Research School of International Taxation

A Structural Quantitative Analysis of Services Trade De-liberalization

Sven Blank

Peter H. Egger

Valeria Merlo

Georg Wamser

Working Paper
12/2018

Eberhard Karls Universität Tübingen

School Of Business and Economics

A Structural Quantitative Analysis of Services Trade De-liberalization*

Sven Blank† Peter H. Egger‡ Valeria Merlo§ Georg Wamser¶

December 7, 2018

Abstract

This paper suggests a quantifiable multi-sector-multi-country economic model of goods and services production and consumption. It calibrates overall (variable and fixed) costs to market-specific sales by sector and decomposes these costs into observable and unobservable components. In an empirical analysis based on census-type data on firm-sector-country sales of German services sellers as well as sector-country-by-sector-country input-output matrices for various economies and sectors, the paper provides the following insights. The overall (variable and fixed) costs on seller-to-customer-market transactions in services have quite a high distance equivalent and are reduced substantially by preferential market access for services through trade agreements. If all countries considered abandoning existing preferential market access to services, this would reduce their real consumption by up to 7.7 percent with a similar decline in real wages and real dividends (depending on the country). If one country alone abandoned its preferential services market access reciprocally with its partners, the effect would be smaller. However, it would still involve a decline of real consumption of 0.3 percent for a country as large (and as remote relative to continental Europe) as the United Kingdom. For most economies, depending on their input-output structure, de-liberalizing preferential services-market access would have adverse spillover effects on manufacturing (in terms of real wages as well as dividends).

Keywords: Services trade; De-liberalization; Structural estimation; Counterfactual analysis
JEL classification: F12; F14; F15; F17; L11; L25

---

*The views expressed in this paper are those of the authors and need not reflect those of the Deutsche Bundesbank. We thank seminar participants at the University of Innsbruck, the University of Ulm, the annual meeting of the *Verein für Socialpolitik*'s International Economics Committee in Trier, and the 19th ETSG in Florence for helpful comments. We are especially thankful for numerous suggestions by Gabriel Felbermayr, Vanessa Gunnella, Stefanie Haller, Wilhelm Kohler, and Thomas Sampson on an earlier version of the paper.

†Affiliation: Deutsche Bundesbank. Address: Deutsche Bundesbank, Wilhelm-Epstein-Str. 14, 60431 Frankfurt am Main, Germany. E-mail: sven.blank@bundesbank.de

‡Affiliation: ETH Zürich, CEPR, CESifo, Leverhulme Centre for Research on Globalisation and Economic Policy (GEP) at the University of Nottingham, and Oxford University Centre for Business Taxation (OUCBT). Address: ETH Zürich, KOF, Leonhardstr. 21, LEE G101, 8092 Zürich, Switzerland. E-mail: egger@kof.ethz.ch

§Affiliation: University of Tübingen, CESifo and NoCet. Address: University of Tübingen, Nauklerstr. 47, 72074 Tübingen, Germany. E-mail: valeria.merlo@uni-tuebingen.de

¶Affiliation: University of Tübingen, CESifo and NoCet. Address: University of Tübingen, Nauklerstr. 47, 72074 Tübingen, Germany. E-mail: georg.wamser@uni-tuebingen.de

1 Introduction

While services transactions account for the lion's share of economic activity in developed economies, and such transactions often cross national borders, many quantitative open-economy models portray countries to produce manufacturing goods only (see, e.g., Anderson and van Wincoop, 2003, Costinot et al., 2012), or services to be non-tradable (see, e.g., Eaton and Kortum, 2002). One consequence of this practice is that we know much less about key parameters governing quantitative responses of the services sector than about those of manufacturing. For example, there is a wealth of results on the so-called trade elasticity (with all its different theory-dependent interpretations) for goods (see Broda and Weinstein, 2006, Kee et al., 2008, 2009). The latter calls for price- or ad-valorem-trade-cost data at the country or country-product level, which is abundant for goods but not services. In recent open-economy models of the firm, new key parameters, e.g. those governing the efficiency distribution of firms, co-determine general equilibrium (see Melitz, 2003, or Eaton et al., 2011). Again, information on those parameters is by now relatively abundant for manufacturers but still relatively scarce for services providers. Overall, a data-informed parametrization of modern open-economy models of trade with an emphasis on services production has been infeasible until recently. The reason is that high-quality data on services-producing firms and their trade have become available only in the past few years (Breinlich and Criscuolo, 2011, and Ariu, 2016a, provide evidence for the United Kingdom and Belgium, respectively; Haller et al., 2014, as well as Damijan et al., 2015, provide evidence on services producers and their trading patterns for Finland, France, Ireland, and Slovenia).

The present paper analyzes census-type data on services producers and traders in Germany, which is one of the most important open economies in the world. We contribute to the literature by informing a quantifiable multi-sector-multi-country model of goods and services production and consumption, which allows the calibration of overall (variable and fixed) costs to market-specific sales in a sector and decomposing these costs into observable and unobservable components. The model features sector-specific markups, market-penetration and productivity-distribution parameters, as well as overall (variable and fixed) country-pair-sector-specific transaction costs. While variants of such a structural analysis have been undertaken for manufacturing firms and their trade (see, e.g., Eaton et al., 2011), we believe that the present paper is among the first ones to conduct a micro-data-guided structural quantitative analysis of services suppliers and their trade.

All of the fundamental parameters are estimated and calibrated on the basis of three datasets: one pertaining to transaction-level data of services exports of firms in Germany; one pertaining to overall sales of manufactures and services of firms in Germany; and one pertaining to input-output relationships for multiple countries and sectors (the World Input-Output Database; see

Timmer et al., 2015, 2016).

The transaction-level data suggest that the (export) sales distribution of services is not Pareto, and that matching the data requires allowing for sector-destination-country-specific shape parameters of a Pareto distribution (involving a single shape and truncation parameter) of firms' productivity levels as well as of an imperfect market penetration across firms. We find that the corresponding parametrization is able to capture the distribution of sales across sectors quite well. Moreover, the data suggest that the variance of (normalized) overall transaction costs differs substantially across the considered service-sector aggregates, being largest for Construction Services. Across all considered sectors, the role of geographical distance is relatively minor for overall transaction costs, while preferential services-market access through trade agreements reduces transaction costs substantially. Hence, the distance equivalent to preferential services-market access is large.

We proceed by using the partial effects of preferential market access on services transaction costs to study the exit from – or de-liberalization of – preferential services trade agreements by individual countries and, alternatively, all covered countries jointly. The corresponding findings suggest that abandoning preferential market access bilaterally and reciprocally for a large and remote economy (with relatively little preferential market access ex ante) such as the United States leads to a relatively small reduction of real consumption below 0.02 percent. The effect amounts to about 0.3 percent for a somewhat smaller and less remote country (that operates under relatively wider preferential market access ex ante) such as the United Kingdom. And the effect amounts to about 0.9 percent for a small, centrally located, open economy such as Belgium.

We also conduct a broader counterfactual experiment, where services trade and market-access costs are raised to an extent as if a hypothetical preexisting services trade agreement were globally abandoned in 2014. In that case, the model suggests that real consumption would drop across all countries in the range of 0.1 percent to 12.6 percent. If we increased those costs only for those countries that actually had a services trade agreement in that year, real consumption would still drop by up to 7.7 percent. Hence, the global effects on services costs induced by preferential trade agreements are important and large. The effects on real wages and dividends are quantified at a similar magnitude, and negative effects are found even for manufactures, on average, in spite of keeping the policy environment unchanged for the latter sector.

The remainder of the paper is organized as follows. The subsequent section introduces our data. Section 3 outlines the key elements of our firm-level model. Section 4 presents the estimation of the fundamental model parameters. Section 5 presents the multi-country-multi-sector general equilibrium. Section 6 outlines the effects of a partial removal of deep preferential market access in multi-country-multi-sector general equilibrium. The last section concludes with a brief summary of our findings.

2 Data

In this section we show that producers of services are heterogeneous as in Melitz (2003), do not serve all markets as in Helpman et al. (2008), but the distribution of their sales deviates from a single-parameter Pareto distribution as in Eaton et al. (2011) and Arkolakis (2010). Furthermore, we highlight that the pattern of entry into foreign markets differs across types of services traded.

Our analysis is based on a cross section of sales in services and manufactures by German firms in 28 EU countries (including Germany) and 15 other major countries plus the rest of the world for 2014. In order to construct the dataset we use census-type data at the transaction and firm level, compiled and provided by the Deutsche Bundesbank, as well as country-sector-level information from various sources, which we describe in detail in the appendix.

For our analysis we group individual services transactions into one of five broad categories: Transport Services, Construction Services, Information and Communication (ICT) Services, Other Business Services, and Other Services.[1] We also include firms in manufacturing and other (non-services-non-manufacturing) sectors. However, as the focus of the paper is on services, we do not distinguish sectors within manufacturing nor within other sectors but treat these two as one block each.[2]

Table 1: German Services Exporters in 2014

	Mean	Std.Dev.	Percentiles				
			1st	25th	50th	75th	99th
Total exports	14,183.91	285,047.90	2.00	100.00	527.00	2,677.00	165,908.00
Exports per service market	1,251.12	9,513.63	2.00	50.46	166.00	563.00	16,569.53
Number of service categories	1.34	0.68	1	1	1	1	4
Number of markets	5.70	9.80	1	1	2	6	45

Note: Statistics based on 126,314 observations (firm-service category-country triplets). Exports reported in thousand Euro.

Table 1 presents some descriptive statistics on the activity of German services exporters in 2014.[3] On average, a firm exports 1.3 service types or categories to 5.7 countries. While the

[1] We broadly follow the IMF's BPM6 Compilation Guide (2014), Chapter 12, see http://www.imf.org/external/pubs/ft/bop/2014/pdf/Guide.pdf (accessed December 2017). See the Appendix for further details.

[2] In 2014 services exports accounted for 17 percent of Germanys overall exports.

[3] We drop sector-destination-country combinations with fewer than 50 observations. For a rich description of

median firm exports only one type of service to only two destinations for a total value of 527 thousand Euro, the largest 1% firms' export volume is over 300 times larger and involves sales of four types of services to 45 destinations. Table 2 reports the volume of German service exports to the top six destinations as well as the number of firms selling to each market.[4]

Table 2: Top Six Destinations of German Services Exporters in 2014

Export Destination	Export Volume	Number of Exporters	Fraction of Exporters
United States of America	41,520.44	5,645	0.30
United Kingdom	34,575.41	5,764	0.31
Switzerland	24,551.53	6,608	0.35
France	13,821.21	5,151	0.28
Netherlands	11,671.40	5,075	0.27
China	9,178.91	2,674	0.14

Note: Exports reported in million Euro.

Figure 1 shows German firms' exports in the Other Business Services sector to the United Kingdom plotted against their respective rank in the export sales distribution on a log-log scale. If these sales were single-parameter Pareto distributed, the data would be located on a straight line. Hence, the data suggest relatively substantial deviations from the assumption that firm productivity follows this distribution.[5] The same deviations materialize in all other sector-country samples of the same data.

Figure 2 displays boxplots of a firm's export share and number of services categories sold across the top six destination markets. The right-skewness of the distribution documented in Table 1 prevails across all destinations. While the distribution of the number of broad services categories traded by a firm is identical across these markets, the degree of heterogeneity across firms in terms of market shares differs. Very large firms which account for a large share of overall German services exports to that market are more frequent in France, the Netherlands, and China than in the United States, United Kingdom, or Switzerland.

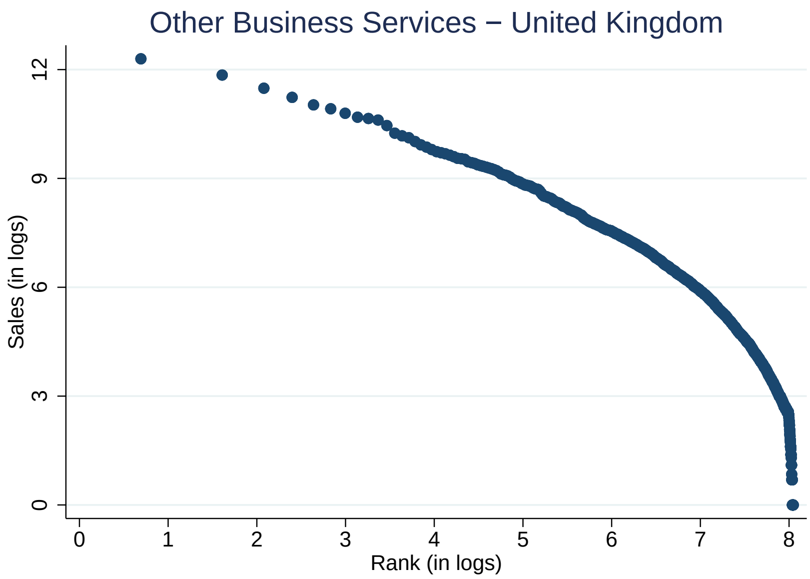
Disaggregating the data further into different services activities, we find that the number of German firms selling to a market, the number of markets served per firm, and the most popular destinations vary largely across services type. Furthermore, the shape of the distribution of services producers' export activity differs not only across destinations but also – and more starkly so – across types of services traded. Figure 3 is analogous to Figure 2, but now we

the raw dataset for the period 2001 to 2012, see Biewen and Blank (2018).

[4]Table A.1 in the appendix displays the same figures for all destinations.

[5]As is well known, in models of firms with heterogenous productivity drawn from a Pareto distribution which is governed by a single shape parameter and fixed costs of market access (as in Chaney, 2008), firms' sales are single-shape-parameter Pareto-distributed as well (though with a different shape parameter than productivity).

Figure 1: German Firms' Sales of Other Business Services to the United Kingdom



Note: Due to the confidential nature of the data, each dot corresponds to the mean of three adjacent ranked sales.

break down the data into the five service categories considered. Again, the distributions of the number of markets served and the export share per firm are skewed to the right across all types of services. While in terms of number of destinations served firm heterogeneity seems to be similar across services categories, the boxplots of a firm's export share reveal large differences in both absolute and relative terms. Firms offering construction services display the largest market shares, and firms with a market share below the median are also more frequent in that services category than in any other. Firms' market shares are more similar across the other four services categories considered, with a higher variability in ICT and transport services.

Finally, Figure 4 portrays the number of German exporters by destination and services category against exports by service type and market as a share of (i) total exports by service category (upper panel) and (ii) total exports by market (lower panel). For instance, around 2,000 German service producers export Other Services to the UK. These firms account for around 19% of all German exports in Other Services (upper panel), and for around 60% of all German exports to the UK (lower panel). The graphs reveal that the set of top six destinations and their rank vary across services types. Even though the United Kingdom, the United States, Switzerland, France and the Netherlands belong to the top six destinations in every services category (with the exception of Construction Services), the ranking of the countries is not once identical across services types. This is true both in terms of share of total exports by service or by destination and in terms of number of firms exporting to a destination.

Figure 2: Exporter Heterogeneity Across Top Six Destinations

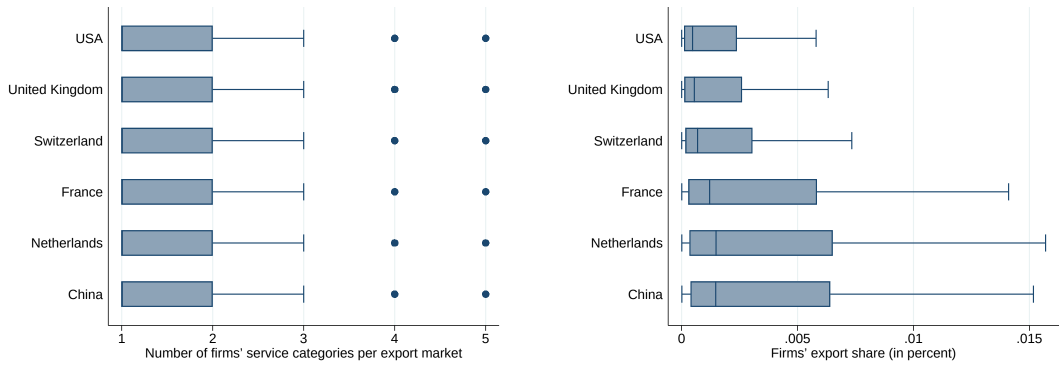
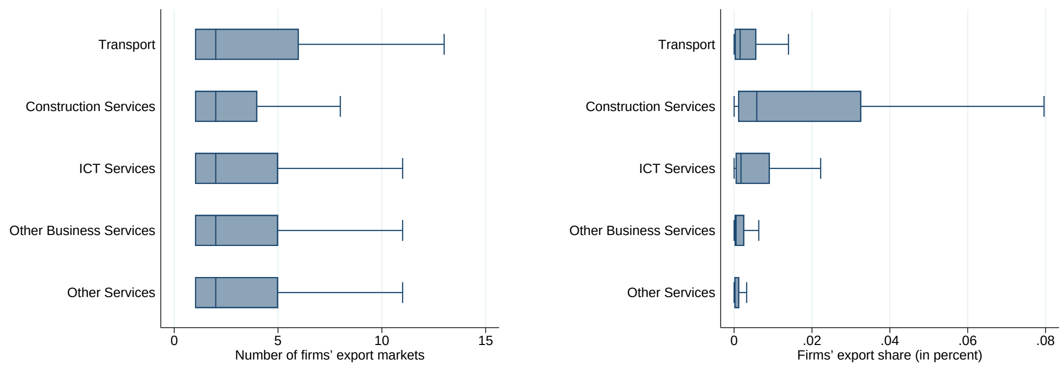
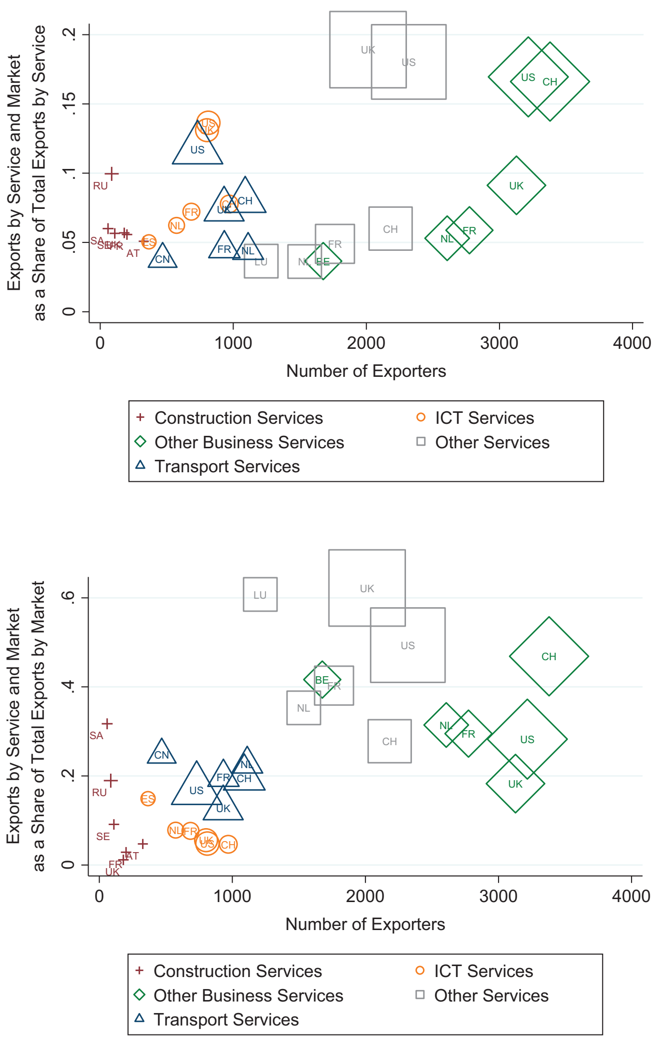


Figure 3: Exporter Heterogeneity Across Service Categories



Summarising, the descriptive evidence above reveals that services producers are strongly heterogeneous with respect to their traded volume and the number of destinations served, which is consistent with what has been documented for exporters of manufactures (see, e.g., Bernard et al., 2007), as well as services (see Breinlich and Criscuolo, 2011, Ariu, 2016b, and Biewen and Blank, 2018). However, our findings also suggest large deviations from the assumption of a single-parameter Pareto distribution for firm sales. In order to accommodate this feature of the data, one would either need to abandon that assumption (see, e.g. Bas et al., 2015) or account for an imperfect penetration of customer markets by the sellers (see Arkolakis, 2010, Eaton et al., 2011). We will adopt the latter approach in the following. Furthermore, we show that the number of German firms selling to a market, the number of markets served per firm, and the most popular destinations vary largely across service type. This calls for allowing the parameters of the productivity distribution and the market-penetration-cost function to vary across services and destinations. This seems to be the first paper that allows for such a service-destination-specific pattern.

Figure 4: Number of German Exporters and Export Shares to Top Six Destinations by Services Category



Note: The size of the markers represents the volume of exports by destination and services category.

3 Theoretical Framework

For the subsequent outline of the model, it will be useful to use indices $\{v, s, i, j\}$ to denote firms, sectors, producer countries, and customer countries, respectively. We use S and J to denote the total number of sectors and countries in the world economy, respectively.

3.1 Firm-level Trade

Following Arkolakis (2010), we assume that firm v in country i – offering one differentiated variety v of sector-s output under monopolistic competition – must incur costs to penetrate market j, which are paid in si-specific factor costs per efficiency unit, c_i^s,

$$f_{ij}^s(v) = c_i^s f_{ij}^s \frac{1 - \left[1 - n_{ij}^s(v)\right]^{1-1/\lambda_j^s}}{1 - 1/\lambda_j^s} . \tag{1}$$

The term $f_{ij}^s > 0$ is a fixed-cost shifter that is common to all producers in sector s and country i who target customers in country j, and the last term (the ratio) on the right-hand side of equation (1) represents firm-specific endogenous market penetration costs to customers in country j. The latter are increasing in the fraction of buyers reached, $n_{ij}^s(v) \in [0, 1]$, where the degree of reach is governed by the shape parameter of the penetration cost function, $\lambda_j^s > 0$. An increase in λ_j^s makes it easier to penetrate a market, resulting in higher overall entry costs. As $\lambda_j^s \to \infty$, $n_{ij}^s(v) \to 1$ so that the market-penetration-cost specification in equation (1) degenerates to the fixed-cost specification in Melitz (2003) or Helpman et al. (2008).

Buyers combine a continuum of varieties of sector-s output with a constant-elasticity-of-substitution (CES) aggregator with elasticity $\sigma^s > 1$. The sales of firm v offering sector-s output in market j and reaching a fraction $n_{ij}^s(v)$ of buyers are then given by

$$x_{ij}^s(v) = n_{ij}^s(v) \left(\frac{p_{ij}^s(v)}{P_j^s} \right)^{1-\sigma_s} E_j^s ,$$

where $p_{ij}^s(v)$ is the price in country j for variety v which belongs to sector s and originates from country i. P_j^s denotes the sectoral price index of sector-s output in country j, and E_j^s are aggregate expenditure shares on that output. Total profits of firm v from providing service s in country j are given by its operating profits, i.e., sales net of input costs, minus market penetration costs:

$$\pi_{ij}^{s}(v)=\frac{1}{\sigma^{s}}n_{ij}^{s}(v)\left(\frac{p_{ij}^{s}(v)}{P_{ij}^{s}}\right)^{1-\sigma^{s}}E_{ij}^{s}-c_{i}^{s}f_{ij}^{s}\frac{1-\left[1-n_{ij}^{s}(v)\right]^{1-1/\lambda_{j}^{s}}}{1-1/\lambda_{j}^{s}}.$$

Under monopolistic competition, $p_{ij}^{s}(v)$ involves a fixed markup over marginal costs of the form

$$p_{ij}^{s}(v)=\frac{\sigma^{s}}{\sigma^{s}-1}\frac{\tau_{ij}^{s}c_{i}^{s}}{\phi(v)},$$

where $\tau_{ij}^{s}\geq 1$ are common ad-valorem (iceberg) trade costs[6] for sector s and shipments from country i to country j, and $\phi(v)$ is the efficiency of firm v. The degree of market penetration is optimal if an i-borne firm's operating profit in sector s and market j for a buyer will just cover the marginal cost of reaching that buyer:

$$\frac{1}{\sigma^{s}}\left[\frac{\frac{\sigma^{s}}{\sigma^{s}-1}\frac{\tau_{ij}^{s}c_{i}^{s}}{\phi(v)}}{P_{j}^{s}}\right]^{1-\sigma^{s}}E_{j}^{s}=\frac{c_{i}^{s}f_{ij}^{s}}{\left[1-n_{ij}^{s}(v)\right]^{1/\lambda_{j}^{s}}}. \tag{2}$$

The marginal firm – indicated by $*$ – in sector s and country i will just not serve any customer in market j, so that $n_{ij}^{s}(v^{*})=0$. Using equation (2), the cutoff-efficiency level pertaining to the marginal firm can be expressed as

$$\left(\phi_{ij}^{s*}\right)^{\sigma^{s}-1}=\sigma^{s}c_{i}^{s}f_{ij}^{s}\left[\left(\frac{\frac{\sigma^{s}}{\sigma^{s}-1}\tau_{ij}^{s}c_{i}^{s}}{P_{j}^{s}}\right)^{1-\sigma^{s}}E_{j}^{s}\right]^{-1}. \tag{3}$$

Using equation (2) and the expression for $\left(\phi_{ij}^{s*}\right)^{\sigma^{s}-1}$ we can write the firm-v-specific optimal degree of market penetration as a function of $\phi(v)$:

$$n_{ij}^{s}(v)=1-\left[\frac{\phi_{ij}^{s*}}{\phi(v)}\right]^{(\sigma^{s}-1)\lambda_{j}^{s}}.$$

For a given efficiency level $\phi(v)>\phi_{ij}^{s*}$, $n_{ij}^{s}(v)$ is increasing in the degree of competition, σ^{s}, as firms try to compensate for a decline in sales per buyer by reaching more buyers.

Using these insights, the sales of an i-borne firm v in sector s to buyers in destination j can

[6] With services, one could think of iceberg-type trade costs as a broad concept which accounts for aspects such as information costs.

be expressed as

$$\begin{aligned} x^s_{ij}(v) &= \sigma^s c^s_i f^s_{ij} \left[\frac{\phi(v)}{\phi^{*s}_{ij}}\right]^{\sigma^s-1} \left\{1 - \left[\frac{\phi^{s*}_{ij}}{\phi(v)}\right]^{(\sigma^s-1)\lambda^s_j}\right\} \\ &= \tilde{x}^s_{ij}(v) n^s_{ij}(v)\,, \end{aligned} \tag{4}$$

where $\tilde{x}^s_{ij}(v)$ are firm v's sales of service s in market j per fraction of customers reached.

3.2 Producer Heterogeneity and Average Sales

Let us assume that there is a constant mass of firms in country i, $\mathcal{M}_i$, which draw their efficiency level from a Pareto distribution with support $[b^s_i, +\infty)$. Rather than assuming that the shape of the distribution is independent of the country where output is sold, e.g., as in Eaton and Kortum (2002) or Melitz (2003), we allow this shape to be specific for a sector and country of destination of sales. Implicitly, this means that a fixed number of firms in a country of origin, $\mathcal{M}_i$, is quasi endowed with a *minimum efficiency* b^s_i, and gets a free draw of *actual efficiency* for any destination country j from the aforementioned support with a shape parameter $k^s_j > \sigma^s - 1$, but still has to invest in market-access costs $f^s_{ij}(v)$ if it wishes to serve that market after all.

The probability that a firm v with productivity $\phi(v)$ is active in providing a service s out of country i to market j is given by $1 - \Pr\left[\phi(v) < \phi^{s*}_{ij}\right] = \left(\frac{b^s_i}{\phi^{s*}_{ij}}\right)^{k^s_j}$. The measure of firms selling sector-s output to country j is then given by

$$M^s_{ij} = \mathcal{M}_i \left(\frac{b^s_i}{\phi^{s*}_{ij}}\right)^{k^s_j} . \tag{5}$$

Integrating bounded-Pareto-distributed firms' sales, equation (4) gives average sales per selling firm of

$$\bar{x}^s_{ij} = \int_{\phi^{s*}_{ij}}^{\infty} x^s_{ij}(v) k^s_j \left(\phi^{s*}_{ij}\right)^{k^s_j} (\phi)^{(-1-k^s_j)}\ d\phi = \sigma^s c^s_i f^s_{ij} \Theta^s_j\,, \tag{6}$$

with $\Theta^s_j = \frac{\theta^s_j \lambda^s_j}{(1-\theta^s_j)\left[1-\theta^s_j(1-\lambda_j)\right]}$ and $\theta^s_j = \frac{\sigma^s-1}{k^s_j}$.[7] Average sales of firms whose efficiency is higher than $\phi(v)$ are given by:

$$\bar{x}^s_{ij}(v) = \sigma^s c^s_i f^s_{ij} \left(\frac{\phi^{s*}_{ij}}{\phi(v)}\right)^{-(\sigma^s-1)} \left[\frac{1}{1-\theta^s_j} - \frac{1}{1-\theta^s_{ij}(1-\lambda^s_{ij})}\left(\frac{\phi^{s*}_{ij}}{\phi(v)}\right)^{(\sigma^s-1)\lambda_j}\right] . \tag{7}$$

[7] This formulation has the advantage that $\theta^s_j \in (0,1)$.

For later use, let us also define the ratio of equation (7) and equation (6)

$$\frac{\bar{x}_{ij}^s(v)}{\bar{x}_{ij}^s} = \left(\frac{\phi_{ij}^{s*}}{\phi(v)}\right)^{-(\sigma^s-1)} \left\{\frac{1-\theta_j^s}{\theta_j^s \lambda_j}\left[1-\left(\frac{\phi_{ij}^{s*}}{\phi(v)}\right)^{(\sigma^s-1)\lambda_j}\right]+1\right\}. \tag{8}$$

By the same token, sales of firm v per fraction of buyers reached,

$$\tilde{x}_{ij}^s(v) = \sigma^s c_i^s f_{ij}^s \left(\frac{\phi_{ij}^{s*}}{\phi(v)}\right)^{-(\sigma^s-1)},$$

and the average value thereof can be written as

$$\bar{\tilde{x}}_{ij}^s = \frac{\sigma^s c_i^s f_{ij}^s}{1-\theta_{ij}^s}.$$

The average of $\tilde{x}_{ij}^s(v)$ for firms whose efficiency is greater than $\phi(v)$ is then given by

$$\bar{\tilde{x}}_{ij}^s(v) = \frac{\sigma^s c_i^s f_{ij}^s}{1-\theta_j^s}\left(\frac{\phi_{ij}^{s*}}{\phi(v)}\right)^{-(\sigma^s-1)}. \tag{9}$$

3.3 Aggregate Sales, Market Shares, and Profits

Aggregate sales of all i-borne firms in sector s to market j are then given by

$$X_{ij}^s = M_{ij}^s \bar{x}_{ij}^s = M_{ij}^s \sigma^s c_i^s f_{ij}^s \Theta_j^s. \tag{10}$$

Average total profits, $\bar{\pi}_{ij}^s$, are a constant multiple of average sales:

$$\bar{\pi}_{ij}^s = c_i^s f_{ij}^s \Theta_j^s \theta_j^s = \frac{\theta_j^s}{\sigma^s}\,\bar{x}_{ij}^s. \tag{11}$$

Aggregate sectoral profits are $\Pi_i^s = \sum_{j=1}^J \Pi_{ij}^s = \sum_{j=1}^J M_{ij}^s \bar{\pi}_{ij}^s$. The market share of country i exporting varieties of sector s to country j can be written as

$$\mu_{ij}^s = \frac{X_{ij}^s}{E_j^s} = \frac{X_{ij}^s}{\sum_{l=1}^J X_{lj}^s}.$$

Following Arkolakis (2010), we can use equations (3), (5), and (10), and write the market share as

$$\mu_{ij}^s = \frac{M_{ij}^s \sigma^s c_i^s f_{ij}^s \Theta_j^s}{\sum_{l=1}^J M_{lj}^s \sigma^s c_l^s f_{lj}^s \Theta_j^s} = \frac{\mathcal{M}_i \left(\frac{b_i^s}{\tau_{ij}^s}\right)^{k_j^s} \left(f_{ij}^s\right)^{1-\frac{1}{\theta_j^s}} \left(c_i^s\right)^{1-\frac{1}{\theta_j^s}-k_j^s}}{\sum_{l=1}^J \mathcal{M}_l \left(\frac{b_l^s}{\tau_{lj}^s}\right)^{k_j^s} \left(f_{lj}^s\right)^{1-\frac{1}{\theta_j^s}} \left(c_l^s\right)^{1-\frac{1}{\theta_j^s}-k_j^s}}.$$

It turns out that changes in the fixed component of market entry, f_{ij}^s, and variable trade costs, τ_{ij}^s, affect aggregate outcomes in general equilibrium jointly via $\zeta_{ij}^s \equiv \left(\tau_{ij}^s\right)^{-k_j^s} \left(f_{ij}^s\right)^{1-\frac{1}{\theta_j^s}}$. Hence, changes in variable iceberg-type trade costs are observationally equivalent to scaled changes in the fixed-cost component of market-access costs. Given the restriction $k_j^s > \sigma^s - 1$, an increase in τ_{ij}^s has a larger negative impact on ζ_{ij}^s than an increase in f_{ij}^s. The market share μ_{ij}^s can then be written as

$$\mu_{ij}^s = \frac{\mathcal{M}_i \left(b_i^s\right)^{k_j^s} \left(c_i^s\right)^{1-\frac{1}{\theta_j^s}-k_j^s} \zeta_{ij}^s}{\sum_{l=1}^J \mathcal{M}_l \left(b_l^s\right)^{k_j^s} \left(c_l^s\right)^{1-\frac{1}{\theta_j^s}-k_j^s} \zeta_{lj}^s}. \tag{12}$$

4 Measuring the Fundamental Model Parameters

Fundamental parameters of the model can be determined in sequential steps. These steps will pertain to measuring $\{\sigma^s\}$, $\{\theta_j^s, \lambda_j^s, k_j^s\}$, and $\{f_{ij}^s, \tau_{ij}^s\}$. We address each of these steps in the following.

4.1 Estimation of σ^s

As in any CES framework with monopolistic competition, firm v's operating profits from selling sector-s output in market j are proportional to the respective sales, namely $x_{ij}^s(v)/\sigma^s$. Hence, we can determine the elasticity of substitution by using information on firms' balance sheets.[8] We measure σ^s as the sum of firms' sales belonging to sector s over all destination markets divided by the sum of their corresponding operating profits. The results are summarized in Table 3. We find the highest values of $\widehat{\sigma}^s$ for Other Sectors (7.65) and Construction Services (6.00), suggesting high competition in these sectors. The lowest values (i.e., high market power) are found for Other Services (3.27) and ICT Services (3.92).

[8]While we observe firms' sales in the data directly, we calculate firms' operating profits as revenues minus personnel costs, material costs, and expenses on purchased services. We do not use earnings before the deduction of interest and taxes, as these also comprise expenses that are not reflected in the model. In order to deal with outliers and negative operating profits, we exclude observations below and above the 5th and 95th percentile of sales and operating profits, respectively. However our results are quantitatively very similar if we use the top one percent of values as upper threshold.

Table 3: Estimates of σ^s Using Firm-level Data

Sector	$\widehat{\sigma}^s$		Obs
Transport	5.164	(0.418)	179
Construction Services	5.997	(0.280)	675
ICT Services	3.915	(0.244)	282
Other Business Services	4.512	(0.219)	590
Other Services	3.273	(0.078)	3836
Manufacturing	4.855	(0.036)	6934
Other Sectors	7.647	(0.102)	7558

Note: Bootstrapped standard errors using sector blocks are in parentheses.

4.2 Estimation of θ_j^s, λ_j^s, and k_j^s

Towards estimating the structural parameters θ_j^s and λ_j^s, note that, when distinguishing M_{ij}^s quantiles in the distribution of sales of firms in country i and sector s to market j, the probability that a firm has higher efficiency than $\phi(v)$ can be written as

$$1 - \Pr_{ij}^s(v) = \left(\frac{\phi_{ij}^{s*}}{\phi(v)}\right)^{k_j^s} = \frac{rank_{ij}^s(v)}{M_{ij}^s}\,, \tag{13}$$

where, after sorting firms according to their rank in terms of sales and letting v denote this rank, $rank_{ij}^s(v) = (v-1)$.[9] Since we focus on all firms rather than percentiles, $rank_{ij}^s(v)$ is quasi-continuous. Note that a stochastic version of the log-transformed equation (8) is

$$\ln\left[\frac{\bar{x}_{ij}^s(v)}{\bar{x}_{ij}^s}\right] = -\theta_j^s \ln\left[1 - \Pr_{ij}^s(v)\right] + \ln\left\{\frac{1-\theta_j^s}{\theta_j^s\lambda_j^s}\left\{1 - \left[1 - \Pr_{ij}^s(v)\right]^{(\theta_j^s\lambda_j^s)}\right\} + 1\right\} + \varepsilon_{vij}^s\,, \tag{14}$$

from which θ_j^s and λ_j^s could be principally estimated using non-linear least squares. However, it turns out that this optimization problem is very flat, which makes it hard to estimate the global optimum of $\{\theta_j^s, \lambda_j^s\}$ for each country j and sector s. We overcome this problem by additionally using an expression for $\bar{\tilde{x}}_{ij}^s(v)$, which can be calculated as the cumulative average of $\tilde{x}_{ij}(v) = x_{ij}^s/n_{ij}^s$. Doing so involves the fraction of customers reached, which, using equation (13), can be written as

$$n_{ij}^s(v) = 1 - \left[1 - \Pr_{ij}^s(v)\right]^{\theta_j^s\lambda_j^s}\,. \tag{15}$$

[9] Note that for all sector-country combinations of German firm-level services trade, the number of firms exceeds 50 so that there is a relatively large number of quantiles available for the estimations supporting the shape parameter of the productivity distribution.

The latter and, hence, $\bar{\bar{x}}_{ij}^s(v)$, depends on the yet unknown $\theta_j^s\lambda_j^s$. After using the insight of equation (15) in equation (9), a stochastic equation for $\ln\bar{\bar{x}}_{ij}^s(v)$ can be written as

$$\ln\bar{\bar{x}}_{ij}^s(v) = \ln\frac{\sigma^s c_s f_{ij}^s}{1-\theta_j^s} - \theta_j^s \ln\left[1-\mathrm{Pr}_{ij}^s(v)\right] + \epsilon_{vij}^s\,. \tag{16}$$

In order to estimate θ_j^s and λ_j^s based on equations (14) and (16), we apply an iterative procedure based on the following steps:

1. Form a guess about $\theta_j^s\lambda_j^s$ and compute $n_{ij}^s(v)$ and $\ln\bar{\bar{x}}_{ij}^s(v)$.
2. Estimate equation (16) for each $\{sj\}$ by OLS, where $\ln\frac{\sigma^s c_s f_{ij}^s}{1-\theta_j^s}$ is a constant,[10] and θ_j^s is estimated as a parameter on $\ln\left[1-\mathrm{Pr}_{ij}^s(v)\right]$.
3. Reformulate equation (14) as

$$\ln\left[\frac{\bar{x}_{ij}^s(v)}{\bar{x}_{ij}^s}\right] = -\theta_j^s\ln\left[1-\mathrm{Pr}_{ij}^s(v)\right] + \ln\left\{\frac{1-\theta_j^s}{\theta_j^s\lambda_j^s}\,n_{ij}^s(v)+1\right\} + \varepsilon_{vij}^s\,,$$

   using the just-obtained estimate of θ_j^s therein and estimate $\theta_j^s\lambda_j^s$.
4. With the estimated $\theta_j^s\lambda_j^s$, repeat until convergence.

The results corresponding to this procedure are summarized in considerable detail in Tables A.2 to A.6 in the Appendix. Each of the tables corresponds to one sector and contains six column blocks of which four pertain to results for the above model and two pertain to a Melitz-Chaney-type model (indicated by superscript *fixed* without imperfect market penetration, where $\lambda\to\infty$). In each column block, we report point estimates and standard errors in parentheses for estimated parameters but, for the sake of brevity, only point estimates for derived/computed parameters.[11] Note that, given that there is no trade (or an insufficient number of observations) in a few country-sector combinations, involving mostly small economies, there are some empty lines in Tables A.3, A.4 and A.6. As the services-transactions dataset used here does not cover bilateral trade in manufactures and other non-service sectors and we know about the domestic sales (Germany) and global exports (Rest of the World) only from the financial statements of German firms, we summarize the corresponding results more compactly in Tables 4 and 5.

[10]Note that the only country i in this estimation is Germany, so that f_{ij}^s is a constant parameter.

[11]We run the above procedure using 100 different starting values for $\theta_j^s\lambda_j^s$. For the sake of faster convergence, we set the parameter space of $\theta_j^s\lambda_j^s$ at $[0.001, 1000.000]$. In some cases the estimate $\theta_j^s\lambda_j^s$ is at the lower bound of the considered parameter space. However, this is of limited importance, as the boundary problem of $\theta_j^s\lambda_j^s$ is mainly absorbed by and reflected in the estimate of λ_j^s, whereas it influences the estimate of θ_j^s to a lesser extent. For the counterfactual analysis, $\widehat{\theta}_j^s$ matters but not $\widehat{\lambda}_j^s$.

For the sake of brevity, we portray the distribution of $\{\widehat{\theta}_j^s, \widehat{\lambda}_j^s, \widehat{k}_j^s\}$, which are of main interest here, by way of boxplots in Figures 5 to 7 and refer the reader to the appendix for more detail. In each figure (as well as the corresponding tables) we report on the model of choice relative to a Melitz-Chaney-type model with a full market penetration. Moreover, we focus on a discussion of the estimates of the market-penetration-cost-function parameter in the proposed model, $\widehat{\lambda}_j^s$, and of the firm-efficiency-distribution parameter, $\widehat{k}_j^s$, for the proposed model as well as the Melitz-Chaney-type model.

Figure 5: Distribution of $\widehat{\theta}_j^s$ in German Services Transaction Data

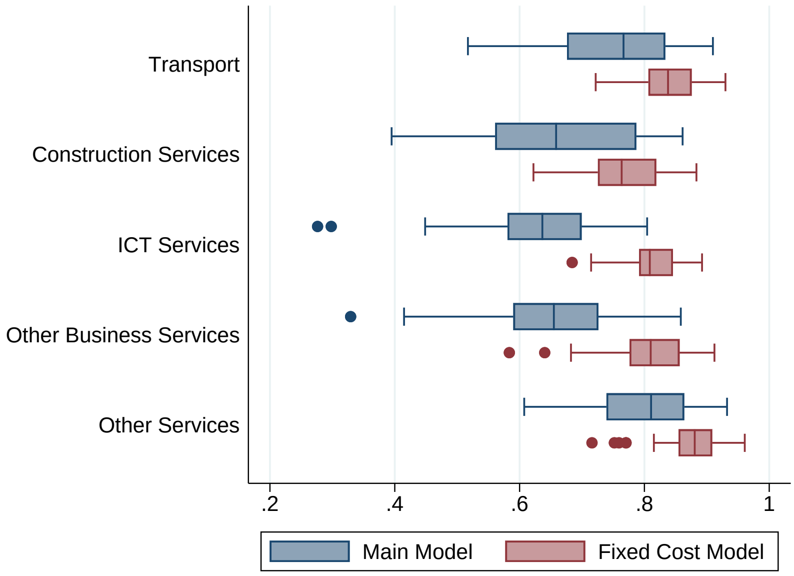


Table 4: Estimates of θ_j^s, λ_j^s and k_j^s Using Firm-level Data, Manufacturing

	Main Model						Fixed Cost Model		
Country	$\widehat{\theta_j^s\lambda_j^s}$		$\widehat{\theta}_j^s$		$\widehat{\lambda}_j^s$	$\widehat{k}_j^s$	$\left(\widehat{\theta}_j^s\right)^{\text{fixed}}$		$\left(\widehat{k}_j^s\right)^{\text{fixed}}$
Germany	0.051	(0.033)	0.619	(0.032)	0.082	6.225	0.837	(0.012)	4.607
Rest of the World	0.087	(0.072)	0.773	(0.062)	0.113	4.985	0.916	(0.015)	4.209

Table 5: Estimates of θ_j^s, λ_j^s and k_j^s Using Firm-level Data, Other Sectors

	Main Model						Fixed Cost Model		
Country	$\widehat{\theta_j^s\lambda_j^s}$		$\widehat{\theta}_j^s$		$\widehat{\lambda}_j^s$	$\widehat{k}_j^s$	$\left(\widehat{\theta}_j^s\right)^{\text{fixed}}$		$\left(\widehat{k}_j^s\right)^{\text{fixed}}$
Germany	0.199	(0.017)	0.726	(0.017)	0.274	9.156	0.857	(0.008)	7.761
Rest of the World	0.001	(0.013)	0.775	(0.036)	0.001	8.575	0.951	(0.003)	6.988

Recall that a lower (higher) value of λ_j^s means that relatively fewer (more) customers are

Figure 6: Distribution of $\widehat{\lambda}_j^s$ in German Services Transaction Data

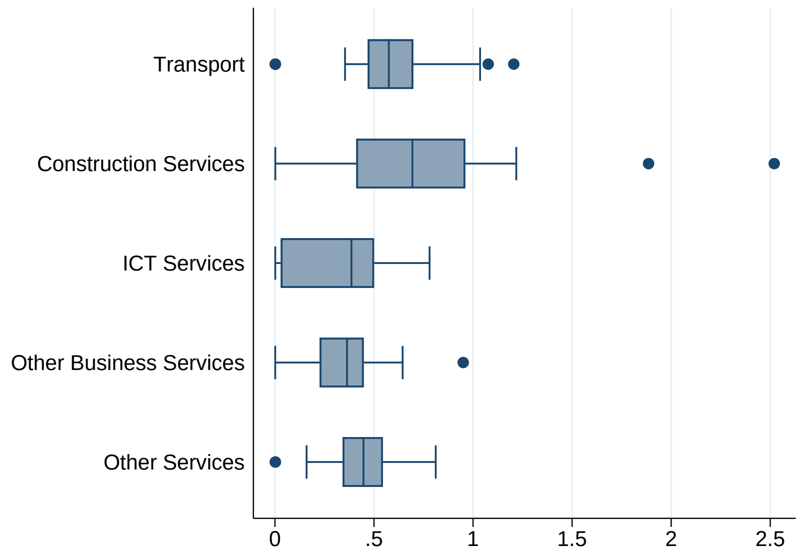
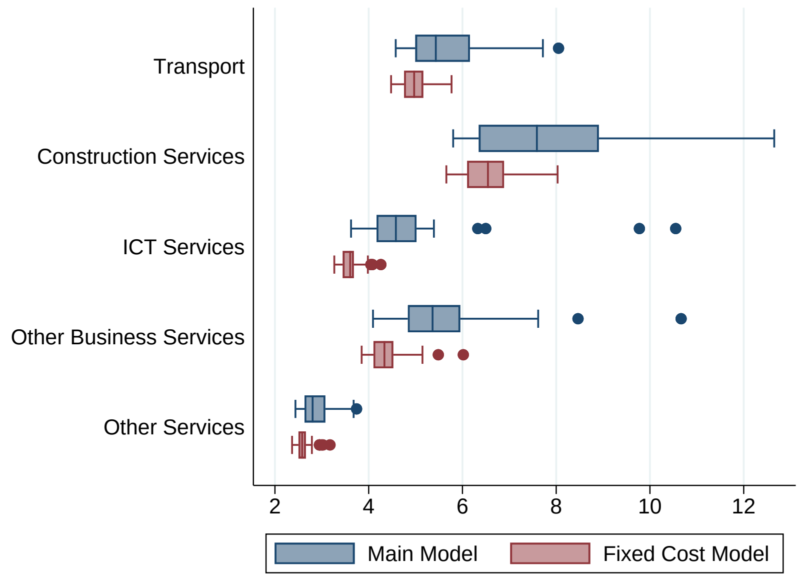


Figure 7: Distribution of $\widehat{k}_j^s$ in German Services Transaction Data



reached at lower (higher) corresponding market penetration costs. Across the five services sectors in Tables A.2 to A.6, the average value of $\widehat{\lambda}_j^s$ is highest for Other Services (0.87) and lowest for Transport Services (0.58).[12] The range of $\widehat{\lambda}_j^s$ is very large across targeted countries and spans

[12]Note that the moments of λ_j^s we refer to are calculated from slightly different samples of countries across the

an interval from about the lower bound of the considered support to about 2.52 for exports of Construction Services to Romania and 1.21 for exports of Transport Services to India.

Note that a smaller value of k_j^s means that the density of small productivity levels of firms is relatively low compared to high productivity levels. The average implied value of $\widehat{k}_j^s$ across countries varies among the services sectors between 2.9 for Other Services and 7.86 for Construction Services. Hence, extremely productive services producers arise more likely in Other Services than in Construction Services. The range of the estimates $\widehat{k}_j^s$ across countries is, with $[2.44; 3.74]$, relatively small for Other Services and, with $[3,62; 10.55]$, relatively wide for ICT Services. This suggests that allowing for productivity distributions that differ across targeted markets is important. When comparing the Melitz-Chaney-type model with the one proposed here, two things stand out regarding $\widehat{k}_j^s$: First, the country-sector-specific point estimates are smaller, on average; second, the range across targeted countries is considerably more narrow for all sectors than with the proposed model.

In Figure 8 we plot the log of firms' sales over mean sales of Other Business Services to the UK against the respective quantiles of the distribution in the data (blue circles) as well as the estimated theoretical counterpart (red locus). We find that the model captures large and small firm sales very well, while there is some overprediction of sales for firms between the first and seventh decile.[13] We contrast these findings with the estimates for the Melitz-Chaney-type set-up (green locus). As Figure 8 shows, a model that does not allow for firm-specific market-penetration costs does not perform well in explaining the cross-border activity of the majority of firms trading smaller volumes that we observe for German services exporters.

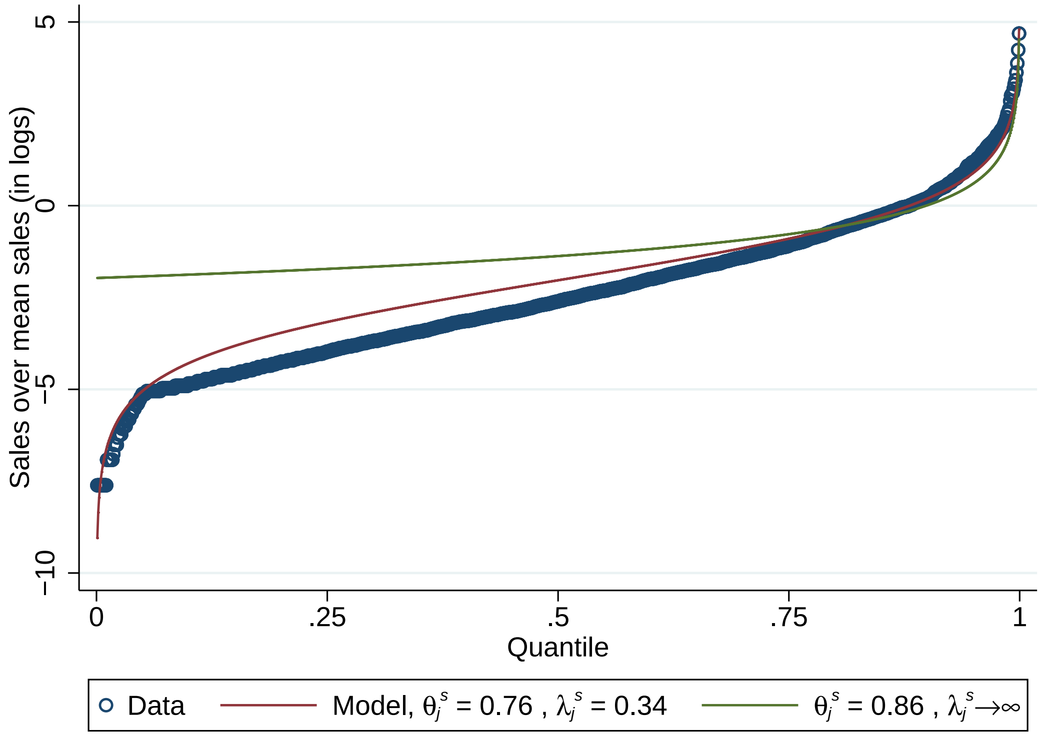
Next, we compare the model fit across all trading partners by services sector. Figure 9 illustrates the log of sales over mean sales by the top and bottom five percent of firms as well as the median plotted against log mean sales for the data as well as the model. Apparently, the proposed model captures the cross section of firms' exports across all traded volumes and services sectors quite well, with the only two exceptions being the Transport and Other Services sectors, where there is some overprediction for firms trading smaller volumes.

For manufactures in Table 4, the estimate of $\widehat{\lambda}_j^s$ is with 0.082 within the range of estimates for the services sectors (e.g. the estimate for Germany and Construction Services is 0.440 in Table A.3), and the one for the Rest of the World in Table 4 is, with a value of 0.113, considerably smaller than the one for Germany. The values of $\widehat{k}_j^s$ for Germany and the Rest of the World in Table 4 are estimated at 6.23 and 4.99, respectively. The value of $\widehat{k}_j^s$ for Germany is relatively low in comparison to those for the services sectors (except for Construction Services, where it is 8.91), suggesting that high-productivity firms in German Manufactures are relatively less

tables.

[13]Results for other trading partners and service sectors are qualitatively very similar.

Figure 8: Model Fit, Export Sales of Other Business Services to the United Kingdom



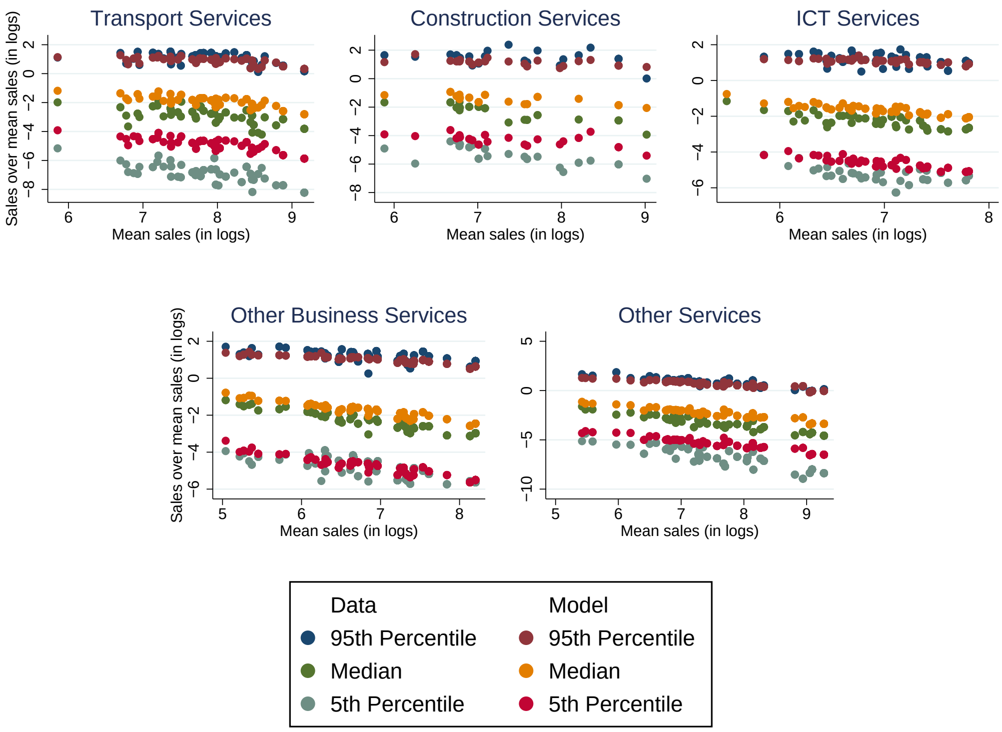
Note: Due to the confidential nature of the data, each dot corresponds to the mean of three adjacent ranked sales.

frequent than those for services, except for Construction Services. With Other Sectors (neither services nor manufactures) in Table 5, $\widehat{\lambda}_j^s$ is tiny for the Rest of the World but large for Germany. Moreover, the values of $\widehat{k}_j^s$ with Other Sectors in Table 5 are similar to those for manufactures in Table 4.

4.3 Estimation and Decomposition of ζ_{ij}^s

In this subsection, we outline how ζ_{ij}^s, which encompasses the fixed component of the market-penetration-cost function, f_{ij}^s, and the iceberg-type trade-cost parameter, τ_{ij}^s, is parameterized and quantified. For this, consider the market share of aggregate services exports from country i to country j in sector s, μ_{ij}^s, as given by equation (12). The parameters determining ζ_{ij}^s can be estimated in a normalized fashion as the residuals from a log-linear regression of μ_{ij}^s on the following variables: an i-specific country effect that reflects $\ln \mathcal{M}_i$; an sj-specific effect that reflects the log-transformed denominator of μ_{ij}^s; k_j^s, whose si-specific parameter is $\ln b_i^s$; and

Figure 9: Model Fit, by Sector



Note: Due to the confidential nature of the data, each dot corresponds to the mean of three adjacent ranked sales.

$1 - \frac{1}{\theta_j^s} - k_j^s$, whose si-specific parameter is $\ln c_i^s$.

Clearly, this fixed-effects procedure obtains values of $\ln \widehat{\zeta}_{ij}^s$ which are centered around zero in all sectors. However, the dispersion of $\ln \widehat{\zeta}_{ij}^s$ is not degenerate. We portray the distribution of $\ln \widehat{\zeta}_{ij}^s$ across the five considered services sectors by way of histograms in Figure 10. The standard deviation across country relationships ranges from 1.794 for Other Services to 2.150 for Construction Services. We exploit this dispersion to investigate the role of major factors of influence behind ζ_{ij}^s such as geography or services trade policy in the following.

We use $\ln \widehat{\zeta}_{ij}^s$ and regress it on four candidate explanatory variables: a binary services-trade-agreement indicator, STA_{ij};[14] the log of bilateral distance between the economic centers of two countries; a binary land-contiguity indicator variable; and an ethnic-common-language indicator. Let us collect these four regressors into the vector Z_{ij}, where the first element is STA_{ij}.

[14]This indicator is unity for all country pairs which are members of a pure services-trade agreement or of a general trade agreement with services-trade provisions according to information at the World Trade Organization.

Figure 10: Distribution of $\ln \widehat{\zeta}_{ij}^{s}$, by Sector

Specifically, we estimate a log-linear regression of the form[15]

$$\ln \widehat{\zeta}_{ij}^{s} \quad = \quad Z_{ij}\beta^{s,Z} + u_{ij}^{s,Z} \, ,$$

where for inference one has to take into account that $\widehat{\zeta}_{ij}^{s}$ is estimated (and "measured") with error. Then, the first element of the estimates $\widehat{\beta}^{s,Z} = [\widehat{\beta}^{s,STA}, ...]'$ is informative about the impact of STA provisions on $\widehat{\zeta}_{ij}^{s}$. As the latter is inversely related to obstacles to cross-border trade, we would hypothesize that $\beta^{s,STA} > 0$.

The parameters (and correctly size-adjusted standard errors) from the respective regression for each sector are summarized in Table 6. The table suggests that membership in an STA is relatively least important for Construction Services and relatively most important for ICT Services, followed by Other Business Services. The parameters on land-border contiguity and common ethnic language are even bigger than those on STA membership except for Other

[15]As the dependent variable of interest, $\ln \widehat{\zeta}_{ij}^{s}$, is already centered around zero, there is no need to include a constant in the model.

Business Services and Other Services. The parameter on (log) distance is negative and relatively small in absolute value.[16] Descriptive statistics for the elements in Z_{ij} are provided in Table 7.

Table 6: Decomposing Log Scaled Inverse Trade and Market Access Costs Using Bilateral Country-level Data

Sector	Services Trade Agreement		Distance		Contiguity		Ethnic Language	
Transport	0.311	(0.033)	-0.056	(0.002)	1.376	(0.049)	0.529	(0.050)
Construction Services	0.204	(0.022)	-0.049	(0.002)	0.740	(0.066)	0.334	(0.079)
ICT Services	0.343	(0.039)	-0.056	(0.003)	1.008	(0.022)	0.525	(0.020)
Other Business Services	0.338	(0.021)	-0.054	(0.002)	0.918	(0.039)	0.320	(0.051)
Other Services	0.219	(0.043)	-0.049	(0.003)	1.141	(0.049)	0.331	(0.052)

Notes: Bootstrapped standard errors using sector-destination-country blocks are in parentheses.

Table 7: Summary Statistics of Bilateral Country-level Data Used to Decompose Log Scaled Inverse Trade and Market Access Costs

	Mean	Std. Dev.	Min	Median	Max
Services Trade Agreements	0.511	0.491	0.000	0.287	1.000
Log Distance	7.949	1.183	1.900	7.825	9.843
Contiguity	0.060	0.237	0.000	0.000	1.000
Ethnic Language	0.060	0.229	0.000	0.000	1.000

Table 8: Impact of Services Trade Agreements on Log Scaled Inverse Trade and Market Access Costs and Its Distance Equivalent

Sector	Percentage Change Decrease in ζ_{ij}^{s}	Percentage Change Distance Equivalent
Transport	-26.716	477.140
Construction Services	-18.484	374.339
ICT Services	-29.062	520.841
Other Business Services	-28.675	534.635
Other Services	-19.694	398.157

In Table 8 we convert the point estimates $\widehat{\beta}^{s,STA} > 0$ into semi-elasticities in percent and compute the distance equivalent in percent. While the coefficient estimates are all block-sampled to obtain proper inference, we pursue the customary approach to work with point estimates in the counterfactual analysis (see, e.g., Caliendo and Parro, 2015).The corresponding numbers are informative about the percentage change in distance that is equivalent to leaving an STA in terms of a trade-cost change. The figures in Table 8 suggest that the termination of the membership in an STA boosts overall scaled trade costs in a range of 18.48 percent (in Construction Services) and 29.06 percent (in ICT Services). The distance equivalent to exiting an STA membership

[16] Relative to the literature on gravity models based on aggregate trade, in particular the coefficient on log distance appears small; see the meta-study in Head and Mayer (2014). However, using less aggregated data tends to result in lower point estimates in absolute value; see, e.g., Crozet and Koenig (2010).

corresponds to an increase in distance between 374.34 percent (in Construction Services) and 534.64 percent (in Other Business Services) among STA partners.

5 General Equilibrium

In general equilibrium, factor prices respond endogenously to shocks in the economy. In order to gauge the magnitude of the responses it is important to consider the well-documented input-output structure of economies where services play a prominent role.[17] We follow Caliendo and Parro (2015) in implementing this input-output structure based on the model of Eaton and Kortum (2002).

5.1 The Structure of Production and Demand

In each country i and sector s there is a unit measure of perfectly competitive firms which bundle a composite good that is a CES-basket of individual varieties belonging to sector s from J countries:

$$Q_i^s = \left\{ \sum_{j=1}^{J} \int_{\phi_{ji}^{s*}}^{\infty} \left[q_{ji}^s(v) \right]^{\frac{\sigma^s - 1}{\sigma^s}} g(\phi_{ji}^s) d\phi_{ji}^s \right\}^{\frac{\sigma^s}{\sigma^s - 1}},$$

where $q_{ji}^s(v)$ is the quantity of output purchased from firm v located in country j.[18] Demand for an individual variety of firm v which reaches a fraction of $n_{ji}^s(v)$ buyers in country i is given by

$$q_{ji}^s(v) = n_{ji}^s(v) \frac{\left[p_{ji}^s(v) \right]^{-\sigma^s}}{(P_i^s)^{1-\sigma^s}} E_i^s ,$$

[17] See the World Input-Output Tables (WIOT).

[18] We think of the quantity of a service input to be a similar concept to labour and capital-service inputs in manufacturing goods production. In that sense, the quantity of such an input is well defined. Consequently, the price of a service input is the cost per efficiency unit of a purchased service.

where total expenditure on varieties of sector s in country i corresponds to $E_i^s = P_i^s Q_i^s$. P_i^s is the sectoral price index,

$$
\begin{aligned}
P_i^s &= \left\{ \sum_{j=1}^{J} M_{ji}^s \int_{\phi_{ji}^{s*}}^{\infty} n_{ji}^s(v) \left[p_{ji}^s(v) \right]^{1-\sigma^s} g(\phi_{ji}^s) d\phi_{ji}^s \right\}^{\frac{1}{1-\sigma^s}} \\
&= \left[\Theta_i^s \sum_{j=1}^{J} M_{ji}^s \left(\frac{\sigma^s}{\sigma^s - 1} \frac{c_j^s \tau_{ji}^s}{\phi_{ji}^{s*}} \right)^{1-\sigma^s} \right]^{\frac{1}{1-\sigma^s}} .
\end{aligned}
$$

The composite good may be used for final consumption or as an input for other domestic firms. To produce any output of services or goods, firms use labour and intermediates with a Cobb-Douglas technology. To produce $y_i^s(v)$ units, firm v in country i combines $\ell_i^s(v)$ units of labour and intermediates of each sector z, $q_i^{zs}(v)$,

$$
y_i^s(v) = \phi(v) \left[\frac{\ell_i^s(v)}{\gamma_i^s} \right]^{\gamma_i^s} \prod_{z=1}^{S} \left[\frac{q_i^{zs}(v)}{\gamma_i^{zs}} \right]^{\gamma_i^{zs}} ,
$$

where γ_i^{zs} is the input share of the composite intermediate goods or services inputs from sector z in sector s and country i. The parameters γ_i^s and $\sum_{z=1}^{S} \gamma_i^{zs} = 1 - \gamma_i^s$ denote the value added shares accruing to labour and intermediates, respectively. The cost per unit of $y_i^s(v)$ is given by

$$
c_i^s = (w_i^s)^{\gamma_i^s} \prod_{z=1}^{S} (P_i^z)^{\gamma_i^{zs}} ,
$$

where w_i^s are sector-specific wages.[19] We assume that households' upper-tier utility function is Cobb-Douglas and of the form

$$
U(\mathcal{C}_i) = \prod_{s=1}^{S} (\mathcal{C}_i^s)^{\alpha_i^s} ,
$$

with aggregate consumption of output from sector s, $\mathcal{C}_i^s$, and $\sum_{s=1}^{S} \alpha_i^s = 1$. While P_i^s is the ideal price index for sector-s consumption in country i, the ideal price index in that country for

[19] Our choice of considering labor as to be immobile between sectors roots in the observation of statistically significant differences in average wages across not only countries but also sectors within countries. The comparative static responses to shocks in this paper should thus be interpreted as ones which would materialize in the short run when labor is relatively immobile across sectors. We refrain from considering longer-term responses, as we believe that not only the mobility of factors but even of technology would change over the longer horizon in response to shocks. It is well known that quantitative effects of shocks based on sector-specific-factor general-equilibrium models tend to be smaller than ones where factors are mobile across sectors (see Costinot and Rodríguez-Clare, 2014).

consumption at large (across all sectors) is given by

$$P_i = \prod_{s=1}^{S} \left(\frac{P_i^s}{\alpha_i^s} \right)^{\alpha_i^s} .$$

5.2 Labour Market Clearing and Trade Balance

Labour market clearing implies that the wage bill in country i for producing a variety of sector s equals the labour earnings from production, $\gamma_i^s \sum_{j=1}^{J} \frac{\sigma^s - 1}{\sigma^s} X_{ij}^s$, plus labour earnings from market penetration, $\gamma_i^s \sum_{j=1}^{J} \frac{1-\theta_j^s}{\sigma^s} X_{ij}^s$,

$$w_i^s L_i^s = \gamma_i^s \sum_{j=1}^{J} \left(\frac{\sigma^s - 1}{\sigma^s} X_{ij}^s + \frac{1 - \theta_j^s}{\sigma^s} X_{ij}^s \right) = \gamma_i^s \sum_{j=1}^{J} \frac{\sigma^s - \theta_j^s}{\sigma^s} X_{ij}^s . \tag{18}$$

Aggregate expenditures in country i for goods or services of sector s are given by the sum of firms' spending on intermediates of sector s and a share α_i^s times households' overall income, which is given by the aggregate wage bill and dividends net of the share of the trade balance, net-exports B_i of sector s-output, denoted by B_i^s. Hence, the trade balance is a lump-sum transfer (possibly negative) to households. Sectoral expenditures are then given by

$$E_i^s = \sum_{j=1}^{J} X_{ji}^s = \alpha_i^s \left(\sum_{z=1}^{S} w_i^z L_i^z + \sum_{z=1}^{S} \sum_{j=1}^{J} M_{ij}^z \bar{\pi}_{ij}^z \right) - B_i^s + \sum_{z=1}^{S} \gamma_i^{sz} \sum_{j=1}^{J} \frac{\sigma^z - \theta_j^z}{\sigma^z} X_{ij}^z . \tag{19}$$

We assume that each country's trade balance is a constant multiple of aggregate spending, whereby $B_i^s = \beta_i^s \sum_{s=1}^{S} E_i^s$, to ensure that trade imbalances are scaled by a country's economic size, and adjust as that size changes. Using equations (11) and (18), (19) can be written as

$$E_i^s = \alpha_i^s \left(\sum_{z=1}^{S} \sum_{j=1}^{J} \frac{\gamma_i^z \sigma^z + (1 - \gamma_i^z)\theta_j^z}{\sigma^z} \mu_{ij}^s E_j^z \right) - \beta_i^s \sum_{z=1}^{S} E_i^z + \sum_{z=1}^{S} \gamma_i^{sz} \sum_{j=1}^{J} \frac{\sigma^z - \theta_j^z}{\sigma^z} \mu_{ij}^z E_j^z , \tag{20}$$

where the market share of country i exporting varieties of sector s to country j, μ_{ij}^s, is given by equation (12).

5.3 Changes in Endogenous Variables

For any generic variable h, h' denotes its counterfactual value and $\dot{h}$ denotes the ratio of counterfactual and benchmark values with $\dot{h} \equiv h'/h$ so that $h' = \dot{h}h$.

Using equation (12), the change in the market share of country i supplying varieties of sector

s in country j is given by

$$\dot{\mu}_{ij}^s = \frac{\left(\dot{c}_i^s\right)^{1-\frac{1}{\theta_j^s}-k_j^s} \dot{\zeta}_{ij}^s}{\sum_{l=1}^J \mu_{lj}^s \left(\dot{c}_l^s\right)^{1-\frac{1}{\theta_j^s}-k_j^s} \dot{\zeta}_{lj}^s} .$$

Note that, given the exponents, $\dot{\mu}_{ij}^s$ depends on the endogenous $\dot{c}_i^s$ and the exogenous $\dot{\zeta}_{ji}^s = \left(\dot{\tau}_{ij}^s\right)^{-k_{ij}^s} \left(\dot{f}_{ij}^s\right)^{1-\frac{1}{\theta_{ij}^s}}$ only. Using equation (20), changes in sectoral expenditures in country i are given by

$$\begin{aligned} \dot{E}_i^s E_i^s = \alpha_i^s &\left(\sum_{z=1}^S \sum_{j=1}^J \frac{\gamma_i^z \sigma^z + (1-\gamma_i^z)\theta_j^z}{\sigma^z} \dot{\mu}_{ij}^z \dot{E}_j^z \mu_{ij}^z E_j^z \right) - \beta_i^s \sum_{z=1}^S \dot{E}_i^z E_i^z \\ &+ \sum_{z=1}^S \sum_{j=1}^J \gamma_i^{sz} \frac{\sigma^z - \theta_j^z}{\sigma^z} \dot{\mu}_{ij}^z \dot{E}_j^z \mu_{ij}^z E_j^z . \end{aligned}$$

Factor costs evolve according to

$$\dot{c}_i^s = (\dot{w}_i^s)^{\gamma_i^s} \prod_{z=1}^S \left(\dot{P}_i^z\right)^{\gamma_i^{zs}} ,$$

with

$$\left(\dot{P}_i^s\right)^{1-\sigma^s} = \sum_{j=1}^J \mu_{ji}^s \dot{M}_{ji}^s \left(\frac{\dot{c}_j^s \dot{\tau}_{ji}^s}{\dot{\phi}_{ji}^{s*}} \right)^{1-\sigma^s} \tag{21}$$

$$= \left(\dot{E}_i^s\right)^{1-\theta_i^s} \sum_{j=1}^J \mu_{ji}^s \left(\dot{\mu}_{ji}^s\right)^{1-\theta_i^s} \left(\dot{c}_j^s\right)^{\theta_i^s-(\sigma^s-1)} \left(\dot{\zeta}_{ji}^s\right)^{1-\theta_i^s} . \tag{22}$$

We assume that the measure of potential entrants in each country i, $\mathcal{M}_i$, and its overall technology level for providing varieties of different sectors to individual countries j, b_i^s, are invariant to changes in trade costs. It then follows from equation (5) that changes in the measure of active firms and the underlying cut-off efficiency levels are directly linked through $\dot{\phi}_{ij}^{s*} = (\dot{M}_{ij}^s)^{-1/k_j^s}$. Apart from that, we have used the fact that the change in overall exports of country i to market j of varieties of sector s is given by $\dot{X}_{ij}^s = \dot{\mu}_{ij}^s \dot{E}_j^s = \dot{M}_{ij}^s \dot{c}_i^s \dot{f}_{ij}^s$, so that $\dot{M}_{ij}^s = \dot{\mu}_{ij}^s \dot{E}_j^s / (\dot{c}_i^s \dot{f}_{ij}^s)$. Accordingly, equation (21) can be expressed as equation (22).

We assume that labour is immobile across sectors and that the number of employees within sectors is unaffected by trade liberalization. Then, $\dot{w}_i^s$ can be derived from equation (18) as

$$\dot{w}_i^s = \frac{\gamma_i^s}{w_i^s L_i^s} \sum_{j=1}^{J} \dot{\mu}_{ij}^s \dot{E}_j^s \frac{\sigma^s - \theta_j^s}{\sigma^s} \mu_{ij}^s E_j^s \, .$$

Using $\eta_{ij}^s = \frac{(\sigma^s - \theta_j^s) X_{ij}^s}{\sum_{j=1}^{J} (\sigma^s - \theta_j^s) X_{ij}^s}$, the latter can be expressed as

$$\dot{w}_i^s = \sum_{j=1}^{J} \eta_{ij}^s \dot{\mu}_{ij}^s \dot{E}_j^s \, .$$

Changes in nominal dividends are given by

$$\dot{\Pi}_i^s = \sum_{j=1}^{J} \kappa_{ij}^s \dot{\mu}_{ij}^s \dot{E}_j^s \, ,$$

with $\kappa_{ij}^s = \frac{\theta_j^s X_{ij}^s}{\sum_{j=1}^{J} \theta_l^s X_{ij}^s}$.

After choosing a suitable set of S numéraires, the system of equations in this subsection can be solved uniquely for changes in the endogenous outcomes of interest in response to shocks in, e.g., $\dot{\zeta}_{ij}^s$, within admissible parameter bounds. For computational convenience, we choose the S values of $\dot{E}_i^s$ for the Rest of the World as our numéraires.

6 Quantitative Counterfactual Analysis of De-liberalizations of Preferential Services-Market Access

We organise this section into two subsections; one is dedicated to the description of the counterfactual experiments we undertake and the other summarises the findings from these experiments.

6.1 Counterfactual Experiments

In the counterfactual analysis, we will consider three alternative types of experiments. In the first one, we consider the case where one specific country at a time abandons all its existing services-trade-agreement memberships (STAs) with all its trading partners in the data. There, for one specific country that appears as an exporter i and as an importer j in the data, we consider the case where $\dot{\zeta}_{ij}^s = \exp(-\widehat{\beta}^{s,STA} STA_{ij})$ if *either i or j* is that country (not when $i = j$). Clearly, the associated effects should be expected to be bigger, the more preferential trading partners a country has. However, the general-equilibrium effects will also depend on technology, endowments, the pattern of $\dot{\zeta}_{ij}^s$ as well as the input-output structure of the economies at the outset.[20] In the second experiment, we abandon all existing STAs jointly rather than removing them for individual countries one at a time. Hence, we consider the case where $\dot{\zeta}_{ij}^{s} = \exp(-\widehat{\beta}^{s,STA} STA_{ij})$ for all country pairs ij with $i \neq j$. We expect the effects of this to be larger on average than those with the first experiment. In the third experiment, we consider the case where $\dot{\zeta}_{ij}^{s} = \exp(-\widehat{\beta}^{s,STA})$ for all country pairs ij with $i \neq j$, irrespective of whether they have preferential services trade provisions in place or not. Hence, in comparison to the second experiment, the binary indicator variable STA_{ij} is absent in the exponent $\dot{\zeta}_{ij}^{s} = \exp(\cdot)$. This serves to gauge insights into the quantitative impact of an increase in services trade costs to an extent that corresponds to that of abandoning a hypothetical STA (no matter whether an STA is in place or not). Clearly, as the latter experiment is of a non-discriminatory nature (among foreign trade partners), the associated effects should be largest in comparison to the other experiments.

As for the consequences of the aforementioned types of changes for real economic outcomes, we will consider responses in real consumption for the representative household (a utilitarian measure of welfare in this model, U_i), as well as sector-specific changes in real wages (w_i^s/P_i^s) and dividends ($\sum_{j=1}^{J} M_{ij}^s \bar{\pi}_{ij}^s / P_i^s$), which, apart from changes in real trade imbalances, real changes in household consumption depend upon.[21]

6.2 Abandoning Services-trade-agreement (STA) Membership for Selected Individual Countries

When quantifying the effects of an exit from existing STAs for individual countries, we focus on the following economies: Austria (small, centrally located, and many STA partners); Belgium (small, centrally located, many STA partners); Canada (small, peripherally located, and few STA partners); France (large, centrally located, and many STA partners); Germany (large, centrally located, and many STA partners); Netherlands (small, centrally located, and many STA partners); United Kingdom (large, centrally located, and many STA partners); United States (large, peripherally located, and few STA partners). Table 9 displays the ranks of these countries in terms of their STA network, geographical remoteness and overall service expenditure.

Since all countries are connected through trade in this model, there are effects on third

[20] The heterogeneity of responses to services-trade de-liberalization is governed by structural parameters here. Davies and Studnicka (2017) provide reduced-form evidence supporting the notion of input-output-related heterogeneous responses of economic outcomes at the firm level to expected de-liberalization consequences associated with Brexit. Felbermayr et al. (2018) and Dhingra et al. (2017) provide a discussion of de-liberalization with a specific focus on Brexit. Sampson (2017) provides an overview of this type of research. In contrast to that work, we take a more detailed look on services firms and inform a quantitative model with details from this inspection which is not possible from a sectoral and less so a country-level analysis.

[21] Note that both real wages and real dividends depend on the nominal sales of firms in a country and sector so that the effects on these aggregates are not independent of each other.

Table 9: Rank of Considered Countries in Terms of Number of STA Partners, Average Distance to Trading Partners and Total Services Expenditures

Country	STA Partners	Average Distance	Services Spending
Austria	1	8	8
Belgium	1	6	7
Canada	7	1	5
France	1	4	4
Germany	1	7	2
Netherlands	1	5	6
United Kingdom	1	3	3
United States of America	8	2	1

countries from abandoning STA membership in a single economy at a time. The magnitude of effects on the respective economies and on third countries depends on the "connectedness" of the countries in the international WIOD network. In order to capture the heterogeneity of effects, we report one table for each STA-abandoning country and, within a table, moments of the distribution of effects across partner countries (some of which are STA members with the respective country and some of which are not).[22] In each table, we summarize the effects on real consumption across all sectors, on real wages across sectors, and on real dividends across sectors. The effects across sectors depend on the importance of STA membership for $\widehat{\zeta}_{ij}^{s}$, i.e., on $\widehat{\beta}^{s,STA}$, as well as on the input-output linkages between sectors, which are specific to an economy. All effects are expressed in percent and summarized in Tables 10 to 17.

Table 10: Removal of Preferential Market Access for Services, Austria

	Impact on Austria	Impact on Other Countries				
Change in		min	p10	p50	p90	max
Real Consumption						
All Sectors	-0.482	-0.302	-0.059	-0.005	0.000	0.001
Real Wages						
Transport	-2.006	-0.758	-0.307	-0.004	0.005	0.023
Construction	-0.227	-0.169	-0.048	-0.003	0.000	0.000
ICT Services	-1.778	-0.170	-0.130	-0.007	0.001	0.004
Other Business Services	-0.920	-0.452	-0.090	-0.006	0.000	0.003
Other Services	-0.478	-0.399	-0.063	-0.004	0.000	0.001
Manufacturing	-0.240	-0.083	-0.016	-0.002	0.000	0.012
Other Sectors	-0.239	-0.105	-0.019	-0.001	0.000	0.005
Real Dividends						
Transport	-2.439	-0.586	-0.239	-0.004	0.004	0.025
Construction	-0.231	-0.167	-0.046	-0.002	0.000	0.079
ICT Services	-2.962	-0.158	-0.070	-0.002	0.002	0.004
Other Business Services	-0.959	-0.487	-0.096	-0.008	0.000	0.001
Other Services	-0.454	-0.413	-0.078	-0.003	0.000	0.001
Manufacturing	-0.242	-0.081	-0.016	-0.001	0.000	0.011
Other Sectors	-0.239	-0.104	-0.018	-0.001	0.001	0.006

Notes: This table shows percentage changes in real consumption as well as real sectoral wages and dividends in response to a removal of services trade agreements for Austria.

[22] Specifically, we report the minimum (min), the 10th, 50th, and 90th percentile (p10, p50, p90), and the maximum (max) effect across third countries.

Table 11: Removal of Preferential Market Access for Services, Belgium

Change in	Impact on Belgium	Impact on Other Countries min	p10	p50	p90	max
Real Consumption						
All Sectors	-0.875	-0.607	-0.043	-0.015	0.000	0.003
Real Wages						
Transport	-2.355	-0.473	-0.212	-0.030	0.007	0.068
Construction	-0.593	-0.242	-0.067	-0.006	0.000	0.002
ICT Services	-2.230	-1.594	-0.084	-0.017	0.001	0.005
Other Business Services	-1.893	-0.482	-0.146	-0.027	0.002	0.011
Other Services	-0.893	-0.812	-0.048	-0.014	0.000	0.000
Manufacturing	-0.549	-0.195	-0.030	-0.004	0.001	0.005
Other Sectors	-0.430	-0.205	-0.023	-0.004	0.000	0.009
Real Dividends						
Transport	-2.602	-0.393	-0.149	-0.025	0.004	0.064
Construction	-0.795	-0.244	-0.052	-0.004	0.000	0.029
ICT Services	-3.059	-1.331	-0.070	-0.017	0.003	0.010
Other Business Services	-1.242	-0.579	-0.243	-0.060	0.003	0.005
Other Services	-0.893	-0.787	-0.061	-0.014	0.000	0.000
Manufacturing	-0.551	-0.196	-0.030	-0.004	0.001	0.005
Other Sectors	-0.430	-0.203	-0.023	-0.003	0.000	0.010

Notes: This table shows percentage changes in real consumption as well as real sectoral wages and dividends in response to a removal of services trade agreements for Belgium.

Table 12: Removal of Preferential Market Access for Services, Canada

Change in	Impact on Canada	Impact on Other Countries min	p10	p50	p90	max
Real Consumption						
All Sectors	-0.114	-0.011	-0.001	0.000	0.000	0.001
Real Wages						
Transport	-0.203	-0.053	0.001	0.003	0.005	0.011
Construction	-0.119	-0.001	0.000	0.000	0.001	0.002
ICT Services	-0.181	-0.020	0.000	0.001	0.002	0.009
Other Business Services	-0.346	-0.025	0.000	0.001	0.001	0.004
Other Services	-0.139	-0.014	-0.002	0.000	0.000	0.001
Manufacturing	-0.069	-0.011	-0.001	-0.001	0.000	0.000
Other Sectors	-0.051	-0.007	-0.001	0.000	0.000	0.000
Real Dividends						
Transport	-0.180	-0.058	0.001	0.004	0.007	0.013
Construction	-0.133	-0.001	0.000	0.000	0.001	0.002
ICT Services	-0.429	-0.005	0.000	0.001	0.002	0.010
Other Business Services	-0.657	-0.012	0.000	0.001	0.002	0.003
Other Services	-0.159	-0.014	-0.002	0.000	0.000	0.001
Manufacturing	-0.069	-0.011	-0.001	-0.001	0.000	0.000
Other Sectors	-0.051	-0.007	-0.001	0.000	0.000	0.000

Notes: This table shows percentage changes in real consumption as well as real sectoral wages and dividends in response to a removal of services trade agreements for Canada.

Table 13: Removal of Preferential Market Access for Services, France

Change in	Impact on France	Impact on Other Countries min	p10	p50	p90	max
Real Consumption						
All Sectors	-0.243	-0.659	-0.077	-0.018	0.000	0.002
Real Wages						
Transport	-1.187	-0.680	-0.317	-0.032	0.012	0.031
Construction	-0.105	-0.441	-0.101	-0.012	0.000	0.000
ICT Services	-0.438	-1.143	-0.124	-0.026	0.001	0.006
Other Business Services	-0.774	-0.695	-0.212	-0.021	0.005	0.013
Other Services	-0.201	-0.836	-0.052	-0.018	0.000	0.000
Manufacturing	-0.157	-0.187	-0.067	-0.005	0.000	0.003
Other Sectors	-0.138	-0.244	-0.060	-0.005	0.000	0.013
Real Dividends						
Transport	-1.583	-0.424	-0.209	-0.018	0.018	0.036
Construction	-0.105	-0.523	-0.102	-0.012	0.000	0.020
ICT Services	-0.424	-1.195	-0.132	-0.033	0.002	0.009
Other Business Services	-0.832	-0.653	-0.200	-0.031	0.005	0.017
Other Services	-0.197	-0.835	-0.051	-0.020	0.000	0.001
Manufacturing	-0.157	-0.187	-0.065	-0.005	0.000	0.003
Other Sectors	-0.138	-0.242	-0.060	-0.005	0.000	0.013

Notes: This table shows percentage changes in real consumption as well as real sectoral wages and dividends in response to a removal of services trade agreements for France.

Table 14: Removal of Preferential Market Access for Services, Germany

Change in	Impact on Germany	Impact on Other Countries min	p10	p50	p90	max
Real Consumption						
All Sectors	-0.281	-0.811	-0.147	-0.033	0.000	0.002
Real Wages						
Transport	-0.720	-0.699	-0.380	-0.031	0.012	0.032
Construction	-0.054	-0.579	-0.111	-0.020	0.000	0.000
ICT Services	-1.006	-2.311	-0.424	-0.049	0.004	0.023
Other Business Services	-0.695	-1.091	-0.334	-0.050	0.002	0.016
Other Services	-0.314	-0.880	-0.129	-0.029	0.000	0.001
Manufacturing	-0.226	-0.251	-0.063	-0.010	0.002	0.037
Other Sectors	-0.186	-0.259	-0.051	-0.007	0.001	0.035
Real Dividends						
Transport	-0.573	-0.904	-0.429	-0.043	0.014	0.040
Construction	-0.072	-0.447	-0.117	-0.017	0.000	0.016
ICT Services	-1.100	-2.210	-0.311	-0.045	0.010	0.028
Other Business Services	-1.064	-0.693	-0.264	-0.032	0.002	0.038
Other Services	-0.400	-0.728	-0.121	-0.024	0.000	0.014
Manufacturing	-0.224	-0.251	-0.062	-0.009	0.003	0.039
Other Sectors	-0.186	-0.256	-0.051	-0.007	0.001	0.035

Notes: This table shows percentage changes in real consumption as well as real sectoral wages and dividends in response to a removal of services trade agreements for Germany.

Table 15: Removal of Preferential Market Access for Services, Netherlands

Change in	Impact on the Netherlands	Impact on Other Countries				
		min	p10	p50	p90	max
Real Consumption						
All Sectors	-0.699	-0.467	-0.063	-0.013	0.001	0.001
Real Wages						
Transport	-3.113	-0.381	-0.267	-0.002	0.010	0.045
Construction	-1.356	-0.326	-0.054	-0.005	0.000	0.058
ICT Services	-1.305	-0.772	-0.199	-0.023	0.002	0.005
Other Business Services	-2.211	-0.759	-0.221	-0.016	0.003	0.012
Other Services	-0.454	-0.622	-0.069	-0.012	0.000	0.002
Manufacturing	-0.092	-0.235	-0.069	-0.015	0.001	0.004
Other Sectors	-0.075	-0.192	-0.045	-0.011	0.000	0.002
Real Dividends						
Transport	-2.980	-0.418	-0.221	-0.002	0.009	0.024
Construction	-1.493	-0.278	-0.057	-0.005	0.000	0.056
ICT Services	-1.627	-0.734	-0.196	-0.022	0.005	0.016
Other Business Services	-1.571	-0.922	-0.252	-0.044	0.002	0.008
Other Services	-0.423	-0.722	-0.075	-0.015	0.000	0.002
Manufacturing	-0.095	-0.236	-0.070	-0.016	0.001	0.004
Other Sectors	-0.076	-0.192	-0.045	-0.011	0.000	0.002

Notes: This table shows percentage changes in real consumption as well as real sectoral wages and dividends in response to a removal of services trade agreements for the Netherlands.

Table 16: Removal of Preferential Market Access for Services, United Kingdom

Change in	Impact on the United Kingdom	Impact on Other Countries				
		min	p10	p50	p90	max
Real Consumption						
All Sectors	-0.330	-3.143	-0.142	-0.034	0.000	0.001
Real Wages						
Transport	-0.262	-2.251	-0.470	-0.075	0.006	0.041
Construction	-0.150	-1.648	-0.142	-0.031	0.001	0.005
ICT Services	-0.806	-3.296	-0.300	-0.059	0.004	0.009
Other Business Services	-0.929	-2.330	-0.241	-0.062	0.005	0.011
Other Services	-0.384	-4.087	-0.151	-0.034	0.001	0.004
Manufacturing	-0.085	-0.924	-0.076	-0.015	-0.001	0.029
Other Sectors	-0.122	-1.422	-0.071	-0.013	-0.001	0.024
Real Dividends						
Transport	-0.632	-1.954	-0.373	-0.033	0.004	0.046
Construction	-0.150	-1.630	-0.170	-0.028	0.001	0.103
ICT Services	-0.500	-3.404	-0.470	-0.110	0.007	0.019
Other Business Services	-0.661	-2.459	-0.426	-0.100	0.005	0.010
Other Services	-0.337	-5.050	-0.276	-0.039	0.002	0.003
Manufacturing	-0.083	-0.910	-0.076	-0.015	-0.001	0.029
Other Sectors	-0.121	-1.419	-0.070	-0.013	0.000	0.025

Notes: This table shows percentage changes in real consumption as well as real sectoral wages and dividends in response to a removal of services trade agreements for the United Kingdom.

Table 17: Removal of Preferential Market Access for Services, United States of America

Change in	Impact on the USA	Impact on Other Countries				
		min	p10	p50	p90	max
Real Consumption						
All Sectors	-0.018	-0.108	-0.017	0.000	0.002	0.021
Real Wages						
Transport	-0.145	-0.141	-0.024	0.007	0.015	0.028
Construction	-0.009	-0.114	-0.002	0.001	0.004	0.009
ICT Services	-0.051	-0.156	-0.006	0.002	0.005	0.041
Other Business Services	-0.055	-0.332	-0.013	0.001	0.003	0.014
Other Services	-0.026	-0.132	-0.015	0.001	0.002	0.029
Manufacturing	-0.008	-0.076	-0.009	-0.001	0.000	0.004
Other Sectors	-0.008	-0.059	-0.005	-0.001	0.000	0.004
Real Dividends						
Transport	-0.146	-0.164	-0.022	0.010	0.019	0.033
Construction	-0.009	-0.127	-0.005	0.001	0.004	0.008
ICT Services	-0.025	-0.346	-0.008	0.004	0.006	0.038
Other Business Services	-0.014	-0.625	-0.019	0.001	0.004	0.011
Other Services	-0.025	-0.151	-0.016	0.001	0.003	0.032
Manufacturing	-0.008	-0.075	-0.009	-0.001	0.000	0.004
Other Sectors	-0.007	-0.059	-0.005	-0.001	0.000	0.004

Notes: This table shows percentage changes in real consumption as well as real sectoral wages and dividends in response to a removal of services trade agreements for the United States of America.

In a nutshell, three key findings from this analysis stand out. First, exiting STAs is costly in terms of real household consumption, and the costs tend to be higher for smaller countries than larger ones as well as for well-connected countries (more STA partners in the outset; more central countries) than for less-well-connected ones (fewer STA partners in the outset; more peripheral countries).

Second, the effects on third countries are largely heterogeneous and may be even bigger at the extremes in absolute value than for the exiting country at stake. The latter is more likely the case for larger and less peripheral exiting countries with more STA partners in the outset (see the lower-bound effect on third countries for Germany in Table 14 or the United Kingdom in Table 16 and compare it with those of other countries). Due to a redirection ("diversion") of trade through STA memberships, some third countries will benefit from removing STAs, but these effects tend to be relatively small in magnitude. To see this, consider the effects in the columns p90 or max in Tables 10 to 17.

Third, the magnitude of the effects on real wages and real dividends across sectors is relatively similar on average, but there is a large degree of heterogeneity of the effects on these outcomes across sectors. Accruing to the relatively large absolute value of $\widehat{\beta}^{s,STA}$ for Transport Services and ICT Services in Table 6, the effect is largest on average for the mentioned outcomes in these sectors. The largest effects in percent are found for Belgium and the Netherlands, and the smallest are found for the United States. However, the degree of variation of the effects across sectors (and third countries) depends inter alia on the input-output structure of an economy.

Across all countries considered, there are relatively large average negative effects on real wages and real dividends in manufacturing, even though there are no direct effects on that sector from exiting an STA.[23]

6.3 Abandoning Services-trade-agreement (STA) Membership for All Countries Jointly

While the analysis in the previous subsection was devoted to a removal of preferential services market access between a single country and its trading partners as of 2014, we quantify effects of a joint de-liberalization among all preferential trading partners in this subsection. To put the two types of experiments in perspective, note that a joint removal of preferential market access means larger global economic costs on the one hand but smaller diversion effects on the other hand. Diversion is of greater importance if preferential market access is more selective and, hence, covers fewer economies and a smaller share of the world market.

Table 18: Removal of Services Trade Agreement Membership For All Countries Jointly

	Impact on All Countries				
Change in	min	p10	p50	p90	max
Real Consumption					
All Sectors	-7.718	-0.898	-0.326	-0.006	0.017
Real Wages					
Transport	-6.035	-3.560	-1.028	0.008	0.176
Construction	-4.610	-0.888	-0.189	-0.002	0.004
ICT Services	-14.228	-1.980	-0.715	0.006	0.117
Other Business Services	-7.772	-2.142	-0.728	-0.005	0.051
Other Services	-9.764	-1.042	-0.308	-0.005	0.003
Manufacturing	-2.346	-0.382	-0.141	-0.007	0.043
Other Sectors	-3.085	-0.372	-0.109	-0.005	0.032
Real Dividends					
Transport	-6.593	-3.591	-1.070	0.008	0.226
Construction	-4.652	-0.907	-0.188	-0.001	0.105
ICT Services	-13.938	-2.761	-0.938	0.007	0.172
Other Business Services	-9.345	-2.581	-0.918	-0.007	0.029
Other Services	-11.210	-1.375	-0.346	-0.005	0.007
Manufacturing	-2.333	-0.383	-0.139	-0.007	0.042
Other Sectors	-3.061	-0.372	-0.109	-0.005	0.037

Notes: This table shows percentage changes in real consumption as well as real sectoral wages and dividends in response to a removal of all existing services trade agreements.

Table 18 summarizes the findings for this experiment, giving moments for all countries. Table 19 does so for real consumption in the selected countries as considered in the previous subsection. These two tables confirm precisely the above argument: for each and every de-liberalizing country considered, the effects on economic outcomes are smaller in absolute value with a world-wide joint de-liberalization than with an individual one (for this, compare the top

[23]Note that we chose the design of the experiment such that countries only change preferential market access to services but not goods in the counterfactual analysis.

Table 19: Impact of the Removal of All Services Trade Agreement Membership on Real Consumption in Selected Countries

Country	All Sectors
Austria	-0.466
Belgium	-0.866
Canada	-0.111
France	-0.240
Germany	-0.278
Netherlands	-0.686
United Kingdom	-0.326
United States of America	-0.016

row of Tables 10 to 17 with the corresponding cells in Table 19), and particularly so for small and less remote countries which extensively used preferential trade agreements ex ante in 2014.

Table 18 suggests that the effects of the considered type of de-liberalization on real consumption range from -7.72 (Malta) percent to 0.82 percent (Switzerland) for all 42 countries and the Rest of the World together. Among the eight selected economies in Table 19, this range is from -0.02 (United States) to -0.87 percent (Belgium). Relative to the rates of annual growth of real GDP of the covered economies, we might say that they correspond to not much less than a year's real income growth in the post-Economic-and-Financial-Crisis era. Hence, the effects of a de-liberalization of preferential market access in services only are not trivially small, and they spill over to economies which do not change their policies (as they did not operate under preferential services market access in 2014) and to sectors such as manufacturing, for which we keep the policy environment constant. Whether and to what extent workers and shareholders in manufacturing would be hurt by the considered de-liberalization depends on the ramifications established through the industrial input-output structure of an economy, but on average they would suffer a loss from higher services input costs.

6.4 Raising Services Trade Costs Everywhere to an Extent as if a Hypothetical Global Services Trade Agreement (STA) Were Abandoned

The experiments in the two previous subsections pertained to some discriminatory change – abandoning all preferential STAs of a single country versus abandoning all STAs globally. In this subsection, we envisage a non-discriminatory global increase in services trade costs. However, in order to link the results to the earlier discussion, we consider an increase in services trade costs which is equivalent to a removal of a global STA, where all countries hypothetically participate as of 2014. Accordingly, there is no diversion present with this experiment (except for diverting trade towards domestic sales). Hence, the associated effects should be even bigger on average than with the second experiment.

Table 20: Global Removal of Services Trade Agreement Membership

Change in	Impact on All Countries min	p10	p50	p90	max
Real Consumption					
All Sectors	-12.625	-1.517	-0.621	-0.141	-0.086
Real Wages					
Transport	-7.891	-6.817	-2.032	-0.355	-0.034
Construction	-7.331	-1.430	-0.408	-0.077	0.020
ICT Services	-19.264	-3.060	-1.404	-0.208	-0.027
Other Business Services	-10.550	-3.139	-1.198	-0.335	-0.061
Other Services	-16.349	-1.451	-0.586	-0.132	-0.086
Manufacturing	-3.713	-0.667	-0.260	-0.048	0.119
Other Sectors	-4.890	-0.637	-0.226	-0.002	0.038
Real Dividends					
Transport	-8.857	-7.287	-2.397	-0.285	-0.066
Construction	-7.461	-1.723	-0.444	-0.047	0.126
ICT Services	-19.289	-4.223	-1.933	-0.256	-0.045
Other Business Services	-10.767	-4.101	-1.536	-0.296	-0.065
Other Services	-16.524	-2.060	-0.723	-0.136	-0.091
Manufacturing	-3.719	-0.658	-0.254	-0.045	0.132
Other Sectors	-4.847	-0.634	-0.226	-0.001	0.046

Notes: This table shows percentage changes in real consumption as well as real sectoral wages and dividends in response to a global removal of services trade agreements.

Table 21: Impact of the Global Removal of Services Trade Agreement Membership on Real Consumption in Selected Countries

Country	All Sectors
Austria	-0.663
Belgium	-1.438
Canada	-0.318
France	-0.414
Germany	-0.500
Netherlands	-1.255
United Kingdom	-0.601
United States of America	-0.106

Tables 20 and 21 summarize the corresponding findings in a way akin to the previous subsection. It is apparent from a comparison of Table 20 with Table 18 and of Table 21 with Table 19 that the economic costs of such an increase in non-tariff barriers to services trade are considerably bigger than for a global removal of preferential market access in services, as expected. Again, the general patterns across countries and sectors are similar to those with the second experiment, however.

7 Conclusion

This paper provides a quantitative analysis of a multi-sector model of trade with an imperfect coverage of customers by suppliers as in Arkolakis (2010), with a special focus on services rather than goods. The structural model is informed by transaction-level and firm-level data for Germany as well as by aggregate sector-level (input-output) data for multiple countries.

The wealth of data available permits an identification of all fundamental model parameters and alludes to the variation of these parameters across sectors and, where applicable, across consumer countries. The parameter estimates support an apparently good model fit of the relevant moments of the data for the purpose at hand.

The estimates are then used to inform a quantitative counterfactual analysis towards assessing the relevance of economic policy. In that regard, we focus on the role of services trade agreements (STAs) as an instrument which affects the conglomerate of variable and fixed costs of cross-border services transactions. We proceed towards an assessment of the quantitative effects of STA membership on economies through activity in services sectors in two steps.

First, we establish a negative link between estimated overall (variable and fixed) transaction costs in services and STA membership with the data at hand.

Second, we use the estimated increase of overall trade costs and quantify their impact on various economic aggregates (such as real consumption, real wages, and real dividends) across countries from individually versus jointly abandoning existing STAs as of 2014. The findings suggest, as expected, that (i) smaller and less remote countries suffer bigger losses which range from about -7.7 percent to about zero (for STA-untreated countries) in the case of a world-wide exit from all STAs; (ii) there are non-trivial detrimental spillover effects to the manufacturing sector from abandoning services-trade provisions in trade agreements on average, depending on the input-output relationships in a country; (iii) effects on partner countries and third countries may be larger than for large STA-abandoning economies; (iv) effects on real wages and on real dividends are of a similar magnitude.

We hope that these results help in improving our understanding of the quantitative importance of services and of economic policy addressing them. Due to recent political developments in Europe and elsewhere, preferential market access of business transactions in trade agreements – not only in goods but also in services – is at risk. This paper suggests that preferential services provisions alone in such agreements are relatively important. For example, for the United Kingdom, abandoning existing provisions for services in trade agreements as of 2014 would involve a loss of real consumption per capita of about 0.3 percentage point – a magnitude that is in the ballpark of a year's worth of growth of the real economy in Europe since after the Economic and Financial Crisis.

The quantified effects should be understood as a lower bound of what one might expect to happen in the long run in reality for the following reasons. First, preferential services provisions rarely come in isolation and are often tied to goods-market provisions. A simultaneous deliberalization of market access in services as well as goods should be expected to result in larger effects than those obtained here. Second, preferential market liberalization often goes hand in hand with (works as a building block of) overall, unilateral liberalization. Again associated effects are neglected in the counterfactual analysis conducted here, but might have large economic effects.

References

Anderson, J. E., van Wincoop, E., 2003. Gravity with gravitas: A solution to the border puzzle. American Economic Review 93(1), 170–192.

Ariu, A., 2016a. Crisis-proof services: Why trade in services did not suffer during the 2008-2009 collapse. Journal of International Economics 98(C), 138–149.

Ariu, A., 2016b. Services versus goods trade: A firm-level comparison. Review of World Economics (Weltwirtschaftliches Archiv) 152(1), 19–41.

Arkolakis, C., 2010. Market penetration costs and the new consumers margin in international trade. Journal of Political Economy 118(6), 1151–1199.

Bas, M., Mayer, T., Thoenig, M., 2015. From micro to macro: Demand, supply, and heterogeneity in the trade elasticity. CEPR Discussion Papers no. 10637.

Bernard, A. B., Jensen, J. B., Redding, S. J., Schott, P. K., 2007. Firms in international trade. Journal of Economic Perspectives 21(3), 105–130.

Biewen, E., Blank, S., 2018. Variations in services trade. mimeo, Deutsche Bundesbank.

Biewen, E., Lohner, S., 2017. Statistics on international trade in services. Data Report 2017-07, Research Data and Service Centre, Deutsche Bundesbank.

Breinlich, H., Criscuolo, C., 2011. International trade in services: A portrait of importers and exporters. Journal of International Economics 84(2), 188–206.

Broda, C., Weinstein, D. E., 2006. Globalization and the gains from variety. The Quarterly Journal of Economics 121(2), 541–585.

Caliendo, L., Parro, F., 2015. Estimates of the trade and welfare effects of NAFTA. Review of Economic Studies 82(1), 1–44.

Chaney, T., 2008. Distorted gravity: The intensive and extensive margins of international trade. American Economic Review 98(4), 1707–21.

Costinot, A., Donaldson, D., Komunjer, I., 2012. What goods do countries trade? A quantitative exploration of Ricardo's ideas. Review of Economic Studies 79(2), 581–608.

Costinot, A., Rodríguez-Clare, A., 2014. Trade theory with numbers: Quantifying the consequences of globalization. Vol. 4 of Handbook of International Economics. Elsevier, pp. 197–261.

Crozet, M., Koenig, P., 2010. Structural gravity equations with intensive and extensive margins. Canadian Journal of Economics 43(1), 41–62.

Damijan, J., Haller, S. A., Kaitila, V., Črt Kostevc, Maliranta, M., Milet, E., Mirza, D., Rojec, M., 2015. The performance of trading firms in the services sectors comparable evidence from four EU countries. The World Economy 38(12), 1809–1849.

Davies, R. B., Studnicka, Z., 2017. The heterogeneous impact of Brexit: Early indications from the FTSE. CESifo Working Paper Series 6478, CESifo Group Munich.

Dhingra, S., Huang, H., Ottaviano, G., Pessoa, J. P., Sampson, T., Reenen, J. V., 2017. The costs and benefits of leaving the EU: Trade effects. Economic Policy 32(92), 651–705.

Eaton, J., Kortum, S., 2002. Technology, geography, and trade. Econometrica 70(5), 1741–1779.

Eaton, J., Kortum, S., Kramarz, F., 2011. An anatomy of international trade: Evidence from French firms. Econometrica 79(5), 1453–1498.

Felbermayr, G., Grschl, J. K., Heiland, I., 2018. Undoing Europe in a new quantitative trade model. ifo Working Paper Series 250, ifo Institute - Leibniz Institute for Economic Research at the University of Munich.

Haller, S., Damijan, J., Kaitila, V., Črt Kostevc, Maliranta, M., Milet, E., Mirza, D., Rojec, M., 2014. Trading firms in the services sectors: comparable evidence from four EU countries. Review of World Economics (Weltwirtschaftliches Archiv) 150(3), 471–505.

Head, K., Mayer, T., 2014. Gravity equations: Workhorse, toolkit, and cookbook. Handbook of International Economics. Vol. 4, Elsevier, pp. 131–195.

Head, K., Mayer, T., Ries, J., 2010. The erosion of colonial trade linkages after independence. Journal of International Economics 81(1), 1–14.

Helpman, E., Melitz, M., Rubinstein, Y., 2008. Estimating trade flows: Trading partners and trading volumes. The Quarterly Journal of Economics 123(2), 441–487.

Kee, H. L., Nicita, A., Olarreaga, M., 2008. Import demand elasticities and trade distortions. The Review of Economics and Statistics 90(4), 666–682.

Kee, H. L., Nicita, A., Olarreaga, M., 2009. Estimating trade restrictiveness indices. Economic Journal 119(543), 172–199.

Melitz, M. J., 2003. The impact of trade on intra-industry reallocations and aggregate industry productivity. Econometrica 71(6), 1695–1725.

Sampson, T., 2017. Brexit: The economics of international disintegration. Journal of Economic Perspectives 31(4), 163–184.

Stöß, E., 2001. Deutsche Bundesbank's corporate balance sheet statistics and areas of application. Schmollers Jahrbuch 121(1), 131–137.

Timmer, M. P., Dietzenbacher, E., Los, B., Stehrer, R., Vries, G. J., 2015. An illustrated user guide to the World Input-output Database: The case of global automotive production. Review of International Economics 23(3), 575–605.

Timmer, M. P., Los, B., Stehrer, R., de Vries, G. J., 2016. An anatomy of the global trade slowdown based on the WIOD 2016 release. GGDC Research Memorandum GD-162, Groningen Growth and Development Centre, University of Groningen.

Appendix

A.1 Data Sources

Our analysis relies on transaction-level, firm-level as well as country-sector-level information from the following sources.

Statistics on International Trade in Services The Statistics on International Trade in Services (SITS) are compiled by the Deutsche Bundesbank and provided by its Research Data and Service Centre (RDSC). The data comprise the population of German services exports at the transaction-level, including information on the period of the occurrence of transactions, the destination country and the type of service traded. Firms and individuals are required to report service transactions with an overall outgoing value exceeding 12,500 Euro per month. A unit of observation in the data is actually the aggregate trade volume per firm, sector, destination country, and month. We refer to these as transaction-level data in order to distinguish them conceptually from firm-level data on aggregate sales per year. For a detailed description of the dataset, see Biewen and Lohner (2017). The data cover all modes of services transactions of the General Agreement on Trade in Services (GATS), i.e. cross-border trade (mode 1), consumption abroad (mode 2), and the presence of natural persons in the country of the customer (mode 4) with the exception of services transactions of foreign affiliates in the country of the customer (mode 3). Individual transactions are reported according to the sixth version of the IMF's Balance of Payments and International Investment Position Manual (BPM6), which allows classifying transactions into 133 different service sectors. For our analysis, we group transactions into five broad service categories. We use the cross-section for 2014 and drop sector-destination-country combinations with fewer than 50 observations. This is to ensure a sufficient number of observations for the estimation of the fundamental model parameters. We thus discard 26 sector-country combinations that represent not even 0.2 percent of overall services sales in our data. Our sample includes 18,646 German service exporters selling to one or more of 228 foreign destinations. In our analysis, we consider 42 country destinations individually plus one rest of the world, which together yield 107,545 firm-sector-destination-country observations among the aforementioned 18,646 German services exporters. Table A.1 reports on the volume of German service exports and the number of firms selling to each destination.

Corporate Balance Sheets (Ustan) As SITS covers neither bilateral trade in manufactures nor German services sales at home, we employ the database Corporate Balance Sheets (Ustan) as an additional source. This dataset, which comprises German non-financial firms' financial statements and is also compiled and provided by the Deutsche Bundesbank, covers firms' overall

Table A.1: Destination Markets Considered in the Analysis

Export Destination	Export Volume	Number of Exporters	Fraction of Exporters
Australia	2,941.67	1,123	0.06
Austria	7,664.12	5,180	0.28
Belgium	6,074.32	3,277	0.18
Brazil	2,751.60	1,131	0.06
Bulgaria	356.00	581	0.03
Canada	2,576.13	1,260	0.07
China	9,178.91	2,674	0.14
Croatia	258.23	562	0.03
Cyprus	595.47	550	0.03
Czech Republic	3,297.18	2,062	0.11
Denmark	3,016.85	2,265	0.12
Estonia	151.14	345	0.02
Finland	1,342.95	1,299	0.07
France	13,821.21	5,151	0.28
Greece	911.66	818	0.04
Hungary	2,176.28	1,397	0.07
India	2,289.53	1,249	0.07
Indonesia	377.85	438	0.02
Ireland	6,657.15	1,514	0.08
Italy	6,655.87	3,760	0.20
Japan	5,690.03	1,634	0.09
Korea	2,691.12	1,170	0.06
Latvia	124.15	417	0.02
Lithuania	215.89	403	0.02
Luxembourg	6,841.85	2,666	0.14
Malta	455.86	345	0.02
Mexico	4,122.74	886	0.05
Netherlands	11,671.40	5,075	0.27
Norway	1,649.65	1,357	0.07
Poland	3,645.57	2,525	0.14
Portugal	888.22	1,028	0.06
Romania	1,357.02	1,095	0.06
Russian Federation	3,744.60	1,889	0.10
Slovakia	1,071.22	916	0.05
Slovenia	494.30	619	0.03
Spain	4,969.06	2,966	0.16
Sweden	4,413.53	2,372	0.13
Switzerland	24,551.53	6,608	0.35
Taiwan	737.52	644	0.03
Turkey	2,101.25	1,723	0.09
United Kingdom	34,575.41	5,764	0.31
United States of America	41,520.44	5,645	0.30
Rest of the World	33,860.86	5,718	0.31
Total	264,487.3	18,647	1.00

Note: Exports reported in million Euro.

sales and exports; see Stöß (2001) for a description of the dataset. Note that the information on exports in Ustan is provided by firms on a voluntary basis. Hence, in some cases a zero may indicate no export activity or no information provided. From this dataset we gather information for 2014 on the domestic sales, operating profits, and total exports of 6,961 German firms belonging to the five services sectors. Moreover, we collect data on 7,903 German manufacturers and 8,431 German firms in Other Sectors on these variables.

Regional Trade Agreements of the WTO We gather information on a country's membership in a pure services-trade agreement or a general trade agreement with services-trade provisions from the WTO's Regional Trade Agreements Information System (RTA-IS).

Gravity Database In order to gauge information on the level of barriers to international services trade as well as their decomposition, we use the Gravity Database of the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII; see Head et al., 2010).

World Input-Output Database To calibrate the model to inform the counterfactual analysis we use sector-country information from the World Input-Output Database Release 2016 (WIOD; see Timmer et al., 2015 and Timmer et al., 2016).

A.2 Services Categories

To build our five Services categories we follow the IMF's BPM6 Compilation Guide (2014) with a few exceptions. First, we add Maintenance and Repair Services as well as Travel to the group of Other Services given that the sectoral counterpart in firm-level data and the WIOD is not clear. Second, given the sectoral breakdown in the WIOD, we further extract Construction, Other Business Services and Telecommunication, Computer and Information Services from the group of Other Services. Third, we add Manufacturing Services on Physical Inputs Owned by Others given that we cannot separate manufacturing services from other manufacturing activities and this item apparently is most closely related to Other Business Services. This results in the following classification:

- Transport Services
- Construction
- Telecommunication, Computer and Information Services, ICT
- Other Business Services:
  - Manufacturing Services on Physical Inputs Owned by Others (formely goods trade)
  - Research and Development
  - Professional and Management Services
  - Technical, Trade-related and Other Business Services
  - Operating Leasing

- Other Services:
  - Maintenance and Repair Services
  - Travel
  - Insurance Services
  - Financial Services
  - Charges for the Use of Intellectual Property
  - Personal, Cultural and Recreational Services, Audiovisual Services; Other Personal, Culural, and Recreational Services
  - Government Goods and Services n.i.e.

Table A.2: Estimates of θ_j^s, λ_j^s and k_j^s Using Transaction-level Data, Transport Services

	Main Model						Fixed Cost Model		
Country	$\widehat{\theta_j^s \lambda_j^s}$		$\widehat{\theta}_j^s$		$\widehat{\lambda}_j^s$	$\widehat{k}_j^s$	$\left(\widehat{\theta}_j^s\right)^{\text{fixed}}$		$\left(\widehat{k}_j^s\right)^{\text{fixed}}$
Australia	0.862	(0.268)	0.893	(0.068)	0.965	4.663	0.887	(0.013)	4.696
Austria	0.378	(0.045)	0.754	(0.030)	0.502	5.524	0.830	(0.014)	5.016
Belgium	0.421	(0.030)	0.733	(0.025)	0.574	5.684	0.801	(0.013)	5.196
Brazil	0.457	(0.194)	0.837	(0.065)	0.547	4.977	0.891	(0.012)	4.674
Bulgaria	0.732	(0.310)	0.821	(0.129)	0.892	5.071	0.839	(0.019)	4.963
Canada	0.589	(0.287)	0.893	(0.093)	0.659	4.665	0.909	(0.010)	4.579
China	0.449	(0.140)	0.857	(0.057)	0.524	4.857	0.897	(0.013)	4.640
Croatia	0.892	(0.395)	0.829	(0.103)	1.076	5.025	0.843	(0.020)	4.938
Cyprus	0.380	(0.076)	0.653	(0.045)	0.583	6.379	0.765	(0.022)	5.443
Czech Republic	0.518	(0.068)	0.799	(0.034)	0.648	5.213	0.837	(0.014)	4.976
Denmark	0.329	(0.063)	0.712	(0.047)	0.462	5.847	0.815	(0.016)	5.111
Estonia	0.362	(0.185)	0.630	(0.097)	0.575	6.612	0.770	(0.024)	5.410
Finland	0.416	(0.066)	0.658	(0.046)	0.631	6.325	0.755	(0.019)	5.516
France	0.244	(0.059)	0.690	(0.038)	0.354	6.031	0.822	(0.010)	5.062
Germany	0.468	(0.184)	0.843	(0.090)	0.555	4.937	0.886	(0.010)	4.699
Greece	0.001	(0.000)	0.517	(0.063)	0.002	8.050	0.871	(0.011)	4.779
Hungary	0.527	(0.141)	0.780	(0.063)	0.675	5.335	0.829	(0.016)	5.022
India	1.097	(0.268)	0.910	(0.063)	1.205	4.577	0.888	(0.015)	4.689
Indonesia	0.685	(0.308)	0.801	(0.104)	0.855	5.196	0.846	(0.020)	4.920
Ireland	0.382	(0.076)	0.596	(0.050)	0.641	6.988	0.722	(0.019)	5.768
Italy	0.390	(0.082)	0.810	(0.049)	0.481	5.142	0.871	(0.016)	4.780
Japan	0.376	(0.136)	0.757	(0.064)	0.497	5.502	0.844	(0.013)	4.931
Korea	0.553	(0.080)	0.765	(0.037)	0.722	5.441	0.809	(0.018)	5.149
Latvia	0.394	(0.178)	0.584	(0.117)	0.675	7.129	0.722	(0.030)	5.765
Lithuania	0.001	(0.002)	0.583	(0.044)	0.002	7.142	0.867	(0.012)	4.802
Luxembourg	0.323	(0.129)	0.768	(0.056)	0.421	5.422	0.864	(0.012)	4.821
Malta	0.514	(0.301)	0.673	(0.162)	0.764	6.187	0.774	(0.029)	5.382
Mexico	0.913	(0.234)	0.881	(0.045)	1.035	4.724	0.880	(0.016)	4.731
Netherlands	0.352	(0.022)	0.716	(0.025)	0.491	5.815	0.805	(0.013)	5.170
Norway	0.322	(0.093)	0.679	(0.059)	0.474	6.133	0.798	(0.018)	5.220
Poland	0.371	(0.105)	0.830	(0.042)	0.447	5.014	0.892	(0.007)	4.666
Portugal	0.001	(0.088)	0.540	(0.078)	0.002	7.716	0.807	(0.017)	5.158
Romania	0.720	(0.264)	0.865	(0.088)	0.833	4.816	0.870	(0.015)	4.784
Russian Federation	0.462	(0.121)	0.803	(0.058)	0.575	5.183	0.855	(0.015)	4.869
Slovakia	0.810	(0.180)	0.821	(0.053)	0.987	5.074	0.824	(0.019)	5.054
Slovenia	0.647	(0.351)	0.840	(0.156)	0.770	4.955	0.870	(0.013)	4.787
Spain	0.392	(0.065)	0.752	(0.043)	0.522	5.540	0.828	(0.016)	5.030
Sweden	0.446	(0.048)	0.733	(0.032)	0.609	5.678	0.799	(0.014)	5.209
Switzerland	0.297	(0.044)	0.713	(0.032)	0.416	5.836	0.822	(0.012)	5.063
Taiwan	0.391	(0.140)	0.669	(0.079)	0.584	6.224	0.781	(0.018)	5.329
Turkey	0.456	(0.093)	0.770	(0.052)	0.592	5.407	0.830	(0.017)	5.016
United Kingdom	0.001	(0.009)	0.665	(0.038)	0.002	6.259	0.903	(0.006)	4.612
United States of America	0.375	(0.138)	0.890	(0.054)	0.421	4.678	0.930	(0.007)	4.478
Rest of the World	0.346	(0.067)	0.861	(0.041)	0.401	4.835	0.912	(0.011)	4.566

Table A.3: Estimates of θ_j^s, λ_j^s and k_j^s Using Transaction-level Data, Construction Services

	Main Model						Fixed Cost Model		
Country	$\widehat{\theta_j^s \lambda_j^s}$		$\widehat{\theta}_j^s$		$\widehat{\lambda}_j^s$	$\widehat{k}_j^s$	$\left(\widehat{\theta}_j^s\right)^{\text{fixed}}$		$\left(\widehat{k}_j^s\right)^{\text{fixed}}$
Australia									
Austria	0.193	(0.114)	0.651	(0.074)	0.296	7.676	0.819	(0.014)	6.101
Belgium	0.481	(0.031)	0.519	(0.034)	0.927	9.626	0.622	(0.025)	8.031
Brazil									
Bulgaria									
Canada									
China	0.963	(0.279)	0.791	(0.084)	1.218	6.321	0.795	(0.025)	6.284
Croatia									
Cyprus									
Czech Republic	0.607	(0.111)	0.631	(0.056)	0.961	7.913	0.703	(0.030)	7.104
Denmark	0.232	(0.138)	0.571	(0.090)	0.406	8.758	0.764	(0.022)	6.544
Estonia									
Finland	0.835	(0.245)	0.717	(0.089)	1.165	6.973	0.759	(0.038)	6.581
France	0.571	(0.128)	0.782	(0.055)	0.730	6.388	0.823	(0.017)	6.070
Germany	0.247	(0.026)	0.561	(0.029)	0.440	8.909	0.725	(0.015)	6.888
Greece									
Hungary	0.001	(0.019)	0.395	(0.061)	0.003	12.651	0.747	(0.027)	6.687
India									
Indonesia									
Ireland									
Italy	0.728	(0.288)	0.805	(0.108)	0.905	6.211	0.825	(0.020)	6.054
Japan									
Korea									
Latvia									
Lithuania									
Luxembourg	0.219	(0.110)	0.535	(0.070)	0.410	9.348	0.734	(0.022)	6.805
Malta									
Mexico									
Netherlands	0.370	(0.038)	0.561	(0.030)	0.659	8.909	0.689	(0.019)	7.249
Norway	1.525	(33.422)	0.809	(0.077)	1.886	6.180	0.779	(0.044)	6.410
Poland	0.365	(0.090)	0.545	(0.054)	0.668	9.161	0.695	(0.024)	7.194
Portugal									
Romania	2.170	(51.521)	0.861	(0.112)	2.520	5.802	0.819	(0.033)	6.104
Russian Federation	0.070	(0.067)	0.682	(0.069)	0.103	7.327	0.883	(0.011)	5.656
Slovakia									
Slovenia									
Spain	0.001	(0.056)	0.523	(0.096)	0.002	9.550	0.830	(0.016)	6.022
Sweden	0.541	(0.127)	0.684	(0.061)	0.791	7.307	0.763	(0.030)	6.552
Switzerland	0.345	(0.097)	0.617	(0.067)	0.560	8.096	0.747	(0.023)	6.692
Taiwan									
Turkey	0.420	(0.236)	0.663	(0.120)	0.634	7.537	0.788	(0.024)	6.340
United Kingdom	0.556	(0.053)	0.659	(0.034)	0.844	7.588	0.719	(0.023)	6.947
United States of America	0.782	(0.298)	0.787	(0.087)	0.993	6.348	0.813	(0.027)	6.143
Rest of the World	0.551	(0.103)	0.794	(0.042)	0.694	6.292	0.834	(0.016)	5.991

Table A.4: Estimates of θ_j^s, λ_j^s and k_j^s Using Transaction-level Data, ICT Services

	Main Model						Fixed Cost Model		
Country	$\widehat{\theta_j^s\lambda_j^s}$		$\widehat{\theta}_j^s$		$\widehat{\lambda}_j^s$	$\widehat{k}_j^s$	$\left(\widehat{\theta}_j^s\right)^{\text{fixed}}$		$\left(\widehat{k}_j^s\right)^{\text{fixed}}$
Australia	0.001	(0.124)	0.581	(0.119)	0.002	5.020	0.839	(0.014)	3.475
Austria	0.001	(0.017)	0.541	(0.027)	0.002	5.392	0.817	(0.008)	3.568
Belgium	0.272	(0.075)	0.620	(0.047)	0.439	4.705	0.768	(0.014)	3.794
Brazil	0.242	(0.177)	0.627	(0.115)	0.386	4.650	0.794	(0.024)	3.672
Bulgaria	0.396	(0.222)	0.677	(0.134)	0.585	4.306	0.811	(0.020)	3.596
Canada	0.001	(0.004)	0.461	(0.059)	0.002	6.327	0.809	(0.015)	3.605
China	0.172	(0.093)	0.625	(0.058)	0.276	4.663	0.807	(0.012)	3.613
Croatia	0.001	(0.036)	0.542	(0.066)	0.002	5.380	0.839	(0.016)	3.473
Cyprus									
Czech Republic	0.407	(0.130)	0.761	(0.067)	0.535	3.830	0.838	(0.015)	3.477
Denmark	0.449	(0.089)	0.723	(0.048)	0.621	4.033	0.798	(0.016)	3.655
Estonia									
Finland	0.001	(0.025)	0.598	(0.049)	0.002	4.875	0.860	(0.014)	3.390
France	0.350	(0.044)	0.732	(0.030)	0.478	3.984	0.821	(0.012)	3.551
Germany	0.162	(0.132)	0.676	(0.086)	0.240	4.314	0.846	(0.013)	3.446
Greece	0.001	(0.002)	0.449	(0.077)	0.002	6.497	0.837	(0.015)	3.483
Hungary	0.532	(0.118)	0.753	(0.054)	0.706	3.872	0.808	(0.020)	3.608
India	0.369	(0.202)	0.775	(0.101)	0.477	3.763	0.864	(0.013)	3.374
Indonesia	0.001	(0.014)	0.276	(0.073)	0.004	10.549	0.684	(0.031)	4.260
Ireland	0.197	(0.108)	0.699	(0.054)	0.281	4.168	0.852	(0.013)	3.423
Italy	0.284	(0.077)	0.662	(0.050)	0.429	4.403	0.794	(0.016)	3.671
Japan	0.290	(0.135)	0.654	(0.072)	0.443	4.455	0.799	(0.019)	3.648
Korea	0.057	(0.141)	0.555	(0.121)	0.102	5.256	0.808	(0.020)	3.609
Latvia									
Lithuania									
Luxembourg	0.342	(0.110)	0.687	(0.056)	0.498	4.244	0.802	(0.017)	3.634
Malta									
Mexico	0.194	(0.173)	0.598	(0.122)	0.324	4.876	0.791	(0.023)	3.683
Netherlands	0.079	(0.068)	0.661	(0.045)	0.119	4.410	0.855	(0.009)	3.411
Norway	0.287	(0.167)	0.573	(0.118)	0.501	5.089	0.748	(0.026)	3.896
Poland	0.016	(0.076)	0.543	(0.068)	0.029	5.372	0.803	(0.014)	3.629
Portugal	0.454	(0.089)	0.607	(0.053)	0.747	4.800	0.715	(0.023)	4.079
Romania	0.460	(0.146)	0.673	(0.076)	0.684	4.333	0.767	(0.020)	3.801
Russian Federation	0.403	(0.108)	0.675	(0.059)	0.598	4.318	0.776	(0.020)	3.755
Slovakia	0.486	(0.100)	0.623	(0.056)	0.780	4.680	0.720	(0.024)	4.046
Slovenia	0.273	(0.213)	0.636	(0.129)	0.430	4.580	0.810	(0.021)	3.599
Spain	0.001	(0.001)	0.623	(0.031)	0.002	4.676	0.892	(0.008)	3.267
Sweden	0.382	(0.124)	0.767	(0.060)	0.498	3.801	0.848	(0.014)	3.436
Switzerland	0.169	(0.074)	0.666	(0.051)	0.253	4.375	0.831	(0.012)	3.510
Taiwan	0.001	(0.000)	0.298	(0.065)	0.003	9.775	0.732	(0.031)	3.982
Turkey	0.439	(0.080)	0.634	(0.047)	0.693	4.598	0.734	(0.018)	3.973
United Kingdom	0.382	(0.052)	0.804	(0.031)	0.475	3.624	0.866	(0.011)	3.367
United States of America	0.095	(0.085)	0.700	(0.056)	0.136	4.164	0.873	(0.010)	3.339
Rest of the World	0.289	(0.103)	0.775	(0.052)	0.373	3.762	0.871	(0.011)	3.345

Table A.5: Estimates of θ_j^s, λ_j^s and k_j^s Using Transaction-level Data, Other Business Services

Country	Main Model						Fixed Cost Model		
	$\widehat{\theta_j^s \lambda_j^s}$		$\widehat{\theta}_j^s$		$\widehat{\lambda}_j^s$	$\widehat{k}_j^s$	$\left(\widehat{\theta}_j^s\right)^{\text{fixed}}$		$\left(\widehat{k}_j^s\right)^{\text{fixed}}$
Australia	0.258	(0.067)	0.630	(0.050)	0.409	5.571	0.779	(0.016)	4.508
Austria	0.178	(0.029)	0.636	(0.031)	0.280	5.523	0.804	(0.013)	4.366
Belgium	0.272	(0.049)	0.779	(0.038)	0.349	4.509	0.874	(0.013)	4.020
Brazil	0.179	(0.107)	0.640	(0.084)	0.279	5.488	0.812	(0.023)	4.323
Bulgaria	0.288	(0.072)	0.505	(0.058)	0.570	6.951	0.682	(0.021)	5.147
Canada	0.158	(0.104)	0.658	(0.080)	0.241	5.337	0.830	(0.020)	4.229
China	0.273	(0.061)	0.793	(0.047)	0.344	4.429	0.883	(0.015)	3.977
Croatia	0.297	(0.049)	0.461	(0.040)	0.644	7.616	0.640	(0.019)	5.485
Cyprus	0.001	(0.079)	0.652	(0.120)	0.002	5.388	0.903	(0.006)	3.889
Czech Republic	0.126	(0.112)	0.739	(0.095)	0.170	4.750	0.888	(0.020)	3.953
Denmark	0.195	(0.066)	0.637	(0.057)	0.307	5.516	0.803	(0.019)	4.376
Estonia	0.001	(0.000)	0.329	(0.057)	0.003	10.665	0.765	(0.015)	4.591
Finland	0.257	(0.056)	0.626	(0.051)	0.410	5.609	0.776	(0.019)	4.528
France	0.171	(0.036)	0.689	(0.026)	0.248	5.097	0.842	(0.008)	4.172
Germany	0.268	(0.055)	0.598	(0.051)	0.448	5.874	0.750	(0.022)	4.685
Greece	0.161	(0.074)	0.511	(0.045)	0.316	6.878	0.728	(0.015)	4.821
Hungary	0.001	(0.028)	0.702	(0.040)	0.001	5.005	0.912	(0.005)	3.850
India	0.172	(0.062)	0.594	(0.041)	0.289	5.913	0.780	(0.012)	4.500
Indonesia	0.352	(0.077)	0.586	(0.052)	0.602	5.994	0.723	(0.021)	4.857
Ireland	0.306	(0.087)	0.802	(0.048)	0.382	4.381	0.884	(0.012)	3.973
Italy	0.274	(0.016)	0.662	(0.019)	0.415	5.306	0.785	(0.010)	4.475
Japan	0.319	(0.045)	0.756	(0.028)	0.422	4.646	0.847	(0.010)	4.146
Korea	0.330	(0.061)	0.727	(0.044)	0.454	4.829	0.825	(0.014)	4.259
Latvia	0.394	(0.054)	0.415	(0.045)	0.950	8.465	0.584	(0.026)	6.018
Lithuania	0.185	(0.137)	0.481	(0.101)	0.384	7.295	0.714	(0.026)	4.917
Luxembourg	0.334	(0.030)	0.709	(0.027)	0.471	4.951	0.805	(0.014)	4.363
Malta	0.049	(0.077)	0.557	(0.062)	0.089	6.308	0.809	(0.020)	4.343
Mexico	0.059	(0.136)	0.712	(0.118)	0.083	4.934	0.892	(0.015)	3.937
Netherlands	0.277	(0.020)	0.733	(0.025)	0.378	4.789	0.839	(0.013)	4.188
Norway	0.310	(0.038)	0.621	(0.029)	0.500	5.659	0.749	(0.013)	4.687
Poland	0.053	(0.055)	0.617	(0.048)	0.086	5.694	0.834	(0.012)	4.213
Portugal	0.094	(0.105)	0.660	(0.083)	0.143	5.322	0.852	(0.014)	4.121
Romania	0.001	(0.000)	0.552	(0.031)	0.002	6.358	0.875	(0.007)	4.012
Russian Federation	0.251	(0.045)	0.647	(0.037)	0.388	5.429	0.789	(0.013)	4.449
Slovakia	0.405	(0.054)	0.725	(0.035)	0.558	4.842	0.803	(0.016)	4.375
Slovenia	0.289	(0.087)	0.561	(0.070)	0.515	6.256	0.725	(0.024)	4.841
Spain	0.142	(0.065)	0.675	(0.050)	0.210	5.206	0.843	(0.013)	4.166
Sweden	0.258	(0.041)	0.677	(0.031)	0.381	5.189	0.807	(0.011)	4.353
Switzerland	0.337	(0.021)	0.858	(0.015)	0.392	4.092	0.908	(0.007)	3.867
Taiwan	0.325	(0.130)	0.695	(0.085)	0.468	5.057	0.812	(0.020)	4.328
Turkey	0.004	(0.046)	0.502	(0.048)	0.009	7.003	0.777	(0.014)	4.521
United Kingdom	0.258	(0.025)	0.756	(0.022)	0.342	4.645	0.860	(0.009)	4.082
United States of America	0.266	(0.036)	0.826	(0.034)	0.322	4.254	0.905	(0.013)	3.883
Rest of the World	0.332	(0.014)	0.741	(0.014)	0.449	4.739	0.825	(0.008)	4.254

Table A.6: Estimates of θ_j^s, λ_j^s and k_j^s Using Transaction-level Data, Other Services

	Main Model						Fixed Cost Model		
Country	$\widehat{\theta_j^s \lambda_j^s}$		$\widehat{\theta}_j^s$		$\widehat{\lambda}_j^s$	$\widehat{k}_j^s$	$\left(\widehat{\theta}_j^s\right)^{\text{fixed}}$		$\left(\widehat{k}_j^s\right)^{\text{fixed}}$
Australia	0.649	(0.131)	0.913	(0.028)	0.710	2.488	0.917	(0.008)	2.479
Austria	0.307	(0.041)	0.813	(0.029)	0.377	2.794	0.888	(0.010)	2.560
Belgium	0.388	(0.043)	0.833	(0.021)	0.466	2.728	0.884	(0.009)	2.571
Brazil	0.564	(0.111)	0.889	(0.034)	0.634	2.556	0.904	(0.009)	2.514
Bulgaria	0.506	(0.071)	0.705	(0.039)	0.718	3.224	0.771	(0.018)	2.949
Canada	0.589	(0.072)	0.869	(0.023)	0.678	2.615	0.883	(0.011)	2.573
China	0.424	(0.065)	0.886	(0.024)	0.479	2.564	0.918	(0.008)	2.477
Croatia	0.446	(0.056)	0.670	(0.030)	0.666	3.394	0.759	(0.023)	2.993
Cyprus	0.430	(0.220)	0.761	(0.110)	0.566	2.987	0.845	(0.016)	2.690
Czech Republic	0.238	(0.080)	0.740	(0.043)	0.322	3.071	0.860	(0.009)	2.643
Denmark	0.299	(0.100)	0.759	(0.062)	0.393	2.994	0.858	(0.015)	2.648
Estonia	0.493	(0.178)	0.607	(0.097)	0.812	3.742	0.716	(0.027)	3.174
Finland	0.258	(0.132)	0.684	(0.084)	0.377	3.321	0.821	(0.020)	2.767
France	0.285	(0.094)	0.863	(0.054)	0.330	2.633	0.925	(0.012)	2.456
Germany	0.245	(0.019)	0.733	(0.022)	0.334	3.100	0.849	(0.010)	2.678
Greece	0.284	(0.108)	0.815	(0.041)	0.349	2.790	0.902	(0.011)	2.519
Hungary	0.408	(0.064)	0.794	(0.029)	0.514	2.864	0.854	(0.011)	2.660
India	0.468	(0.156)	0.870	(0.067)	0.538	2.611	0.902	(0.012)	2.520
Indonesia	0.264	(0.205)	0.738	(0.116)	0.357	3.080	0.864	(0.014)	2.630
Ireland	0.240	(0.124)	0.853	(0.059)	0.282	2.666	0.930	(0.005)	2.443
Italy	0.389	(0.049)	0.869	(0.024)	0.448	2.615	0.909	(0.007)	2.499
Japan	0.310	(0.132)	0.870	(0.053)	0.356	2.611	0.929	(0.006)	2.447
Korea	0.489	(0.117)	0.837	(0.044)	0.584	2.715	0.878	(0.011)	2.589
Latvia	0.437	(0.147)	0.640	(0.082)	0.683	3.553	0.752	(0.025)	3.023
Lithuania	0.341	(0.191)	0.618	(0.118)	0.552	3.679	0.770	(0.021)	2.950
Luxembourg	0.371	(0.044)	0.831	(0.029)	0.446	2.736	0.886	(0.011)	2.565
Malta	0.002	(0.039)	0.631	(0.047)	0.003	3.600	0.867	(0.015)	2.620
Mexico	0.133	(0.094)	0.830	(0.046)	0.160	2.739	0.938	(0.005)	2.422
Netherlands	0.360	(0.044)	0.860	(0.023)	0.419	2.643	0.908	(0.008)	2.504
Norway	0.150	(0.117)	0.770	(0.070)	0.195	2.952	0.902	(0.009)	2.519
Poland	0.374	(0.044)	0.794	(0.026)	0.471	2.864	0.858	(0.009)	2.648
Portugal	0.471	(0.101)	0.808	(0.047)	0.583	2.813	0.855	(0.013)	2.659
Romania	0.394	(0.095)	0.777	(0.048)	0.507	2.925	0.850	(0.013)	2.673
Russian Federation	0.350	(0.067)	0.800	(0.028)	0.437	2.841	0.872	(0.007)	2.608
Slovakia	0.342	(0.097)	0.709	(0.049)	0.481	3.204	0.815	(0.013)	2.788
Slovenia	0.001	(0.027)	0.640	(0.037)	0.002	3.553	0.871	(0.015)	2.609
Spain	0.327	(0.058)	0.821	(0.030)	0.398	2.768	0.891	(0.008)	2.552
Sweden	0.374	(0.059)	0.786	(0.037)	0.475	2.891	0.855	(0.012)	2.658
Switzerland	0.267	(0.061)	0.865	(0.030)	0.309	2.628	0.929	(0.007)	2.446
Taiwan	0.354	(0.212)	0.783	(0.094)	0.453	2.903	0.872	(0.016)	2.608
Turkey	0.449	(0.080)	0.853	(0.033)	0.526	2.666	0.891	(0.011)	2.551
United Kingdom	0.204	(0.137)	0.905	(0.067)	0.226	2.511	0.961	(0.006)	2.366
United States of America	0.285	(0.120)	0.918	(0.052)	0.310	2.475	0.957	(0.009)	2.375
Rest of the World	0.335	(0.122)	0.932	(0.048)	0.359	2.438	0.959	(0.007)	2.369