percent of all service exports in every industry.<sup>4</sup> The service exporting firms may belong to either the service or the manufacturing sector. In total our sample covers 5,554 service traders and excludes financial and insurance companies as well as the tourism sector. Moreover, the sample includes only firms that exported services during the period 2006 to 2009 and that reported exports of services for at least one destination country and one type of service. Additional information on the industry affiliation of the company, employment and sales revenues is drawn from matched Structural Business Survey data from Statistics Austria. We aggregated this information to a cross-section by averaging over these years so that the data vary by firm, type of service and destination country.<sup>5</sup>

Furthermore, the matched OeNB's company database provides us with information on outward FDI (yes or no) as well as foreign ownership of the firms (yes or no). The country dimension of service exports is restricted to 37 individual destination/source countries<sup>6</sup> and we merged diverse country information from different sources, including CEPII sources<sup>7</sup> for variables on geographical, cultural and historical ties. This set of explanatory variables includes information on bilateral distance between the trading partners, contiguity, common language, past colonial links and whether the destination country is landlocked. The size of the destination market is captured by real GDP (measured in billions of constant 2000 US Dollars) which in addition to real GDP per capita is drawn from the World Bank's World Development Indicators (WDI) database. In addition, we make use of the starting a business indicators provided by the World Bank. These indicators collect information on the number of days and procedures as well as the costs to start a business in the respective host country. We use the information on the number of days as a proxy for the fixed costs exporting firms face when they decide to start exporting to a particular host country. For an overview of the data sources see Table A2 in the Appendix.

Summary statistics for both the dependent variable as well as the set of explanatory variables are reported in Table 1. Interestingly, in our data set the percentage of positive service export

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<sup>4</sup>The survey data used in this paper do not include imputed values for missing data or estimates for trade values below the reporting thresholds.

<sup>5</sup>As the focus of this paper is on the application of the new decomposition method, we refrain from applying a sample selection panel model which would complicate the empirical setting and estimation and is thus beyond the scope of the current contribution.

<sup>6</sup>A list of destination countries is reported in Table A1 in the Appendix.

<sup>7</sup><http://www.cepii.fr/CEPII/en/welcome.asp>



flows across all 37 individual destination countries is higher in the sub-sample of service firms (23 percent) than for manufacturing firms (17 percent). On average, service sector firms are active in 8 export destinations, while manufacturing service exporters serve an average of 6 destinations. However, the observed service export flows are higher for manufacturing firms on average.

Table 1: Descriptive statistics

Variables	Service Sector Total Trade				Manufacturing Sector Total Trade			
	Obs	Mean	Min	Max	Obs	Mean	Min	Max
Exports	159470	512.27	0	1880818	46028	550.14	0	2553461
Imports	159470	353.63	0	1.17E+06	46028	495.43	0	2.58E+06
Foreign control	159470	0.36	0	1	46028	0.36	0	1
Outward FDI	159470	0.07	0	1	46028	0.20	0	1
Sales	159470	49242.14	1.26	1.35E+07	46028	135882.70	25.11	1.02E+07
Employees	154882	105.63	1	25159.25	45325	303.81	1	19237.25
real GDP	159470	775.16	2.90	11482.97	46028	775.16	2.90	11482.97
real GDP p.c.	159470	19316.72	1078.12	81854.59	46028	19316.72	1078.12	81854.59
real GDP 2017	159470	897.54	3.41	13999.72	46028	897.54	3.41	13999.72
Distance	159470	2507.45	59.62	18322.31	46028	2507.45	59.62	18322.31
Contiguity	159470	0.22	0	1	46028	0.22	0	1
Colony	159470	0.08	0	1	46028	0.08	0	1
Com. language	159470	0.14	0	1	46028	0.14	0	1
Landlocked	159470	0.16	0	1	46028	0.16	0	1
Time zone diff.	159470	1.46	0	11	46028	1.46	0	11
Start Business	150850	21.17	2	141.5	43540	21.17	2	141.5
Market coverage	159470	8.35	0	37	46028	6.37	0	37

  

Variables	Service Sector				Manufacturing Sector			
	Zero Export flows		Positive Exports: 23%		Zero Export flows		Positive Exports: 17%	
	Obs	Mean	Obs	Mean	Obs	Mean	Obs	Mean
Exports	123463	0	36007	2268.77	38100	0	7928	3193.97
Imports	123463	51.02	36007	1391.24	38100	121.94	7928	2290.35
Foreign control	123463	0.37	36007	0.36	38100	0.34	7928	0.41
Outward FDI	123463	0.07	36007	0.09	38100	0.17	7928	0.34
Sales	123463	37688.80	36007	88856.97	38100	113506.50	7928	243417.00
Employees	119408	84.44	35474	176.96	37457	258.93	7868	517.47
real GDP	123463	735.30	36007	911.80	38100	730.49	7928	989.79
real GDP p.c.	123463	19148.08	36007	19894.98	38100	19273.23	7928	19525.73
real GDP 2017	123463	884.74	46235	1061.40	38100	877.41	7928	1133.25
Distance	123463	2813.04	36007	1459.62	38100	2701.77	7928	1573.60
Contiguity	123463	0.17	36007	0.38	38100	0.18	7928	0.40
Colony	123463	0.07	36007	0.11	38100	0.07	7928	0.11
Com. language	123463	0.11	36007	0.21	38100	0.12	7928	0.21
Landlocked	123463	0.14	36007	0.23	38100	0.15	7928	0.22
Time zone diff.	123463	1.66	36007	0.77	38100	1.59	7928	0.83
Start Business	115755	21.79	35095	19.13	35730	21.47	7810	19.82

*Notes:* The upper panel refers to total trade flows, the lower panel distinguishes between zero trade flows and positive trade flows. In both panels, columns 2 to 5 refer to service sector firms, columns 6 to 9 to manufacturing sector firms. Source: OeNB, Statistics Austria, WIFO calculations. - For an overview of the data sources see Table A2 in the Appendix.

Service exporting manufacturing firms are also characterized by higher sales and more employees and are more often foreign direct investors as compared to service firms. In general, destination markets are on average 2,507 kilometers away from Austria and 8 out of 37 desti-

nation markets share a common border with Austria. Regarding time zone differences that are seen to be important for service transactions, the average time zone difference amounts to 1.5 hours. However, also distant destination countries with differences up to 11 hours are represented in the data set. While 6 out of the 37 destination countries are landlocked, 5 countries share a common language and 3 countries share past colonial links with Austria

Comparing the characteristics of firms, which serve foreign markets by service exports, the importance of firm size and productivity prevails in both sub-samples of service and manufacturing sector firms. On average, firms serving a specific destination market have more employees and are more productive in terms of sales per employee than service exporters not serving this particular market. They are also more highly engaged in outward FDI. Additionally, also all of the trade friction variables (except landlocked) indicate higher trade barriers for firms less engaged in service exports. In particular, more than 20 percent of firms with positive service trade flows export to destination markets that do share a common language with Austria. Additionally, these destination markets are less distant in terms of geographical distance and time zone differences. Moreover, almost 40 percent of the positive trade flows take place between neighbouring countries of Austria.

To sum up, the descriptive evidence highlights the primacy of productivity and size differences and the role of destination market characteristics and suggests a self-selection of more productive firms into particular export destination markets. In the next section we provide deeper insights into the determinants of service exports.

### 3.2 Econometric Analysis

Table 2 reports the estimation results of the Heckman sample selection model based on the specification discussed in Section 2.1, thereby distinguishing between service exporters in services sectors (NACE divisions from 45 upwards) and manufacturing sectors (NACE divisions 01-43). The Heckman sample selection model is estimated by maximum likelihood and includes industry dummies. Accordingly, the table refers to the probability of trading (selection equation) and the value of exports traded (outcome equation). In order to avoid relying on the normality assumption for identification only, we need to select valid exclusion restrictions for the outcome equation. The theoretical model displayed in Section 2.1 suggests that trade frictions that affect the fixed trade cost of exporting but not the variable trade costs fulfill the exclusion restriction. In line with Helpman et al. (2008) we make use of the country-level data on regulation costs of firm-entry provided by the World Bank. These "starting a business" indicators measure the regulation costs by the number of days, the number of legal procedures as well as the costs (as percentage of GDP per capita) firms face when they legally start operating a business in the particular host country. Although exporting may not need a business operation in the respective host country, we surmise that these costs are a good proxy variable for the costs exporting firms face. Additionally, we also include the foreign control indicator variable as an exclusion variable as firms may have better access to foreign markets if they are part of a multinational network of firms. On the other hand, these affiliates may concentrate on local markets. As the results in column 2 and 4 of Table 2 confirm, the additional cost measures have substantial explanatory power in the Probit equation. The number of days to start a business is economically and statistically significant in explaining the selection into export markets. Also, the foreign control dummy variable as a measure of fixed costs significantly affects the formation of service trading relationships, although the impact differs between firms in the service and manufacturing sec-

tor. The negative correlation of foreign control and the formation of new export relations in the service sector seem plausible, as multinational firms use the affiliate in the service sector firstly to provide services to the domestic market rather than using the affiliate as an export channel for services.

Table 2: Heckman estimates

Variable	Service Sector		Manufacturing Sector	
	Selection	Outcome	Selection	Outcome
Ln Size	0.185*** (0.002)	0.600*** (0.014)	0.207*** (0.005)	0.596*** (0.048)
Ln Productivity	0.147*** (0.003)	0.625*** (0.014)	0.086*** (0.010)	0.687*** (0.047)
Ln Distance	-0.245*** (0.009)	-0.561*** (0.039)	-0.202*** (0.018)	-0.305*** (0.085)
Time zone diff.	-0.040*** (0.003)	-0.026* (0.014)	-0.033*** (0.007)	-0.048* (0.028)
Ln GDP	0.193*** (0.003)	0.646*** (0.018)	0.207*** (0.006)	0.627*** (0.053)
Ln GDP pc.	-0.072*** (0.006)	-0.347*** (0.023)	-0.085*** (0.011)	-0.441*** (0.049)
Contiguity	0.381*** (0.014)	0.970*** (0.054)	0.432*** (0.027)	0.928*** (0.132)
Colony	0.141*** (0.016)	0.329*** (0.056)	0.133*** (0.030)	0.235** (0.118)
Com. language	0.431*** (0.014)	1.435*** (0.053)	0.347*** (0.027)	1.082*** (0.116)
Landlocked	-0.161*** (0.016)	-0.475*** (0.055)	-0.183*** (0.031)	-0.268** (0.116)
Foreign control	-0.025*** (0.009)		0.059*** (0.017)	
Ln Start Business	-0.084*** (0.006)		-0.043*** (0.012)	
Constant	-0.878*** (0.076)	-0.548* (0.306)	-1.159*** (0.165)	-1.615** (0.821)
Mills ratio		0.803*** (0.087)		0.510* (0.279)
Industry dummies ( $\chi^2$ )	5394.783***		307.579***	
Observations		146510		42875
Log-Likelihood		-150289.5		-35997.83

*Notes:* Dependent variables are (i) service export participation (selection equation); (ii) non-zero export flows (output equation). Standard errors are reported in parentheses. \*, \*\* and \*\*\* indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level. Source: OeNB, Statistics Austria, WIFO calculations.

The significant coefficients in the selection equation as well as the significant mills ratio highlight that the selection of firms into exporting is systematic and needs to be considered in the econometric specification to consistently estimate the export flows. Regarding the trade friction variables in Table 2 all estimated coefficients exhibit the expected sign and are significant in explaining the probability of exporting services as well as the magnitude of export flows. Both firm characteristics - size (in terms of the number of employees) and productivity (defined as sales per employee) - have a significant impact on the selection into specific export destinations and the volume of flows. Distinguishing between the service and the manufacturing sector highlights

that the productivity level seems to be more important for firms in the service sector exporting genuine services. The estimation results also indicate significant effects of trade frictions both for the extensive and intensive margin of service trade as indicated by the significant impact of log distance, the timezone difference, contiguity, common language and landlockedness of the export destination.

In order to interpret the coefficients also in quantitative terms, we compute marginal effects for the most important explanatory variables following Greene (2008) and report them in Table 3. The calculated marginal effects give the full effect of a change in one regressor (that explains the selection as well as the volume of trade) on service exports and can be interpreted as elasticities. Comparing the marginal effects for a change in distance by 1 percent across firms we can conclude that the impact of distance is almost twice as large for service firms than manufacturing firms (service export flows are reduced by 0.410 percent for service firms compared to 0.223 percent for manufacturing firms all other factors equal). Also, the marginal impact for an increase in size suggests that firm size plays an even higher role for service firms than manufacturing firms for service exports. In contrast, the marginal effects from changes in market size (proxied by real GDP) on service exports are relatively balanced across service and manufacturing firms. An 1 percent increase in market size raises service exports by 0.5 percent in service and manufacturing sectors all other factors held constant. The corresponding marginal effect for an increase in productivity (all other factors, especially employment, held constant) is slightly higher for manufacturing (0.652) than service sector firms (0.535).

Table 3: Marginal effects on export flows

	Mean	Std. dev.	Minimum	Maximum
Service Sector				
Ln Distance	-0.410	0.019	-0.540	-0.372
Ln Size	0.486	0.014	0.457	0.584
Ln Productivity	0.535	0.011	0.512	0.613
Ln GDP	0.527	0.015	0.497	0.629
Manufacturing Sector				
Ln Distance	-0.223	0.008	-0.278	-0.208
Ln Size	0.512	0.008	0.496	0.568
Ln Productivity	0.652	0.003	0.645	0.675
Ln GDP	0.543	0.008	0.528	0.600

Source: OeNB, Statistics Austria, WIFO calculations.

The empirical results point at the relevance of trade frictions, firm characteristics and destination market conditions for Austrian service exports. To assess the impact of substantial changes in trade related costs, firm productivity and market conditions, we perform a counterfactual analysis in the Section 4. This enables us to make predictions on the response of service exports of specific firm groups to changes in one of the above mentioned dimensions. This allows us to examine how different scenarios influence the observed pattern of trade and the composition of service exports between extensive and intensive margins.

### 3.3 Robustness Analysis

We assess the robustness of the estimation results along several dimensions (see Table A3 in the Appendix). First, we re-estimate the first stage Probit model using the semiparametric SNP estimator discussed by De Luca (2008), which allows for deviations from the normal in terms of skewness and kurtosis. In general, the estimated parameters of the SNP-models all have the same sign and almost all of them exhibit similar size as that of the corresponding Probit models, although the SNP-model indicates some deviations from the normal distribution, especially for the sample of the service firms. However, plotting estimates of the densities of the disturbances against the normal shows only slight deviations, despite the rejection of a Likelihood ratio test of the Probit model in favour of the SNP-model. Overall, we conclude that the normality assumption provides a reasonable approximation of the data generating process and that the pursued maximum likelihood approach seems to be justified.

Second, we re-estimated the outcome equation model using alternative two-step (parametric and semiparametric series) estimators (not reported in Table A3, but are available upon request). However, it turns out that the available alternative estimators bear their own problems, again confirming the use of the maximum likelihood estimator.<sup>8</sup> Overall, however the predictions of all estimated ML and two-step outcome models turned out nearly identical and highly correlated (correlation >0.95). Given that the counterfactual analysis relies on these predictions, we are confident to obtain reliable comparative static results.

Third, we introduced destination country dummies and re-estimated all specifications. This implies that country specific variables (like log GDP of the destinations) cannot be included. The estimation results for the remaining parameters of the firm specific variables turn out very similar to the baseline model.

To sum up, the robustness analysis suggests that maximum likelihood estimates are preferable and reasonably robust. The normality assumption is possibly somewhat restrictive. However, the deviations in terms of the third and fourth moment seem to be moderate. This justifies to proceed with the normality assumption as a reasonable approximation of the data generating process and the maximum likelihood estimates reported in Table 2. As mentioned above, the main advantage of this approach lies in the possibility to derive counterfactual predictions based on the estimated probabilities of exporter status and conditional expectations given positive export flows as demonstrated in Section 2.1. With a semiparametric estimation procedure the prediction of counterfactuals along these lines is not possible.

## 4 Counterfactual Analysis

### 4.1 Design of Experiments

The subsequent counterfactual analysis is based on the estimation results from the Heckman sample selection model reported in Table 2. The empirical results point at the relevance of

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<sup>8</sup>The estimation of the standard two-step Heckman sample selection model yields differences in some of the estimated parameters (i.e., that of log firm size) despite significant parameter estimates referring to the exclusion restriction (see Table 2). This indicates that the Heckman two-step estimator is prone to collinearity of the estimated mills ratio and the explanatory variables in the outcome equation. The same problems arise even more severely if one uses the two-step series estimators proposed by Newey (2009). The reason is that these series estimators include a linear term in the approximation of the mills ratio that is highly correlated with the explanatory variables of the outcome model.

firm heterogeneity, trade barriers and characteristics of the destination market (market size). In order to assess the importance of these factors for Austrian service exports we consider a comprehensive set of four counterfactual scenarios for all countries and country groups in our sample. In particular, we can use the predictions from the model to examine how a change in one of these variables affects the pattern of trade along both the extensive and intensive margin as introduced in Section 2.1. This decomposition is new and extends the existing evidence on trade margins.

Regarding the firm’s decision to serve foreign markets and the respective productivity threshold we assume important differences across countries, especially with respect to contributions from the extensive and intensive margin. Markets that can be served with service exports more easily (less costly) will experience an increase in services trade mainly due to an increase in volume of existing trade relationships (intensive margin). In contrast, new markets in which uncertainty or other cost factors still hamper bilateral trade flows will experience an increase in trade attributable to the formation of new trade relationships besides also increasing trade flows from existing trading partners.

In particular, the four experiments designed are the following: (i) a reduction in bilateral distance by 10 percent which mirrors a proportional reduction in distance related costs for all countries, (ii) an increase in productivity for all firms in the lowest quantile of the productivity distribution by 5 percent, (iii) an increase in productivity for all firms in the highest quantile of the productivity distribution by 5 percent and (iv) a change in market size based on projections of the IMF World Economic Outlook for the GDP in 2017 which predict an increase (decrease) in market size in 34 (3, namely Ireland, Portugal and Greece) countries. In particular, these projections suggest an average increase in real GDP of 20.3% over the period 2012 – 2017.

## 4.2 Counterfactual Results

Based on the different counterfactual experiments considered in the analysis we can identify the heterogeneous trade responses due to changes in trade related costs, firm characteristics and market size. To highlight how these elasticities vary along specific country dimensions we report the results according to the popularity of the respective export destination by considering the export share and border effects. Hence, we group destination markets into the following 5 groups: (1) neighbouring countries including the Czech Republic, Germany, Hungary, Italy, Liechtenstein, Slovakia, Slovenia and Switzerland, (2) traditional export markets in the EU comprising Belgium, Croatia, Finland, France, Great Britain, the Netherlands, Poland, Romania, Spain and Sweden, (3) traditional export markets in the Extra-EU including Japan, Russia, Turkey, Ukraine and the USA, (4) new export markets in the EU which are defined by Bulgaria, Cyprus, Denmark, Estonia, Greece, Ireland, Latvia, Lithuania, Luxembourg, Malta and Portugal as well as (5) new export markets Extra-EU which include Australia, Brazil and New Zealand.

The first column in Table 4 refers to the overall response in service exports associated with a reduction in bilateral distance by 10 percent, which mirrors a proportional reduction in trade related costs. Considering that this change induces the highest impact for distant markets the results highlight a more pronounced increase in export flows the more ”distant” (in many respects) export destinations are. The gains in exports vary between 6.51 percent for countries sharing a common border and 8.31 percent for new export markets in the Extra-EU area in the upper panel for service firms. The overall increase in export flows for manufacturing firms (lower

panel) is significantly smaller and varies between 4.10 percent and 5.84 percent. However, the pattern of trade responses point to the same direction.

Table 4: Reduction of bilateral distance by 10 percent: Change in overall exports and composition between intensive and extensive margin of trade by export destination groups - service and manufacturing sector

	Change in service exports	Contribution intensive margin	Contribution extensive margin
	as percent	as percent of overall change	
Service Sector			
Neighbouring countries	6.51	93.9	6.1
Traditional export markets in the EU	7.17	85.8	14.2
Traditional export markets Extra-EU	7.49	82.4	17.6
New export markets in the EU	7.78	79.5	20.5
New export markets Extra-EU	8.31	74.8	25.2
Total	6.73	91.0	9.0
Manufacturing Sector			
Neighbouring countries	4.10	80.2	19.8
Traditional export markets in the EU	4.99	66.5	33.5
Traditional export markets Extra-EU	5.20	64.0	36.0
New export markets in the EU	5.68	58.8	41.2
New export markets Extra-EU	5.84	57.2	42.8
Total	4.42	74.7	25.3

*Notes:* Neighbouring countries: Czech Republic, Germany, Hungary, Italy, Liechtenstein, Slovakia, Slovenia and Switzerland; Traditional export markets in the EU: Belgium, Croatia, Finland, France, Great Britain, Netherlands, Poland, Romania, Spain and Sweden; Traditional export markets Extra-EU: Japan, Russia, Turkey, Ukraine and USA; New export markets in the EU: Bulgaria, Cyprus, Denmark, Estonia, Greece, Ireland, Latvia, Lithuania, Luxembourg, Malta and Portugal; New export markets Extra-EU: Australia, Brazil and New Zealand. - Source: OeNB, Statistics Austria, WIFO calculations.

We then further decompose the overall change in exports into contributions from the intensive and extensive margin following the procedure given in Section 2.1. Table 4 shows that with falling trade costs the increase in service exports is predominately driven by changes of the intensive margin rather than the extensive margin. However, elasticities vary by country groups and imply an unambiguous shift in the pattern of trade. While the intensive margin contributes most in neighbouring countries, the adjustment of the extensive margin gains increased importance the more distant and the less relevant export markets are. This holds in both sub-samples of service exporters. The contribution from the extensive margin is more pronounced for manufacturing firms where more than one third of the overall change in service exports in traditional export markets, and more than 40 percent in new export markets can be attributed to the formation of new trade relationships. Considering the theoretical model, lower trade related costs induce firms to overcome the threshold level of serving a foreign market more easily, and the impact of fallen distance costs is more pronounced for export destinations far away which confirms the results predicted in this scenario.

Measures to increase firm productivity play a major role in industrial promotion schemes designed to foster internationalization of specific firm classes. Productivity is also the key variable in the new new trade theory literature emphasizing the heterogeneity of firms. To assess the importance of promoting productivity we consider two treatments: first promoting less pro-

Table 5: Promotion of less productive firms: Change in overall exports and composition between intensive and extensive margin of trade by export destination groups - service and manufacturing sector

	Change in service exports	Contribution intensive margin	Contribution extensive margin
	as percent	as percent of overall change	
Service Sector			
Neighbouring countries	0.32	95.7	4.3
Traditional export markets in the EU	0.32	90.5	9.5
Traditional export markets Extra-EU	0.33	88.4	11.6
New export markets in the EU	0.33	86.6	13.4
New export markets Extra-EU	0.34	83.7	16.3
Total	0.32	94.0	6.0
Manufacturing Sector			
Neighbouring countries	0.39	94.3	5.7
Traditional export markets in the EU	0.37	89.6	10.4
Traditional export markets Extra-EU	0.36	88.6	11.4
New export markets in the EU	0.35	86.5	13.5
New export markets Extra-EU	0.35	85.8	14.2
Total	0.38	92.8	7.2

*Notes:* Neighbouring countries: Czech Republic, Germany, Hungary, Italy, Liechtenstein, Slovakia, Slovenia and Switzerland; Traditional export markets in the EU: Belgium, Croatia, Finland, France, Great Britain, Netherlands, Poland, Romania, Spain and Sweden; Traditional export markets Extra-EU: Japan, Russia, Turkey, Ukraine and USA; New export markets in the EU: Bulgaria, Cyprus, Denmark, Estonia, Greece, Ireland, Latvia, Lithuania, Luxembourg, Malta and Portugal; New export markets Extra-EU: Australia, Brazil and New Zealand. - Source: OeNB, Statistics Austria, WIFO calculations.



ductive firms and second fostering high productive firms. The service export responses in both sub-samples (services and manufacturing firms) are quite low in the group of least productive firms and are presented in Table 5. While the promotion of less productive firms yields an overall increase in exports of 0.32 percent (0.38 percent) for services firms (manufacturing firms), trade responses from stimulating high productive firms are about 4 times larger (Table 6). However, in both scenarios the highest contribution along the extensive margin can be seen in the new export markets which is line with the theory. These are markets which are costly to serve, so that this is only profitable for the most productive firms and as such increasing firm productivity can enhance the formation of new trade relationships. Nevertheless, in both scenarios the major contribution is assigned to adjustments along the intensive margin which explains between 84 percent and 97 percent of total trade responses. These results suggest that productivity increases are very important for trade deepening, but can additionally foster new export relations in distant markets. In particular, given uncertainty and incomplete information, exporters are likely to start with small transactions in new markets (e.g. Segura-Cayuella and Vilarrubia, 2008; Rauch and Watson, 2003). The extensive margin will therefore involve small quantities, especially in more distant and difficult markets.

Table 6: Promotion of high productive firms: Change in overall exports and composition between intensive and extensive margin of trade by export destination groups - service and manufacturing sector

	Change in service exports	Contribution intensive margin	Contribution extensive margin
	as percent	as percent of overall change	
Service Sector			
Neighbouring countries	1.27	96.6	3.4
Traditional export markets in the EU	1.35	91.6	8.4
Traditional export markets Extra-EU	1.38	89.4	10.6
New export markets in the EU	1.41	87.4	12.6
New export markets Extra-EU	1.47	84.0	16.0
Total	1.30	94.9	5.1
Manufacturing Sector			
Neighbouring countries	1.41	95.8	4.2
Traditional export markets in the EU	1.52	91.6	8.4
Traditional export markets Extra-EU	1.55	90.7	9.3
New export markets in the EU	1.61	88.5	11.5
New export markets Extra-EU	1.63	87.9	12.1
Total	1.45	94.2	5.8

*Notes:* Neighbouring countries: Czech Republic, Germany, Hungary, Italy, Liechtenstein, Slovakia, Slovenia and Switzerland; Traditional export markets in the EU: Belgium, Croatia, Finland, France, Great Britain, Netherlands, Poland, Romania, Spain and Sweden; Traditional export markets Extra-EU: Japan, Russia, Turkey, Ukraine and USA; New export markets in the EU: Bulgaria, Cyprus, Denmark, Estonia, Greece, Ireland, Latvia, Lithuania, Luxembourg, Malta and Portugal; New export markets Extra-EU: Australia, Brazil and New Zealand. - Source: OeNB, Statistics Austria, WIFO calculations.

To assess the relevance of growing destination markets we make use of the GDP projections of the year 2017 from the IMF World Economic Outlook which predict increases in market size for almost all countries in our sample (only Ireland, Greece and Portugal experience a decrease) of 20.3% on average. As depicted in Table 7 the overall increase in service exports

is extremely pronounced in Extra-EU export destinations, where many countries experience the highest increase in market size. Specifically, five countries out of these two country groups (USA, Japan, Brazil, Turkey and Australia) are ranked top regarding their future market size expansions which induces potential trade gains for Austrian service exporters. Overall the counterfactual analysis predicts an increase in service exports in Extra-EU markets between 19.07 percent and 28.49 percent for service firms (upper panel) and 20.60 percent to 31.83 percent for manufacturing firms (lower panel).

Regarding the composition along the intensive and extensive margin, the results allow for similar conclusions across sectors, although export growth along the extensive margin is in general higher for manufacturing sector firms. In both sub-samples the major impact comes through the expansion of existing trade relationships. For service firms, the highest contribution to export growth from newly built trade relations (17.1 percent) is predicted in new export destinations in the Extra-EU area, while Austrian firms expand existing relationships mostly in neighbouring countries. In manufacturing sectors export growth along the extensive margin is extremely dynamic in new export markets (both in the EU and outside the EU). In particular, 26.5 percent (24.5 percent) of overall export changes in manufacturing sectors can be assigned to firm entries in less popular export markets in the EU (Extra-EU).

Table 7: Market size growth: Change in overall exports and composition between intensive and extensive margin of trade by export destination groups - service and manufacturing sector

	Change in service exports	Contribution intensive margin	Contribution extensive margin
	as percent	as percent of overall change	
Neighbouring countries	5.84	96.7	3.3
Traditional export markets in the EU	7.60	89.9	10.1
Traditional export markets Extra-EU	19.07	88.5	11.5
New export markets in the EU	4.53	84.2	15.8
New export markets Extra-EU	28.49	82.9	17.1
Total	7.14	93.5	6.5
Manufacturing Sector			
Neighbouring countries	5.84	91.0	9.0
Traditional export markets in the EU	8.42	80.4	19.6
Traditional export markets Extra-EU	20.60	80.0	20.0
New export markets in the EU	4.60	73.5	26.5
New export markets Extra-EU	31.83	75.5	24.5
Total	7.98	85.4	14.6

*Notes:* Neighbouring countries: Czech Republic, Germany, Hungary, Italy, Liechtenstein, Slovakia, Slovenia and Switzerland; Traditional export markets in the EU: Belgium, Croatia, Finland, France, Great Britain, Netherlands, Poland, Romania, Spain and Sweden; Traditional export markets Extra-EU: Japan, Russia, Turkey, Ukraine and USA; New export markets in the EU: Bulgaria, Cyprus, Denmark, Estonia, Greece, Ireland, Latvia, Lithuania, Luxembourg, Malta and Portugal; New export markets Extra-EU: Australia, Brazil and New Zealand. - Source: OeNB, Statistics Austria, WIFO calculations.

## 5 Conclusions

As more productive firms are more likely to select themselves into exporter status, the econometric analysis of firm-level export activities has to account for sample selection. Estimating a Heckman sample selection gravity model for a large sample of Austrian service exporting firms with potential trade relations to 37 destination countries reveals an important role of (physical) trade barriers in restricting services trade. Furthermore, destination market size is an important determinant of service exports of Austrian companies. In line with previous findings the estimation results confirm significant self-selection of firms into service exporting. Hence, the large and productive firms both exhibit a higher probability of exporting to a specific destination and a higher volume of exports if they indeed serve these markets.

Moreover, this paper introduces a new approach to decompose changes in exports into one component referring to the extensive margin and one referring to the intensive margin. The decomposition allows to quantify counterfactual scenarios for aggregates of firm groups that might be relevant for economic policy. The scenarios considered are related to changes in trade costs, productivity and destination market size.

Distinguishing between services exports of manufacturing and service firms, all counterfactual scenarios reveal larger overall changes in exports (except of a reduction in distance related costs) and more pronounced contributions at the extensive margin of service trade for manufacturing firms as compared the services firms. In particular, the results suggest that export market growth and a reduction in distance related costs produce the relatively strongest impact on the entry into new destination markets. However, their impact on the intensive margin dominates and contributes with more than 70 percent to the overall change in export flows. IMF projections of the expected increase in market size of 20.3% on average between 2012 and 2017 suggest a pronounced increase in Austrian service exports to Extra-EU destinations. Specifically, five countries in the group of traditional and new Extra-EU markets (USA, Japan, Brazil, Turkey and Australia) are ranked top regarding their future market size expansions which may induce substantial trade gains. Policies aiming at promoting firm productivity are found to bear the potential to broaden the exporter base and play an important role for trade deepening in services. In this respect, the largest effects on the intensive margin have been found for the group of firms with high productivity levels.

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## 7 Appendix

Table A1: Country list

ISO code	Name	ISO code	Name
AU	Australia	JP	Japan
BE	Belgium	LI	Liechtenstein
BG	Bulgaria	LT	Lithuania
BR	Brazil	LU	Luxembourg
CH	Switzerland	LV	Latvia
CY	Cyprus	MT	Malta
CZ	Czech Republic	NL	Netherlands
DE	Germany	NZ	New Zealand
DK	Denmark	PL	Poland
EE	Estonia	PT	Portugal
ES	Spain	RO	Romania
FI	Finland	RU	Russia
FR	France	SE	Sweden
GB	Great Britain	SI	Slovenia
GR	Greece	SK	Slovakia
HR	Croatia	TR	Turkey
HU	Hungary	UA	Ukraine
IE	Ireland	US	USA
IT	Italy		

Table A2: Description and sources of additional variables

Variable	Definition	Source
Distance	km	CEPII: Mayer and Zignago (2011)
Time zone difference	Hours	WIFO calculations
Common border	0=No, 1=Yes	CEPII: Mayer and Zignago (2011)
Colony	0=No, 1=Yes	CEPII: Mayer and Zignago (2011)
Common language	0=No, 1=Yes	CEPII: Mayer and Zignago (2011)
Landlocked	0=No, 1=Yes	CEPII: Mayer and Zignago (2011)
real GDP	bn constant 2000 \$	The World Bank (2012)
real GDP per capita	bn constant 2000 \$	The World Bank (2012)
real GDP 2017	bn constant 2000 \$	IMF (2012), WIFO calculations
Start Business	Days	The World Bank (2012)
Productivity	Sales/Employees	OeNB
Size	Employees	OeNB
Foreign control	0=No, 1=Yes	OeNB
Outward FDI	0=No, 1=Yes	OeNB
Exports	in 1000 \$	OeNB, WIFO calculations
Sales	in 1000 \$	OeNB, WIFO calculations

Table A3: Robustness analysis

	SNP Binary Choice Model		FE Estimation			
	Service	Manufacturing	Service		Manufacturing	
	Probit		Selection	Outcome	Selection	Outcome
Ln Size	0.222*** (0.013)	0.340*** (0.034)	0.188*** (0.002)	0.614*** (0.014)	0.209*** (0.005)	0.594*** (0.047)
Ln Productivity	0.187*** (0.011)	0.140*** (0.020)	0.150*** (0.003)	0.636*** (0.014)	0.087*** (0.011)	0.685*** (0.046)
Ln Distance	-0.287*** (0.019)	-0.308*** (0.041)				
Time zone diff.	-0.069*** (0.006)	-0.068*** (0.013)				
Ln GDP	0.247*** (0.015)	0.336*** (0.034)				
Ln GDP pc.	-0.085*** (0.008)	-0.135*** (0.022)				
Contiguity	0.362*** (0.027)	0.717*** (0.091)				
Colony	0.202*** (0.021)	0.199*** (0.053)				
Com. Language	0.463*** (0.029)	0.533*** (0.066)				
Landlocked	-0.122*** (0.019)	-0.294*** (0.060)				
Foreign control	-0.021* (0.011)	0.088*** (0.029)		-0.025*** (0.009)		0.060*** (0.017)
Ln Start Business	-0.085*** (0.009)	-0.059*** (0.021)				
Constant	-0.832 fixed	-1.151 fixed	-3.537*** (0.054)	-5.556*** (0.297)	-3.163*** (0.129)	-5.099*** (0.919)
Mills ratio				0.844*** (0.083)		0.461* (0.278)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	Yes	Yes	Yes	Yes
Observations	146510	42875				
Skewness	0.586	0.352				
Kurtosis	4.039	2.935				

Notes: Dependent variables are (i) service export participation (selection equation); (ii) non-zero export flows (output equation). Standard errors are reported in parentheses. \*, \*\* and \*\*\* indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level. Source: OeNB, Statistics Austria, WIFO calculations