# On the Geography of Global Value Chains

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## B Online Appendix (Not for Publication)

### B.1 The Partial Equilibrium Example without Sequentiality

In this Appendix, we revisit our partial equilibrium example with four countries and four stages in section 2.4, but we consider an alternative scenario without sequentiality. More specifically, we still consider a symmetric Cobb-Douglas technology with four 'stages' contributing to value added, but we assume that these four stages occur simultaneously and are combined into a non-tradeable final good. We continue to focus on serving consumers in country $D$, so this boils down to a "spider" sourcing model in which assemblers in $D$ choose the optimal source for each of the required four inputs. The rest of the specifics of the exercise are as in section 2.4: for each level of trade costs considered, we run one million simulations with production costs $a_j^n c_j$ being drawn independently for each stage $n$ and each country $j$ from a lognormal distribution with mean 0 and variance 1.

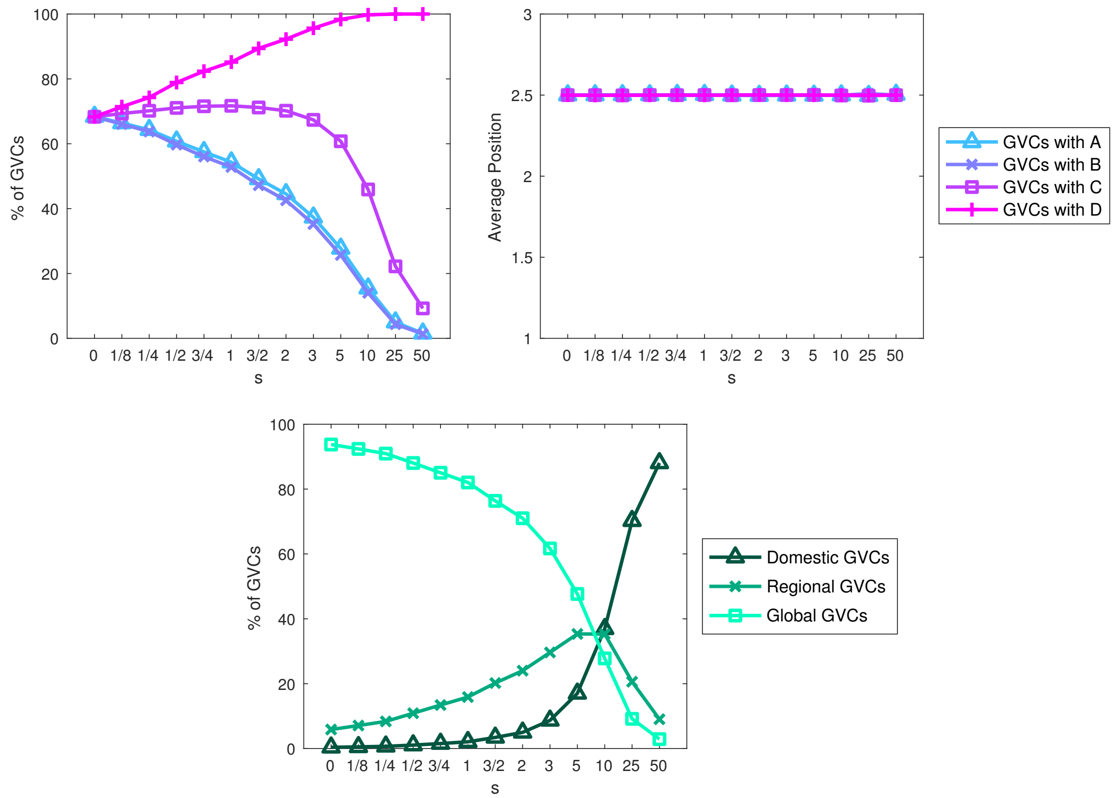


Figure B.1: Some Features of Optimal Sourcing Without Sequentiality

The results of this exercise are in Figure B.1 which is organized in a manner analogous to that in Figure 1. We continue to denote these sourcing strategies as GVCs, and also index stages from 1 to 4, although we should stress that all inputs are sourced simultaneously. For this reason, and unsurprisingly, the particular *position* or index of an input has no bearing for where it is sourced from. This is reflected in the upper right panel of Figure B.1, which shows that the average position of all countries is 2.5 for all trade costs. More interestingly, the upper left panel of Figure B.1 demonstrates that, in the absence of sequentiality, the relative prevalence of countries in GVCs serving $D$ is strictly monotonic in the distance between these countries and $D$. In particular, the most remote country $B$ is now less likely to be a source of inputs than country $A$, conversely to our findings in Figure 1. The lower panel of Figure B.1 unveils another interesting difference between sequential and non-sequential models of GVCs. Note, in particular, that relative to Figure 1, the relative prevalence of domestic GVCs (i.e., strategies in which all four inputs assembled in $D$ are sourced in $D$ itself) declines much faster with trade cost reductions. This share is close to 100% for prohibitively high trade costs, but for those in Figure 1 (i.e., $\tau_{AB} = \tau_{CD} = 1.3$, $\tau_{BC} = 1.5$, $\tau_{AD} = 1.75$, $\tau_{AC} = \tau_{BD} = 1.8$, and $s = 1$ in the Figures), 12.2% of GVCs are domestic with sequential production, but only 2.1% when inputs are all shipped simultaneously to $D$. When (net) trade costs are doubled (i.e., $s = 2$ in the figures), these shares are 26.6% and 5.0%, respectively.

## B.2 Proof of Existence and Uniqueness

The aim of this Appendix is to study the existence and uniqueness of the general equilibrium of our model. Let us begin with some assumptions and definitions.

We shall assume throughout the following:

1. $\forall i \in J$: $\gamma_i \in (0, 1]$.
2. $\sum_{n \in N} \alpha_n \beta_n = 1$.
3. There exist lower ($T_{\min}$, $\tau_{\min}$) and upper ($T_{\max}$, $\tau_{\max}$) bounds on $\tau_{ij}$ $\forall \{i, j\} \in \mathcal{J}^2$ and $T_j$ $\forall j \in \mathcal{J}$.

**Definition 2** ***(M-matrix)*** *An $n \times n$ matrix $A$ is an M-matrix if the following* ***equivalent*** *statements hold:*

*(i) $A$ can be represented as $sI - B$, where $I$ is $n \times n$ identity matrix, $s \in R_{++}$ is a constant and $B$ is the matrix with positive elements and the moduli of $B$'s eigenvalues are all $\leq s$.*

*(ii) $A$ has a non-negative inverse.*

**Definition 3** ***(Excess demand)*** *The excess demand function $\mathbf{Z}(\mathbf{w})$ is defined as*

$$Z_i(\mathbf{w}) = \frac{1}{w_i} \left( \sum_{j \in \mathcal{J}} \sum_{n \in \mathcal{N}} \alpha_n \beta_n \times \Pr(\Lambda_i^n, j) \times \frac{1}{\gamma_j} w_j L_j \right) - \frac{1}{\gamma_i} L_i, \tag{B.1}$$

*with $\Pr(\Lambda_i^n, j) = \sum_{\boldsymbol{\ell} \in \Lambda_i^n} \pi_{\boldsymbol{\ell} j}$, and where remember that $\Lambda_i^n = \left\{ \boldsymbol{\ell} \in \mathcal{J}^N \mid \ell(n) = i \right\}$.*

**Definition 4** ***(Gross Substitutes)*** *The function* $\mathbf{F}(\mathbf{w}) : \mathbb{R}^J \rightarrow \mathbb{R}^J$ *has the gross substitutes property in* $\mathbf{w}$ *if*

$$\forall \{i,j\} \in \mathcal{J}^2, i \neq j: \qquad \frac{\partial F_i}{\partial w_j} > 0.$$

We next use these assumptions and definitions to develop proofs of existence and uniqueness that parallel those of Theorems 1-3 in Alvarez and Lucas (2007).

**Theorem 1** *For any* $\mathbf{w} \in \mathbb{R}^J_{++}$ *there is a unique* $\mathbf{p}^*(\mathbf{w})$ *that solves, for all* $j \in J$

$$P_j = \kappa \left( \sum_{\boldsymbol{\ell} \in \mathcal{J}^N} \prod_{n=1}^{N} \left( \left( \left(w_{\ell(n)}\right)^{\gamma_{\ell(n)}} \left(P_{\ell(n)}\right)^{1-\gamma_{\ell(n)}} \right)^{-\theta} T_{\ell(n)} \right)^{\alpha_n \beta_n} \times \prod_{n=1}^{N-1} \left(\tau_{\ell(n)\ell(n+1)}\right)^{-\theta\beta_n} \times \left(\tau_{\ell(N)j}\right)^{-\theta} \right)^{-1/\theta}. \tag{B.2}$$

*The function* $\mathbf{p}^*(\mathbf{w})$ *has the following properties*

*(i)* *continuous in* $\mathbf{w}$*.*

*(ii)* *each component of* $\mathbf{p}^*(\mathbf{w})$ *is homogeneous of degree one in* $\mathbf{w}$*;*

*(iii)* *strictly increasing in* $\mathbf{w}$*;*

*(iv)* *strictly decreasing in* $\tau_{ij}$ *for all* $\{i,j\} \in \mathcal{J}^2$ *and strictly increasing in* $T_j$ *for all* $j \in \mathcal{J}$*.*

*(v)* $\forall \mathbf{w} \in R^J_{++}$*, bounded between* $\underline{\mathbf{p}^*}(\mathbf{w})$ *and* $\overline{\mathbf{p}^*}(\mathbf{w})$*:*

**Proof.** Let us set $\tilde{p}_j = \log(P_j)$ and $\tilde{w}_j = \log(w_j)$. For each supply chain $\boldsymbol{\ell} \in \mathcal{J}^N$, let

$$d_{p,i}(\boldsymbol{\ell}) = (1-\gamma_i) \sum_{n:\boldsymbol{\ell}(n)=i} \alpha_n \beta_n < 1 \qquad d_{w,i}(\boldsymbol{\ell}) = \gamma_i \sum_{n:\boldsymbol{\ell}(n)=i} \alpha_n \beta_n < 1$$

Note that for all $i \in \mathcal{J}$, $d_{p,i} \leq 1$ and $d_{w,i} \leq 1$. Now, for all $j \in \mathcal{J}$, define $f_j(\tilde{p}, \tilde{w})$

$$f_j(\tilde{p}, \tilde{w}) = \log(\kappa) - \frac{1}{\theta} \log \left( \sum_{\boldsymbol{\ell} \in \mathcal{J}^N} \prod_{n=1}^{N} \exp\left\{ -\theta \alpha_n \beta_n \left[ \gamma_{\ell(n)} \tilde{w}_{\ell(n)} + \left(1-\gamma_{\ell(n)}\right) \tilde{p}_{\ell(n)} \right] \right\} T_{\ell(n)}^{\alpha_n \beta_n} \times \Upsilon_{\boldsymbol{\ell}} \right)$$

where $\Upsilon_{\boldsymbol{\ell}} = \prod_{n=1}^{N-1} \left(\tau_{\ell(n)\ell(n+1)}\right)^{-\theta\beta_n} \times \left(\tau_{\ell(N)j}\right)^{-\theta}$.

To establish uniqueness of $\mathbf{p}^*(\mathbf{w})$, we need to show that the Blackwell's sufficiency conditions for the contraction mapping theorem hold. Note that we also need to show that $f(p) = f(p, \tilde{w})$ is a bounded function for all values of $\tilde{w}$. This corresponds to property (v) of $\mathbf{p}^*(\mathbf{w})$, which will be proven below. For the time being, we proceed to prove the other parts of the theorem assuming a unique solution to the system exists.

If there indeed exists a unique solution to $\tilde{p} - f(\tilde{p}, \tilde{w}) = 0$, then homogeneity of degree one in wages (property (ii)) is simple to verify by noting that, given that $\sum_n \alpha_n \beta_n = 1$, if all wages and prices in the right-hand-side of (B.2) are multiplied by a common factor, the price level in the left-hand-side of that equation () is also scaled up or down by the same factor.

To prove differentiability and monotonicity with respect to $\mathbf{w}$, we need to determine the comparative static $\frac{\partial \mathbf{p}}{\partial \mathbf{w}}$. First, note that

$$\frac{\partial f_j(\tilde{p},\tilde{w})}{\partial p_k} = \sum_{\boldsymbol{\ell}\in\mathcal{J}^N} d_{p,k}(\boldsymbol{\ell})\pi_{\boldsymbol{\ell}j}, \tag{B.3}$$

where $\pi_{\boldsymbol{\ell}j}$ is given in (11) in the main text. Then, the Jacobian of the system $\tilde{p} - f(\tilde{p},\tilde{w})$ is given by

$$\frac{\partial\left(\tilde{p} - f\left(\tilde{p},\tilde{w}\right)\right)}{\partial \tilde{p}} = I - A^P,$$

where $\left[A^P\right]_{ij} = \frac{\partial f_i(\tilde{p},\tilde{w})}{\partial p_j}$. Note that matrix $A^P$ is totally positive (this follows from the equation (B.3)), and therefore, by the Perron-Frobenius Theorem, we can bound above the largest eigenvalue of $A^P$, denoted by $\lambda_{\max}$, by the largest row sum of $A^P$. More precisely,

$$\begin{aligned}\lambda_{\max} &\leq \max_k \sum_i \frac{\partial f_k(\tilde{p},\tilde{w})}{\partial \tilde{p}_i} = \max_k \sum_i \left(\sum_{\boldsymbol{\ell}\in\mathcal{J}^N} d_{p,i}(\boldsymbol{\ell})\pi_{\boldsymbol{\ell}k}\right) \\ &= \max_k \left(\sum_{\boldsymbol{\ell}\in\mathcal{J}^N}\left(\sum_{n\in\mathcal{N}}(1-\gamma_{\boldsymbol{\ell}(n)})\alpha_n\beta_n\right)\pi_{\boldsymbol{\ell}k}\right)\end{aligned}$$

But consider the country with the lowest $\gamma_j = \underline{\gamma}$. And note that

$$\lambda_{\max} \leq (1-\underline{\gamma})\max_k \left(\sum_{\boldsymbol{\ell}\in\mathcal{J}^N}\left(\sum_{n\in\mathcal{N}}\alpha_n\beta_n\right)\pi_{\boldsymbol{\ell}j}\right) = 1-\underline{\gamma}.$$

Because $\lambda_{\max} < 1$, it follows that $I - A^P$ is an M-matrix, and, by properties of M-matrices, the inverse $\left(I - A^P\right)^{-1}$ is totally (weakly) positive. By the implicit function theorem, the Jacobian $\frac{\partial\tilde{p}}{\partial\tilde{w}}$ is given by

$$\frac{\partial\tilde{p}}{\partial\tilde{w}} = \left[I - A^P\right]^{-1} A^W,$$

where $A^W$ is defined as

$$\left[A^W\right]_{ij} = \frac{\partial f_i(\tilde{p},\tilde{w})}{\partial \tilde{w}_j} = \sum_{\boldsymbol{\ell}\in\mathcal{J}^N} d_{w,j}(\boldsymbol{\ell})\pi_{\boldsymbol{\ell}i}.$$

Both $A^W$ and $\left[I - A^P\right]^{-1}$ are totally positive, so $\tilde{p}$ is continuous (property (i)) and monotonically increasing (property (iii)) in $\tilde{w}$.

By analogy, we can show that property (iv) of the theorem also holds by defining $\forall\{i,j\}\in\mathcal{J}^2$, $\tilde{\tau}_{ij} = \log\tau_{ij}$ and $\forall j\in\mathcal{J}$, $\tilde{T}_j = \log T_j$, and also

$$d_{\tau,i}\left(\boldsymbol{\ell}\right) = \sum_{n:\boldsymbol{\ell}(n)=i}\beta_n, \qquad d_{T,i}\left(\boldsymbol{\ell}\right) = -\frac{1}{\theta}\sum_{n:\boldsymbol{\ell}(n)=i}\alpha_n\beta_n.$$

Applying the implicit function theorem to $f(p) = f(p, \tilde{w})$, we get:

$$\forall \{k,j\} \in \mathcal{J}^2 : \qquad \frac{\partial \mathbf{p}}{\partial \tilde{\tau}_{kj}} = \left[I - A^P\right]^{-1} A^{\tau_{kj}},$$

where $A^{\tau_{kj}}$ is $J \times 1$ vector with

$$\left[A^{\tau_{kj}}\right]_i = \frac{\partial f_i(p)}{\partial \tilde{\tau}_{kj}} = \sum_{\boldsymbol{\ell} \in \mathcal{J}} d_{\tau_{kj},i}\left(\boldsymbol{\ell}\right) \pi_{\boldsymbol{\ell} i}.$$

Also,

$$\forall j \in \mathcal{J} : \qquad \frac{\partial \mathbf{p}}{\partial \tilde{T}} = \left[I - A^P\right]^{-1} A^T,$$

where $A^T$ is $J \times J$ matrix with elements

$$\left[A^T\right]_{ij} = \frac{\partial f_i(p)}{\partial T_j} = \sum_{\boldsymbol{\ell} \in \mathcal{J}} d_{T,i}\left(\boldsymbol{\ell}\right) \pi_{\boldsymbol{\ell} i}.$$

Note that, as was shown above, $\left[I - A^P\right]^{-1}$ is totally positive. Then, since for all $i \in \mathcal{J}$ and for all supply chains $d_{T,i}\left(\boldsymbol{\ell}\right) \geq 0$, $f(p)$ is decreasing in $T$. By analogy, since for all $\{k,j,i\} \in \mathcal{J}^3$, $d_{\tau_{kj},i}\left(\boldsymbol{\ell}^{\boldsymbol{i}}\right)$ is totally positive, $f(p)$ is increasing in $\tau_{jk}$.

As for property (v) on bounds, we can define $\underline{\mathbf{p}^*}\left(\mathbf{w}\right)$ and $\overline{\mathbf{p}^*}\left(\mathbf{w}\right)$ in the following way:

$$\overline{\mathbf{p}^*}\left(\mathbf{w}\right) = \exp\left(f\left(\log\left(\mathbf{p}\right), \tilde{\mathbf{w}}, \mathbf{T}_{\min}, \boldsymbol{\tau}_{\max}\right)\right) \qquad \underline{\mathbf{p}^*}\left(\mathbf{w}\right) = \exp\left(f\left(\log\left(\mathbf{p}\right), \tilde{\mathbf{w}}, \mathbf{T}_{\max}, \boldsymbol{\tau}_{\min}\right)\right),$$

where $\mathbf{T}_{\max}\left(\tau_{\max}\right)$ and $\mathbf{T}_{\min}\left(\tau_{\min}\right)$ are $J \times 1$ $\left(J \times J\right)$ vectors (matrices) with all elements equal to the upper bound on labor productivity (trade costs)$T_{\max}$ $\left(\tau_{\max}\right)$ and the lower bound $T_{\min}\left(\tau_{\min}\right)$, respectively. Then, we can note that the set $\mathbf{C}$, defined as

$$\mathbf{C} = \left\{z \in R^J : \quad \log\left(\underline{p^*}_i\left(\mathbf{w}\right)\right) \leq z_i \leq \log\left(\overline{p^*}_i\left(\mathbf{w}\right)\right)\right\}$$

is compact and, by analogy with Alvarez and Lucas (2007), $f(\cdot, \tilde{\mathbf{w}}) : \mathbf{C} \to \mathbf{C}$.

Let us finally tackle the existence and unique of the solution by verifying Blackwell's sufficient conditions for $f(\cdot, \tilde{\mathbf{w}})$ to be a contraction on $\mathbf{C}$. We have already shown that $f(\cdot, \tilde{\mathbf{w}})$ is monotone. We next show that the discounting property also holds. Set $f_i(p) = f_i(p, \tilde{w})$ for any fixed $\tilde{w}$. Then, for $a > 0$ and some $\nu \in (0,1)$, using a Taylor approximation and the mean-value theorem, we get:

$$\forall i \in \mathcal{J} : \quad f_i(p+a) = f_i(p) + \sum_{k \in \mathcal{J}} a \cdot \frac{\partial f_i\left(p + (1-\nu)a\right)}{\partial p_k} \leq f_i(p) + a\left(1 - \underline{\gamma}\right)$$

The last inequality follows from the fact that every row sum of $A^P$ can be bounded above by

$$(1 - \underline{\gamma}) \max_k \left(\sum_{\boldsymbol{\ell} \in \mathcal{J}^N} \left(\sum_{n \in \mathcal{N}} \alpha_n \beta_n\right) \pi_{\boldsymbol{\ell} j}\right) = 1 - \underline{\gamma}.$$

Thus, both the monotonicity and discounting properties hold for $f(p) = f(p, \tilde{w})$. Therefore, we can apply the Contraction Mapping Theorem to $f(p, \tilde{w})$, and conclude that there is a unique solution $\mathbf{p}^*(\mathbf{w})$ to the system $\tilde{p} - f(\tilde{p}, \tilde{w})$, and that it satisfies properties (i) through (v). ■

**Theorem 2** *There exists* $\mathbf{w}^* \in R^{\mathcal{J}}_{++}$ *which solves the system of equations*

$$Z(\mathbf{w}^*) = 0.$$

**Proof.** To show the existence of the equilibrium, we need to verify that the excess demand satisfies the following properties (see Propositions 17.C.1 in Mas-Colell et al., 1995, p. 585):

(i) $Z(\mathbf{w})$ is continuous on $\mathbb{R}^{\mathcal{J}}_{++}$;

(ii) $Z(\mathbf{w})$ is homogeneous of degree 0 in $w$

(iii) Walras Law: $\mathbf{w} \cdot Z(\mathbf{w}) = 0 \ \forall \mathbf{w} \in \mathbb{R}^{J}_{++}$;

(iv) for $k = \max_j L_j > 0$, $Z_i(\mathbf{w}) > -k$ for all $i = 1, ..., n$ and $\mathbf{w} \in \mathbb{R}^{n}_{++}$;

(v) if $w^m \to w^0$, where $w^0 \neq 0$ and $w^0_i \neq 0$ for some $i$, then

$$\lim_{w^m \to w^0} \left( \max_j \{ Z_j(w^m) \} \right) = \infty$$

Let us discuss each of these properties in turn.

(i) **Continuity** of $Z(\mathbf{w})$ on $\mathbb{R}^{\mathcal{J}}_{++}$ follows since $\Pr(\Lambda^n_i, j)$ is a continuous function of $\mathbf{w}$ – for strictly positive wages, each supply chain $\boldsymbol{\ell}$ in $\mathcal{J}^N$ is realized with non-zero probability.

(ii) **Homogeneity of degree zero** follows since $\Pr(\Lambda^n_i, j)$ is homogeneous of degree 0 in $\mathbf{w}$. To show this, note that, from the proof of Theorem 1, the equilibrium price level $\mathbf{p}^*(\mathbf{w})$ is homogeneous of degree 1 in $\mathbf{w}$. Then, both nominator and denominator ( i.e., the destination specific term $\Theta_j$) of $\Pr(\Lambda^n_i, j)$ are homogeneous of degree $-\theta$ in $\mathbf{w}$ (remember that $\sum_{n \in \mathcal{N}} \alpha_n \beta_n = 1$). It follows that $\Pr(\Lambda^n_i, j)$ is homogeneous of degree 0 in $\mathbf{w}$, and thus $Z(\mathbf{w})$ is homogeneous of degree 0 in $\mathbf{w}$ as well.

(iii) **Walras Law** follows since the system, $\mathbf{w} \cdot Z(\mathbf{w}) = 0$ is just the set of the general equilibrium conditions. Moreover, by summing up $Z(\mathbf{w})$, we get:

$$\begin{aligned}
\sum_{i\in\mathcal{J}} w_i \cdot Z_i(\mathbf{w}) &= \sum_{i\in\mathcal{J}} \gamma_i \left( \sum_{j\in\mathcal{J}} \sum_{n\in\mathcal{N}} \alpha_n \beta_n \times \Pr\left(\Lambda_i^n, j\right) \times \frac{1}{\gamma_j} w_j L_j \right) - \sum_{i\in\mathcal{J}} \frac{1}{\gamma_i} w_i L_i \\
&= \left( \sum_{n\in\mathcal{N}} \alpha_n \beta_n \times \sum_{j\in\mathcal{J}} \underbrace{\sum_{i\in\mathcal{J}} \Pr\left(\Lambda_i^n, j\right)}_{=1} \times \frac{1}{\gamma_j} w_j L_j \right) - \sum_{i\in\mathcal{J}} \frac{1}{\gamma_i} w_i L_i \\
&= \left( \underbrace{\sum_{n\in\mathcal{N}} \alpha_n \beta_n}_{=1} \times \sum_{j\in\mathcal{J}} \frac{1}{\gamma_j} w_j L_j \right) - \sum_{i\in\mathcal{J}} \frac{1}{\gamma_i} w_i L_i = 0.
\end{aligned}$$

Hence, $\mathbf{w} \cdot Z(\mathbf{w}) = 0$.

(iv) **The lower bound on $Z(\mathbf{w})$**: Since the first term in equation (B.1) is always positive, it follows that $Z(\mathbf{w})$ can be bounded from below by $Z_i(\mathbf{w}) \geq -\frac{1}{\gamma_i} L_i$.

(v) **The limit case**: Suppose $\{w^m\}$ is a sequence such that $w^m \to w^0 \neq 0$, and $w_i^0 = 0$ for some $i \in \mathcal{J}$. In this case, and given that all trade costs parameters are bounded, the probability of the supply chain that is located entirely in country $i$ converges to 1, and the probabilities of realization of all other supply chains converge to 0 (keeping the destination fixed). Let $\Pr\left(i^N, j\right)$ denote the probability of realization of the supply chain for which all stages are located in country $i$ with destination $j$. Then,

$$\lim_{w^m \to w^0} \left( \max_k \{Z_k(\mathbf{w})\} \right) = \lim_{w^m \to w^0} \left(Z_i(\mathbf{w})\right)$$

and

$$\begin{aligned}
\lim_{w^m \to w^0} \left( \max_k \{Z_k(\mathbf{w})\} \right) &= \lim_{w^m \to w^0} \left( \frac{1}{w_i} \sum_{j\in\mathcal{J}} \left( \sum_{n\in N} \alpha_n \beta_n \right) \Pr\left(i^N, j\right) \frac{1}{\gamma_j} w_j L_j \right) - \frac{1}{\gamma_i} L_i \\
&= \lim_{w^m \to w^0} \left( \frac{1}{w_i} \sum_{j\in\mathcal{J}} \Pr\left(i^N, j\right) \frac{1}{\gamma_j} w_j L_j \right) - \frac{1}{\gamma_i} L_i \\
&= \lim_{w^m \to w^0} \left( \frac{1}{w_i} \sum_{j\neq i} \Pr\left(i^N, j\right) \frac{1}{\gamma_j} w_j L_j \right) = +\infty.
\end{aligned}$$

In sum, conditions (i) through (v) hold and thus a general equilibrium exists.

■

**Theorem 3** *The solution* $\mathbf{w}^* \in R_{++}^{\mathcal{J}}$ *to the system of equations* $Z(\mathbf{w}^*) = 0$ *is unique if the following condition holds:*

$$\frac{2(1-\overline{\gamma})}{\xi^{\theta}(1-\underline{\gamma})} - (1-\underline{\gamma}) - \xi^{2\theta} \geq 0, \quad \text{where} \quad \xi = \max_{i,j\in\mathcal{J}} \frac{\max_{k\in\mathcal{J}} \tau_{kj}/\tau_{ki}}{\min_{k\in\mathcal{J}} \tau_{kj}/\tau_{ki}} = 1,$$

*and where* $\overline{\gamma}$ *and* $\underline{\gamma}$ *are the largest and smallest values of* $\gamma_j$*.*

**Proof.** The proof boils down to verifying that $Z(\mathbf{w})$ has the gross substitutes property in $\mathbf{w}$ under the condition stated in the Theorem (see Proposition 17.F.3 in Mas-Colell et al., 1995, p. 613). More specifically, we need to show that

$$\forall \{i,k\} \in \mathcal{J}^2, i \neq k: \qquad \frac{\partial Z_i}{\partial w_k} > 0.$$

Totally differentiating the equation (B.1) wrt $w_k$, $k \neq i$, we get:

$$\frac{\partial Z_i(\mathbf{w})}{\partial w_k} = \frac{1}{w_i}\left(\sum_{n\in\mathcal{N}} \alpha_n \beta_n \times \left(\frac{1}{\gamma_k} L_k \Pr(\Lambda_i^n, k) + \sum_{j\in\mathcal{J}} \frac{1}{\gamma_j} w_j L_j \frac{d\Pr(\Lambda_i^n, j)}{dw_k}\right)\right),$$

where

$$\frac{d\Pr(\Lambda_i^n, j)}{dw_k} = \frac{\partial \Pr(\Lambda_i^n, j)}{\partial w_k} + \sum_{l\in\mathcal{J}} \frac{\partial \Pr(\Lambda_i^n, j)}{\partial P_l} \frac{\partial P_l}{\partial w_k}$$

From here, we proceed in three steps:

**Step 1:**.

Remember that $\Pr(\Lambda_i^n, j) = \sum_{\boldsymbol{\ell}\in\Lambda_i^n} \pi_{\boldsymbol{\ell}j}$, where $\Lambda_i^n = \left\{\boldsymbol{\ell} \in \mathcal{J}^N \mid \ell(n) = i\right\}$. Thus,

$$\frac{\partial \Pr(\Lambda_i^n, j)}{\partial w_k} = \frac{\Pr(\Lambda_i^n, j)}{w_k}\left(\frac{\partial \log(\Pr(\Lambda_i^n, j)\cdot \Theta_j)}{\partial \log(w_k)} - \frac{\partial \log(\Theta_j)}{\partial \log(w_k)}\right). \tag{B.4}$$

Since in equilibrium $\Theta_j = (p_j(\mathbf{w}))^{-\theta}$, we can use the envelope theorem to get

$$\frac{\partial \Pr(\Lambda_i^n, j)}{\partial w_k} = \frac{\theta}{w_k}\left(-\sum_{\boldsymbol{\ell}\in\Lambda_i^n} d_{w,k}(\boldsymbol{\ell})\pi_{\boldsymbol{\ell}j} + \Pr(\Lambda_i^n, j)\frac{\partial \tilde{p}_j}{\partial \tilde{w}_j}\right).$$

**Step 2: Bounds on** $\frac{\partial \tilde{p}}{\partial \tilde{w}}$.

Note that we can bound the row sums of $A^P$ and $[I - A^P]^{-1}$:

$$(1-\overline{\gamma})\,\mathbf{1} \leq A^P\mathbf{1} \leq \left(1-\underline{\gamma}\right)\mathbf{1},$$

$$\left(1-\underline{\gamma}\right)^{-1}\mathbf{1} \leq \left[I - A^P\right]^{-1}\mathbf{1} \leq (1-\overline{\gamma})^{-1}\,\mathbf{1}, \tag{B.5}$$

where $\overline{\gamma}$ and $\underline{\gamma}$ are the largest and smallest values of $\gamma_j$.

For two identical supply chains with different destinations $i$ and $j$, $\boldsymbol{\ell^i}$ and $\boldsymbol{\ell^j}$ it holds that

$$\forall\{i,j\} \in \mathcal{J}^2: \qquad d_{p,k}(\boldsymbol{\ell^j}) = d_{p,k}(\boldsymbol{\ell^i}), \qquad d_{w,k}(\boldsymbol{\ell^j}) = d_{w,k}(\boldsymbol{\ell^i})$$

$$\forall\{i,j\} \in \mathcal{J}^2: \qquad \pi_{\boldsymbol{\ell}j} = \frac{\left(\tau_{\boldsymbol{\ell}(N)j}/\tau_{\boldsymbol{\ell}(N)i}\right)^{-\theta}\pi_{\boldsymbol{\ell}i}}{\sum\limits_{\tilde{\boldsymbol{\ell}}\in\Lambda}\left(\tau_{\tilde{\boldsymbol{\ell}}(N)j}/\tau_{\tilde{\boldsymbol{\ell}}(N)i}\right)^{-\theta}\pi_{\tilde{\boldsymbol{\ell}}i}}$$

Let's set $\xi = \max_{i,j\in\mathcal{J}} \dfrac{\max_{k\in\mathcal{J}}\tau_{kj}/\tau_{ki}}{\min_{k\in\mathcal{J}}\tau_{kj}/\tau_{ki}} \geq 1$.

$$\forall\{i,j,k\} \in \mathcal{J}^2: \qquad \frac{1}{\xi^\theta} \leq [A^W]_{ij}\cdot\left([A^W]_{kj}\right)^{-1} \leq \xi^\theta$$

Since $\dfrac{\partial \mathbf{p}}{\partial w_j} = \left[I - A^P\right]^{-1} A^W_{[j]}$ , where $A^W_{[j]}$ is the $j$th column of $A^W$, we can bound the ratio $\dfrac{\partial\tilde{p}_j}{\partial\tilde{w}_k}\Big/\dfrac{\partial\tilde{p}_i}{\partial\tilde{w}_k}$:

$$\forall\{i,j\} \in \mathcal{J}^2: \qquad \frac{(1-\overline{\gamma})}{\xi(1-\underline{\gamma})} \leq \frac{\partial\tilde{p}_j}{\partial\tilde{w}_k}\Big/\frac{\partial\tilde{p}_i}{\partial\tilde{w}_k} \leq \frac{\xi(1-\underline{\gamma})}{(1-\overline{\gamma})}.$$

Since all elements of $A^W$ and $A^P$ are less than one,

$$\left[A^W\right]_{jk} \leq \frac{\partial\tilde{p}_j}{\partial\tilde{w}_k} \leq \frac{1}{(1-\overline{\gamma})}. \tag{B.6}$$

Finally we show that for all $n$ and $i$,

$$\frac{\sum\limits_{\boldsymbol{\ell}\in\Lambda_i^n} d_{w,m}(\boldsymbol{\ell})\pi_{\boldsymbol{\ell}j}}{\left[A^W\right]_{jk}} \leq \Pr\left(\Lambda_i^n, j\right)\xi^{2\theta} \tag{B.7}$$

Let $\lambda^n_{\boldsymbol{\ell}}$ denote the set of supply chains, identical to $\boldsymbol{\ell} \in J^N$ in all stages except for $n$ (note that there are $J$ chains in $\lambda^n_{\boldsymbol{\ell}}$). With this definition we have

$$\left[A^W\right]_{jk} \geq \sum_{\boldsymbol{\ell}\in\Lambda_i^n} d_{w,m}(\boldsymbol{\ell})\pi_{\boldsymbol{\ell}j}\left(\frac{\sum_{\tilde{\boldsymbol{\ell}}\in\lambda^n_{\boldsymbol{\ell}}}\pi_{\boldsymbol{\ell}j}}{\pi_{\boldsymbol{\ell}j}}\right)$$

and

$$\frac{\sum\limits_{\boldsymbol{\ell}\in\Lambda_i^n} d_{w,m}(\boldsymbol{\ell})\pi_{\boldsymbol{\ell}j}}{\left[A^W\right]_{jk}} \leq \frac{\sum\limits_{\boldsymbol{\ell}\in\Lambda_i^n} d_{w,m}(\boldsymbol{\ell})\pi_{\boldsymbol{\ell}j}}{\sum\limits_{\boldsymbol{\ell}\in\Lambda_i^n} d_{w,m}(\boldsymbol{\ell})\pi_{\boldsymbol{\ell}j}}\left(\min_{\boldsymbol{\ell}\in\Lambda_i^n}\left(\frac{\sum_{\tilde{\boldsymbol{\ell}}\in\lambda^n_{\boldsymbol{\ell}}}\pi_{\boldsymbol{\ell}j}}{\pi_{\boldsymbol{\ell}j}}\right)\right)^{-1} \tag{B.8}$$

Then, let us bound $\Pr\left(\Lambda_i^n, j\right)$:

$$\Pr\left(\Lambda_i^n, j\right) \geq \left(\max_{\boldsymbol{\ell}\in\Lambda_i^n}\left(\frac{\sum_{\tilde{\boldsymbol{\ell}}\in\lambda^n_{\boldsymbol{\ell}}}\pi_{\boldsymbol{\ell}j}}{\pi_{\boldsymbol{\ell}j}}\right)\right)^{-1} \tag{B.9}$$

Therefore, combining (B.8) and (B.9) we get:

$$\frac{\sum_{\boldsymbol{\ell}\in\Lambda_i^n} d_{w,m}(\boldsymbol{\ell})\pi_{\boldsymbol{\ell}j}}{[A^W]_{jk}} \leq \left(\max_{\boldsymbol{\ell}\in\Lambda_i^n}\left(\frac{\sum_{\tilde{\boldsymbol{\ell}}\in\lambda_{\boldsymbol{\ell}}^n}\pi_{\boldsymbol{\ell}j}}{\pi_{\boldsymbol{\ell}j}}\right)\right)\cdot\left(\min_{\boldsymbol{\ell}\in\Lambda_i^n}\left(\frac{\sum_{\tilde{\boldsymbol{\ell}}\in\lambda_{\boldsymbol{\ell}}^n}\pi_{\boldsymbol{\ell}j}}{\pi_{\boldsymbol{\ell}j}}\right)\right)^{-1}\Pr\left(\Lambda_i^n, j\right)$$

Note that by definition of $\lambda_{\boldsymbol{\ell}}^n$,

$$\left(\frac{\sum_{\tilde{\boldsymbol{\ell}}\in\lambda_{\boldsymbol{\ell}}^n}\pi_{\boldsymbol{\ell}j}}{\pi_{\boldsymbol{\ell}j}}\right)\in\left[\frac{\sum_{k\in\mathcal{J}}\left((c_k)^{-\theta}T_k\right)^{\alpha_n\beta_n}}{\xi^\theta\left((c_i)^{-\theta}T_i\right)^{\alpha_n\beta_n}}, \frac{\xi^\theta\sum_{k\in\mathcal{J}}\left((c_k)^{-\theta}T_k\right)^{\alpha_n\beta_n}}{\left((c_i)^{-\theta}T_i\right)^{\alpha_n\beta_n}}\right],$$

so

$$\frac{\sum_{\boldsymbol{\ell}\in\Lambda_i^n} d_{w,m}(\boldsymbol{\ell})\pi_{\boldsymbol{\ell}j}}{[A^W]_{jk}} \leq \xi^{2\theta}\Pr\left(\Lambda_i^n, j\right).$$

**Step 3:** To prove the GS property, we need to show that for a fixed destination $j$, fixed stage $n$ and $m\neq i$

$$\frac{\partial\Pr\left(\Lambda_i^n, j\right)}{\partial w_m}+\sum_{k\in\mathcal{J}}\frac{\partial\Pr\left(\Lambda_i^n, j\right)}{\partial\tilde{p}_k}\frac{\partial\tilde{p}_k}{\partial w_m}\geq 0.$$

By analogy with Step 1,

$$\sum_{k\in\mathcal{J}}\frac{\partial\Pr\left(\Lambda_i^n, j\right)}{\partial\tilde{p}_k}\frac{\partial\tilde{p}_k}{\partial\tilde{w}_m}=\Pr\left(\Lambda_i^n, j\right)\sum_{k\in\mathcal{J}}\frac{\partial\tilde{p}_k}{\partial\tilde{w}_m}\left(\frac{\partial\log\left(\Pr\left(\Lambda_i^n, j\right)\cdot\Theta_j\right)}{\partial\log\left(p_k\right)}-\frac{\partial\log\left(\Theta_j\right)}{\partial\log\left(p_k\right)}\right)$$

$$\sum_{k\in\mathcal{J}}\frac{\partial\pi_{\boldsymbol{\ell}j}}{\partial\tilde{p}_k}\frac{\partial\tilde{p}_k}{\partial\tilde{w}_m}=\theta\pi_{\boldsymbol{\ell}j}\left(-\left(\sum_{k\in\mathcal{J}}d_{p,k}(\boldsymbol{\ell})\frac{\partial\tilde{p}_k}{\partial\tilde{w}_m}\right)+\frac{\partial\tilde{p}_j}{\partial\tilde{w}_m}\right). \tag{B.10}$$

Combining equations (B.4) and (B.10),

$$\frac{d\Pr\left(\Lambda_i^n, j\right)}{d\tilde{w}_k}=\theta\left(2\Pr\left(\Lambda_i^n, j\right)\frac{\partial\tilde{p}_j}{\partial\tilde{w}_m}-\sum_{\boldsymbol{\ell}\in\Lambda_i^n}\pi_{\boldsymbol{\ell}j}\left(\left(\sum_{k\in\mathcal{J}}d_{p,k}(\boldsymbol{\ell})\frac{\partial\tilde{p}_k}{\partial\tilde{w}_m}\right)+d_{w,m}(\boldsymbol{\ell})\right)\right).$$

Let us use the bounds derived in Step 2: from equation (B.5),

$$\frac{d\Pr\left(\Lambda_i^n, j\right)}{dw_k}\geq\theta\left(\frac{\partial\tilde{p}_j}{\partial\tilde{w}_m}\left(\frac{2(1-\overline{\gamma})}{\xi^\theta(1-\underline{\gamma})}\Pr\left(\Lambda_i^n, j\right)-\sum_{\boldsymbol{\ell}\in\Lambda_i^n}\pi_{\boldsymbol{\ell}j}\left(\sum_{k\in\mathcal{J}}d_{p,k}(\boldsymbol{\ell})\right)\right)-\sum_{\boldsymbol{\ell}\in\Lambda_i^n}\pi_{\boldsymbol{\ell}j}d_{w,m}(\boldsymbol{\ell})\right).$$

Finally, invoking equations (B.6) and (B.6), we have:

$$\frac{d\Pr\left(\Lambda_i^n, j\right)}{dw_k}\geq\theta[A^W]_{kj}\Pr\left(\Lambda_i^n, j\right)\left(\frac{2(1-\overline{\gamma})}{\xi^\theta(1-\underline{\gamma})}-\frac{1}{\Pr\left(\Lambda_i^n, j\right)}\sum_{\boldsymbol{\ell}\in\Lambda_i^n}\pi_{\boldsymbol{\ell}j}\left(\sum_{k\in\mathcal{J}}d_{p,k}(\boldsymbol{\ell})\right)-\xi^{2\theta}\right)$$

and thus

$$\frac{d\Pr\left(\Lambda_i^n, j\right)}{dw_k}\geq\theta[A^W]_{kj}\Pr\left(\Lambda_i^n, j\right)\left(\frac{2(1-\overline{\gamma})}{\xi^\theta(1-\underline{\gamma})}-(1-\underline{\gamma})-\xi^{2\theta}\right). \tag{B.11}$$

■

**Corollary 1** *Suppose the trade costs have the following form:*

$$(\tau_{ij})^{-\theta} = \rho_i \rho_j.$$

*Then the equilibrium is unique if*

$$\underline{\gamma}(3-\underline{\gamma}) \geq 2\overline{\gamma} \tag{B.12}$$

**Proof.** Note that for this specification of trade costs $\xi = 1$, and the RHS of equation (B.11) is positive whenever (B.12) holds. ■

## B.3 Introducing Trade Deficits

Let $D_j$ be country $j$'s aggregate deficit in dollars, where $\sum_j D_j = 0$ holds since global trade is balanced. The only difference in the model's equations is that the general equilibrium equation is given by

$$\frac{1}{\gamma_i} w_i L_i = \sum_{j\in\mathcal{J}} \sum_{n\in\mathcal{N}} \alpha_n \beta_n \times \Pr\left(\Lambda_i^n, j\right) \times \left(\frac{1-\gamma_j}{\gamma_j} w_j L_j + w_j L_j - D_j\right).$$

where $w_j L_j - D_j$ is aggregate final good consumption in country $j$.

## B.4 Further Details on Suggestive Evidence

In this Appendix we provide additional details on the suggestive empirical results in section 5. We begin by exploring the robustness of our results in Table 1. For that table, we used 2011 data for 180 countries from the Eora dataset. In Table A.1 we replicate that same table but pooling data from the 19 years for which the Eora dataset is available, namely 1995-2013, while including exporter-year and importer-year fixed effects (rather than the simpler exporter and importer fixed effects in Table A.1). As is apparent from comparing Tables 1 and A.1, the results are remarkably similar, both qualitatively as well as quantitatively. The reason for this is that the estimated elasticities are quite actually quite stable over time, as we have verified by replicating Table 1 year by year (details available upon request).

Tables A.2 and A.3 run the same specifications with the WIOT database using its 2013 and 2016 releases, respectively. The former covers the period 1995-2011 for 40 countries, while the latter covers 2000-2014 for 43 countries. As mentioned in the main text, the results with the 2013 release of the WIOD are generally qualitatively in line with those obtained with the Eora database, and indicate a significantly lower distance elasticity and lower 'home bias' in intermediate-input relative to final-good trade. Nevertheless, the results with the 2016 release of the same dataset are much weaker, and only indicate a lower 'home bias' in intermediate-input relative to final-good trade.

We finally incorporate the scatter plots mentioned in section 5, when describing the results in Table 2. More precisely, the left panel corresponds to the partial correlation underlying column (5) of Table 2 (i.e., partialling out GDP per capita). The right panel is the analogous scatter plot after dropping the Netherlands ('NLD').

Table A.1. Trade Cost Elasticities for Final Goods and Intermediate Inputs (Eora all years)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Distance | -1.118*** | -0.824*** | -1.153*** | -0.854*** | -1.224*** | -0.910*** | -0.797*** |
| | (0.020) | (0.014) | (0.020) | (0.014) | (0.021) | (0.015) | (0.015) |
| Distance × Input | | | | | 0.141*** | 0.113*** | 0.104*** |
| | | | | | (0.005) | (0.006) | (0.006) |
| Continguity | | 2.239*** | | 2.254*** | | 2.350*** | 1.210*** |
| | | (0.111) | | (0.112) | | (0.120) | (0.098) |
| Continguity × Input | | | | | | -0.191*** | -0.058 |
| | | | | | | (0.035) | (0.037) |
| Language | | 0.481*** | | 0.512*** | | 0.601*** | 0.515*** |
| | | (0.026) | | (0.026) | | (0.029) | (0.027) |
| Language × Input | | | | | | -0.179*** | -0.168*** |
| | | | | | | (0.012) | (0.012) |
| Domestic | | | | | | | 5.826*** |
| | | | | | | | (0.176) |
| Domestic × Input | | | | | | | -0.656*** |
| | | | | | | | (0.059) |
| Observations | 615,600 | 615,600 | 1,231,200 | 1,231,200 | 1,231,200 | 1,231,200 | 1,231,200 |
| $R^2$ | 0.977 | 0.978 | 0.967 | 0.969 | 0.967 | 0.969 | 0.971 |

**Notes:** Standard errors clustered at the country-pair level reported. ***, **, and * denote 1, 5 and 10 percent significance levels. All regressions include exporter-year and importer-year fixed effects. Regressions in columns (3)-(7) also include a dummy variable for inputs flows. See Appendix **??** for details on data sources.

Table A.2. Trade Cost Elasticities for Final Goods and Intermediate Inputs (2013 WIOD sample)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Distance | -1.550*** | -1.244*** | -1.560*** | 1.243*** | -1.587*** | -1.265*** | -1.081*** |
| | (0.056) | (0.044) | (0.057) | (0.044) | (0.059) | (0.045) | (0.042) |
| Distance × Input | | | | | 0.055*** | 0.045*** | 0.032* |
| | | | | | (0.014) | (0.017) | (0.017) |
| Continguity | | 0.724*** | | 0.750*** | | 0.733*** | 0.302** |
| | | (0.135) | | (0.138) | | (0.148) | (0.126) |
| Continguity × Input | | | | | | 0.033 | 0.164* |
| | | | | | | (0.085) | (0.086) |
| Language | | 0.964*** | | 1.002*** | | 1.131*** | 0.258* |
| | | (0.169) | | (0.169) | | (0.175) | (0.137) |
| Language × Input | | | | | | -0.257** | -0.064 |
| | | | | | | (0.075) | (0.080) |
| Domestic | | | | | | | 3.634*** |
| | | | | | | | (0.275) |
| Domestic × Input | | | | | | | -0.787*** |
| | | | | | | | (0.092) |
| Observations | 27,194 | 27,194 | 54,380 | 54,380 | 54,380 | 54,380 | 54,380 |
| $R^2$ | 0.981 | 0.983 | 0.972 | 0.974 | 0.972 | 0.974 | 0.978 |

**Notes:** Standard errors clustered at the country-pair level reported. ***, **, and * denote 1, 5 and 10 percent significance levels. All regressions include exporter-year and importer-year fixed effects. Regressions in columns (3)-(7) also include a dummy variable for inputs flows. See the Appendix for details on data sources.

Table A.3. Trade Cost Elasticities for Final Goods and Intermediate Inputs (2016 WIOD sample)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Distance | -1.638*** | -1.396*** | -1.648*** | 1.395*** | -1.656*** | -1.396*** | -1.210*** |
| | (0.053) | (0.044) | (0.053) | (0.044) | (0.055) | (0.045) | (0.043) |
| Distance × Input | | | | | 0.016 | 0.000 | -0.012 |
| | | | | | (0.014) | (0.017) | (0.017) |
| Continguity | | 0.556*** | | 0.573*** | | 0.603*** | 0.241** |
| | | (0.122) | | (0.123) | | (0.139) | (0.121) |
| Continguity × Input | | | | | | -0.061 | 0.061 |
| | | | | | | (0.092) | (0.094) |
| Language | | 0.769*** | | 0.808*** | | 0.883*** | 0.131 |
| | | (0.149) | | (0.150) | | (0.161) | (0.127) |
| Language × Input | | | | | | -0.150** | -0.024 |
| | | | | | | (0.072) | (0.072) |
| Domestic | | | | | | | 3.453*** |
| | | | | | | | (0.257) |
| Domestic × Input | | | | | | | -0.785*** |
| | | | | | | | (0.083) |
| Observations | 26,460 | 26,460 | 52,920 | 52,920 | 52,920 | 52,920 | 52,920 |
| $R^2$ | 0.982 | 0.984 | 0.974 | 0.975 | 0.974 | 0.975 | 0.978 |

**Notes:** Standard errors clustered at the country-pair level reported. ***, **, and * denote 1, 5 and 10 percent significance levels. All regressions include exporter-year and importer-year fixed effects. Regressions in columns (3)-(7) also include a dummy variable for inputs flows. See the Appendix for details on data sources.

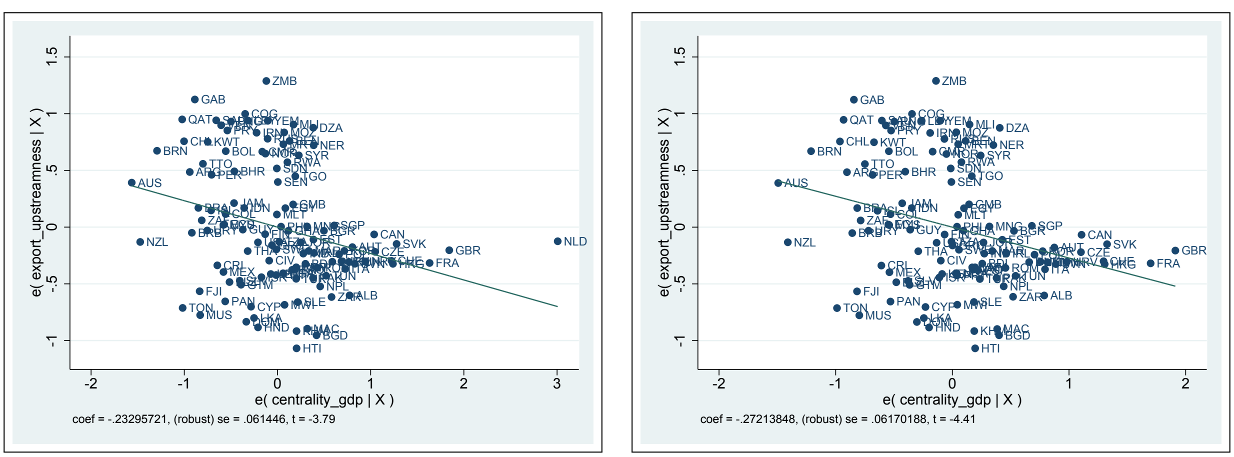


Figure B.2: Partial Correlation between Export Upstreamness and Centrality

## B.5 Real Income Gains

Table B.1 reports the real income implications of the three counterfactuals studied in section 7 of the paper for the WIOD sample, and compares them with the numbers that would be obtained in an analogous Eaton and Kortum (2002) framework without sequential production (see the main text for details). Table B.2 presents the same numbers for the Eora sample of countries.

Table B.1: Real Income Gains: WIOD sample

| | Autarky | | 50% Fall | | Free Trade | |
|---|---|---|---|---|---|---|
| | EK | GVC | EK | GVC | EK | GVC |
| Australia | 4.9 | 4.4 | 23.1 | 20.6 | 438.4 | 403.7 |
| Austria | 13.0 | 14.0 | 44.3 | 47.1 | 607.0 | 564.3 |
| Belgium | 21.4 | 22.4 | 62.8 | 64.0 | 609.5 | 618.3 |
| Bulgaria | 17.9 | 19.3 | 74.9 | 74.3 | 1715.9 | 1855.9 |
| Brazil | 3.2 | 3.4 | 14.8 | 15.6 | 307.3 | 354.1 |
| Canada | 8.0 | 8.2 | 27.4 | 29.0 | 350.4 | 371.3 |
| Switzerland | 10.2 | 10.9 | 41.6 | 39.1 | 507.6 | 424.5 |
| China | 4.1 | 5.3 | 15.8 | 18.5 | 189.4 | 310.2 |
| Cyprus | 13.1 | 13.9 | 63.6 | 60.8 | 1886.3 | 2422.6 |
| Czech Republic | 21.1 | 22.8 | 69.6 | 70.0 | 1071.3 | 932.2 |
| Germany | 9.4 | 10.2 | 30.9 | 30.9 | 242.8 | 252.2 |
| Denmark | 12.6 | 13.8 | 50.0 | 52.1 | 656.3 | 640.1 |
| Spain | 7.2 | 7.6 | 28.0 | 27.7 | 405.4 | 355.1 |
| Estonia | 21.5 | 24.0 | 87.0 | 87.4 | 2115.5 | 3026.4 |
| Finland | 10.1 | 10.8 | 44.8 | 47.1 | 803.3 | 816.7 |
| France | 7.2 | 7.6 | 25.0 | 25.7 | 282.4 | 281.0 |
| Great Britain | 6.6 | 6.8 | 24.1 | 24.5 | 277.7 | 275.3 |
| Greece | 8.3 | 9.2 | 34.0 | 38.1 | 709.0 | 763.1 |
| Croatia | 11.8 | 12.9 | 54.0 | 55.2 | 1315.5 | 1376.0 |
| Hungary | 27.8 | 28.9 | 83.1 | 82.1 | 1058.6 | 1078.1 |
| Indonesia | 5.6 | 6.1 | 25.4 | 29.8 | 472.1 | 570.6 |
| India | 4.2 | 4.6 | 17.0 | 21.1 | 326.3 | 404.5 |
| Ireland | 34.0 | 34.9 | 89.1 | 84.6 | 746.9 | 795.3 |
| Italy | 6.3 | 6.8 | 26.0 | 25.8 | 344.8 | 323.9 |
| Japan | 4.6 | 4.9 | 17.2 | 17.7 | 236.2 | 265.5 |
| South Korea | 10.6 | 11.3 | 42.2 | 43.0 | 492.8 | 544.1 |
| Lithuania | 20.1 | 22.4 | 75.8 | 72.3 | 1232.2 | 1491.2 |
| Luxembourg | 73.7 | 75.9 | 184.1 | 167.9 | 3851.8 | 3935.5 |
| Latvia | 14.0 | 15.5 | 64.5 | 67.3 | 2187.6 | 2403.5 |
| Mexico | 7.5 | 9.2 | 26.7 | 33.4 | 373.5 | 445.1 |
| Malta | 53.9 | 52.9 | 165.1 | 155.7 | 5179.7 | 7635.3 |
| Netherlands | 16.0 | 17.9 | 53.5 | 57.5 | 472.9 | 512.8 |
| Norway | 6.9 | 8.3 | 34.1 | 51.4 | 520.1 | 865.0 |
| Poland | 11.9 | 12.6 | 44.1 | 43.2 | 646.3 | 533.4 |
| Portugal | 9.7 | 10.3 | 39.6 | 40.9 | 779.6 | 706.4 |
| Romania | 10.6 | 11.3 | 45.6 | 47.4 | 938.6 | 866.2 |
| Russia | 5.4 | 5.2 | 24.5 | 27.9 | 364.9 | 468.2 |
| Slovakia | 23.4 | 25.5 | 79.5 | 77.3 | 1342.1 | 1117.2 |
| Slovenia | 18.2 | 20.3 | 76.5 | 71.7 | 1536.7 | 1393.2 |
| Sweden | 10.0 | 10.5 | 40.4 | 41.1 | 540.5 | 496.3 |
| Turkey | 7.6 | 8.2 | 33.9 | 33.8 | 538.4 | 472.6 |
| Taiwan | 15.7 | 17.9 | 59.8 | 70.8 | 670.8 | 913.2 |
| USA | 3.1 | 3.3 | 9.8 | 10.2 | 116.0 | 163.2 |
| Rest of World | 11.6 | 11.1 | 28.1 | 26.3 | 160.1 | 227.3 |

Table B.2: Real Income Gains: Eora sample

| | Autarky | | 50% fall | | Free Trade | |
|---|---|---|---|---|---|---|
| | EK | GVC | EK | GVC | EK | GVC |
| Afghanistan | 4.1 | 4.6 | 17.9 | 26.5 | 3128.1 | 3613.8 |
| Eastern Europe | 17.0 | 18.1 | 48.4 | 52.7 | 675.4 | 732.9 |
| Algeria | 4.6 | 3.4 | 28.7 | 37.9 | 818.1 | 1484.6 |
| Western Europe | 35.0 | 37.7 | 88.9 | 94.0 | 1090.1 | 1377.0 |
| Angola | 3.1 | 1.5 | 30.1 | 13.8 | 1936.6 | 906.8 |
| Latin America & Caribbean | 8.1 | 8.0 | 26.1 | 27.3 | 794.6 | 675.5 |
| Argentina | 5.4 | 6.6 | 24.2 | 26.6 | 519.7 | 554.3 |
| Australia | 5.8 | 7.0 | 27.1 | 27.0 | 490.4 | 463.8 |
| Central Europe | 15.6 | 17.4 | 43.0 | 50.1 | 417.2 | 507.7 |
| Central Asia | 7.6 | 8.5 | 34.4 | 34.9 | 1381.0 | 1316.3 |
| Middle East & North Africa | 6.3 | 7.0 | 29.9 | 29.6 | 506.5 | 495.6 |
| Bangladesh | 3.7 | 4.5 | 21.8 | 24.7 | 1055.4 | 888.0 |
| Belgium | 28.9 | 24.9 | 71.5 | 84.7 | 639.3 | 982.5 |
| Benin | 5.2 | 6.7 | 26.5 | 45.2 | 3223.1 | 6889.5 |
| South Asia | 13.5 | 22.2 | 65.2 | 134.0 | 4804.1 | 19628.6 |
| Bolivia | 6.7 | 4.6 | 47.3 | 29.6 | 1556.2 | 1391.1 |
| Sub-Saharan Africa | 9.7 | 9.8 | 43.5 | 45.0 | 1255.3 | 1025.0 |
| Brazil | 3.1 | 3.7 | 15.6 | 16.0 | 401.5 | 442.8 |
| East Asia & Pacific | 7.0 | 8.6 | 38.9 | 36.9 | 891.6 | 723.5 |
| Burkina Faso | 7.9 | 7.9 | 23.2 | 38.8 | 2733.8 | 3837.6 |
| Burundi | 4.3 | 6.4 | 29.9 | 54.1 | 3447.3 | 8806.1 |
| Cambodia | 9.8 | 10.2 | 50.9 | 55.8 | 3133.6 | 2824.4 |
| Cameroon | 3.6 | 4.6 | 25.5 | 30.5 | 1691.8 | 2272.2 |
| Canada | 8.3 | 9.8 | 27.5 | 33.6 | 361.5 | 473.9 |
| Chad | 2.0 | 3.2 | 21.5 | 30.7 | 4484.0 | 3552.0 |
| Chile | 7.7 | 9.3 | 40.9 | 43.2 | 828.2 | 886.9 |
| China | 5.0 | 5.8 | 19.6 | 20.8 | 253.9 | 402.9 |
| Colombia | 5.0 | 7.1 | 20.9 | 27.1 | 567.2 | 799.9 |
| Cuba | 4.5 | 5.7 | 21.0 | 27.3 | 1113.5 | 1236.9 |
| Czech Republic | 19.0 | 21.1 | 62.8 | 71.2 | 1042.4 | 1306.0 |
| Cote dIvoire | 3.6 | 4.1 | 32.5 | 26.5 | 1724.8 | 1148.0 |
| North Korea | 3.0 | 3.0 | 39.2 | 23.1 | 3986.5 | 1527.9 |
| DR Congo | 5.5 | 0.9 | 22.8 | 5.7 | 2851.1 | 780.1 |
| Scandinavia | 9.1 | 10.2 | 33.6 | 39.4 | 392.2 | 503.3 |
| Dominican Republic | 6.0 | 8.1 | 29.2 | 35.9 | 1322.3 | 1452.0 |
| Ecuador | 6.0 | 7.4 | 36.2 | 38.0 | 1091.3 | 1130.7 |
| Egypt | 3.1 | 3.9 | 16.8 | 19.7 | 663.7 | 752.0 |
| Eritrea | 2.7 | 3.8 | 23.7 | 37.3 | 4009.3 | 6419.1 |
| Ethiopia | 659.8 | 1.43E+36 | 192.7 | 1111.1 | 1626.1 | 9477.2 |
| France | 8.0 | 8.0 | 27.5 | 28.7 | 290.9 | 358.5 |
| Germany | 12.3 | 12.9 | 37.2 | 41.8 | 269.8 | 404.1 |
| Ghana | 3.6 | 5.0 | 24.6 | 30.9 | 1176.5 | 1561.1 |
| Greece | 10.0 | 10.6 | 31.4 | 36.2 | 789.6 | 782.6 |
| Guatemala | 5.7 | 4.7 | 28.4 | 22.4 | 1320.7 | 918.3 |
| Guinea | 6.1 | 10.8 | 45.4 | 76.2 | 2329.0 | 9668.8 |
| Haiti | 4.1 | 4.7 | 27.5 | 33.0 | 2801.2 | 3400.4 |
| Hong Kong | 138.5 | 107.6 | 142.8 | 121.8 | 1860.7 | 1081.0 |
| India | 4.1 | 4.3 | 20.8 | 19.5 | 400.8 | 391.0 |
| Indonesia | 5.3 | 6.2 | 27.0 | 29.3 | 482.0 | 481.3 |
| Iran | 6.3 | 6.4 | 31.2 | 28.2 | 809.7 | 686.8 |

| | Autarky | | 50% fall | | Free Trade | |
|---|---|---|---|---|---|---|
| | EK | GVC | EK | GVC | EK | GVC |
| Iraq | 1.9 | 6.7 | 14.9 | 49.0 | 782.7 | 4424.3 |
| Israel | 8.2 | 6.2 | 38.9 | 30.2 | 795.9 | 595.0 |
| Italy | 7.8 | 9.2 | 30.7 | 35.5 | 327.5 | 430.6 |
| Japan | 4.4 | 5.1 | 18.6 | 19.3 | 240.3 | 280.7 |
| Kazakhstan | 5.3 | 6.0 | 27.5 | 34.4 | 1000.7 | 1476.1 |
| Kenya | 8.8 | 11.0 | 33.7 | 51.1 | 1380.3 | 1556.2 |
| Madagascar | 6.6 | 6.2 | 44.1 | 38.2 | 2511.7 | 2019.8 |
| Malawi | 7.1 | 13.6 | 41.4 | 76.9 | 3648.3 | 9329.9 |
| Malaysia | 21.0 | 20.0 | 69.3 | 73.2 | 752.5 | 869.8 |
| Mali | 4.8 | 3.9 | 24.1 | 25.4 | 3022.8 | 2344.1 |
| Mexico | 6.9 | 10.4 | 24.9 | 36.7 | 369.9 | 560.5 |
| Morocco | 6.6 | 7.5 | 32.3 | 32.9 | 1007.6 | 880.0 |
| Mozambique | 3.4 | 4.3 | 15.4 | 24.4 | 1596.0 | 2753.7 |
| Myanmar | 0.0 | 0.1 | 2.0 | 1.3 | 2775.7 | 1088.0 |
| Nepal | 6.6 | 7.4 | 36.3 | 39.7 | 2380.9 | 2131.6 |
| Netherlands | 25.6 | 25.8 | 65.5 | 81.4 | 517.1 | 850.8 |
| Niger | 5.9 | 7.5 | 29.9 | 42.2 | 2547.8 | 4952.7 |
| Nigeria | 4.2 | 7.4 | 20.7 | 29.4 | 555.8 | 1078.0 |
| Pakistan | 2.0 | 3.1 | 16.6 | 19.5 | 851.3 | 743.2 |
| Peru | 4.8 | 5.6 | 25.5 | 27.3 | 953.4 | 893.9 |
| Philippines | 9.0 | 12.8 | 42.1 | 55.4 | 613.7 | 817.4 |
| Poland | 10.9 | 11.7 | 36.8 | 38.4 | 782.8 | 763.2 |
| Portugal | 11.4 | 12.7 | 41.3 | 42.4 | 876.8 | 857.3 |
| South Korea | 16.0 | 19.8 | 60.3 | 65.0 | 846.6 | 1129.7 |
| Romania | 11.5 | 12.9 | 44.1 | 48.6 | 1086.0 | 1143.7 |
| Russia | 3.6 | 3.7 | 18.7 | 20.3 | 392.5 | 497.0 |
| Rwanda | 6.5 | 3.1 | 24.6 | 22.9 | 3494.0 | 2666.9 |
| Saudi Arabia | 6.5 | 7.7 | 28.0 | 29.4 | 620.4 | 603.8 |
| Senegal | 4.5 | 6.1 | 24.7 | 34.4 | 1575.3 | 2272.9 |
| Singapore | 46.3 | 47.1 | 97.3 | 102.0 | 981.8 | 1152.0 |
| Somalia | 1.7 | 1.9 | 14.5 | 20.9 | 6917.6 | 16193.2 |
| South Africa | 7.2 | 8.2 | 38.3 | 41.3 | 692.8 | 788.0 |
| South Sudan | 0.2 | 0.4 | 4.1 | 5.9 | 3180.4 | 1704.8 |
| Spain | 8.7 | 9.3 | 31.8 | 32.3 | 441.9 | 501.1 |
| Sri Lanka | 4.3 | 6.8 | 28.6 | 38.1 | 953.4 | 1237.6 |
| Sudan | 0.0 | 0.0 | 0.6 | 0.3 | 1693.6 | 666.8 |
| Syria | 4.6 | 2.3 | 33.3 | 14.6 | 2124.7 | 1006.9 |
| Taiwan | 10.2 | 9.6 | 53.8 | 39.8 | 918.7 | 622.8 |
| Thailand | 10.7 | 12.7 | 49.9 | 48.1 | 781.7 | 705.2 |
| Tunisia | 11.0 | 10.6 | 45.6 | 41.4 | 1972.2 | 1225.7 |
| Turkey | 8.9 | 12.5 | 26.2 | 36.2 | 432.6 | 624.3 |
| Uganda | 5.5 | 6.1 | 19.4 | 31.5 | 2210.0 | 2587.1 |
| Ukraine | 14.0 | 15.3 | 50.4 | 51.5 | 1556.1 | 1410.4 |
| UK | 10.2 | 10.7 | 30.6 | 33.2 | 322.4 | 383.2 |
| Tanzania | 17.5 | 40.7 | 64.8 | 164.2 | 4897.0 | 16160.2 |
| USA | 3.8 | 4.1 | 11.5 | 12.0 | 135.0 | 213.5 |
| Uzbekistan | 3.4 | 4.4 | 24.1 | 24.6 | 1186.1 | 1240.1 |
| Venezuela | 3.3 | 2.0 | 23.6 | 19.9 | 695.7 | 793.4 |
| Viet Nam | 32.8 | 29.9 | 78.9 | 77.9 | 2251.6 | 1591.6 |
| Yemen | 4.3 | 6.1 | 29.8 | 37.0 | 1663.5 | 2162.6 |
| Zambia | 5.3 | 5.8 | 31.5 | 35.4 | 2294.5 | 2023.9 |