Global Production with Export Platforms – Online Appendix

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Appendix III: Sensitivity

TABLE A.3
Sensitivity of Estimation Results to Fixed Costs of Market Access

	True Parameters of data generating process	Baseline	Mean parameter estimates if data is simulated according to With fixed costs of exporting			
			50,000€	100,000€	200,000€	300,000€
Unit input costs						
Austria	1.051	1.053	1.015	1.033	1.057	1.090
Belgium	1.150	1.158	1.168	1.185	1.231	1.280
Canada	1.261	1.250	1.267	1.369	1.547	1.660
Switzerland	1.155	1.153	1.168	1.209	1.280	1.332
Spain	1.155	1.162	1.167	1.181	1.277	1.384
France	1.152	1.153	1.158	1.168	1.205	1.264
United Kingdom	1.234	1.233	1.240	1.250	1.335	1.426
Ireland	1.106	1.099	1.109	1.185	1.257	1.295
Italy	1.235	1.231	1.237	1.246	1.315	1.413
Netherlands	1.118	1.107	1.115	1.131	1.174	1.235
United States	1.353	1.353	1.351	1.353	1.391	1.469
Fixed costs						
Austria	3.544	3.549	3.284	3.321	3.211	3.042
Belgium	3.859	3.860	4.148	4.180	3.992	3.733
Canada	3.776	3.815	4.085	4.011	3.684	3.446
Switzerland	3.462	3.505	3.731	3.746	3.506	3.294
Spain	3.207	3.230	3.448	3.492	3.249	2.980
France	3.227	3.252	3.479	3.535	3.353	3.123
United Kingdom	3.176	3.219	3.435	3.486	3.260	3.007
Ireland	4.054	4.087	4.311	4.261	4.035	3.812
Italy	3.284	3.327	3.566	3.632	3.405	3.131
Netherlands	3.724	3.829	4.162	4.150	3.944	3.737
United States	3.205	3.270	3.488	3.546	3.383	3.128
S.d. log fixed cost, $\sigma_{\tilde{\eta}}$	1.086	1.103	1.181	1.212	1.126	1.019
Scale parameter productivity, μ_ϕ	0.783	0.780	0.751	0.731	0.731	0.729
Shape parameter productivity, σ_ϕ	6.436	6.588	6.191	5.916	6.237	6.212
S.d. log productivity shock, σ_ϵ	0.108	0.107	0.125	0.118	0.134	0.144
Model predictions						
Share of MNEs that serve all markets			0.352	0.247	0.162	0.124
Share of export platform sales			0.392	0.388	0.380	0.374
Average number of foreign plants by MNEs			1.363	1.375	1.396	1.411

Notes: Columns 2-6 present estimated parameter values if the data was generated by an augmented model with various levels of fixed costs of market access. I simulate 20 data sets of 10,000 firms and conduct the estimation on these data sets. Column 2 (Baseline) contains the mean parameter estimates without fixed costs of market access, column 3 with 50,000 Euros of fixed cost of market access per market, and so forth.

TABLE A.4

Estimation Results: Robustness to Different Values of θ

	Baseline	Alternative values of θ	
	$\theta = 7$	$\theta = 6$	$\theta = 9$
Unit input costs			
Austria	1.051	1.048	1.019
Belgium	1.150	1.202	1.118
Canada	1.261	1.246	1.296
Switzerland	1.155	1.187	1.115
Spain	1.155	1.162	1.145
France	1.152	1.169	1.133
United Kingdom	1.234	1.254	1.220
Ireland	1.106	1.106	1.068
Italy	1.235	1.242	1.239
Netherlands	1.118	1.161	1.070
United States	1.353	1.356	1.367
Fixed costs			
Austria	3.544	3.498	3.361
Belgium	3.859	3.995	3.722
Canada	3.776	3.843	3.696
Switzerland	3.462	3.531	3.348
Spain	3.207	3.212	3.066
France	3.227	3.250	3.087
United Kingdom	3.176	3.180	3.094
Ireland	4.054	4.104	3.932
Italy	3.284	3.298	3.231
Netherlands	3.724	3.712	3.582
United States	3.205	3.220	3.157
S.d. log fixed cost, $\sigma_{\tilde{\eta}}$	1.086	1.086	1.032
Scale parameter productivity, μ_{ϕ}	0.783	0.700	0.854
Shape parameter productivity, σ_{ϕ}	6.436	6.522	6.113
S.d. log productivity shock, σ_{ϵ}	0.108	0.110	0.103

Notes: This table contains the point estimation results for these alternative models based on the German micro data.

Appendix IV: Number of Production Locations and Export Platform Shares

This section shows in a numerical example for a world with symmetric countries that the share of export platform sales decreases with in the number of production locations. This result is numerically robust so long as $\tau_{lm} \geq \gamma_{il} \geq 1$ and $\theta > \max\{\sigma - 1, 1\}$. For the figure below, I specify the parameter values: $\sigma = 6$, $\tau_{lm} = 1.6$, $\gamma_{il} = 1.2$ and set $\epsilon_l = 1 \ \forall \ l$. Using equation (10) one can calculate the share of total output by a plant that is sold outside the host country. Figure A.1 displays the export platform shares for plant $l \neq i$ as the number of plants increase. The level of export platform shares is influenced by the parameter θ. For these values of θ, as θ increases the cannibalization effect between plants becomes stronger, leading to a sharper fall of export platform sales when the number of countries in which the firm has a plant rises.

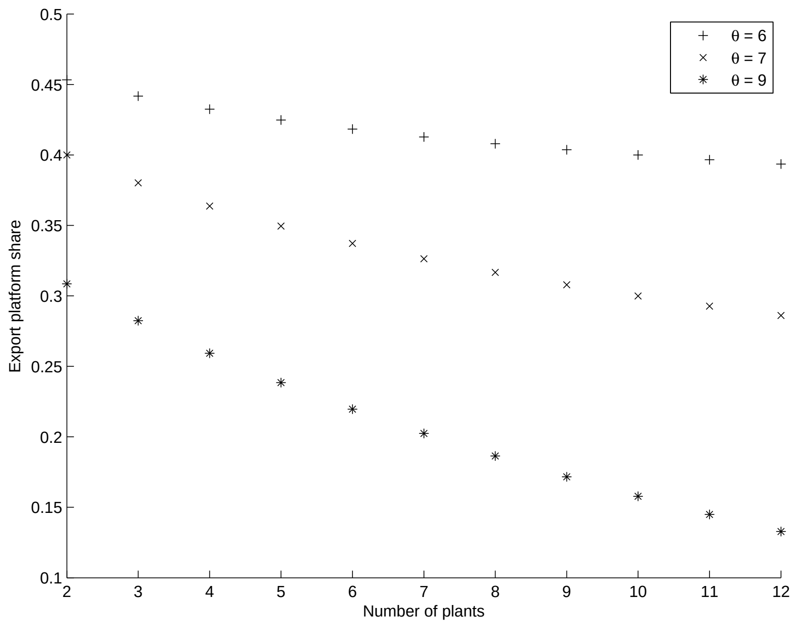

Figure A.1
Export Platform Shares - Symmetric Countries

Numerically, it is possible to show that in a symmetric world with no plant-specific productivity shifters and satisfying $\tau_{lm} \geq \gamma_{il} \geq 1$ and $\theta > \max\{\sigma - 1, 1\}$, export platform shares decrease with more production locations for all parameter values. Demonstrating this result algebraically is challenging, and therefore I limit the following proposition to the simpler case in which $\gamma = 1$, which is suggestive of the methodology needed to prove the more general result.

Proposition 3. *In a world with symmetric countries and no plant-specific productivity shifters, export platform shares decrease with more production locations if* $\tau > \gamma = 1$.

Proof. Considering the symmetric model, equation (10) in the paper simplifies to:

$$s_{lm} = \frac{\kappa Y}{P^{1-\sigma}} \phi^{\sigma-1} w^{1-\sigma} \frac{(\gamma_{il}\tau_{lm})^{-\theta} \epsilon_l^{-\theta}}{\left(\sum_{k \in Z} (\gamma_{il}\tau_{lm})^{-\theta} \epsilon_l^{-\theta}\right)^{\alpha}},$$

where I define

$$\alpha = \frac{\theta - \sigma + 1}{\theta} \in (0, 1).$$

Imposing symmetry:

$$\gamma_{il} = \begin{cases} 1 & : i = l \\ \gamma & : i \neq l \end{cases}$$

$$\tau_{lm} = \begin{cases} 1 & : l = m \\ \tau & : l \neq m \end{cases}$$

Eliminating plant-specific productivity shifters, one can write the following 4 cases of sales to local (s_{ll}), sales to home (s_{li}), sales to other countries with plants $s_{lm}^{othplant}$, and sales to other countries without plants $s_{lm}^{othnoplant}$ (suppressing other arguments for succinctness):

$$\begin{aligned} s_{ll}(K) &= \frac{\kappa Y}{P^{1-\sigma}} \phi^{\sigma-1} w^{1-\sigma} \frac{\gamma^{-\theta}}{((K-1)(\gamma\tau)^{-\theta} + \gamma^{-\theta} + \tau^{-\theta})^{\alpha}} \\ s_{li}(K) &= \frac{\kappa Y}{P^{1-\sigma}} \phi^{\sigma-1} w^{1-\sigma} \frac{(\gamma\tau)^{-\theta}}{(K(\gamma\tau)^{-\theta} + 1)^{\alpha}} \\ s_{lm}^{othplant}(K) &= \frac{\kappa Y}{P^{1-\sigma}} \phi^{\sigma-1} w^{1-\sigma} \frac{(\gamma\tau)^{-\theta}}{((K-1)(\gamma\tau)^{-\theta} + \gamma^{-\theta} + \tau^{-\theta})^{\alpha}} \\ s_{lm}^{othnoplant}(K) &= \frac{\kappa Y}{P^{1-\sigma}} \phi^{\sigma-1} w^{1-\sigma} \frac{(\gamma\tau)^{-\theta}}{(K(\gamma\tau)^{-\theta} + \tau^{-\theta})^{\alpha}}, \end{aligned}$$

where K denotes the number of foreign plants. Export platform shares are defined as:

$$\begin{aligned} \zeta(K) &= 1 - \frac{s_{ll}(K)}{s_{ll}(K) + s_{li}(K) + (K-1)s_{lm}^{othplant}(K) + (N-K-1)s_{lm}^{othnoplant}(K)} \\ &= 1 - \frac{\gamma^{-\theta}}{\gamma^{-\theta} + (\gamma\tau)^{-\theta}A(K) + (K-1)(\gamma\tau)^{-\theta} + (N-K-1)(\gamma\tau)^{-\theta}B(K)} \\ &= 1 - \frac{1}{1 + \tau^{-\theta}\left(A(K) + (K-1) + (N-K-1)B(K)\right)}, \end{aligned}$$

where

$$\begin{aligned} A(K) &= \frac{((K-1)(\gamma\tau)^{-\theta} + \gamma^{-\theta} + \tau^{-\theta})^{\alpha}}{(K(\gamma\tau)^{-\theta} + 1)^{\alpha}} \\ &= \left(\frac{(K-1)(\gamma\tau)^{-\theta} + \gamma^{-\theta} + \tau^{-\theta}}{K(\gamma\tau)^{-\theta} + 1}\right)^{\alpha} \\ B(K) &= \frac{((K-1)(\gamma\tau)^{-\theta} + \gamma^{-\theta} + \tau^{-\theta})^{\alpha}}{(K(\gamma\tau)^{-\theta} + \tau^{-\theta})^{\alpha}} \\ &= \left(\frac{(K-1)(\gamma\tau)^{-\theta} + \gamma^{-\theta} + \tau^{-\theta}}{K(\gamma\tau)^{-\theta} + \tau^{-\theta}}\right)^{\alpha}. \end{aligned}$$

Note that $B(K) \geq 1 \geq A(K)$. Taking a derivative of ζ with respect to K:

$$\zeta'(K) = \frac{\tau^{-\theta}\left(A'(K) + (1 - B(K)) + (N-K-1)B'(K)\right)}{\left(1 + \tau^{-\theta}\left(A(K) + (K-1) + (N-K-1)B(K)\right)\right)^2}$$

Imposing $\gamma = 1$:

$$\begin{aligned} A(K) &= \left(\frac{K\tau^{-\theta} + 1}{K\tau^{-\theta} + 1}\right)^{\alpha} = 1 \\ A'(K) &= 0 \\ B(K) &= \left(\frac{K\tau^{-\theta} + 1}{(K+1)\tau^{-\theta}}\right)^{\alpha} > 1 \\ B'(K) &= \alpha\left(\frac{K\tau^{-\theta} + 1}{(K+1)\tau^{-\theta}}\right)^{\alpha-1}\left(\frac{1-\tau^{\theta}}{(K+1)^2}\right) < 0 \end{aligned}$$

$B'(K) < 0$ and $N \geq K + 1$ implies that $(N-K-1)B'(K) \leq 0$. Therefore it is sufficient to show that

$A'(K) + (1 - B(K)) < 0$ to demonstrate that $\zeta'(K) < 0$:

$$\begin{aligned} A'(K) + (1 - B(K)) &= 0 + 1 - \frac{C(K)^\alpha}{E(K)^\alpha} \\ &= 1 - \left(\frac{K\tau^{-\theta} + 1}{(K+1)\tau^{-\theta}} \right)^\alpha < 0 \end{aligned}$$

Where the last line follows because $K\tau^{-\theta} + 1 > (K+1)\tau^{-\theta}$ whenever $\tau > 1$. Therefore $\zeta'(K) < 0$. □

In the general case without $\gamma = 1$ assumed, $A'(K) > 0$ and $1 - B(K) < 0$. Therefore assessing the relative magnitudes of these terms would be crucial for determining the sign of $A'(K) + (1 - B(K))$.

Appendix V: Export Platform Sales Statistics

TABLE A.5
Export Platform Shares - Data and Models

		Global Production model			No Fixed Costs model		
Country	Data	$\theta = 6$	$\theta = 7$	$\theta = 9$	$\theta = 6$	$\theta = 7$	$\theta = 9$
Austria	0.54	0.53	0.49	0.47	0.53	0.46	0.34
Belgium	0.63	0.79	0.76	0.76	0.78	0.74	0.67
Canada	0.37	0.35	0.30	0.23	0.31	0.23	0.14
Switzerland	0.69	0.73	0.70	0.71	0.73	0.68	0.58
Germany	0.47	0.23	0.21	0.19	0.21	0.16	0.10
Spain	0.41	0.16	0.13	0.10	0.15	0.10	0.05
France	0.37	0.27	0.24	0.21	0.25	0.19	0.12
United Kingdom	0.34	0.23	0.20	0.17	0.20	0.15	0.09
Ireland	0.80	0.70	0.66	0.65	0.69	0.63	0.54
Italy	0.33	0.15	0.12	0.10	0.13	0.09	0.05
Netherlands	0.62	0.56	0.52	0.51	0.54	0.48	0.38

TABLE A.6
Export Platform Shares: Model Prediction for German Multinational Firms

Country	Export Platform Share of Total Sales
Austria	0.42
Belgium	0.64
Canada	0.27
Switzerland	0.50
Spain	0.24
Germany	0.11
France	0.22
United Kingdom	0.14
Ireland	0.52
Italy	0.09
Netherlands	0.47
United States	0.02

Notes: Export platform sales predictions for German MNEs based on estimates from the German micro data.

Appendix VI: Calculation of Individual Level Parameters

The estimation in Section 3 delivers a distribution of fixed costs faced by the observed multinational firms. With these estimates I derive the distribution of fixed costs for each multinational firm conditional on its observed location choice, Z_t, and the location-specific productivity vector, ψ_t. We can then calculate the mean value of fixed costs that were actually paid to set up a plant in the respective countries. To my knowledge, Revelt and Train (2000) were the first to use such a procedure to infer information about the tastes of each sampled customer from the estimates of the distribution of tastes in the population with a nonlinear - mixed logit - discrete choice model.

Let β denote the parameter vector of estimates in Section 3. The productivity vector across plants of firm t, ψ_t, can be calculated given r_t and β. The density of the fixed cost draws across countries conditional on having chosen a plant in country l can be written as

$$u(f \mid Z_t, \psi_t, \beta) = \frac{Pr(Z_t \mid \psi_t, f) z(f \mid \beta)}{\int_f Pr(Z_t \mid \psi_t, f) z(f \mid \beta) df},$$

where

$$Pr(Z_t \mid \psi_t, f) = \int_\phi Pr(Z_t \mid \phi, f) k(\phi \mid \psi) d\phi,$$

and

$$k(\phi \mid \psi_t) = \frac{g(\phi) \left| \frac{\mathrm{d}\psi_t/\phi}{\mathrm{d}\psi_t} \right| \prod_{l \in Z_t} h(\frac{\psi_{t,l}(\tilde{w}, \sigma_\epsilon)}{\phi} \mid \beta)}{\int_{\phi'} g(\phi') \left| \frac{\mathrm{d}\psi_t/\phi'}{\mathrm{d}\psi_t} \right| \prod_{l \in Z_t} h(\frac{\psi_{t,l}(\tilde{w}, \sigma_\epsilon)}{\phi'} \mid \beta) d\phi'},$$

and

$$Pr(Z_t \mid \phi, f) = \mathbb{1}\{E_\epsilon(\Pi | \phi, Z_t, \epsilon, f; \beta) \geq E_\epsilon(\Pi | \phi, Z', \epsilon, f; \beta) \quad \forall Z'\}.$$

The mean of fixed costs for firm t is

$$\bar{f}^t = \int f u(f \mid Z_{t,l}, \psi_t, \beta) df,$$

and the average fixed cost in country l of firms that actually have a plant there is

$$= \frac{\sum_{t=1}^T \bar{f}_l^t \mathbb{1}\{l \in Z_t\}}{\sum_{t=1}^T \mathbb{1}\{l \in Z_t\}}.$$

Appendix VII: Computational Method

A. Optimization

The constrained optimization problems specified in (26) and (29) are solved using the numerical optimization solver Knitro.[1] I hand-coded the analytical gradients (and checked their accuracy by comparison with a finite difference approximation) and provided the sparsity structure of the problem. In order to find a global optimum to the problem, I started the optimization procedure from multiple starting points. Furthermore, I conducted a Monte Carlo study for the Maximum Likelihood Estimation in Section 3 to ensure that each of the parameters can be recovered if the data process follows the specification of the model. Results for the Monte Carlo Study are available from the author upon request.

B. Numerical Integration

The model contains three dimensions of firm heterogeneity: The core productivity level, ϕ, the vector of fixed unit labor requirements, η, and the vector of firm-country-specific productivity shifters, ϵ.

- **Core productivity level**

  The core productivity level, ϕ, is distributed according to a Pareto distribution. I use a stratified random sampling method in order to obtain good coverage of relatively high productivity levels. I define the following 10 intervals $[0, .2, .4, .6, .8, .9, .95, .98, .99, .999, 1]$ and then draw $S_1/10$ uniform random numbers within these intervals. The draws receive a weight inversely proportional to the length of the interval. One can then obtain realizations from the Pareto distribution by using the draws of numbers between 0 and 1 and the inverse of the Pareto cdf.

- **Firm-country-specific productivity shifter**

  The firm-country-specific productivity shifter, ϵ, is distributed according to a Log-Normal distribution. The country-specific shocks affect smoothly the trade flows and revenues conditional on the location choice of the firm. They also affect smoothly the expected profit from a location choice. In order to obtain good coverage of this N-dimensional shock while maintaining computational tractability, I use sparse grid points and Gaussian quadrature rules as basis functions. Sparse grid points break the curse of dimensionality in high dimensional integration problems and for well behaved functions tend to be more accurate than Monte Carlo integration techniques. The approach is exact for polynomial functions of a given order. This approach is described by Heiss and Winschel (2008), and their web page (`http://sparse-grids.de`) provides the relevant code.

- **Fixed cost draws**

  Similarly, the firm-country-specific fixed cost level, η, is distributed according to a Log-Normal distribution. Since domestic fixed costs are zero, this is an N-1 dimensional vector. When simulating the integrals in (15), (19), (20), and (21), I use a smoothed accept-reject simulator to maintain differentiability of the integrals while evaluating the integrals at a finite number of fixed cost draws. See section 5.6.2 in Train (2009) for a more detailed description and discussion of advantages from this approach. Given the scale of the other variables, the goal is to set the smoothing parameter as low as possible subject to maintaining numerical tractability. Following the notation in Train (2009), I use a smoothing parameter $\lambda = 1$ for the estimation with firm-level data in section 3 and a smoothing parameter $\lambda = 0.01$ for the estimation of the general equilibrium model in section 4 and the counterfactuals in section 5. The reason a different smoothing parameter is used is that the variables are in different scales in these sections. The current appraoch is equivalent to first rescaling all variables by $1/100$ and then using a smoothing parameter of 0.01 in section 3. I use scrambled Halton sequences for the simulation of fixed cost draws, which again have better coverage than pseudo Monte Carlo draws.

[1] Su and Judd (2012) and Dube, Fox, and Su (2012) discuss advantages of this approach over a nested fixed point algorithm.

C. Estimation

The estimation is an implementation of the Mathematical Programming with Equilibrium Constraints (MPEC) procedure proposed by Su and Judd (2012). They show that the estimator is equivalent to a nested fixed-point estimator in which the inner loop solves for the firm-country-specific productivity levels, and the outer loop searches over parameters to maximize the likelihood. The estimator therefore inherits all the statistical properties of a nested fixed-point estimator. It is consistent and asymptotically normal as the number of firms tends to infinity and the number of simulation points used to evaluate the integrals rises proportionally to the number of firms.[2] As there are 1,711 positive firm-country output observations of German multinationals, the constrained optimization problem described in (26) has 1,711 equality constraints. For the purely domestic operating German firms the inversion can be conducted analytically. In total, the data on the firm-output observations and the firms' location set choices is used to estimate 26 structural parameters (15 parameters if the fixed cost distribution is assumed to be the same across host countries). I compute standard errors via bootstrapping and use a logit-smoothed accept-reject simulator to evaluate the probability of location choice described in (21).[3]

D. Counterfactuals

To re-solve the system of equilibrium conditions for a new parameter vector, I again make use of the optimization solver Knitro but have the objective function take the value of a constant and the equilibrium conditions represent the constraints.

[2]As the integrals are evaluated numerically in a finite sample with finite simulation draws, the Simulated Maximum Likelihood Estimator is necessarily biased (after taking logarithms of the Likelihood function). I find in a Monte Carlo study of my estimation procedure that the bias is very small in practice for this problem.

[3]See Train (2009), Chapter 5, for a description of this and other methods of simulation.

Appendix VIII: Fit of the Calibrated Global Production Model

A. Bilateral Trade Shares

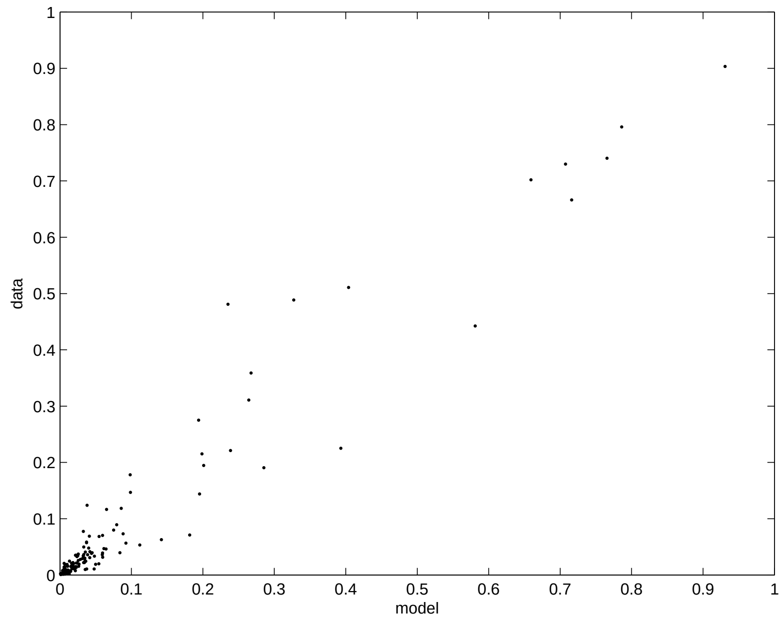

Figure A.2
Bilateral Trade Shares - Data and Model

B. Bilateral MP Shares

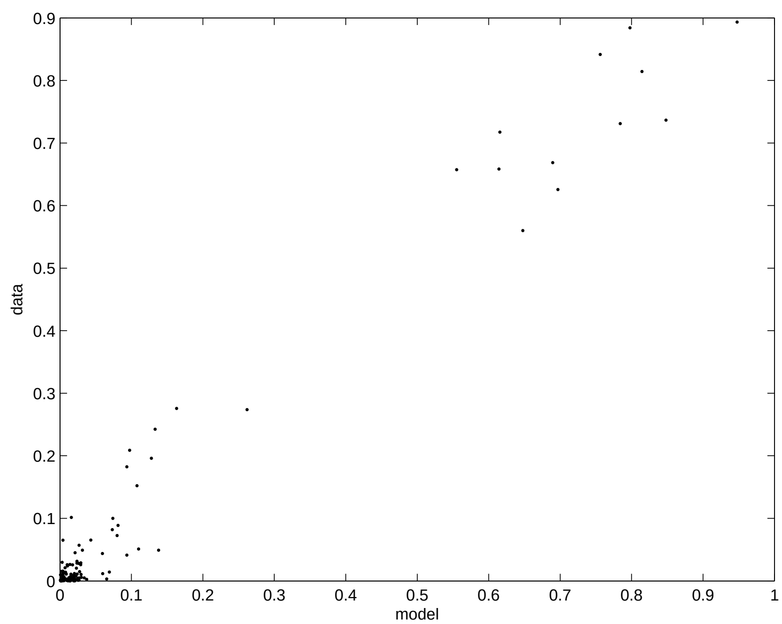

Figure A.3
Bilateral MP Shares - Data and Model

C. Variable Production Costs for German Firms

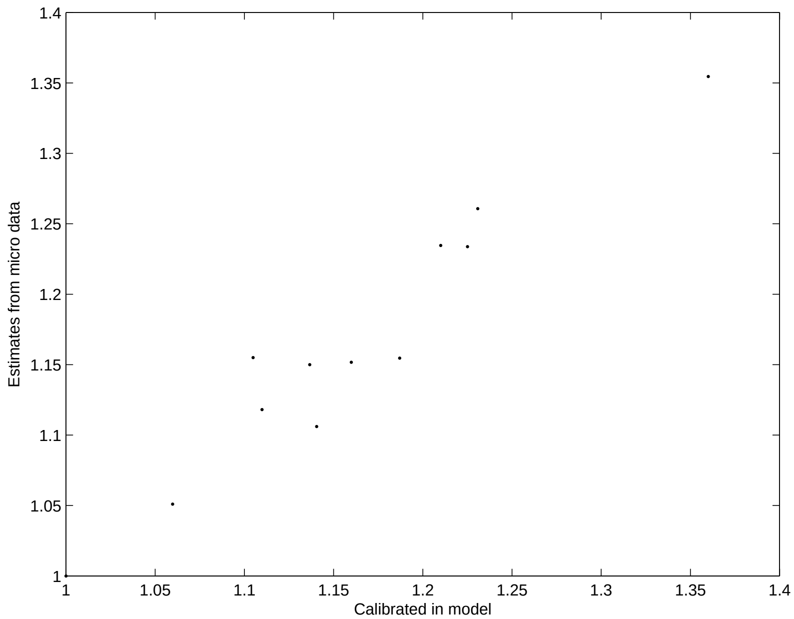

FIGURE A.4
Variable Production Costs for German Firms

D. Median Fixed Costs for German Firms

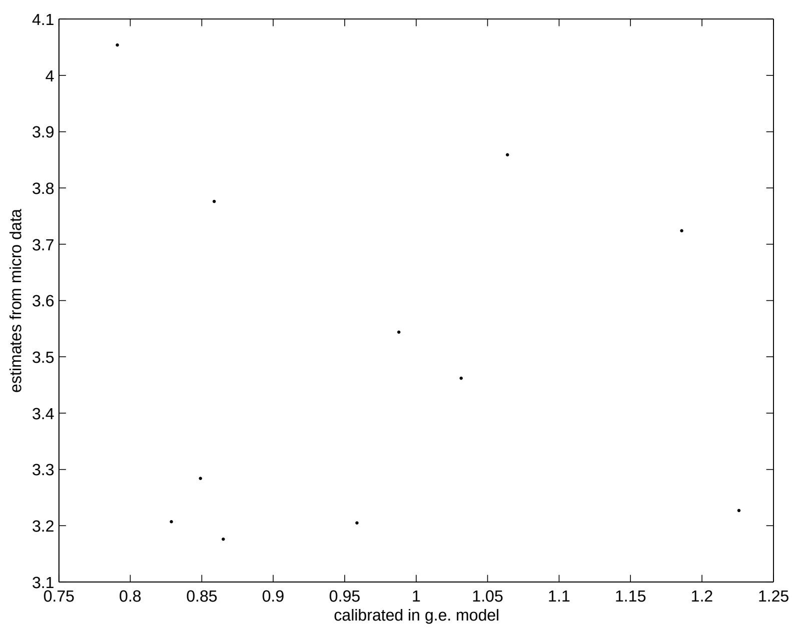

FIGURE A.5
Median Fixed Costs for German Firms

Appendix IX: Comparison of Global Production Model and Pure Trade Model

A. *Trade Costs*

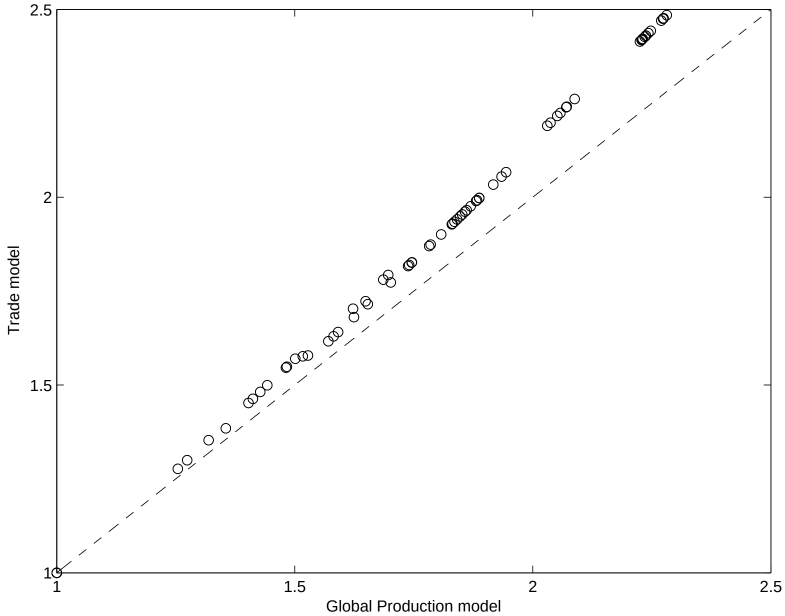

Figure A.6
Trade Costs Estimates in Global Production Model and Pure Trade Model

B. *Price Indices*

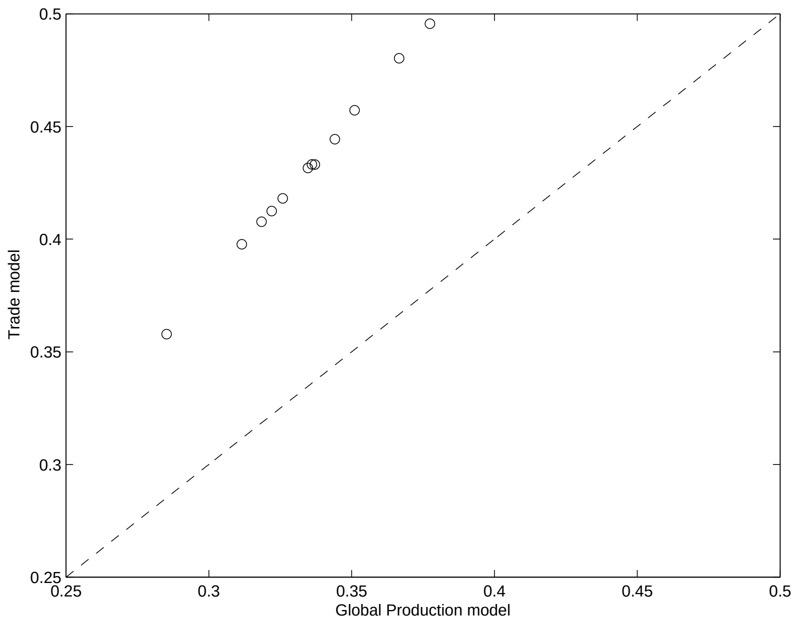

Figure A.7
Price Indices in Global Production Model and Pure Trade Model

Appendix X: The Gains from Trade and Openness

TABLE A.7
Gains from Trade

	Global Production model			Pure Trade model
	Welfare change	Real profit change	Real wage change	Welfare / Real wage change
Austria	1.172	1.437	1.143	1.200
Belgium	1.333	1.613	1.301	1.393
Canada	1.099	1.149	1.092	1.109
Switzerland	1.294	1.685	1.254	1.343
Germany	1.066	1.116	1.058	1.067
Spain	1.045	1.066	1.042	1.051
France	1.079	1.138	1.070	1.082
United Kingdom	1.061	1.098	1.055	1.066
Ireland	1.262	1.783	1.218	1.317
Italy	1.042	1.069	1.038	1.045
Netherlands	1.179	1.314	1.161	1.210
United States	1.018	1.049	1.012	1.012

Notes: A number in this table represents the outcome from the benchmark model divided by the outcome from the same model with no trade.

TABLE A.8
Gains from Openness

	Global Production model		
	Welfare change	Real profit change	Real wage change
Austria	1.297	0.917	1.373
Belgium	1.472	1.091	1.549
Canada	1.170	0.916	1.220
Switzerland	1.450	1.039	1.532
Germany	1.093	0.997	1.112
Spain	1.089	0.900	1.126
France	1.115	0.988	1.140
United Kingdom	1.100	0.945	1.131
Ireland	1.449	0.946	1.549
Italy	1.076	0.931	1.105
Netherlands	1.270	0.982	1.327
United States	1.024	1.019	1.025

Notes: A number in this table represents the outcome from the benchmark model divided by the outcome from the same model with no multinational production and no international trade.

Appendix XI: Potential Effects from an EU-US Trade and Investment Agreement

As a comparison to the potential effects from CETA, which is currently pending ratification, I also compute the potential effects from a hypothetical EU-US agreement that would lower variable and fixed foreign production costs between the signatories by the same proportion. As expected, the effects on the non-signatory partners from such an agreement would be even larger than CETA: the share of EU multinationals' production in Canada would fall from 14 to 13 percent, and the welfare in Canada would fall by about a quarter of a percent.

Table A.9 contains the predicted outcomes for an EU-US agreement that lowers both variable and fixed MP costs between the EU countries and Canada by 20 percent.

TABLE A.9
Counterfactual Changes of Lower EU-US MP Costs - Global Production Model

	Difference in inward MP shares		Rel. welfare
	Canada	United States	
Canada	0.93	-0.04	99.74
EU countries	-0.98	2.89	[100.43, 101.54]
Switzerland	0.03	-0.01	99.79
United States	0.03	-2.85	100.72

Notes: Counterfactual: Reduction in variable and fixed MP costs between EU and US by 20 percent. First two columns: Differences in MP shares: $100 \times (\kappa'_{il} - \kappa_{il})$; column: destination l, row: source i.

Appendix XII: No Fixed Costs Model

Here I present the results for a calibrated model without fixed costs of establishing foreign plants. Excluding fixed costs of foreign production implies that every firm establishes a plant in every country, which is obviously contrary to the firm-level evidence presented in Section 3. I calibrate the model to match aggregate trade and MP shares (the variable production cost estimates for German multinationals are not included as targets because those were estimated from a model with both fixed and variable costs).

One can observe that this restricted model fits the MP data much worse compared to the full model in the main text; it does a slightly better job at fitting the bilateral trade data, but the sum of the two norms of fit (sum of squared deviations of moments from model and data) is considerably higher.

TABLE A.10
Calibrated Parameters

	Model without Fixed Costs of Production
Trade cost	
constant, β^{τ}_{const}	0.796
distance, β^{τ}_{dist}	0.115
language, β^{τ}_{lang}	0.923
contiguity, β^{τ}_{contig}	0.937
Variable MP cost	
constant, β^{γ}_{const}	1.974
distance, β^{γ}_{dist}	0.015
language, β^{γ}_{lang}	0.988
contiguity, β^{γ}_{contig}	0.867
Norm trade fit	0.221
Norm MP fit	0.318

TABLE A.11
Counterfactual Changes of Lower EU-Canada MP Costs

	Model without Fixed Costs of Production		
	Difference in inward MP shares		Rel. welfare
	Canada	United States	
Canada	-6.43	0.00	101.44
EU countries	7.68	-0.02	[100.11, 100.29]
Switzerland	-0.02	0.00	99.97
United States	-1.23	0.01	99.98

Notes: Counterfactual: Reduction in variable MP costs between EU and Canada by 20 percent. First two columns: Differences in MP shares: $100 \times (\kappa'_{il} - \kappa_{il})$; column: destination l, row: source i.

TABLE A.12
GAINS FROM US TECHNOLOGY IMPROVEMENT

	Relative to benchmark	Relative to US gains
	Model without Fixed Costs of Production	Model without Fixed Costs of Production
Austria	1.0210	9.80
Belgium	1.0126	5.88
Canada	1.0225	10.50
Switzerland	1.0176	8.21
Germany	0.9994	-0.27
Spain	1.0041	1.93
France	1.0004	0.17
United Kingdom	1.0016	0.77
Ireland	1.0348	16.29
Italy	1.0013	0.59
Netherlands	1.0106	4.96
United States	1.2138	100.00

Notes: Counterfactual: Productivity improvement of all firms that originated in the United States by 20 percent. Columns 2: Welfare gains by country in percent relative to welfare gains in the United States.

TABLE A.13
GAINS FROM MULTINATIONAL PRODUCTION

	Model without Fixed Costs of Production		
	Welfare change	Real profit change	Real wage change
Austria	1.046	0.738	1.108
Belgium	1.028	0.784	1.077
Canada	1.022	0.904	1.046
Switzerland	1.042	0.719	1.107
Germany	1.015	1.036	1.011
Spain	1.016	0.954	1.029
France	1.018	1.015	1.019
United Kingdom	1.011	0.995	1.015
Ireland	1.060	0.619	1.148
Italy	1.016	0.997	1.020
Netherlands	1.024	0.860	1.057
United States	1.012	1.066	1.001

Notes: A number in this table represents the outcome from the benchmark model divided by the outcome from the same model with no multinational production.

Appendix XIII: No Export Platform Model

I estimate a special case of the model with fixed costs of foreign production, but without the possibility of export platform sales (i.e. the trade costs for foreign affiliates are infinite). First, I re-do the estimation with German firm-level data under the assumption that all the output of foreign affiliates was sold locally. The results are displayed below in Table A.14. Second, I calibrate the general equilibrium version of that model using the same procedure as for the full global production model described in the main text, with the exception that here I fix the dispersion parameter of the fixed cost draws to the estimate obtained from the German firm-level data (I have found the estimate for the dispersion parameter for that model to diverge in the calibration procedure to a very large number if left unconstrained).

TABLE A.14
Estimation Results: No Export Platform Sales

	No export platform sales
Unit input costs	
Austria	0.926
Belgium	0.937
Canada	1.113
Switzerland	0.984
Spain	1.107
France	1.081
United Kingdom	1.186
Ireland	0.913
Italy	1.200
Netherlands	0.973
United States	1.348
Fixed costs	
Austria	3.570
Belgium	3.946
Canada	3.831
Switzerland	3.545
Spain	3.238
France	3.253
United Kingdom	3.197
Ireland	4.167
Italy	3.324
Netherlands	3.752
United States	3.291
S.d. log fixed cost, $\sigma_{\tilde{\eta}}$	1.091
Scale parameter productivity, μ_ϕ	0.786
Shape parameter productivity, σ_ϕ	6.682
S.d. log productivity shock, σ_ϵ	0.1142

Notes: Unit costs in Germany are normalized to one.

TABLE A.15
Calibrated Parameters

	Model without Export Platform Sales
Trade cost	
constant, β^{τ}_{const}	0.940
distance, β^{τ}_{dist}	0.083
language, β^{τ}_{lang}	0.898
contiguity, β^{τ}_{contig}	0.906
Variable MP cost	
constant, β^{γ}_{const}	0.958
distance, β^{γ}_{dist}	0.028
language, β^{γ}_{lang}	0.964
contiguity, β^{γ}_{contig}	0.936
Fixed MP cost	
constant, β^{η}_{const}	2.059
distance, β^{η}_{dist}	0.000
language, β^{η}_{lang}	0.186
contiguity, β^{η}_{contig}	1.455
dispersion, β^{η}_{disp}	1.091
Norm trade fit	0.224
Norm MP fit	0.250

TABLE A.16
Counterfactual Changes of Lower EU-Canada MP Costs

	Model without Export Platform Sales		
	Difference in inward MP shares		Rel. welfare
	Canada	United States	
Canada	-2.00	0.01	101.21
EU countries	3.64	0.01	[100.01, 100.14]
Switzerland	-0.02	0.00	99.90
United States	-1.62	-0.02	99.95

Notes: Counterfactual: Reduction in variable and fixed MP costs between EU and Canada by 20 percent. First two columns: Differences in MP shares: $100 \times (\kappa'_{il} - \kappa_{il})$; column: destination l, row: source i.

TABLE A.17
GAINS FROM US TECHNOLOGY IMPROVEMENT

	Relative to benchmark	Relative to US gains
	Model without Export Platform Sales	Model without Export Platform Sales
Austria	1.0033	1.56
Belgium	0.9806	-9.11
Canada	1.0551	25.82
Switzerland	0.9802	-9.30
Germany	1.0038	1.76
Spain	1.0172	8.08
France	1.0029	1.34
United Kingdom	1.0282	13.20
Ireland	1.0348	16.32
Italy	1.0118	5.55
Netherlands	1.0089	4.17
United States	1.2133	100.00

Notes: Counterfactual: Productivity improvement of all firms that originated in the United States by 20 percent. Columns 2: Welfare gains by country in percent relative to welfare gains in the United States.

TABLE A.18
GAINS FROM MULTINATIONAL PRODUCTION

	Model without Export Platform Sales		
	Welfare change	Real profit change	Real wage change
Austria	1.053	0.914	1.080
Belgium	1.044	1.084	1.036
Canada	1.094	0.973	1.118
Switzerland	1.056	1.087	1.049
Germany	1.019	0.923	1.038
Spain	1.027	0.842	1.064
France	1.024	0.916	1.046
United Kingdom	1.050	0.886	1.083
Ireland	1.067	0.940	1.093
Italy	1.022	0.867	1.053
Netherlands	1.028	0.902	1.053
United States	1.010	0.992	1.014

Notes: A number in this table represents the outcome from the benchmark model divided by the outcome from the same model with no multinational production.

Appendix XIV: Special Case: Gains from Technology Improvements

Section V.B on the benefits of foreign technology has two main results. The first result is that starting from the calibrated model, the magnitude of the gains in foreign countries is much larger if multinational production is taken into account. The second result is that with multinational production the gains from a technology improvement by factor $x > 1$ may yield welfare gains to that country by factor $y > x$. In order to demonstrate the economics behind the second results, I develop an analytic example in this section. In the example, I show that the size of the welfare gains of the country whose technology improved turns on how much the country's firms can increase their world market share.

Proposition 4. *Consider a symmetric world with an identically sized labor force in every country and $\tau_{lm} = 1$, $\gamma_{il} = 1$, $\eta_{il} = 0$, $\forall i, l, m$. Suppose $\sigma = 6$, $M_i = L = 1$, $N = 3$, $x = 1.2$. Then, an increase in productivity to one country by factor x raises its welfare by factor $y > x$.*

I only show the key expressions. Detailed derivations are available from the author upon request. I abstract away from firm heterogeneity (it does not matter for the results) and denote the productivity of all firms in country i by $\phi(i)$. Since both trade and multinational production are frictionless in this example, wages across countries are the same and normalized to 1.

Welfare under the old scenario, $\phi(i) = \phi \ \forall i$, is:

$$\frac{Y_1}{P} = \frac{\frac{\sigma}{\sigma-1} L}{N^{-1/\theta} \left(\sum_i M_i \kappa \phi(i)^{\sigma-1} \right)^{1/(1-\sigma)}}$$

Welfare under the new scenario, $\phi'(1) = x\phi$, $\phi'(j) = \phi \ \forall j = 2, ..., N$, is:

$$\frac{Y_1'}{P'} = \frac{\frac{(\sigma-1+N\lambda_1')}{\sigma-1} L}{N^{-1/\theta} \left(\sum_i M_i \kappa \phi'(i)^{\sigma-1} \right)^{1/(1-\sigma)}}$$

where λ_i denotes the market share of firms from country i in the expenditures of each country:

$$\lambda_i = \frac{M_i \phi(i)^{\sigma-1}}{\sum_k M_k \phi(k)^{\sigma-1}}$$

Note that the equilibrium price index will always change at a rate less than the factor of technology improvement to country 1's firms, x. However, if the market share of country 1 goes up enough, which depends on the size of σ, the ratio of the two welfare expressions may exceed x. Plugging in the numbers, $\lambda_1' = 0.5544$ instead of the old $\lambda_1 = 1/3$. Relative price index is $\frac{P'}{P} = 0.9226$ and the welfare change in country 1 is 1.2036. For a lower value of σ, the welfare in country 1 would have increased less.

Appendix XV: Global Production Model – Sensitivity to Alternative Values for θ

TABLE A.19
Calibrated Parameters – Sensitivity

	Global Production model		
	$\theta = 6$	$\theta = 7$	$\theta = 9$
Trade cost			
constant, β^{τ}_{const}	0.731	0.781	0.782
distance, β^{τ}_{dist}	0.133	0.121	0.118
language, β^{τ}_{lang}	0.916	0.926	0.927
contiguity, β^{τ}_{contig}	0.941	0.931	0.931
Variable MP cost			
constant, β^{γ}_{const}	1.249	1.211	1.076
distance, β^{γ}_{dist}	0.000	0.004	0.019
language, β^{γ}_{lang}	0.963	0.984	0.981
contiguity, β^{γ}_{contig}	0.964	0.944	0.955
Fixed MP cost			
constant, β^{η}_{const}	3.361	2.608	3.037
distance, β^{η}_{dist}	0.000	0.000	0.005
language, β^{η}_{lang}	1.049	0.851	0.773
contiguity, β^{η}_{contig}	1.206	1.429	1.362
dispersion, β^{η}_{disp}	0.223	0.262	0.494
Norm trade fit	0.248	0.242	0.242
Norm MP fit	0.182	0.172	0.165

TABLE A.20
Counterfactual Changes of Lower EU-Canada MP Costs – Sensitivity

	Global Production model								
	Difference in inward MP shares						Rel. welfare		
	Canada			United States					
	$\theta = 6$	$\theta = 7$	$\theta = 9$	$\theta = 6$	$\theta = 7$	$\theta = 9$	$\theta = 6$	$\theta = 7$	$\theta = 9$
Canada	-6.82	-7.51	-6.56	-0.00	0.01	0.02	101.65	101.82	101.58
EU countries	9.78	11.51	10.94	-0.11	-0.24	-0.20	[100.07, 100.21]	[100.07, 100.19]	[100.07, 100.17]
Switzerland	-0.07	-0.11	-0.09	0.00	0.00	0.00	99.95	99.93	99.92
United States	-2.89	-3.89	-4.28	0.11	0.23	0.18	99.96	99.96	99.96

Notes: Counterfactual: Reduction in variable and fixed MP costs between EU and Canada by 20 percent. Columns 1-6: Differences in MP shares: $100 \times (\kappa'_{il} - \kappa_{il})$; column: destination l, row: source i.

TABLE A.21
GAINS FROM US TECHNOLOGY IMPROVEMENT – SENSITIVITY

	Global Production model					
	Relative to benchmark			Relative to US gains		
	$\theta = 6$	$\theta = 7$	$\theta = 9$	$\theta = 6$	$\theta = 7$	$\theta = 9$
Austria	1.0332	1.0299	1.0252	14.97	13.43	11.42
Belgium	1.0244	1.0199	1.0124	11.00	8.96	5.62
Canada	1.0362	1.0410	1.0446	16.32	18.47	20.26
Switzerland	1.0291	1.0231	1.0139	13.11	10.40	6.30
Germany	1.0074	1.0066	1.0048	3.35	2.95	2.17
Spain	1.0187	1.0195	1.0170	8.43	8.78	7.70
France	1.0103	1.0092	1.0066	4.65	4.13	3.00
United Kingdom	1.0172	1.0149	1.0139	7.75	6.69	6.29
Ireland	1.0643	1.0505	1.0412	28.94	22.73	18.70
Italy	1.0135	1.0133	1.0112	6.10	5.98	5.08
Netherlands	1.0238	1.0219	1.0180	10.72	9.84	8.19
United States	1.2221	1.2222	1.2202	100.00	100.00	100.00

Notes: Counterfactual: Productivity improvement of all firms that originated in the United States by 20 percent. Columns 4-6: Welfare gains by country in percent relative to welfare gains in the United States.

TABLE A.22
GAINS FROM MULTINATIONAL PRODUCTION – SENSITIVITY

	Global Production model								
	Welfare change			Real profit change			Real wage change		
	$\theta = 6$	$\theta = 7$	$\theta = 9$	$\theta = 6$	$\theta = 7$	$\theta = 9$	$\theta = 6$	$\theta = 7$	$\theta = 9$
Austria	1.036	1.038	1.035	0.700	0.733	0.773	1.104	1.099	1.087
Belgium	1.028	1.027	1.026	0.725	0.761	0.788	1.088	1.080	1.074
Canada	1.025	1.029	1.033	0.800	0.806	0.812	1.070	1.074	1.077
Switzerland	1.034	1.032	1.030	0.698	0.740	0.774	1.101	1.091	1.081
Germany	1.011	1.013	1.013	0.929	0.924	0.936	1.027	1.030	1.029
Spain	1.016	1.020	1.022	0.850	0.844	0.850	1.050	1.056	1.056
France	1.013	1.015	1.016	0.902	0.900	0.913	1.035	1.038	1.036
United Kingdom	1.015	1.018	1.020	0.882	0.875	0.884	1.041	1.047	1.047
Ireland	1.045	1.044	1.040	0.642	0.682	0.720	1.126	1.117	1.104
Italy	1.013	1.017	1.017	0.888	0.879	0.886	1.038	1.044	1.044
Netherlands	1.023	1.025	1.024	0.769	0.793	0.821	1.074	1.071	1.064
United States	1.007	1.008	1.008	1.004	1.003	1.007	1.008	1.009	1.008

Notes: A number in this table represents the outcome from the benchmark model divided by the outcome from the same model with no multinational production.

Appendix XVI: No Fixed Costs Model – Sensitivity to Alternative Values for θ

TABLE A.23
Calibrated Parameters – Sensitivity

	Model without Fixed Costs of Production		
	$\theta = 6$	$\theta = 7$	$\theta = 9$
Trade cost			
constant, β^{τ}_{const}	0.768	0.796	0.814
distance, β^{τ}_{dist}	0.125	0.115	0.105
language, β^{τ}_{lang}	0.921	0.923	0.924
contiguity, β^{τ}_{contig}	0.936	0.937	0.944
Variable MP cost			
constant, β^{γ}_{const}	2.402	1.974	1.461
distance, β^{γ}_{dist}	0.000	0.015	0.041
language, β^{γ}_{lang}	1.002	0.988	0.969
contiguity, β^{γ}_{contig}	0.839	0.867	0.915
Norm trade fit	0.232	0.221	0.210
Norm MP fit	0.351	0.318	0.268

TABLE A.24
COUNTERFACTUAL CHANGES OF LOWER EU-CANADA MP COSTS – SENSITIVITY

	Model without Fixed Costs of Production								
	Difference in inward MP shares						Rel. welfare		
	Canada			United States					
	$\theta = 6$	$\theta = 7$	$\theta = 9$	$\theta = 6$	$\theta = 7$	$\theta = 9$	$\theta = 6$	$\theta = 7$	$\theta = 9$
Canada	-5.74	-6.43	-7.37	0.00	0.00	0.01	101.32	101.44	101.60
EU countries	6.73	7.68	9.04	-0.01	-0.02	-0.03	[100.10, 100.31]	[100.11, 100.29]	[100.11, 100.26]
Switzerland	-0.01	-0.02	-0.02	0.00	0.00	0.00	99.98	99.97	99.95
United States	-0.98	-1.23	-1.65	0.01	0.01	0.02	99.98	99.98	99.97

Notes: Counterfactual: Reduction in variable and fixed MP costs between EU and Canada by 20 percent. Columns 1-6: Differences in MP shares: $100 \times (\kappa'_{il} - \kappa_{il})$; column: destination l, row: source i.

TABLE A.25
GAINS FROM US TECHNOLOGY IMPROVEMENT – SENSITIVITY

	Model without Fixed Costs of Production					
	Relative to benchmark			Relative to US gains		
	$\theta = 6$	$\theta = 7$	$\theta = 9$	$\theta = 6$	$\theta = 7$	$\theta = 9$
Austria	1.0199	1.0210	1.0215	9.39	9.80	9.91
Belgium	1.0131	1.0126	1.0104	6.15	5.88	4.79
Canada	1.0181	1.0225	1.0304	8.52	10.50	14.02
Switzerland	1.0185	1.0176	1.0149	8.74	8.21	6.88
Germany	0.9996	0.9994	0.9989	-0.18	-0.27	-0.52
Spain	1.0029	1.0041	1.0061	1.39	1.93	2.83
France	1.0004	1.0004	1.0000	0.20	0.17	0.02
United Kingdom	1.0012	1.0016	1.0025	0.58	0.77	1.15
Ireland	1.0340	1.0348	1.0352	16.04	16.29	16.25
Italy	1.0008	1.0013	1.0019	0.39	0.59	0.89
Netherlands	1.0095	1.0106	1.0113	4.48	4.96	5.24
United States	1.2122	1.2138	1.2166	100.00	100.00	100.00

Notes: Counterfactual: Productivity improvement of all firms that originated in the United States by 20 percent. Columns 4-6: Welfare gains by country in percent relative to welfare gains in the United States.

TABLE A.26
GAINS FROM MULTINATIONAL PRODUCTION – SENSITIVITY

	Model without Fixed Costs of Production								
	Welfare change			Real profit change			Real wage change		
	$\theta = 6$	$\theta = 7$	$\theta = 9$	$\theta = 6$	$\theta = 7$	$\theta = 9$	$\theta = 6$	$\theta = 7$	$\theta = 9$
Austria	1.047	1.046	1.041	0.731	0.738	0.751	1.111	1.108	1.100
Belgium	1.031	1.028	1.025	0.776	0.784	0.804	1.082	1.077	1.069
Canada	1.021	1.022	1.021	0.912	0.904	0.889	1.043	1.046	1.048
Switzerland	1.047	1.042	1.034	0.702	0.719	0.751	1.116	1.107	1.090
Germany	1.017	1.015	1.013	1.039	1.036	1.033	1.012	1.011	1.009
Spain	1.017	1.016	1.014	0.968	0.954	0.929	1.027	1.029	1.031
France	1.020	1.018	1.015	1.019	1.015	1.010	1.020	1.019	1.016
United Kingdom	1.012	1.011	1.011	1.002	0.995	0.984	1.014	1.015	1.016
Ireland	1.063	1.060	1.054	0.602	0.619	0.649	1.155	1.148	1.134
Italy	1.017	1.016	1.013	1.007	0.997	0.979	1.019	1.020	1.020
Netherlands	1.024	1.024	1.023	0.862	0.860	0.859	1.057	1.057	1.056
United States	1.012	1.012	1.012	1.061	1.066	1.075	1.002	1.001	1.000

Notes: A number in this table represents the outcome from the benchmark model divided by the outcome from the same model with no multinational production.

Appendix XVII: No Export Platform Model – Sensitivity to Alternative Values for θ

TABLE A.27
Calibrated Parameters – Sensitivity

	Model without Export Platform Sales		
	$\theta = 6$	$\theta = 7$	$\theta = 9$
Trade cost			
constant, β^{τ}_{const}	0.936	0.940	0.954
distance, β^{τ}_{dist}	0.084	0.083	0.080
language, β^{τ}_{lang}	0.897	0.898	0.888
contiguity, β^{τ}_{contig}	0.909	0.906	0.907
Variable MP cost			
constant, β^{γ}_{const}	0.995	0.958	0.959
distance, β^{γ}_{dist}	0.023	0.028	0.028
language, β^{γ}_{lang}	0.966	0.964	0.983
contiguity, β^{γ}_{contig}	0.927	0.936	0.923
Fixed MP cost			
constant, β^{η}_{const}	2.101	2.059	2.145
distance, β^{η}_{dist}	0.050	0.000	0.000
language, β^{η}_{lang}	0.172	0.186	0.124
contiguity, β^{η}_{contig}	1.718	1.455	1.670
dispersion, β^{η}_{disp}	0.924	1.091	1.072
Norm trade fit	0.222	0.224	0.225
Norm MP fit	0.259	0.250	0.251

TABLE A.28
Counterfactual Changes of Lower EU-Canada MP Costs – Sensitivity

	Model without Export Platform Sales								
	Difference in inward MP shares						Rel. welfare		
	Canada			United States					
	$\theta = 6$	$\theta = 7$	$\theta = 9$	$\theta = 6$	$\theta = 7$	$\theta = 9$	$\theta = 6$	$\theta = 7$	$\theta = 9$
Canada	-1.92	-2.00	-2.15	0.01	0.01	0.01	101.24	101.21	101.25
EU countries	3.58	3.64	3.81	0.01	0.01	0.01	[100.01, 100.15]	[100.01, 100.14]	[100.01, 100.15]
Switzerland	-0.02	-0.02	-0.02	0.00	0.00	0.00	99.90	99.90	99.90
United States	-1.63	-1.62	-1.64	-0.01	-0.02	-0.02	99.95	99.95	99.95

Notes: Counterfactual: Reduction in variable and fixed MP costs between EU and Canada by 20 percent. Columns 1-6: Differences in MP shares: $100 \times (\kappa'_{il} - \kappa_{il})$; column: destination l, row: source i.

TABLE A.29
GAINS FROM US TECHNOLOGY IMPROVEMENT – SENSITIVITY

	Model without Export Platform Sales					
	Relative to benchmark			Relative to US gains		
	$\theta = 6$	$\theta = 7$	$\theta = 9$	$\theta = 6$	$\theta = 7$	$\theta = 9$
Austria	1.0016	1.0033	1.0028	0.76	1.56	1.33
Belgium	0.9781	0.9806	0.9801	-10.29	-9.11	-9.33
Canada	1.0548	1.0551	1.0563	25.73	25.82	26.37
Switzerland	0.9772	0.9802	0.9793	-10.69	-9.30	-9.69
Germany	1.0045	1.0038	1.0039	2.12	1.76	1.81
Spain	1.0179	1.0172	1.0174	8.40	8.08	8.14
France	1.0036	1.0029	1.0029	1.67	1.34	1.37
United Kingdom	1.0274	1.0282	1.0280	12.88	13.20	13.10
Ireland	1.0361	1.0348	1.0363	16.96	16.32	16.99
Italy	1.0127	1.0118	1.0120	5.94	5.55	5.60
Netherlands	1.0089	1.0089	1.0094	4.16	4.17	4.42
United States	1.2130	1.2133	1.2137	100.00	100.00	100.00

Notes: Counterfactual: Productivity improvement of all firms that originated in the United States by 20 percent. Columns 4-6: Welfare gains by country in percent relative to welfare gains in the United States.

TABLE A.30
GAINS FROM MULTINATIONAL PRODUCTION – SENSITIVITY

	Model without Export Platform Sales								
	Welfare change			Real profit change			Real wage change		
	$\theta = 6$	$\theta = 7$	$\theta = 9$	$\theta = 6$	$\theta = 7$	$\theta = 9$	$\theta = 6$	$\theta = 7$	$\theta = 9$
Austria	1.054	1.053	1.048	0.919	0.914	0.915	1.081	1.080	1.075
Belgium	1.050	1.044	1.038	1.095	1.084	1.085	1.041	1.036	1.028
Canada	1.103	1.094	1.086	0.982	0.973	0.970	1.127	1.118	1.110
Switzerland	1.062	1.056	1.049	1.102	1.087	1.090	1.054	1.049	1.041
Germany	1.020	1.019	1.018	0.916	0.923	0.926	1.040	1.038	1.036
Spain	1.027	1.027	1.026	0.836	0.842	0.843	1.065	1.064	1.063
France	1.025	1.024	1.023	0.908	0.916	0.918	1.048	1.046	1.044
United Kingdom	1.054	1.050	1.046	0.885	0.886	0.886	1.087	1.083	1.078
Ireland	1.071	1.067	1.062	0.953	0.940	0.928	1.094	1.093	1.089
Italy	1.022	1.022	1.021	0.860	0.867	0.868	1.054	1.053	1.052
Netherlands	1.027	1.028	1.026	0.903	0.902	0.902	1.052	1.053	1.051
United States	1.011	1.010	1.010	0.987	0.992	0.996	1.015	1.014	1.013

Notes: A number in this table represents the outcome from the benchmark model divided by the outcome from the same model with no multinational production.

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