Supplementary Information

Located by Geo-political Shock

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A.1 Notation and Definition

Table A.1: Full expressions with abbreviations of symbol used in the theoretical model.

Expression	Abbr.	Description
		Quality preference
$\mathcal{U}_j$	$\mathcal{U}$	Utility of the representative consumer in destination country j
$\mathbb{V}_j$	$\mathbb{V}$	A set of goods in destination j
$\omega_{ij}(\nu)$	ω	Share parameter
$\mu_{ij}(\nu)$	μ	Quality of variety ν
$\delta_{ij}(\mu)$	δ	Discount factor
$x_{ij}(\nu)$	x	Quantity of variety ν
ρ	ρ	Substitution parameter
σ	σ	Elasticity of substitution
ν	ν	A variety from the good set $\mathbb{V}_j$
$p_{ij}(\nu)$	p	Price of variety ν
$\mathcal{P}_j$	$\mathcal{P}$	Aggregate price index
E_j	E	Budget constraints of consumers
		Production strategy
C	C	Total variable cost
$c(\mu)$	c	Unit variable cost
$F(\mu)$	F	Summative cost
F_0	F_0	Fixed costs unrelated to quality
ϕ	ϕ	Process productivity
φ	φ	Product productivity
p_K	p_K	Price of capital input
K	K	Capital input
p_L	p_L	Price (average quality-related) of labor input
L	L	Labor input
p_M	p_M	Price (average quality-related) of intermediate input
M	M	intermediate input
$\widetilde{p_L}$	$\widetilde{p_L}$	Price (quality-unrelated) of labor input
ϖ_L	ϖ_L	Elasticity of quality on labor input
$\widetilde{p_M}$	$\widetilde{p_M}$	Price (quality-unrelated) of intermediate input
ϖ_M	ϖ_M	Elasticity of quality on intermediate input
α	α	Output elasticity of capital input
r	r	Price of capital input (adjusted by output elasticity α)
β	β	Output elasticity of labor input
w	w	Price of labor input (adjusted by output elasticity β)
γ	γ	Output elasticity of intermediate input
ϱ	ϱ	Price of intermediate input (adjusted by output elasticity γ)
ζ	ζ	Output elasticity of quality in quantity-producing
η	η	Output elasticity of quality in quality-creating
ι	ι	Return to scale parameter

Expression	Abbr.	Description
		Equilibrium price
τ	τ	Iceberg trade cost
$\kappa(\mu)$	κ	Managerial cost
$\theta(\xi)$	θ	Fraction of accessible fund
Θ	Θ	Fraction parameter
ξ	ξ	Geopolitical shock
		Quality decision
$\pi(p,\mu)$	π	Post-entry profit
F_x	F_x	Other fixed cost
$\mathcal{R}(\mu,\xi)$	$\mathcal{R}$	Implicit function of μ and ξ
$\kappa'(\xi)$	κ'	First-order derivative of κ with respect to ξ
$\theta'(\xi)$	θ'	First-order derivative of θ with respect to ξ
$\delta'(\mu)$	δ'	First-order derivative of δ with respect to μ
$\epsilon(\mu)$	ϵ	Quality-elasticity of trade discounts
$\epsilon'(\mu)$	ϵ'	First-order derivative of ϵ with respect to μ
		Financial convenience
$\hat{\theta}_d(\xi)$	$\hat{\theta}_d$	Fraction of domestic attainable fund
$\hat{\theta}_f(\xi)$	$\hat{\theta}_f$	Fraction of cross-border attainable fund
$\hat{\theta}'_d(\xi)$	$\hat{\theta}'_d$	First-order derivative of $\hat{\theta}_d$ with respect to ξ
$\hat{\theta}'_f(\xi)$	$\hat{\theta}'_f$	First-order derivative of $\hat{\theta}_f$ with respect to ξ
s_d	s_d	Securable fraction of domestic fund
s_f	s_f	Securable of cross-border fund

A.2 Quality Preference

As mentioned in the main text, by introducing quality μ of product, the utility $\mathcal{U}_j$ of representative consumer in destination country j can be expressed as:

$$\mathcal{U}_j = \left(\int_{\nu \in \mathbb{V}_j} \omega_{ij}(\nu) \left(\frac{\mu_{ij}(\nu)}{\delta_{ij}(\mu)} x_{ij}(\nu) \right)^{\rho} d\nu \right)^{1/\rho} \tag{A.1}$$

For a variety ν of given specific quality, representative consumers choose the quantity x_{ij} of variety ν in order to maximize their utility, under the budget constraint E_j. Thus, optimization of the consumers corresponds to the programming following:

$$\max_{x_{ij}} \mathcal{U}_j \tag{A.2a}$$

$$\text{s.t.} \int_{\nu \in \mathbb{V}_j} p_{ij}(\nu) x_{ij}(\nu) d\nu \leq E_j \tag{A.2b}$$

While internal solution existing, the programming presented in Eq.(A.2) can be settled by employing the method of Lagrange multiplier, which can be expressed as:

$$\mathcal{L} = \left(\int_{\nu \in \mathbb{V}_j} \omega_{ij}(\nu) \left(\frac{\mu_{ij}(\nu)}{\delta_{ij}(\mu)} x_{ij}(\nu) \right)^{\rho} d\nu \right)^{1/\rho} - \lambda \left(\int_{\nu \in \mathbb{V}_j} p_{ij}(\nu) x_{ij}(\nu) d\nu - E_j \right) \tag{A.3}$$

For a certain source country s and a destination country d, the solution of optimization corresponds to calculating the partial deviation of $\mathcal{L}$ with respect to x_{sd}:

$$\frac{\partial \mathcal{L}}{\partial x_{sd}} = \frac{1}{\rho}\left(\int_{\nu\in\mathbb{V}_d} \omega_{sd}(\nu)\frac{\mu_{sd}(\nu)}{\delta_{sd}(\mu)}x_{sd}(\nu)^{\rho}d\nu\right)^{\frac{1}{\rho}-1} \omega_{sd}(\nu)\left(\frac{\mu_{sd}(\nu)}{\delta_{sd}(\mu)}\right)^{\rho}\rho x_{sd}(\nu)^{\rho-1} - \lambda p_{sd}(\nu) = 0 \tag{A.4}$$

Then, the Lagrange multiplier can be expressed as:

$$\lambda = \mathcal{U}_{sd}^{1-\rho}\frac{\omega_{sd}(\nu)\left({}^{\mu_{sd}(\nu)}/_{\delta_{sd}(\mu)}\right)^{\rho}x_{sd}(\nu)^{\rho-1}}{p_{sd}(\nu)} \tag{A.5}$$

Thus, for any source country i and destination country j, the following expression holds:

$$\frac{\omega_{sd}(\nu)\left({}^{\mu_{sd}(\nu)}/_{\delta_{sd}(\mu)}\right)^{\rho}x_{sd}(\nu)^{\rho-1}}{p_{sd}(\nu)} = \frac{\omega_{ij}(\nu)\left({}^{\mu_{ij}(\nu)}/_{\delta_{ij}(\mu)}\right)^{\rho}x_{ij}(\nu)^{\rho-1}}{p_{ij}(\nu)} \tag{A.6}$$

which means that, any $x_{ij}(\nu)$ with $(i,j)\neq(s,d)$ can be expressed by $x_{sd}(\nu)$:

$$x_{ij}(\nu) = \left(\frac{\omega_{sd}(\nu)\left({}^{\mu_{sd}(\nu)}/_{\delta_{sd}(\mu)}\right)^{\rho}p_{ij}(\nu)}{\omega_{ij}(\nu)\left({}^{\mu_{ij}(\nu)}/_{\delta_{ij}(\mu)}\right)^{\rho}p_{sd}(\nu)}\right)^{\frac{1}{\rho-1}} x_{sd}(\nu) \tag{A.7}$$

and while $(i,j)=(s,d)$, $x_{ij}(\nu)=x_{sd}(\nu)$.

Then, for certain s and d, constraints corresponding to Eq.(A.2b) can be expressed as:

$$\begin{aligned}
E_d &= \int_{\nu\in\mathbb{V}_d} p_{ij}(\nu)\left(\frac{\omega_{sd}(\nu)\left({}^{\mu_{sd}(\nu)}/_{\delta_{sd}(\mu)}\right)^{\rho}p_{ij}(\nu)}{\omega_{ij}(\nu)\left({}^{\mu_{ij}(\nu)}/_{\delta_{ij}(\mu)}\right)^{\rho}p_{sd}(\nu)}\right)^{\frac{1}{\rho-1}} x_{sd}(\nu)d\nu \\
&= \omega_{sd}(\nu)^{\frac{1}{\rho-1}}\left(\frac{\mu_{sd}(\nu)}{\delta_{sd}(\mu)}\right)^{\frac{\rho}{\rho-1}} p_{sd}(\nu)^{\frac{1}{1-\rho}}x_{sd}(\nu)\int_{\nu\in\mathbb{V}_d}\omega_{ij}(\nu)^{\frac{1}{1-\rho}}\left(\frac{\mu_{ij}(\nu)}{\delta_{ij}(\mu)}\right)^{\frac{\rho}{1-\rho}} p_{ij}(\nu)^{\frac{\rho}{\rho-1}}d\nu \\
&= x_{sd}(\nu)\omega_{sd}(\nu)^{-\sigma}\left(\frac{\mu_{sd}(\nu)}{\delta_{sd}(\mu)}\right)^{1-\sigma} p_{sd}(\nu)^{\sigma}\mathcal{P}_d^{1-\sigma}
\end{aligned} \tag{A.8}$$

Thus, while utility of the consumers maximized, the optimal quantity x_{ij} of the variety ν exported from source country i to destination country j can be expressed as:

$$x_{ij}(\nu) = \frac{\omega_{ij}(\nu)^{\sigma}p_{ij}(\nu)^{-\sigma}}{\mathcal{P}_j^{1-\sigma}}\left(\frac{\mu_{ij}(\nu)}{\delta_{ij}(\mu)}\right)^{\sigma-1} E_j \tag{A.9}$$

where $\mathcal{P}_j = \left(\int_{\nu\in\mathbb{V}_j}\omega_{ij}(\nu)^{\sigma}\left(\frac{\mu_{ij}(\nu)}{\delta_{ij}(\mu)}\right)^{1-\sigma}p_{ij}(\nu)^{1-\sigma}d\nu\right)^{\frac{1}{1-\sigma}}$.

A.3 Variable Cost

As discussed in the main text, the firm's production process involves the input of three factors: capital K, labor L, and intermediate inputs M, for which the firm pays respective factor prices p_K, p_L, and p_M. The firm's production function $Y=f(K,L,M)$ takes the Cobb-Douglas form.

For the quantity-producing process, suppose the firm has a quantity productivity ϕ, and the output elasticities of each input satisfy $\alpha,\beta,\gamma>0$. By assuming the constant returns to scale in the production process, the firm's production function of quantity-producing process can be expressed as $Y=f(K,L,M)=\phi K^{\alpha}L^{\beta}M^{\gamma}$. The firm aims to minimize its variable cost (or equivalently,

minimize the unit variable cost), that is, to minimize the total factor payments required to produce one unit of production. The firm's cost-minimizing behavior can thus be formulated as the following optimization programming:

$$\min_{K,L,M} \; C = p_K K + p_L L + p_M M \tag{A.10a}$$

$$\text{s.t. } Y = f(K, L, M) = \phi K^{\alpha} L^{\beta} M^{\gamma} \tag{A.10b}$$

By employing Lagrange Multiplier, Eq.(A.10) can be re-expressed as:

$$\mathcal{L} = p_K K + p_L L + p_M M - \lambda \left(Y - \phi K^{\alpha} L^{\beta} M^{\gamma} \right) \tag{A.11}$$

The first-order condition of Eq.(A.11) will be:

$$\begin{cases} \frac{\partial \mathcal{L}}{\partial K} = p_K + \lambda \phi \alpha K^{\alpha-1} L^{\beta} M^{\gamma} = p_K + \lambda \alpha \frac{Y}{K} = 0 \\ \frac{\partial \mathcal{L}}{\partial L} = p_L + \lambda \phi \beta L^{\beta-1} K^{\alpha} M^{\gamma} = p_L + \lambda \beta \frac{Y}{L} = 0 \\ \frac{\partial \mathcal{L}}{\partial M} = p_M + \lambda \phi \gamma M^{\gamma-1} K^{\alpha} L^{\beta} = p_M + \lambda \gamma \frac{Y}{M} = 0 \end{cases} \tag{A.12}$$

which will make the following equations hold:

$$\frac{p_K K}{\alpha} = \frac{p_L L}{\beta} = \frac{p_M M}{\gamma} \tag{A.13}$$

Based on Eq.(A.13), the production function $Y = f(K, L, M)$ can be expressed by each single input factor:

$$\begin{aligned} Y &= \phi K^{\alpha+\beta+\gamma} \left(\frac{p_K}{\alpha} \right)^{\beta+\gamma} \left(\frac{\beta}{p_L} \right)^{\beta} \left(\frac{\gamma}{p_M} \right)^{\gamma} \\ &= \phi L^{\alpha+\beta+\gamma} \left(\frac{p_L}{\beta} \right)^{\alpha+\gamma} \left(\frac{\alpha}{p_K} \right)^{\alpha} \left(\frac{\gamma}{p_M} \right)^{\gamma} \\ &= \phi M^{\alpha+\beta+\gamma} \left(\frac{p_M}{\gamma} \right)^{\beta+\gamma} \left(\frac{\eta_k}{p_K} \right)^{\alpha} \left(\frac{\beta}{p_L} \right)^{\beta} \end{aligned} \tag{A.14}$$

Then, the induced demand functions of each factor for inputting can be written as:

$$\begin{cases} K = \left(\frac{Y}{\phi} \right)^{\frac{1}{\alpha+\beta+\gamma}} \left(\frac{p_L}{\beta} \right)^{\frac{\beta}{\alpha+\beta+\gamma}} \left(\frac{p_M}{\gamma} \right)^{\frac{\gamma}{\alpha+\beta+\gamma}} \left(\frac{p_K}{\alpha} \right)^{\frac{\alpha}{\alpha+\beta+\gamma}} \frac{\alpha}{p_K} \\ L = \left(\frac{Y}{\phi} \right)^{\frac{1}{\alpha+\beta+\gamma}} \left(\frac{p_L}{\beta} \right)^{\frac{\beta}{\alpha+\beta+\gamma}} \left(\frac{p_M}{\gamma} \right)^{\frac{\gamma}{\alpha+\beta+\gamma}} \left(\frac{p_K}{\alpha} \right)^{\frac{\alpha}{\alpha+\beta+\gamma}} \frac{\beta}{p_L} \\ M = \left(\frac{Y}{\phi} \right)^{\frac{1}{\alpha+\beta+\gamma}} \left(\frac{p_L}{\beta} \right)^{\frac{\beta}{\alpha+\beta+\gamma}} \left(\frac{p_M}{\gamma} \right)^{\frac{\gamma}{\alpha+\beta+\gamma}} \left(\frac{p_K}{\alpha} \right)^{\frac{\alpha}{\alpha+\beta+\gamma}} \frac{\gamma}{p_M} \end{cases} \tag{A.15}$$

By substituting the induced demand functions of each factor for those in the definition function of the variable cost, the variable cost C for the quantity-producing process at a given output level can be expressed as:

$$C = (\alpha + \beta + \gamma) \left(\frac{Y}{\phi} \right)^{\frac{1}{\alpha+\beta+\gamma}} \left(\frac{p_K}{\alpha} \right)^{\frac{\alpha}{\alpha+\beta+\gamma}} \left(\frac{p_L}{\beta} \right)^{\frac{\beta}{\alpha+\beta+\gamma}} \left(\frac{p_M}{\gamma} \right)^{\frac{\gamma}{\alpha+\beta+\gamma}} \tag{A.16}$$

Assume the constant returns to scale, i.e., $\alpha + \beta + \gamma = 1$, the unit variable cost by setting $Y = 1$ will be:

$$c = \frac{1}{\phi} \left(\frac{p_K}{\alpha} \right)^{\alpha} \left(\frac{p_L}{\beta} \right)^{\beta} \left(\frac{p_M}{\gamma} \right)^{\gamma} \tag{A.17}$$

A.4 Fixed Cost

Similar to the firm's quantity-producing process, the firm's quality-creating process also involves the input of three factors: K, L, and M, with corresponding input prices p_K, p_L, and p_M. However, the firm must pay an additional fixed cost F_0, e.g., for product R&D, the implementation of quality control systems, etc. The production function of quality-creating process, $\mu = f(K, L, M)$, also takes the Cobb-Douglas form. The output elasticities with respect to each factor, α, β, and γ, are assumed to be the same as in the quantity production process.

Let the firm's quality productivity be denoted by φ. Unlike the quantity production process, we allow for variable returns to scale in quality creation. This is incorporated by introducing a returns-to-scale parameter ι, such that the quality creation output function is expressed as $\mu = g(K, L, M) = \left(\varphi K^{\alpha} L^{\beta} M^{\gamma}\right)^{\frac{1}{\iota}}$. The firm's objective in the quality-creating process is to minimize the total cost, which includes the payments for all factor inputs as well as the fixed cost. Therefore, the firm's production optimization corresponds to the following programming:

$$\min_{K,L,M} \; F = F_0 + p_K K + p_L L + p_M M \tag{A.18a}$$

$$\text{s.t. } \mu = g(K, L, M) \tag{A.18b}$$

By employing the method of Lagrange Multiplier, the corresponding Lagrange function can be written as:

$$\mathcal{L} = F_0 + p_K K + p_L L + p_M M - \lambda \left[\mu - \left(\varphi K^{\alpha} L^{\beta} M^{\gamma}\right)^{\frac{1}{\iota}}\right] \tag{A.19}$$

The first-order condition of Eq.(A.19) corresponds to:

$$\begin{cases} \frac{\partial \mathcal{L}}{\partial K} = p_K + \lambda \varphi \frac{\alpha}{\iota} K^{\frac{\alpha}{\iota}-1} L^{\frac{\beta}{\iota}} M^{\frac{\gamma}{\iota}} = p_K + \lambda \frac{\alpha}{\iota} \frac{Y}{K} = 0 \\ \frac{\partial \mathcal{L}}{\partial L} = p_L + \lambda \varphi \frac{\beta}{\iota} L^{\frac{\beta}{\iota}-1} K^{\frac{\alpha}{\iota}} M^{\frac{\gamma}{\iota}} = p_L + \lambda \frac{\beta}{\iota} \frac{Y}{L} = 0 \\ \frac{\partial \mathcal{L}}{\partial M} = p_M + \lambda \varphi \frac{\gamma}{\iota} M^{\frac{\gamma}{\iota}-1} K^{\frac{\alpha}{\iota}} L^{\frac{\beta}{\iota}} = p_M + \lambda \frac{\gamma}{\iota} \frac{Y}{M} = 0 \end{cases} \tag{A.20}$$

which will make the following equations hold:

$$\frac{p_K K}{\alpha} = \frac{p_L L}{\beta} = \frac{p_M M}{\gamma} \tag{A.21}$$

The production function of the quality-creating process $Y = g(K, K, M)$ can be now re-expressed as:

$$\begin{aligned} \mu &= \left[\varphi K^{\alpha+\beta+\gamma} \left(\frac{p_K}{\alpha}\right)^{\beta+\gamma} \left(\frac{\beta}{p_L}\right)^{\beta} \left(\frac{\gamma}{p_M}\right)^{\gamma}\right]^{\frac{1}{\iota}} \\ &= \left[\varphi L^{\alpha+\beta+\gamma} \left(\frac{p_L}{\beta}\right)^{\alpha+\gamma} \left(\frac{\alpha}{p_K}\right)^{\alpha} \left(\frac{\gamma}{p_M}\right)^{\gamma}\right]^{\frac{1}{\iota}} \\ &= \left[\varphi M^{\alpha+\beta+\gamma} \left(\frac{p_M}{\gamma}\right)^{\beta+\gamma} \left(\frac{\eta_k}{p_K}\right)^{\alpha} \left(\frac{\beta}{p_L}\right)^{\beta}\right]^{\frac{1}{\iota}} \end{aligned} \tag{A.22}$$

Then, the induced demand functions of each factor for inputting can be written as:

$$\begin{cases} K = \left(\frac{Y}{\varphi}\right)^{\frac{1}{\alpha+\beta+\gamma}} \left(\frac{p_L}{\beta}\right)^{\frac{\beta}{\alpha+\beta+\gamma}} \left(\frac{p_M}{\gamma}\right)^{\frac{\gamma}{\alpha+\beta+\gamma}} \left(\frac{p_K}{\alpha}\right)^{\frac{\alpha}{\alpha+\beta+\gamma}} \frac{\alpha}{p_K} \\ L = \left(\frac{Y}{\varphi}\right)^{\frac{1}{\alpha+\beta+\gamma}} \left(\frac{p_L}{\beta}\right)^{\frac{\beta}{\alpha+\beta+\gamma}} \left(\frac{p_M}{\gamma}\right)^{\frac{\gamma}{\alpha+\beta+\gamma}} \left(\frac{p_K}{\alpha}\right)^{\frac{\alpha}{\alpha+\beta+\gamma}} \frac{\beta}{p_L} \\ M = \left(\frac{Y}{\varphi}\right)^{\frac{1}{\alpha+\beta+\gamma}} \left(\frac{p_L}{\beta}\right)^{\frac{\beta}{\alpha+\beta+\gamma}} \left(\frac{p_M}{\gamma}\right)^{\frac{\gamma}{\alpha+\beta+\gamma}} \left(\frac{p_K}{\alpha}\right)^{\frac{\alpha}{\alpha+\beta+\gamma}} \frac{\gamma}{p_M} \end{cases} \tag{A.23}$$

By substituting the induced demand functions of each factor for those in the definition function of the fix cost, the summative cost F for the quality-creating process at a given output level can be expressed as:

$$F = F_0 + (\alpha+\beta+\gamma)\left(\frac{\mu^{\iota}}{\varphi}\right)^{\frac{1}{\alpha+\beta+\gamma}}\left(\frac{p_K}{\alpha}\right)^{\frac{\alpha}{\alpha+\beta+\gamma}}\left(\frac{p_L}{\beta}\right)^{\frac{\beta}{\alpha+\beta+\gamma}}\left(\frac{p_M}{\gamma}\right)^{\frac{\gamma}{\alpha+\beta+\gamma}} \tag{A.24}$$

Although the quality-creating process allows for variable returns to scale, it is captured by the parameter ι, which permits the condition $\alpha+\beta+\gamma=1$ to still hold. Accordingly, the summative cost F of the firm's quality-creating process can be re-expressed as:

$$F(\mu) = F_0 + \frac{\mu^{\iota}}{\varphi}\left(\frac{p_K}{\alpha}\right)^{\alpha}\left(\frac{p_L}{\beta}\right)^{\beta}\left(\frac{p_M}{\gamma}\right)^{\gamma} \tag{A.25}$$

A.5 Equilibrium Price

As illustrated in the main text, firms primarily aim to maximize their process profits. However, for various reasons, they also seek external financing to support their production and export activities. The process of external financing is typically linked to both geo-political risks and quality decisions made by firms. Therefore, under market equilibrium conditions, the firm's profit maximization behavior is subject to a budget constraint, i.e., the external capital that the firm can secure based on its current product decisions must at least cover the required financing amount (Ding et al., 2018; Feenstra et al., 2014).

Accordingly, the firm's optimization problem under market equilibrium can be formulated as:

$$\max_{p}\ (p-c)x = \left(p-\frac{1}{\phi}\tau\kappa(\xi)w^{\beta}r^{\alpha}\varrho^{\gamma}\mu^{\eta}\right)\frac{p^{-\sigma}}{\mathcal{P}^{1-\sigma}}E \tag{A.26a}$$

$$\text{s.t. } \vartheta(\xi)\left(p-(1-\psi)\frac{1}{\phi}\tau\kappa(\xi)w^{\beta}r^{\alpha}\varrho^{\gamma}\mu^{\eta}\right)\frac{p^{-\sigma}}{\mathcal{P}^{1-\sigma}}E \geq (1-\psi)\left(\frac{1}{\phi}\tau\kappa(\xi)w^{\beta}r^{\alpha}\varrho^{\gamma}\mu^{\eta}\right)\frac{p^{-\sigma}}{\mathcal{P}^{1-\sigma}}E \tag{A.26b}$$

Eq.(A.26) can also be solved by employing method of Lagrange multiplier:

$$\begin{aligned}\mathcal{L} = &\left(p-\frac{1}{\phi}\tau\kappa(\xi)w^{\beta}r^{\alpha}\varrho^{\gamma}\mu^{\eta}\right)\frac{p^{-\sigma}}{\mathcal{P}^{1-\sigma}}E- \\ &-\lambda\left\{\vartheta(\xi)p-[\vartheta(\xi)(1-\psi)-\psi]\left(\frac{1}{\phi}\tau\kappa(\xi)w^{\beta}r^{\alpha}\varrho^{\gamma}\mu^{\eta}\right)\right\}\frac{p^{-\sigma}}{\mathcal{P}^{1-\sigma}}E\end{aligned} \tag{A.27}$$

The partial deviation of $\mathcal{L}$ with respect to x_{sd} corresponds to:

$$\begin{aligned}\frac{\partial\mathcal{L}}{\partial p} = &\frac{p^{-\sigma}}{\mathcal{P}^{1-\sigma}}E-\left(p-\frac{1}{\phi}\tau\kappa(\xi)w^{\beta}r^{\alpha}\varrho^{\gamma}\mu^{\eta}\right)\sigma\frac{p^{-\sigma-1}}{\mathcal{P}^{1-\sigma}}E \\ &-\lambda\vartheta(\xi)\left(\frac{1}{\phi}\tau\kappa(\xi)w^{\beta}r^{\alpha}\varrho^{\gamma}\mu^{\eta}\right)\frac{p^{-\sigma}}{\mathcal{P}^{1-\sigma}}E \\ &+\lambda\left\{\vartheta(\xi)p-[\vartheta(\xi)(1-\psi)-\psi]\left(\frac{1}{\phi}\tau\kappa(\xi)w^{\beta}r^{\alpha}\varrho^{\gamma}\mu^{\eta}\right)\right\}\sigma\frac{p^{-\sigma-1}}{\mathcal{P}^{1-\sigma}}E=0\end{aligned} \tag{A.28}$$

By rearranging both sides of the Eq.(A.28), the following expression can be obtained:

$$\begin{aligned}&p(1-\sigma)(1-\lambda\vartheta(\xi))\frac{p^{-\sigma}}{\mathcal{P}^{1-\sigma}}E \\ &=(\lambda\vartheta(\xi)-\lambda\vartheta(\xi)\psi-\lambda\psi-1)\left(\frac{1}{\phi}\tau\kappa(\xi)w^{\beta}r^{\alpha}\varrho^{\gamma}\mu^{\eta}\right)\sigma\frac{p^{-\sigma}}{\mathcal{P}^{1-\sigma}}E\end{aligned} \tag{A.29}$$

The solution of the optimization problem in Eq.(A.26) by choosing price p (as p^*) can be written as:

$$\begin{aligned} p = p^* &= \frac{\sigma}{\sigma-1}\frac{\lambda\vartheta(\xi)-\lambda\vartheta(\xi)\psi-\lambda\psi-1}{\lambda\vartheta(\xi)-1}\left(\frac{1}{\phi}\tau\kappa(\xi)w^{\beta}r^{\alpha}\varrho^{\gamma}\mu^{\eta}\right) \\ &= \frac{\sigma}{\sigma-1}\left[1+\frac{\lambda(\vartheta(\xi)+1)\psi}{1-\lambda\vartheta(\xi)}\right]\left(\frac{1}{\phi}\tau\kappa(\xi)w^{\beta}r^{\alpha}\varrho^{\gamma}\mu^{\eta}\right) \end{aligned} \tag{A.30}$$

Actually, given the optimal price p^*, namely the equilibrium price, obtained by Eq.(A.30), the budget constraint expressed by Eq.(A.26b) implies:

$$\begin{aligned} & p\frac{p^{-\sigma}}{\mathcal{P}^{1-\sigma}}E \geq (\frac{\psi}{\vartheta}+1-\psi)\left(\frac{1}{\phi}\tau\kappa(\xi)w^{\beta}r^{\alpha}\varrho^{\gamma}\mu^{\eta}\right)\frac{p^{-\sigma}}{\mathcal{P}^{1-\sigma}}E \\ \Longrightarrow\ & \frac{\sigma}{\sigma-1}\Theta \geq \frac{\psi}{\vartheta}+1-\psi \end{aligned} \tag{A.31}$$

A.6 Quality decision

For the quantity demand under the condition of maximizing the process profit, firms can reach their maximized profits by choosing the product price p and quality μ, which means that:

$$\max_{p,\mu}\pi(p,\mu) = \frac{1}{\sigma}\left(\frac{p}{\mathcal{P}}\right)^{1-\sigma}\left(\frac{\delta}{\mu}\right)^{1-\sigma}E - F_0 - \frac{1}{\varphi}w^{\beta}r^{\alpha}\varrho^{\gamma}\mu^{\zeta} - F_x \tag{A.32}$$

where the optimal price p^*, firms should choose, have been given by the standard CES solution. Thus, decisions on quality made by firms corresponds to calculate the partial deviation of $\pi(p,\mu)$ with respect to μ, and subsequently let it be 0:

$$\begin{aligned} \frac{\partial\pi(p,\mu)}{\partial\mu} = \frac{\partial}{\partial\mu}\Bigg[& \left(\frac{1}{\sigma}\right)^{\sigma}\left(\frac{\sigma}{\sigma-1}\Theta\frac{1}{\phi}\tau\kappa(\xi)w^{\beta}r^{\alpha}\varrho^{\gamma}\mu^{\eta}\right)^{1-\sigma}\left(\frac{\delta(\mu)}{\mathcal{P}\mu}\right)^{1-\sigma}E - F_0 \\ & -\frac{1}{\varphi}w^{\beta}r^{\alpha}\varrho^{\gamma}\mu^{\zeta} - F_x\Bigg] \\ = & \left(\frac{\sigma-1}{\sigma}\right)^{\sigma}\left(\Theta\frac{1}{\phi}\tau\kappa(\xi)w^{\beta}r^{\alpha}\varrho^{\gamma}\right)^{1-\sigma}\mathcal{P}^{\sigma-1}E\Big[(1-\eta)\mu^{(1-\eta)(\sigma-1)-1}\delta(\mu)^{1-\sigma} \\ & -\delta^{-\sigma}\frac{\partial\delta(\mu)}{\partial\mu}\mu^{(1-\eta)(\sigma-1)}\Big] - \frac{\zeta}{\varphi}w^{\beta}r^{\alpha}\varrho^{\gamma}\mu^{\zeta-1} = 0 \end{aligned} \tag{A.33}$$

By defining the quality-elasticity of trade discounts, i.e., $\varepsilon(\mu) = -\frac{\partial\delta(\mu)}{\partial\mu}\frac{\mu}{\delta(\mu)}$, according to first-order condition represented by Eq.(A.33), the functional relationship between quality $\mu(\xi)$ and geo-political shock ξ will be embodied in such a implicit function $\mathcal{R}$:

$$\begin{aligned} \mathcal{R}(\mu,\xi) = & \left(\frac{\sigma-1}{\sigma}\right)^{\sigma}\left(\Theta\frac{1}{\phi}\tau\kappa(\xi)w^{\beta}r^{\alpha}\varrho^{\gamma}\right)^{1-\sigma}\mathcal{P}^{\sigma-1}E\delta(\mu)^{1-\sigma}\left(1-\eta+\varepsilon(\mu)\right) \\ & -\frac{\zeta}{\varphi}w^{\beta}r^{\alpha}\varrho^{\gamma}\mu^{\zeta-(1-\eta)(\sigma-1)} = 0 \end{aligned} \tag{A.34}$$

Here, without loss of generality, We do not intend to impose a specific function form on either $\delta(\mu)$ or $\varepsilon(\mu)$. But the quality-elasticity of trade discounts $\varepsilon(\mu)$ should meet the following properties (Hallak and Sivadasan, 2009, 2013): non-negative, for $\delta'(\mu) \leq 0$; limited by the upper bound, i.e., $\varepsilon(\mu) < \frac{\zeta}{\sigma-1} - (1-\eta)$; and decreasing with respect to μ, i.e., $\varepsilon'(\mu) < 0$.

By rearranging both sides of the Eq.(A.34), the following expression can be obtained:

$$\left(\frac{\sigma-1}{\sigma}\right)^{\sigma}\left(\Theta\frac{1}{\phi}\tau\kappa(\xi)\right)^{1-\sigma}\left(w^{\beta}r^{\alpha}\varrho^{\gamma}\right)^{-\sigma}\mathcal{P}^{\sigma-1}E\delta(\mu)^{1-\sigma}(1-\eta+\varepsilon(\mu))=\frac{\zeta}{\varphi}\mu^{\zeta-(1-\eta)(\sigma-1)} \tag{A.35}$$

or in the logged form:

$$\begin{aligned}\ln\frac{\zeta}{\varphi}+[\zeta-(1-\eta)(\sigma-1)]\ln\mu=&\ln\left[\left(\frac{\sigma-1}{\sigma}\right)^{\sigma}\left(w^{\beta}r^{\alpha}\varrho^{\gamma}\right)^{-\sigma}\mathcal{P}^{\sigma-1}E\right]+(1-\sigma)\ln\delta(\mu)\\&+(1-\sigma)\ln\left(\Theta\frac{1}{\phi}\tau\kappa(\xi)\right)+\ln(1-\eta+\varepsilon(\mu))\end{aligned} \tag{A.36}$$

We can investigate how geo-political shocks will affect the product quality by conducting the implicit differentiation for Eq.(A.36) with respect to ξ:

$$[\zeta-(1-\eta)(\sigma-1)]\frac{1}{\mu}\frac{\partial\mu}{\partial\xi}=(1-\sigma)\frac{\partial}{\partial\xi}\ln(\Theta\kappa(\xi))+\frac{1-\sigma}{\delta(\mu)}\frac{\partial\delta(\mu)}{\partial\mu}\frac{\partial\mu}{\partial\xi}+\frac{1}{1-\eta+\varepsilon(\mu)}\frac{\partial\varepsilon(\mu)}{\partial\mu}\frac{\partial\mu}{\partial\xi} \tag{A.37a}$$

$$\Longrightarrow(1-\sigma)\frac{\partial}{\partial\xi}\left[\ln\Theta\kappa(\xi)\right]=\underbrace{\left\{[\zeta-(1-\eta)(\sigma-1)]\frac{1}{\mu}-\frac{1-\sigma}{\delta}\delta'-\frac{1}{1-\eta+\varepsilon}\varepsilon'\right\}}_{positive}\frac{\partial\mu}{\partial\xi} \tag{A.37b}$$

It is not difficult to prove that the coefficient in front of the partial term $\frac{\partial\mu}{\partial\xi}$ in the right-hand side of Eq.(A.37b) will be positive:

$$\begin{aligned}&[\zeta-(1-\eta)(\sigma-1)]\frac{1}{\mu}-\frac{1-\sigma}{\delta}\delta'-\frac{1}{1-\eta+\varepsilon}\varepsilon'\\=&[\zeta-(1-\eta)(\sigma-1)]\frac{1}{\mu}-(\sigma-1)\frac{\varepsilon}{\mu}-\frac{1}{1-\eta+\varepsilon}\varepsilon' && \text{for } \varepsilon=-\frac{\delta'}{\delta}\mu\\>&(\sigma-1)\frac{\varepsilon}{\mu}-(\sigma-1)\frac{\varepsilon}{\mu}-\frac{1}{1-\eta+\varepsilon}\varepsilon' && \text{for } \varepsilon<\frac{\zeta}{\sigma-1}-(1-\eta)\\=&-\frac{1}{1-\eta+\varepsilon}\varepsilon'>0 && \text{for } \varepsilon'<0\end{aligned} \tag{A.38}$$

Actually, Eq.(A.38) implies that $\frac{\partial\mu}{\partial\xi}$ is direct proportionate to $(1-\sigma)\frac{\partial}{\partial\xi}\left[\ln\Theta\kappa(\xi)\right]$, namely:

$$\frac{\partial\mu}{\partial\xi}\propto(1-\sigma)\frac{\partial}{\partial\xi}\left[\ln\Theta\kappa(\xi)\right]=(\sigma-1)\left[-\frac{\kappa'(\xi)}{\kappa(\xi)}+\frac{\psi}{\psi+(1-\psi)\vartheta}\frac{\vartheta'(\xi)}{\vartheta(\xi)}\right] \tag{A.39}$$

Therefore, $\frac{\partial\mu}{\partial\xi}$ should be negative, implying that as the geo-political risk ξ increases, the optimal product quality μ that maximizes the firm's profit will decrease.

$$\frac{\partial\mu}{\partial\xi}\propto\underbrace{-\frac{\kappa'(\xi)}{\kappa(\xi)}}_{negative}+\underbrace{\frac{\psi}{\psi+(1-\psi)\vartheta}\frac{\vartheta'(\xi)}{\vartheta(\xi)}}_{negative}<0 \tag{A.40}$$

A.7 Internal Force

As discussed in the main text, examining how domestic financing convenience — as the internal power — modulates the effect of geo-political risk on product quality decision made by firms can be achieved by taking the partial derivative of $\frac{\partial \mu}{\partial \xi}$ with respect to s_d, namely:

$$\frac{\partial^2 \mu}{\partial \xi \partial s_d} \propto \frac{\partial}{\partial s_d}\left[-\frac{\kappa'(\xi)}{\kappa(\xi)} + \frac{\psi}{\psi+(1-\psi)\vartheta}\frac{\vartheta'(\xi)}{\vartheta(\xi)}\right] \tag{A.41}$$

To elaborate on this expression, we proceed by expanding the derivative as follows:

$$\begin{aligned}&\frac{\partial}{\partial s_d}\left[-\frac{\kappa'(\xi)}{\kappa(\xi)} + \frac{\psi}{\psi+(1-\psi)\vartheta}\frac{\vartheta'(\xi)}{\vartheta(\xi)}\right] \\ &\quad= \frac{\partial}{\partial s_d}\left[\frac{\psi}{\psi+(1-\psi)(\hat{\vartheta}_d(\xi)s_d+\hat{\vartheta}_f(\xi)s_f)}\frac{\hat{\vartheta}'_d(\xi)s_d+\hat{\vartheta}'_f(\xi)s_f}{\hat{\vartheta}_d(\xi)s_d+\hat{\vartheta}_f(\xi)s_f}\right]\end{aligned} \tag{A.42}$$

According to the Chain Rule, it is evident that the partial derivative of the first product term on the right-hand side of Eq.(A.42) with respect to s_d is negative:

$$\frac{\partial}{\partial s_d}\left[\frac{\psi}{\psi+(1-\psi)(\hat{\vartheta}_d(\xi)s_d+\hat{\vartheta}_f(\xi)s_f)}\right] = \frac{-\psi(1-\psi)\hat{\vartheta}_d(\xi)}{\left[\psi+(1-\psi)(\hat{\vartheta}_d(\xi)s_d+\hat{\vartheta}_f(\xi)s_f)\right]^2} < 0 \tag{A.43}$$

since $0<\psi<1$ and $\hat{\vartheta}_d>0$.

Secondly, the partial derivative of the second product term on the right-hand side with respect to s_d is positive:

$$\frac{\partial}{\partial s_d}\left[\frac{\hat{\vartheta}'_d(\xi)s_d+\hat{\vartheta}'_f(\xi)s_f}{\hat{\vartheta}_d(\xi)s_d+\hat{\vartheta}_f(\xi)s_f}\right] = \frac{\left(\hat{\vartheta}'_d(\xi)\hat{\vartheta}_f(\xi)-\hat{\vartheta}_d(\xi)\hat{\vartheta}'_f(\xi)\right)s_f}{\left[\hat{\vartheta}_d(\xi)s_d+\hat{\vartheta}_f(\xi)s_f\right]^2} > 0 \tag{A.44}$$

since $\hat{\vartheta}'_d(\xi)\hat{\vartheta}_f(\xi)-\hat{\vartheta}_d(\xi)\hat{\vartheta}'_f(\xi)>0$, where $\hat{\vartheta}'_f(\xi)<\hat{\vartheta}'_d(\xi)<0$ and $0<\hat{\vartheta}_f(\xi)<\hat{\vartheta}_d(\xi)$.

Then, by combining Eq.(A.43) and Eq.(A.44), we have:

$$\frac{\partial^2 \mu}{\partial \xi \partial s_d} \propto \underbrace{\frac{-\psi(1-\psi)\hat{\vartheta}_d(\xi)}{\left[\psi+(1-\psi)(\hat{\vartheta}_d(\xi)s_d+\hat{\vartheta}_f(\xi)s_f)\right]^2}}_{negative}\underbrace{\frac{\hat{\vartheta}'_d(\xi)s_d+\hat{\vartheta}'_f(\xi)s_f}{\hat{\vartheta}_d(\xi)s_d+\hat{\vartheta}_f(\xi)s_f}}_{negative} \tag{A.45}$$

Thus, $\frac{\partial^2 \mu}{\partial \xi \partial s_d} > 0$, namely, as domestic financing convenience improves, the negative impact of geopolitical risk on quality decisions is mitigated:

$$\frac{\partial^2 \mu}{\partial \xi \partial s_d} \propto \frac{\partial}{\partial s_d}\left[-\frac{\kappa'(\xi)}{\kappa(\xi)} + \frac{\psi}{\psi+(1-\psi)\vartheta}\frac{\vartheta'(\xi)}{\vartheta(\xi)}\right] > 0 \tag{A.46}$$

Appendix B GVC Participation

B.1 Basic Structure of ICIO Table

Table.B.1 presents the structure of the OECD-ICIO table, which includes G sectors in N countries. Z_{NN} and D_{NN} are $G \times G$ matrices, while X_N and V_N are $G \times 1$ vectors. The coefficient of

Table B.1: OECD ICIO table

		Intermediate Use				Final Demand				Total Output
		1	2	…	N	1	2	…	N	
Intermediate Input	1	$\boldsymbol{Z_{11}}$	$\boldsymbol{Z_{12}}$	…	$\boldsymbol{Z_{1N}}$	$\boldsymbol{D_{11}}$	$\boldsymbol{D_{12}}$	…	$\boldsymbol{D_{1N}}$	$\boldsymbol{X_1}$
	2	$\boldsymbol{Z_{21}}$	$\boldsymbol{Z_{22}}$	…	$\boldsymbol{Z_{2N}}$	$\boldsymbol{D_{21}}$	$\boldsymbol{D_{22}}$	…	$\boldsymbol{D_{2N}}$	$\boldsymbol{X_2}$
	…	…	…		…	…	…		…	…
	N	$\boldsymbol{Z_{N1}}$	$\boldsymbol{Z_{N2}}$	…	$\boldsymbol{Z_{NN}}$	$\boldsymbol{D_{N1}}$	$\boldsymbol{D_{N2}}$	…	$\boldsymbol{D_{NN}}$	$\boldsymbol{X_N}$
Value-added		$\boldsymbol{V_1}$	$\boldsymbol{V_2}$	…	$\boldsymbol{V_N}$					
Total Input		$\boldsymbol{(X_1)^T}$	$\boldsymbol{(X_2)^T}$	…	$\boldsymbol{(X_N)^T}$					

intermediate input A_{cs} and the coefficient of value-added $(A_V)_{cs}$ for sector s in country c can be defined as $\boldsymbol{A}$, where $\hat{\boldsymbol{X}}^{-1}$ is the diagonal matrix of X_{cs}. In fact, the final output $\boldsymbol{X}$ can be decomposed as:

$$\boldsymbol{X} = \boldsymbol{AX} + \hat{\boldsymbol{D}} = \boldsymbol{A^D X} + \boldsymbol{A^F X} + \hat{\boldsymbol{D}}^{\boldsymbol{D}} + \hat{\boldsymbol{D}}^{F} = \boldsymbol{A^D X} + \hat{\boldsymbol{D}}^{\boldsymbol{D}} + \boldsymbol{E} \tag{B.1}$$

Where, $\boldsymbol{A^D} = \begin{bmatrix} \boldsymbol{A}_{1,1} & 0 & \cdots & 0 \\ 0 & \boldsymbol{A}_{2,2} & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \boldsymbol{A}_{N,N} \end{bmatrix}$ denotes denotes coefficient of the domestic intermediate input, and each $\boldsymbol{A}_{NN}$ is a $G \times G$ matrix. $\boldsymbol{D}$ denotes the coefficient of inter-country intermediate input. $\hat{\boldsymbol{D}} = \left[\sum_{\boldsymbol{c'}}^{\boldsymbol{N}} \boldsymbol{D_{1,c'}}, \sum_{\boldsymbol{c'}}^{\boldsymbol{N}} \boldsymbol{D_{2,c'}} \ldots, \sum_{\boldsymbol{c'}}^{\boldsymbol{N}} \boldsymbol{D_{N,c'}}\right]^{\boldsymbol{T}}$ denotes the aggregated final demand, $\hat{\boldsymbol{D}}^{\boldsymbol{D}} = [\boldsymbol{D_{1,1}}, \boldsymbol{D_{2,2}}..., \boldsymbol{D_{N,N}}]^T$ denotes domestic final demand, and $\hat{\boldsymbol{D}}^{\boldsymbol{F}} = \hat{\boldsymbol{D}} - \hat{\boldsymbol{D}}^{\boldsymbol{D}}$ denotes inter-country final demand. Based on the Leontief inverse matrix, the total output $\boldsymbol{X}$ can be further expressed as:

$$\boldsymbol{X} = (\boldsymbol{I} - \boldsymbol{A^D})^{-1}\hat{\boldsymbol{D}}^{\boldsymbol{D}} + (\boldsymbol{I} - \boldsymbol{A^D})^{-1}\boldsymbol{E} = \boldsymbol{L}\hat{\boldsymbol{D}}^{\boldsymbol{D}} + \boldsymbol{LE} = \boldsymbol{B}\hat{\boldsymbol{D}} \tag{B.2}$$

Where, $\boldsymbol{L} = (\boldsymbol{I} - \boldsymbol{A^D})^{-1} = \begin{bmatrix} \boldsymbol{I} - \boldsymbol{A}_{1,1} & 0 & \cdots & 0 \\ 0 & \boldsymbol{I} - \boldsymbol{A}_{2,2} & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \boldsymbol{I} - \boldsymbol{A}_{N,N} \end{bmatrix}^{-1}$ is the pure domestic Leontief inverse matrix which takes only the domestic value chains into account, and $\boldsymbol{B} = (\boldsymbol{I} - \boldsymbol{A})^{-1} = \begin{bmatrix} \boldsymbol{I} - \boldsymbol{A}_{1,1} & -\boldsymbol{A}_{1,2} & \cdots & -\boldsymbol{A}_{1,N} \\ -\boldsymbol{A}_{2,1} & \boldsymbol{I} - \boldsymbol{A}_{2,2} & \cdots & -\boldsymbol{A}_{2,N} \\ \vdots & \vdots & \ddots & \vdots \\ -\boldsymbol{A}_{N,1} & -\boldsymbol{A}_{N,2} & \cdots & \boldsymbol{I} - \boldsymbol{A}_{N,N} \end{bmatrix}^{-1}$ is the global matrix for the entire inter-country value chain.

The domestic value-added matrix $\boldsymbol{V}$, which is a $N \times NG$ matrix, can be define as:

$$\boldsymbol{V} = \overbrace{[\boldsymbol{V_1}, \boldsymbol{V_2}, \cdots, \boldsymbol{V_N}]} = \begin{bmatrix} \boldsymbol{V_1} & \boldsymbol{0} & \cdots & \boldsymbol{0} \\ \boldsymbol{0} & \boldsymbol{V_2} & \cdots & \boldsymbol{0} \\ \vdots & \vdots & \ddots & \vdots \\ \boldsymbol{0} & \boldsymbol{0} & \cdots & \boldsymbol{V_N} \end{bmatrix} \tag{B.3}$$

where $\boldsymbol{V_c} = \boldsymbol{u_G}(\boldsymbol{I} - \sum_{c'}^{N} \boldsymbol{A}_{c'c})$ is the direct value-added share in each unit of gross output produced by countrys is equal to one minus the sum of the direct intermediate input share of all the domestic and foreign suppliers, $\boldsymbol{u_N}$ is a $1 \times G$ unit vector. Worthy mentioning, for any given generic vector $\boldsymbol{X}$ with length n, namely, $\boldsymbol{X} = [x_1, x_2, ..., x_n]$ or $\boldsymbol{X} = [x_1, x_2, ..., x_n]^T$, the overbrace-formed $\widehat{X}$ denotes its is its $n \times n$ diagonal form, namely, $\widehat{X} = \begin{bmatrix} x_1 & 0 & \cdots & 0 \\ 0 & x_2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & x_n \end{bmatrix}$

B.2 Trade-related GVC participation

Then the directly absorbed value-added export can be defined as:

$$\boldsymbol{davaE}_{cc'} = \widehat{\boldsymbol{V}_c \boldsymbol{L}_{cc}} \boldsymbol{D}_{cc'} + \widehat{\boldsymbol{V}_c \boldsymbol{L}_{cc}} \boldsymbol{A}_{cc'} \boldsymbol{L}_{c'c'} \boldsymbol{D}_{cc'} \tag{B.4}$$

The pure forward GVC trade-based participation (trGVC_pf) can be simply defined as the difference between the entire domestic value added that is exported and the one that is directly absorbed by the importer, namely, $\boldsymbol{davaE}$:

$$\begin{aligned} \boldsymbol{trGVC\_pf}_{cc'} &= \widehat{\boldsymbol{V}_c \boldsymbol{L}_{cc}} \boldsymbol{E}_{cc'} - \boldsymbol{davaE}_{cc'} \\ &= \widehat{\boldsymbol{V}_c \boldsymbol{L}_{cc}} \boldsymbol{A}_{cc'} \boldsymbol{L}_{c'c'} \left(\sum_{i \neq c'}^{N} \boldsymbol{D}_{c'i} + \sum_{i \neq c'}^{N} \boldsymbol{A}_{c'i} \sum_{j}^{N} \sum_{k}^{N} \boldsymbol{B}_{ij} \boldsymbol{D}_{jk} \right) \end{aligned} \tag{B.5}$$

The pure backward GVC trade-based participation (trGVC_pb) can be given by the imported inputs embedded in the exports to final markets:

$$\begin{aligned} \boldsymbol{trGVC\_pb}_{cc'} &= \sum_{i \neq c}^{N} \widehat{\boldsymbol{u}_N \boldsymbol{A}_{ic} \boldsymbol{L}_{cc}} (\boldsymbol{D}_{cc'} + \boldsymbol{A}_{cc'} \boldsymbol{L}_{c'c'} \boldsymbol{D}_{c'c'}) \\ &= \left(\sum_{t \neq c}^{N} \widehat{\boldsymbol{V}_t \boldsymbol{B}_{tc}} + \overbrace{\boldsymbol{V}_c \boldsymbol{L}_{cc} \sum_{i \neq c}^{N} \boldsymbol{A}_{ci} \boldsymbol{B}_{ic}} \right) (\boldsymbol{D}_{cc'} + \boldsymbol{A}_{cc'} \boldsymbol{L}_{c'c'} \boldsymbol{D}_{c'c'}) \end{aligned} \tag{B.6}$$

The two-sided GVC trade-based participation (trGVC_ts) can be calculated by the imported inputs embedded in the re-exports of the bilateral partner:

$$\begin{aligned} \boldsymbol{trGVC\_ts}_{cc'} &= \sum_{i \neq c}^{N} \widehat{\boldsymbol{u}_N \boldsymbol{A}_{ic} \boldsymbol{L}_{cc}} \left(\boldsymbol{A}_{cc'} \boldsymbol{L}_{c'c'} \sum_{i \neq c'}^{N} \boldsymbol{E}_{c'i} \right) \\ &= \overbrace{\boldsymbol{V}_c \boldsymbol{L}_{cc} \sum_{i \neq c}^{N} \boldsymbol{A}_{ci} \boldsymbol{B}_{ic}} \left[\boldsymbol{A}_{cc'} \boldsymbol{L}_{c'c'} \sum_{i \neq c'}^{N} \left(\boldsymbol{D}_{c'i} + \boldsymbol{A}_{ci} \sum_{j}^{N} \sum_{k \neq c}^{N} \boldsymbol{B}_{ij} \boldsymbol{D}_{jk} \right) \right] \end{aligned} \tag{B.7}$$

Finally, the GVC-related trade (trGVC) within the export flow from s to r for any sector n can be expressed as the sum of three components above:

$$\boldsymbol{trGVC}_{\boldsymbol{cc'}} = \boldsymbol{trGVC\_pf}_{cc'} + \boldsymbol{trGVC\_pb}_{cc'} + \boldsymbol{trGVC\_ts}_{cc'} \tag{B.8}$$

B.3 Output-related GVC participation

The pure forward GVC output-based participation (orGVC_pf) is equal to GVC-related value-added, meaning that value-added are sold by the sector of origin abroad or domestically and incorporated in exports later on, which can be expressed as:

$$\boldsymbol{orGVC\_pf_c} = \widehat{\boldsymbol{V_c}} \sum_{c' \neq c}^{N} (\boldsymbol{A_{cc'} reE_{c'}} + \boldsymbol{A_{cc} L_{cc} A_{cc'} reE_{c'}}) \tag{B.9}$$

where $\boldsymbol{reE}_c$ is the output of country c further re-exported, namely, $\boldsymbol{reE}_c = \boldsymbol{X}_c - \boldsymbol{L}_{cc}\boldsymbol{D}_{cc}$.

The pure backward GVC output-based participation (orGVC_pb) is equal to GVC-related final goods production, meaning that imported inputs are embedded by the sector in final goods, which can be expressed as:

$$\boldsymbol{orGVC\_pb_c} = \sum_{i}^{N} \left(\overbrace{\boldsymbol{V}_i \boldsymbol{L}_{ii} \sum_{j \neq i}^{N} \boldsymbol{A}_{ij} \boldsymbol{B}_{jc}} \sum_{k}^{N} \boldsymbol{D}_{ck} \right) - \sum_{i \neq c}^{N} \overbrace{\boldsymbol{V}_i \boldsymbol{L}_{ii} \boldsymbol{A}_{ic} \boldsymbol{L}_{cc}} \boldsymbol{D}_{cc} \tag{B.10}$$

The two-sided GVC trade-based participation (orGVC_ts) can be calculated by the sum of two components, representing domestic inputs and imported inputs are not embedded in final goods:

$$\boldsymbol{orGVC\_ts}_c = \boldsymbol{impGVC\_ts}_c + \boldsymbol{domGVC\_ts}_c \tag{B.11}$$

where impGVC_ts denotes GVC-related imported inputs, which is not pure backward but can be seen as two-sided, meaning that imported inputs are bought directly or indirectly by the sector (backward) but are sold to other sectors (forward):

$$\boldsymbol{impGVC\_ts}_c = \sum_{i}^{N} \left(\overbrace{\boldsymbol{V}_i \boldsymbol{L}_{ii} \sum_{j \neq i}^{N} \boldsymbol{A}_{ij} \boldsymbol{B}_{jc}} \boldsymbol{X}_c \right) - \sum_{i \neq c}^{N} \overbrace{\boldsymbol{V}_i \boldsymbol{L}_{ii} \boldsymbol{A}_{ic} \boldsymbol{L}_{cc}} \boldsymbol{L}_{cc} \boldsymbol{D}_{cc} - \boldsymbol{orGVC\_pb}_c \tag{B.12}$$

and domGVC_ts denotes GVC-related domestic inputs, which are bought within domestic chains (backward component) but also sold to other domestic sectors or directly exported (forward component):

$$\boldsymbol{domGVC\_ts}_c = \overbrace{\boldsymbol{V}_c \boldsymbol{L}_{cc} \boldsymbol{A}_{cc}} \sum_{c' \neq c}^{N} (\boldsymbol{A_{cc'} reE_{c'}} + \boldsymbol{A_{cc} L_{cc} A_{cc'} reE_{c'}}) \tag{B.13}$$

Finally, the GVC-related output consists of three components mentioned above:

$$\boldsymbol{orGVC}_c = \boldsymbol{orGVC\_pf}_c + \boldsymbol{orGVC\_pb}_c + \boldsymbol{orGVC\_ts}_c \tag{B.14}$$

Appendix C Robustness Check

C.1 Research Design for Robustness Check

The robustness checks referenced in the main text, along with their detailed implementation procedures, are presented below:

- **Rank-transformation on the core explanatory variable**. In the baseline regressions, the core explanatory variable is constructed as an absolute measure transformed by the Max–Min standardization. However, fluctuations in absolute measures may not necessarily reflect a relative deterioration or improvement in exposure to geopolitical shock risk. We therefore reconduct regressions based on the rank-transformed version of geo-polit$_{it}$.

- **Replacement on the dependent variables**. While the baseline regressions employ GVC participation measures based on the output framework, we also replace them with their one-by-one counterparts [†], constructed under the traditional trade framework, and then reconduct regressions based on those indicators.

- **Alternative construction of the core explanatory variable**. As noted earlier, we employ the UMAP method to construct the geopolitical risk indicator, given its advantages over conventional dimensionality reduction techniques. For robustness, we alternatively construct the indicator using standard methods, including Principal Component Analysis (PCA) and the Entropy Method, and reconduct regressions.

- **Time-lag effect test**. Given the inertia of trade and industrial adjustment, the impact of geopolitical risk on GVC participation is expected to exhibit either time lags or temporal continuity. Accordingly, we replace the core explanatory variable with its lagged 1, 2, and 3 terms and reconduct the regressions.

- **Additional interactive fixed effects**. We have incorporated baseline regressions with country and year fixed effects to account for unobserved heterogeneity. To more rigorously address cross-sectional heterogeneity, we further include two types of additional year–region interaction fixed effects.[‡]

- **Additional control variables**. Although the baseline models include a set of controls to mitigate confounding, further potential sources of omitted-variable bias merit attention. We therefore introduce two sets of additional controls: (i) exchange rate volatility (exchange), inflation volatility (inflation), and total factor productivity (TFP);[§] (ii) war experience (war), corruption control (corruption), and governance effectiveness (governance).[¶]

- **Sample period adjustment**. The data sample used in baseline regressions covers the period 1995–2020. The wide time span raises the concern that major economic or geopolitical events might bias the estimates. We therefore reconduct regressions after excluding: (i) 1997–1998, to eliminate the effect of the Asian Financial Crisis; (ii) 2008–2009, to eliminate the effect of the Global Financial Crisis; and (iii) 2014–2015, to eliminate the effect of the Russia–Ukraine conflict.

[†] The four corresponding indicator are tGVC, pb-tGVC, pf-tGVC, and ts-tGVC, respectively.

[‡] The two types of additional fixed effects are distinct with respect to the classification of sub-regions: the first type is classified by the World Development Indicators (WDI) classification, and the second one corresponds to the United Nations (UN).

[§] Exchange rate volatility is measured by the annual variation of the exchange rate in given countries; inflation volatility is measured by the annual variation of the inflation rate in given countries; the Total factor productivity (TFP) is an estimate of how efficiently an economy turns its inputs into outputs, which is provided by Penn World Table version 10.01.

[¶] War experience is coded as whether a country in a given year was experiencing the war; corruption control captures perceptions of the extent to which public power is exercised for private gain; governance effectiveness captures perceptions of the quality of public and civil service with their independence, the policy formulation and implementation, and the credibility of the government's commitment; both the indicators, corruption control and governance effectiveness, are provided by the Worldwide Governance Indicators (WGI).

- **Sample individual adjustment**. The data sample employed in baseline regressions covers 77 countries and regions, whose heterogeneity may introduce confounding not addressed by the preceding robustness checks. To mitigate this concern, we further reconduct regressions after: (i) excluding the prospective founding members of the "Belt and Road" Initiative (BRI);[‖] and (ii) excluding countries directly involved in major geopolitical conflicts between 1995 and 2020.

C.2 Rank-transformation on Explained Variable

Table C.1: Results of robustness checks based on explained variable rank-transformation.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
geo-polit (Ranked)	-0.138**	-0.119**	-0.139***	-0.154**
	(0.050)	(0.053)	(0.044)	(0.055)
growth	-0.016	-0.007	-0.023	-0.020
	(0.039)	(0.032)	(0.046)	(0.038)
enrollment	1.244***	1.159***	1.194***	1.322***
	(0.083)	(0.098)	(0.065)	(0.100)
high-tech	-0.444**	-0.524**	-0.555***	-0.380**
	(0.177)	(0.227)	(0.185)	(0.171)
openness	-0.720***	-0.822***	-0.919***	-0.566***
	(0.158)	(0.169)	(0.201)	(0.157)
service	0.775	0.524	1.539**	0.485
	(0.554)	(0.603)	(0.636)	(0.531)
resource	2.958***	1.370*	4.122***	2.558***
	(0.609)	(0.780)	(0.662)	(0.572)
employment	-3.417***	-4.245***	-2.494***	-3.566***
	(0.481)	(0.478)	(0.554)	(0.477)
CA	0.003	-0.020***	0.028***	0.001
	(0.007)	(0.007)	(0.007)	(0.007)
polity	0.004	0.009	0.013*	-0.001
	(0.007)	(0.008)	(0.008)	(0.007)
Observation	665	665	665	665
Adjusted R^2	0.327	0.313	0.306	0.319
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	40.8***	31.1***	93.1***	33.6***
	[0.000]	[0.000]	[0.000]	[0.000]

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

‖ the "Belt and Road" initiative represents the largest contemporary multilateral cooperation platform, which aims at promoting regional integration and achieving co-development, being likely to have reduced internal geopolitical conflict probability among its founding members.

C.3 Explained Variable Replacement

Table C.2: Results of robustness checks based on explained variable replacement.

Variable	GVC participation			
	tGVC	pb-tGVC	pf-tGVC	ts-tGVC
	(1)	(2)	(3)	(4)
geo-polit	-0.264***	-0.266***	-0.222***	-0.322***
	(0.054)	(0.059)	(0.055)	(0.066)
growth	-0.021	-0.028	-0.026	-0.041
	(0.048)	(0.036)	(0.054)	(0.045)
enrollment	1.432***	1.525***	1.266***	1.597***
	(0.092)	(0.117)	(0.075)	(0.110)
high-tech	-0.512**	-0.715**	-0.483**	-0.568**
	(0.230)	(0.255)	(0.211)	(0.222)
openness	-0.329	0.572**	-1.194***	0.604***
	(0.205)	(0.205)	(0.218)	(0.190)
service	0.520	0.836	0.657	1.170
	(0.661)	(0.681)	(0.657)	(0.773)
resource	3.832***	2.099**	5.045***	3.053***
	(0.834)	(0.791)	(0.850)	(0.759)
employment	-3.750***	-4.781***	-2.706***	-4.238***
	(0.485)	(0.523)	(0.479)	(0.614)
CA	0.013	-0.004	0.033***	0.001
	(0.008)	(0.008)	(0.008)	(0.009)
polity	0.016*	0.019*	0.011	0.017*
	(0.009)	(0.010)	(0.009)	(0.009)
Observation	665	665	665	665
Adjusted R^2	0.309	0.327	0.297	0.343
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	63.2***	46.1***	60.7***	92.2***
	[0.000]	[0.000]	[0.000]	[0.000]

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

C.4 Alternative Construction of Explanatory Variable

Table C.3: Results of robustness checks based on data imputation.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: geo-polit constructed based on PCA				
geo-polit (PCA)	-0.692***	-0.969***	-0.561***	-0.573***
	(0.077)	(0.086)	(0.126)	(0.082)

	(1)	(2)	(3)	(4)
growth	-0.041	-0.038	-0.047	-0.042
	(0.039)	(0.032)	(0.046)	(0.038)
enrollment	1.252***	1.162***	1.196***	1.332***
	(0.094)	(0.100)	(0.069)	(0.114)
high-tech	-0.343*	-0.419*	-0.468**	-0.286
	(0.191)	(0.242)	(0.181)	(0.184)
openness	-0.266**	-0.173	-0.710***	-0.130
	(0.123)	(0.141)	(0.155)	(0.119)
service	0.994*	0.818	1.673**	0.696
	(0.535)	(0.563)	(0.612)	(0.527)
resource	2.965***	1.446*	4.153***	2.568***
	(0.648)	(0.782)	(0.698)	(0.623)
employment	-3.480***	-4.431***	-2.453***	-3.620***
	(0.463)	(0.452)	(0.522)	(0.465)
CA	0.003	-0.024***	0.031***	0.002
	(0.006)	(0.007)	(0.007)	(0.007)
polity	-0.001	-0.001	0.008	-0.004
	(0.007)	(0.008)	(0.008)	(0.008)
Observation	694	694	694	694
Adjusted R^2	0.315	0.325	0.296	0.297
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	31.9***	52.4***	68.4***	21.9***
	[0.000]	[0.000]	[0.000]	[0.000]
Panel B: geo-polit constructed based on Entropy				
ent	-0.920***	-1.169***	-1.025***	-0.697***
	(0.175)	(0.198)	(0.213)	(0.185)
growth	-0.037	-0.030	-0.050	-0.037
	(0.036)	(0.028)	(0.043)	(0.036)
enrollment	1.206***	1.103***	1.148***	1.297***
	(0.086)	(0.094)	(0.066)	(0.107)
high-tech	-0.313	-0.388	-0.419**	-0.267
	(0.197)	(0.256)	(0.179)	(0.190)
openness	-0.293**	-0.224	-0.703***	-0.159
	(0.115)	(0.131)	(0.146)	(0.115)
service	0.858	0.634	1.546**	0.587
	(0.532)	(0.553)	(0.611)	(0.526)
resource	2.844***	1.308*	3.979***	2.485***
	(0.590)	(0.719)	(0.643)	(0.577)
employment	-3.571***	-4.547***	-2.555***	-3.689***
	(0.435)	(0.418)	(0.495)	(0.445)
CA	0.001	-0.026***	0.028***	0.001
	(0.007)	(0.007)	(0.007)	(0.007)
polity	-0.003	-0.002	0.004	-0.005
	(0.008)	(0.010)	(0.009)	(0.008)
Observation	694	694	694	694
Adjusted R^2	0.315	0.316	0.312	0.295
Year FEs	✓	✓	✓	✓

	(1)	(2)	(3)	(4)
Country FEs	✓	✓	✓	✓
F statistic	40.1***	47.7***	93.2***	28.9***
	[0.000]	[0.000]	[0.000]	[0.000]

* p < 0.1, ** p < 0.05, *** p < 0.01

C.5 Time-lag Effect

Table C.4: Results of time-lag effect tests.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: ~ geo-polit (lagged 1)				
geo-polit (lagged 1)	-0.203***	-0.170***	-0.222***	-0.226***
	(0.052)	(0.056)	(0.048)	(0.059)
growth	0.024	0.027	0.022	0.019
	(0.061)	(0.051)	(0.071)	(0.060)
enrollment	1.215***	1.126***	1.167***	1.297***
	(0.090)	(0.108)	(0.065)	(0.107)
high-tech	-0.348	-0.417	-0.490**	-0.281
	(0.206)	(0.254)	(0.212)	(0.194)
openness	-0.666***	-0.767***	-0.899***	-0.522***
	(0.181)	(0.188)	(0.205)	(0.184)
service	0.610	0.315	1.360*	0.330
	(0.649)	(0.670)	(0.755)	(0.608)
resource	3.066***	1.417*	4.302***	2.692***
	(0.567)	(0.764)	(0.599)	(0.520)
employment	-3.458***	-4.264***	-2.656***	-3.547***
	(0.448)	(0.460)	(0.484)	(0.455)
CA	0.001	-0.022***	0.026***	0.001
	(0.007)	(0.008)	(0.007)	(0.007)
polity	0.003	0.007	0.014*	-0.003
	(0.007)	(0.009)	(0.008)	(0.007)
Observation	637	637	637	637
Adjusted R^2	0.333	0.309	0.317	0.325
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	43.8***	22.8***	105***	34.8***
	[0.000]	[0.000]	[0.000]	[0.000]
Panel B: ~ geo-polit (lagged 2)				
geo-polit (lagged 2)	-0.209***	-0.159***	-0.239***	-0.239***
	(0.042)	(0.037)	(0.038)	(0.054)
growth	0.143	0.125	0.157	0.135
	(0.098)	(0.087)	(0.114)	(0.092)
enrollment	1.073***	1.000***	1.014***	1.161***

	(1)	(2)	(3)	(4)
	(0.149)	(0.148)	(0.146)	(0.161)
high-tech	-0.155	-0.241	-0.279	-0.109
	(0.253)	(0.271)	(0.285)	(0.235)
openness	-0.483***	-0.583***	-0.728***	-0.342*
	(0.165)	(0.180)	(0.188)	(0.168)
service	-0.114	-0.421	0.602	-0.361
	(0.787)	(0.801)	(0.896)	(0.724)
resource	2.939***	1.239*	4.201***	2.585***
	(0.550)	(0.719)	(0.610)	(0.493)
employment	-3.197***	-4.028***	-2.329***	-3.301***
	(0.564)	(0.605)	(0.573)	(0.570)
CA	0.002	-0.024***	0.029***	0.002
	(0.007)	(0.008)	(0.008)	(0.008)
polity	0.008	0.013	0.019**	0.000
	(0.008)	(0.010)	(0.008)	(0.008)
Observation	611	611	611	611
Adjusted R^2	0.390	0.342	0.376	0.382
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	56***	27.2***	219***	37.8***
	[0.000]	[0.000]	[0.000]	[0.000]
Panel C: ∼ geo-polit (lagged 3)				
geo-polit (lagged 3)	-0.170***	-0.152***	-0.178***	-0.208***
	(0.040)	(0.038)	(0.036)	(0.052)
growth	0.307***	0.272***	0.346***	0.290***
	(0.027)	(0.031)	(0.033)	(0.027)
enrollment	0.804***	0.743***	0.730***	0.899***
	(0.102)	(0.121)	(0.063)	(0.131)
high-tech	0.154	0.037	0.080	0.173
	(0.158)	(0.184)	(0.203)	(0.150)
openness	-0.298*	-0.386*	-0.568***	-0.161
	(0.165)	(0.204)	(0.162)	(0.169)
service	-1.225***	-1.548***	-0.571	-1.389***
	(0.351)	(0.434)	(0.370)	(0.337)
resource	2.431***	0.772	3.650***	2.096***
	(0.495)	(0.678)	(0.561)	(0.427)
employment	-2.405***	-3.185***	-1.521***	-2.536***
	(0.414)	(0.452)	(0.388)	(0.446)
CA	0.007	-0.022***	0.039***	0.007
	(0.007)	(0.008)	(0.007)	(0.008)
polity	0.008	0.015	0.016*	-0.002
	(0.008)	(0.010)	(0.008)	(0.008)
Observation	591	591	591	591
Adjusted R^2	0.501	0.428	0.498	0.476
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	85.9***	40***	206***	76.8***
	[0.000]	[0.000]	[0.000]	[0.000]

	(1)	(2)	(3)	(4)

* p < 0.1, ** p < 0.05, *** p < 0.01

C.6 Additional Fixed Effect

Table C.5: Results of robustness check based on additional fixed effects.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: Year-(WDI-)Region fixed effct				
geo-polit	-0.328***	-0.267***	-0.374***	-0.340***
	(0.070)	(0.071)	(0.065)	(0.076)
growth	0.053	0.068	0.044	0.050
	(0.057)	(0.045)	(0.070)	(0.055)
enrollment	1.131***	1.067***	1.046***	1.205***
	(0.108)	(0.128)	(0.072)	(0.128)
high-tech	-0.062	0.003	-0.212	-0.014
	(0.192)	(0.222)	(0.189)	(0.217)
openness	-0.494***	-0.778***	-0.542**	-0.334*
	(0.176)	(0.206)	(0.209)	(0.168)
service	0.319	0.126	1.083*	0.120
	(0.484)	(0.525)	(0.592)	(0.475)
resource	2.731***	0.920	3.975***	2.245***
	(0.797)	(0.987)	(0.862)	(0.764)
employment	-1.919***	-3.112***	-0.274	-2.207***
	(0.458)	(0.465)	(0.421)	(0.504)
CA	0.003	-0.021**	0.031***	0.001
	(0.008)	(0.009)	(0.009)	(0.009)
polity	0.004	0.005	0.016*	-0.003
	(0.007)	(0.009)	(0.008)	(0.009)
Observation	665	665	665	665
Adjusted R^2	0.365	0.371	0.350	0.343
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
Year-Regional FEs	✓	✓	✓	✓
F statistic	35.3***	24.7***	67.6***	29.7***
	[0.000]	[0.000]	[0.000]	[0.000]
Panel B: Year-(UN-)Region fixed effect				
geo-polit	-0.290***	-0.221**	-0.376***	-0.278**
	(0.101)	(0.086)	(0.106)	(0.111)
growth	0.050	0.043	0.067	0.034
	(0.095)	(0.078)	(0.114)	(0.093)
enrollment	0.712***	0.690***	0.667***	0.750***
	(0.222)	(0.195)	(0.219)	(0.238)
high-tech	0.211	0.100	0.102	0.301

	(1)	(2)	(3)	(4)
	(0.246)	(0.239)	(0.293)	(0.287)
openness	-0.122	-0.220	-0.173	-0.090
	(0.285)	(0.315)	(0.319)	(0.290)
service	-0.270	-0.306	0.484	-0.587
	(0.814)	(0.715)	(1.016)	(0.825)
resource	2.092**	-0.110	3.220***	1.877*
	(0.980)	(1.059)	(1.127)	(0.957)
employment	-1.088	-2.670***	0.739	-1.257
	(0.765)	(0.673)	(0.758)	(0.846)
CA	0.005	-0.012	0.021	0.009
	(0.015)	(0.015)	(0.017)	(0.015)
polity	0.018*	0.027**	0.029**	0.007
	(0.010)	(0.011)	(0.011)	(0.010)
Observation	665	665	665	665
Adjusted R^2	0.159	0.192	0.157	0.159
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
Year-Regional FEs	✓	✓	✓	✓
F statistic	7.07***	6***	5.43***	10.1***
	[0.000]	[0.000]	[0.000]	[0.000]

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

C.7 Additional Control Variable

Table C.6: Results of robustness check based on additional control variables.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: Set I				
geo-polit	-0.140**	-0.110**	-0.146***	-0.171**
	(0.053)	(0.053)	(0.043)	(0.063)
growth	-0.021	-0.010	-0.031	-0.028
	(0.028)	(0.022)	(0.036)	(0.028)
enrollment	1.149***	1.056***	1.108***	1.235***
	(0.061)	(0.055)	(0.077)	(0.076)
high-tech	-0.738***	-0.857***	-0.829***	-0.660***
	(0.139)	(0.151)	(0.192)	(0.139)
openness	0.081	0.071	-0.161	0.175
	(0.168)	(0.157)	(0.222)	(0.175)
service	-0.152	-0.477	0.650	-0.412
	(0.457)	(0.464)	(0.538)	(0.459)
resource	1.561**	-0.109	2.745***	1.229**
	(0.568)	(0.724)	(0.653)	(0.500)
employment	-2.739***	-3.567***	-1.801***	-2.887***
	(0.370)	(0.370)	(0.455)	(0.376)

	(1)	(2)	(3)	(4)
CA	-0.014*	-0.039***	0.013	-0.013
	(0.007)	(0.008)	(0.007)	(0.008)
polity	0.039***	0.045***	0.048***	0.033***
	(0.008)	(0.009)	(0.010)	(0.008)
exchange	0.009	0.017**	0.007	0.006
	(0.006)	(0.007)	(0.006)	(0.008)
inflation	0.034***	0.035***	0.029***	0.033***
	(0.009)	(0.010)	(0.009)	(0.011)
TFP	1.389***	1.426***	1.388***	1.373***
	(0.143)	(0.183)	(0.125)	(0.160)
Observation	664	664	664	664
Adjusted R^2	0.472	0.471	0.416	0.451
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	90***	95.3***	53.7***	73.1***
	[0.000]	[0.000]	[0.000]	[0.000]
Panel B: Set II				
geo-polit	-0.151**	-0.125*	-0.156***	-0.184**
	(0.061)	(0.063)	(0.045)	(0.073)
growth	0.004	0.010	-0.001	-0.002
	(0.041)	(0.029)	(0.052)	(0.040)
enrollment	1.079***	0.977***	1.045***	1.162***
	(0.058)	(0.060)	(0.070)	(0.072)
high-tech	-0.637***	-0.740***	-0.745***	-0.561***
	(0.147)	(0.168)	(0.199)	(0.138)
openness	0.154	0.175	-0.129	0.255
	(0.162)	(0.137)	(0.230)	(0.166)
service	-0.149	-0.476	0.724	-0.454
	(0.468)	(0.454)	(0.562)	(0.465)
resource	1.884***	0.152	3.200***	1.544***
	(0.528)	(0.679)	(0.588)	(0.478)
employment	-2.103***	-2.863***	-1.225***	-2.185***
	(0.402)	(0.485)	(0.394)	(0.410)
CA	-0.018**	-0.044***	0.010	-0.018**
	(0.007)	(0.007)	(0.009)	(0.008)
polity	0.032***	0.037***	0.042***	0.025***
	(0.008)	(0.008)	(0.010)	(0.008)
exchange	0.012**	0.020***	0.007	0.010
	(0.005)	(0.006)	(0.006)	(0.006)
inflation	0.018**	0.020**	0.014*	0.017*
	(0.008)	(0.009)	(0.008)	(0.010)
TFP	1.247***	1.288***	1.209***	1.240***
	(0.144)	(0.193)	(0.107)	(0.171)
war	-0.092*	-0.072	-0.120**	-0.092*
	(0.047)	(0.050)	(0.057)	(0.048)
corruption	0.032	0.002	0.020	0.074
	(0.073)	(0.072)	(0.100)	(0.076)
governance	0.146***	0.157***	0.154***	0.153**

	(1)	(2)	(3)	(4)
	(0.049)	(0.051)	(0.044)	(0.056)
Observation	636	636	636	636
Adjusted R^2	0.490	0.484	0.437	0.466
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	213***	228***	105***	118***
	[0.000]	[0.000]	[0.000]	[0.000]

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

C.8 Period Adjustment

Table C.7: Results of robustness check based on period adjustments.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: Adjustment I				
geo-polit	-0.177**	-0.154*	-0.194***	-0.189**
	(0.074)	(0.079)	(0.057)	(0.083)
growth	-0.015	-0.006	-0.020	-0.020
	(0.045)	(0.037)	(0.054)	(0.044)
high-tech	-0.493**	-0.581**	-0.615***	-0.413**
	(0.188)	(0.243)	(0.185)	(0.184)
openness	-0.722***	-0.822***	-0.914***	-0.577***
	(0.177)	(0.186)	(0.219)	(0.184)
service	0.314	-0.049	1.096	0.079
	(0.592)	(0.639)	(0.698)	(0.560)
resource	2.570***	1.014	3.668***	2.200***
	(0.599)	(0.812)	(0.638)	(0.562)
employment	-3.537***	-4.323***	-2.678***	-3.655***
	(0.490)	(0.474)	(0.587)	(0.494)
enrollment	1.232***	1.145***	1.213***	1.296***
	(0.088)	(0.105)	(0.063)	(0.106)
CA	0.000	-0.024***	0.025***	-0.001
	(0.008)	(0.008)	(0.007)	(0.008)
polity	0.006	0.012	0.013	0.000
	(0.008)	(0.010)	(0.008)	(0.008)
Observation	615	615	615	615
Adjusted R^2	0.311	0.310	0.288	0.299
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	48.3***	25.9***	98.4***	49.5***
	[0.000]	[0.000]	[0.000]	[0.000]
Panel B: Adjustment II				
geo-polit	-0.202***	-0.175**	-0.186***	-0.231***

	(1)	(2)	(3)	(4)
	(0.063)	(0.068)	(0.057)	(0.069)
growth	-0.011	-0.002	-0.020	-0.015
	(0.038)	(0.032)	(0.046)	(0.037)
high-tech	-0.492**	-0.580**	-0.580**	-0.442**
	(0.211)	(0.256)	(0.243)	(0.204)
openness	-0.752***	-0.863***	-0.922***	-0.603***
	(0.172)	(0.181)	(0.239)	(0.165)
service	0.984	0.725	1.822**	0.641
	(0.575)	(0.625)	(0.696)	(0.534)
resource	3.070***	1.451*	4.402***	2.578***
	(0.760)	(0.834)	(0.877)	(0.759)
employment	-3.468***	-4.287***	-2.550***	-3.610***
	(0.545)	(0.548)	(0.608)	(0.543)
enrollment	1.252***	1.159***	1.208***	1.329***
	(0.090)	(0.104)	(0.072)	(0.109)
CA	0.005	-0.018**	0.030***	0.004
	(0.006)	(0.007)	(0.007)	(0.007)
polity	0.003	0.006	0.014	-0.003
	(0.008)	(0.009)	(0.009)	(0.008)
Observation	587	587	587	587
Adjusted R^2	0.345	0.336	0.312	0.339
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	40.4***	37.4***	66.4***	29.2***
	[0.000]	[0.000]	[0.000]	[0.000]
Panel C: Adjustment III				
geo-polit	-0.189***	-0.166**	-0.188***	-0.208***
	(0.060)	(0.065)	(0.053)	(0.066)
growth	-0.019	-0.011	-0.025	-0.024
	(0.036)	(0.030)	(0.043)	(0.035)
high-tech	-0.361**	-0.443*	-0.469**	-0.297*
	(0.170)	(0.222)	(0.184)	(0.162)
openness	-0.707***	-0.822***	-0.903***	-0.549***
	(0.166)	(0.175)	(0.211)	(0.166)
service	0.854	0.642	1.566**	0.566
	(0.590)	(0.642)	(0.670)	(0.563)
resource	3.213***	1.614**	4.391***	2.804***
	(0.579)	(0.771)	(0.643)	(0.531)
employment	-3.267***	-4.120***	-2.339***	-3.409***
	(0.510)	(0.515)	(0.573)	(0.510)
enrollment	1.185***	1.133***	1.130***	1.251***
	(0.088)	(0.114)	(0.078)	(0.103)
CA	0.002	-0.021**	0.028***	0.000
	(0.007)	(0.008)	(0.007)	(0.007)
polity	0.004	0.009	0.011	-0.001
	(0.008)	(0.009)	(0.008)	(0.008)
Observation	605	605	605	605
Adjusted R^2	0.319	0.300	0.305	0.307

	(1)	(2)	(3)	(4)
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	55.4***	35.2***	71.6***	46.4***
	[0.000]	[0.000]	[0.000]	[0.000]

* p < 0.1, ** p < 0.05, *** p < 0.01

C.9 Country Adjustment

Table C.8: Results of robustness check based on country adjustments.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: Adjustment I				
geo-polit	-0.135**	-0.137**	-0.106**	-0.154**
	(0.048)	(0.050)	(0.040)	(0.061)
growth	-0.027	-0.009	-0.033	-0.036
	(0.022)	(0.018)	(0.027)	(0.021)
high-tech	0.059	-0.164	0.097	0.115
	(0.194)	(0.230)	(0.214)	(0.175)
openness	-0.729***	-0.859***	-0.815***	-0.593***
	(0.193)	(0.251)	(0.205)	(0.182)
service	-0.134	0.098	0.272	-0.509
	(0.355)	(0.422)	(0.428)	(0.340)
resource	2.847***	1.086*	3.792***	2.671***
	(0.401)	(0.591)	(0.450)	(0.395)
employment	-1.071***	-2.363***	0.617	-1.352***
	(0.367)	(0.406)	(0.385)	(0.386)
enrollment	0.841***	0.839***	0.667***	0.937***
	(0.076)	(0.096)	(0.061)	(0.092)
CA	-0.020***	-0.041***	0.000	-0.021***
	(0.006)	(0.007)	(0.009)	(0.006)
polity	0.002	0.007	0.008	-0.001
	(0.007)	(0.010)	(0.007)	(0.007)
Observation	495	495	495	495
Adjusted R^2	0.246	0.236	0.212	0.260
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	50***	27.4***	81.3***	35.4***
	[0.000]	[0.000]	[0.000]	[0.000]
Panel B: Adjustment II				
geo-polit	-0.226***	-0.195***	-0.244***	-0.241***
	(0.049)	(0.052)	(0.051)	(0.054)
growth	0.064	0.066*	0.065	0.059
	(0.040)	(0.035)	(0.044)	(0.039)

	(1)	(2)	(3)	(4)
high-tech	0.297	0.276	0.134	0.384*
	(0.197)	(0.213)	(0.202)	(0.203)
openness	-1.164***	-1.513***	-1.142***	-1.025***
	(0.231)	(0.263)	(0.257)	(0.221)
service	-1.571***	-1.487**	-1.043**	-1.990***
	(0.444)	(0.590)	(0.502)	(0.393)
resource	2.617***	0.987	4.157***	1.972***
	(0.542)	(0.749)	(0.576)	(0.536)
employment	0.273	-0.969**	1.957***	0.034
	(0.398)	(0.390)	(0.371)	(0.463)
enrollment	1.109***	1.088***	0.969***	1.201***
	(0.098)	(0.104)	(0.067)	(0.122)
CA	-0.004	-0.019**	0.014*	-0.007
	(0.007)	(0.007)	(0.008)	(0.008)
polity	0.028*	0.045**	0.019	0.027
	(0.014)	(0.016)	(0.014)	(0.016)
Observation	540	540	540	540
Adjusted R^2	0.444	0.418	0.443	0.412
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	48.6***	37.8***	85***	50***
	[0.000]	[0.000]	[0.000]	[0.000]

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix D Endogeneity Handling

D.1 Two-Stage Least Square

Table D.1: TSLS regression results of the second stage.

Variable	geo-polit	GVC participation			
		oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)	(5)
Panel A: ext-conf as IV					
ext-conf	1.041***				
	(0.279)				
geo-polit (fitted)		-1.370***	-1.180**	-1.904***	-1.156***
		(0.354)	(0.424)	(0.377)	(0.358)
Observation	665	665	665	665	665
growth	0.032***	0.023	0.026	0.032	0.010
	(0.008)	(0.036)	(0.031)	(0.048)	(0.034)
high-tech	0.377**	0.083	-0.071	0.205	0.045
	(0.138)	(0.254)	(0.256)	(0.348)	(0.225)
openness	0.197	-0.572**	-0.694***	-0.704**	-0.447**
	(0.126)	(0.219)	(0.200)	(0.294)	(0.207)

	(1)	(2)	(3)	(4)	(5)
service	-0.211	0.588	0.363	1.258	0.342
	(0.338)	(0.745)	(0.802)	(0.925)	(0.640)
resource	-0.523	2.603***	1.064	3.608***	2.273***
	(0.529)	(0.525)	(0.691)	(0.626)	(0.479)
employment	0.513	-2.835***	-3.745***	-1.651	-3.101***
	(0.448)	(0.721)	(0.634)	(0.993)	(0.647)
enrollment	-0.174**	0.989***	0.940***	0.827***	1.117***
	(0.074)	(0.109)	(0.105)	(0.157)	(0.111)
CA	-0.014***	-0.015	-0.035***	0.003	-0.013
	(0.005)	(0.011)	(0.012)	(0.014)	(0.011)
polity	-0.014	-0.013	-0.006	-0.011	-0.015
	(0.012)	(0.015)	(0.014)	(0.023)	(0.014)
Adjusted R^2	0.059	-0.256	-0.094	-0.728	-0.033
Year FEs	✓	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓	✓
F statistic	31***	51.7***	64.5***	34.8***	55.1***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Panel B: nbr-pres as IV					
nbr-pres	1.305**				
	(0.477)				
geo-polit (fitted)		-2.188***	-2.035***	-2.613***	-2.025***
		(0.512)	(0.580)	(0.611)	(0.473)
Observation	665	665	665	665	665
growth	0.032***	0.049	0.053	0.055	0.039
	(0.008)	(0.041)	(0.036)	(0.053)	(0.038)
high-tech	0.377**	0.440	0.303	0.514	0.425
	(0.139)	(0.358)	(0.346)	(0.451)	(0.324)
openness	0.183	-0.470	-0.588*	-0.616	-0.339
	(0.126)	(0.318)	(0.295)	(0.384)	(0.304)
service	-0.201	0.443	0.211	1.132	0.188
	(0.338)	(0.937)	(1.010)	(1.091)	(0.829)
resource	-0.481	2.359***	0.809	3.396***	2.014***
	(0.529)	(0.728)	(0.822)	(0.852)	(0.658)
employment	0.504	-2.433**	-3.324***	-1.303	-2.674**
	(0.449)	(1.057)	(0.969)	(1.317)	(0.984)
enrollment	-0.173**	0.816***	0.760***	0.677***	0.933***
	(0.077)	(0.162)	(0.153)	(0.216)	(0.152)
CA	-0.014***	-0.027	-0.048**	-0.008	-0.026
	(0.005)	(0.017)	(0.017)	(0.019)	(0.016)
polity	-0.014	-0.024	-0.018	-0.021	-0.027
	(0.012)	(0.025)	(0.024)	(0.033)	(0.024)
Adjusted R^2	0.056	-1.344	-1.072	-1.759	-0.979
Year FEs	✓	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓	✓
F statistic	25.5***	31.2***	41.8***	17.4***	40***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table D.2: Results of instrument variable diagnoses.

Statistic	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: ext-conf as IV				
Cragg-Donald	8.76***	8.76***	8.76***	8.76***
	[0.003]	[0.003]	[0.003]	[0.003]
Kleibergen-Paap	13.9***	13.9***	13.9***	13.9***
	[0.000]	[0.000]	[0.000]	[0.000]
Durbin-Wu-Hausman	7.44***	5.06**	12.9***	4.43**
	[0.007]	[0.025]	[0.000]	[0.036]
Hansen-Sargan J	-	-	-	-
	-	-	-	-
Panel B: nbr-pres as IV				
Cragg-Donald	7.01***	7.01***	7.01***	7.01***
	[0.008]	[0.008]	[0.008]	[0.008]
Kleibergen-Paap	7.48***	7.48***	7.48***	7.48***
	[0.006]	[0.006]	[0.006]	[0.006]
Durbin-Wu-Hausman	17.3***	13.9***	20.8***	13.2***
	[0.000]	[0.000]	[0.000]	[0.000]
Hansen-Sargan J	-	-	-	-
	-	-	-	-

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

D.2 Donald-Newey bias-corrected TSLS

Table D.3: Results of Donald-Newey bias-corrected TSLS regressions.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: ext-conf as IV				
geo-polit	-1.255**	-1.081**	-1.737***	-1.064**
	(0.520)	(0.503)	(0.656)	(0.491)
growth	0.019	0.023	0.027	0.007
	(0.024)	(0.023)	(0.030)	(0.023)
high-tech	0.033	-0.115	0.132	0.005
	(0.337)	(0.326)	(0.425)	(0.319)
openness	-0.586**	-0.706***	-0.725**	-0.459**
	(0.236)	(0.229)	(0.298)	(0.223)
service	0.609	0.380	1.287**	0.359
	(0.471)	(0.456)	(0.594)	(0.445)
resource	2.637***	1.094	3.658***	2.301***

	(1)	(2)	(3)	(4)
	(0.690)	(0.668)	(0.871)	(0.652)
employment	-2.892***	-3.794***	-1.733**	-3.146***
	(0.623)	(0.603)	(0.787)	(0.589)
enrollment	1.013***	0.961***	0.862***	1.136***
	(0.168)	(0.162)	(0.212)	(0.158)
CA	-0.013	-0.034***	0.005	-0.011
	(0.013)	(0.013)	(0.017)	(0.013)
polity	-0.011	-0.004	-0.009	-0.013
	(0.015)	(0.014)	(0.018)	(0.014)
Observation	665	665	665	665
k class	0.998	0.998	0.998	0.998
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
Panel B: nbr-pres as IV				
geo-polit	-1.951***	-1.813**	-2.325***	-1.810**
	(0.743)	(0.722)	(0.875)	(0.708)
growth	0.041	0.046	0.046	0.032
	(0.033)	(0.032)	(0.039)	(0.031)
high-tech	0.337	0.206	0.389	0.331
	(0.460)	(0.447)	(0.542)	(0.439)
openness	-0.500	-0.615**	-0.652*	-0.366
	(0.312)	(0.303)	(0.367)	(0.297)
service	0.485	0.250	1.183	0.226
	(0.619)	(0.602)	(0.729)	(0.590)
resource	2.429***	0.875	3.482***	2.078**
	(0.908)	(0.883)	(1.070)	(0.866)
employment	-2.550***	-3.433***	-1.444	-2.779***
	(0.830)	(0.806)	(0.978)	(0.791)
enrollment	0.866***	0.806***	0.737***	0.979***
	(0.228)	(0.222)	(0.269)	(0.218)
CA	-0.024	-0.045**	-0.004	-0.022
	(0.018)	(0.018)	(0.021)	(0.017)
polity	-0.021	-0.015	-0.017	-0.024
	(0.020)	(0.019)	(0.023)	(0.019)
Observation	665	665	665	665
k class	0.998	0.998	0.998	0.998

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

D.3 Anatolyev bias-corrected TSLS

Table D.4: Results of Anatolyev bias-corrected TSLS regressions.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: ext-conf as IV				
geo-polit	-1.516**	-1.304*	-2.115**	-1.273*
	(0.714)	(0.677)	(0.927)	(0.657)
growth	0.027	0.030	0.039	0.014
	(0.030)	(0.028)	(0.039)	(0.028)
high-tech	0.146	-0.017	0.297	0.096
	(0.416)	(0.395)	(0.541)	(0.383)
openness	-0.554**	-0.678***	-0.678*	-0.433*
	(0.267)	(0.253)	(0.347)	(0.246)
service	0.562	0.341	1.220*	0.321
	(0.527)	(0.500)	(0.685)	(0.485)
resource	2.559***	1.027	3.545***	2.239***
	(0.775)	(0.735)	(1.006)	(0.713)
employment	-2.764***	-3.684***	-1.548*	-3.044***
	(0.721)	(0.684)	(0.937)	(0.664)
enrollment	0.958***	0.914***	0.782***	1.092***
	(0.206)	(0.195)	(0.268)	(0.190)
CA	-0.017	-0.037**	0.000	-0.014
	(0.016)	(0.015)	(0.021)	(0.015)
polity	-0.015	-0.008	-0.014	-0.016
	(0.017)	(0.016)	(0.022)	(0.016)
Observation	665	665	665	665
k class	1.002	1.002	1.002	1.002
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
Panel B: nbr-pres as IV				
geo-polit	-2.504**	-2.330**	-2.995**	-2.312**
	(1.182)	(1.135)	(1.406)	(1.110)
growth	0.059	0.063	0.068	0.048
	(0.047)	(0.045)	(0.056)	(0.044)
high-tech	0.578	0.432	0.682	0.550
	(0.651)	(0.625)	(0.774)	(0.611)
openness	-0.431	-0.551	-0.569	-0.303
	(0.391)	(0.375)	(0.465)	(0.367)
service	0.387	0.159	1.064	0.137
	(0.765)	(0.734)	(0.910)	(0.718)
resource	2.264**	0.721	3.282**	1.929*
	(1.128)	(1.083)	(1.341)	(1.059)
employment	-2.278**	-3.179***	-1.114	-2.533**
	(1.076)	(1.033)	(1.280)	(1.011)
enrollment	0.749**	0.697**	0.596	0.873***
	(0.321)	(0.308)	(0.382)	(0.301)
CA	-0.032	-0.053**	-0.014	-0.030

	(1)	(2)	(3)	(4)
	(0.025)	(0.024)	(0.029)	(0.023)
polity	-0.029	-0.022	-0.027	-0.031
	(0.026)	(0.025)	(0.031)	(0.025)
Observation	665	665	665	665
k class	1.002	1.002	1.002	1.002
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

D.4 Two-Step FoD GMM

Table D.5: Results of Two-Step FoD GMM estimations.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: ext-conf as IV				
geo-polit	-0.876*	-0.892	-1.616***	-0.303
	(0.471)	(0.545)	(0.594)	(0.450)
growth	0.011	0.020	0.033	-0.018
	(0.031)	(0.035)	(0.037)	(0.024)
high-tech	-0.122	-0.194	0.111	-0.258
	(0.281)	(0.304)	(0.360)	(0.275)
openness	-0.671***	-0.772***	-0.789***	-0.594***
	(0.203)	(0.225)	(0.265)	(0.189)
service	0.694	0.501	1.403*	0.289
	(0.489)	(0.554)	(0.735)	(0.354)
resource	2.590***	1.131*	3.744***	2.294***
	(0.558)	(0.635)	(0.677)	(0.653)
employment	-3.776***	-4.546***	-2.680***	-3.650***
	(0.509)	(0.533)	(0.704)	(0.489)
enrollment	1.037***	0.953***	0.873***	1.190***
	(0.142)	(0.157)	(0.192)	(0.133)
CA	-0.003	-0.029***	0.015	0.002
	(0.010)	(0.011)	(0.015)	(0.009)
polity	-0.015	-0.008	-0.014	-0.015
	(0.013)	(0.013)	(0.024)	(0.010)
Observation	665	665	665	665
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
Panel B: nbr-pres as IV				
geo-polit	-1.672**	-1.818**	-2.313**	-1.082*
	(0.723)	(0.875)	(0.917)	(0.587)
growth	0.038	0.051	0.056	0.008
	(0.040)	(0.047)	(0.048)	(0.032)

	(1)	(2)	(3)	(4)
high-tech	0.205	0.186	0.398	0.061
	(0.390)	(0.436)	(0.497)	(0.339)
openness	-0.563**	-0.647**	-0.695**	-0.489**
	(0.278)	(0.307)	(0.348)	(0.240)
service	0.562	0.347	1.287	0.160
	(0.656)	(0.735)	(0.913)	(0.459)
resource	2.324***	0.822	3.511***	2.034***
	(0.700)	(0.849)	(0.922)	(0.607)
employment	-3.545***	-4.277***	-2.478***	-3.423***
	(0.692)	(0.783)	(0.877)	(0.536)
enrollment	0.864***	0.751***	0.721***	1.021***
	(0.203)	(0.230)	(0.261)	(0.169)
CA	-0.013	-0.041**	0.006	-0.008
	(0.015)	(0.017)	(0.020)	(0.012)
polity	-0.026	-0.020	-0.023	-0.026
	(0.023)	(0.024)	(0.034)	(0.016)
Observation	665	665	665	665
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix E Financing Convenience

E.1 Moderating Effect of Financing Convenience

Table E.1: Results of moderating effect of financial convenience.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
geo-polit	-0.718***	-1.094***	-0.579***	-0.553***
	(0.097)	(0.127)	(0.142)	(0.094)
fin-conve	0.034	0.018	-0.038	0.076
	(0.043)	(0.044)	(0.049)	(0.045)
geo-polit×fin-conve	0.439***	0.560***	0.454***	0.340**
	(0.149)	(0.172)	(0.160)	(0.142)
growth	0.016	0.024	0.017	0.006
	(0.033)	(0.029)	(0.037)	(0.032)
high-tech	0.170	-0.016	0.171	0.192
	(0.183)	(0.200)	(0.182)	(0.190)
openness	-0.272**	-0.150	-0.825***	-0.112
	(0.106)	(0.125)	(0.105)	(0.114)
service	-0.757**	-1.254***	0.000	-0.895**
	(0.311)	(0.327)	(0.397)	(0.348)
resource	3.180***	1.613***	4.904***	2.792***
	(0.457)	(0.488)	(0.556)	(0.515)
employment	-2.663***	-3.783***	-1.523**	-2.804***
	(0.535)	(0.539)	(0.559)	(0.560)
enrollment	0.994***	0.939***	0.915***	1.076***
	(0.088)	(0.087)	(0.066)	(0.106)
CA	-0.010	-0.034***	0.017**	-0.009
	(0.009)	(0.009)	(0.007)	(0.009)
polity	0.022***	0.024***	0.029***	0.019***
	(0.006)	(0.007)	(0.007)	(0.006)
Observation	583	583	583	583
Adjusted R^2	0.349	0.392	0.288	0.334
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	40.7***	43.3***	40.1***	43.1***
	[0.000]	[0.000]	[0.000]	[0.000]

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

E.2 Alternative Indicators of Financing Convenience

Table E.2: Results of moderating effect with bank credit as moderating variable.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
geo-polit	-0.898***	-1.189***	-0.696***	-0.805***
	(0.176)	(0.175)	(0.213)	(0.188)
bank-cred	-0.129***	-0.107***	-0.102**	-0.154***
	(0.041)	(0.034)	(0.043)	(0.045)
geo-polit×bank-cred	0.303*	0.290**	0.241	0.326*
	(0.169)	(0.139)	(0.179)	(0.187)
growth	-0.034	-0.035	-0.039	-0.035
	(0.038)	(0.030)	(0.045)	(0.037)
high-tech	-0.378*	-0.485*	-0.496**	-0.320
	(0.205)	(0.249)	(0.202)	(0.200)
openness	-0.157	-0.066	-0.614***	-0.032
	(0.125)	(0.151)	(0.145)	(0.119)
service	0.945*	0.808	1.674**	0.635
	(0.506)	(0.570)	(0.597)	(0.475)
resource	2.586***	1.113	3.903***	2.208***
	(0.498)	(0.684)	(0.603)	(0.443)
employment	-3.328***	-4.203***	-2.358***	-3.473***
	(0.481)	(0.455)	(0.559)	(0.489)
enrollment	1.134***	1.025***	1.105***	1.226***
	(0.085)	(0.098)	(0.065)	(0.105)
CA	0.000	-0.028***	0.030***	0.000
	(0.008)	(0.009)	(0.009)	(0.009)
polity	0.003	0.000	0.013	-0.002
	(0.008)	(0.009)	(0.009)	(0.008)
Observation	629	629	629	629
Adjusted R^2	0.283	0.306	0.254	0.275
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	39.9***	42.2***	69***	37.8***
	[0.000]	[0.000]	[0.000]	[0.000]

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table E.3: Results of moderating effect with bank deposits as moderating variable.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
geo-polit	-1.653***	-2.093***	-1.546***	-1.430***
	(0.204)	(0.229)	(0.266)	(0.208)
bank-depos	-0.125	-0.236**	-0.266**	0.004
	(0.109)	(0.110)	(0.126)	(0.103)
geo-polit×bank-depos	1.876***	2.109***	1.931***	1.698***
	(0.286)	(0.297)	(0.354)	(0.277)
growth	-0.033	-0.030	-0.036	-0.037
	(0.035)	(0.027)	(0.042)	(0.034)
high-tech	-0.464**	-0.544**	-0.544***	-0.441**
	(0.177)	(0.219)	(0.188)	(0.171)
openness	-0.219*	-0.112	-0.623***	-0.123
	(0.110)	(0.129)	(0.128)	(0.114)
service	0.266	0.137	1.113*	-0.094
	(0.500)	(0.549)	(0.594)	(0.487)
resource	2.219***	0.764	3.583***	1.803***
	(0.454)	(0.620)	(0.554)	(0.419)
employment	-3.666***	-4.485***	-2.574***	-3.885***
	(0.508)	(0.502)	(0.549)	(0.519)
enrollment	1.080***	0.965***	1.035***	1.177***
	(0.077)	(0.076)	(0.086)	(0.086)
CA	0.003	-0.024***	0.033***	0.004
	(0.008)	(0.008)	(0.009)	(0.008)
polity	0.023**	0.021**	0.033***	0.018*
	(0.010)	(0.010)	(0.011)	(0.010)
Observation	627	627	627	627
Adjusted R^2	0.338	0.364	0.296	0.323
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	123***	85.2***	74.6***	136***
	[0.000]	[0.000]	[0.000]	[0.000]

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table E.4: Results of moderating effect with domestic credit as moderating variable.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
geo-polit	-2.057***	-2.310***	-1.933***	-1.961***
	(0.239)	(0.288)	(0.301)	(0.257)
demo-cred	-0.384***	-0.328***	-0.464***	-0.387***
	(0.064)	(0.068)	(0.066)	(0.069)
geo-polit×demo-cred	1.814***	1.729***	1.981***	1.770***
	(0.286)	(0.291)	(0.299)	(0.306)
growth	-0.046	-0.053	-0.036	-0.052
	(0.046)	(0.040)	(0.052)	(0.045)
high-tech	-0.453**	-0.658***	-0.587***	-0.300*
	(0.169)	(0.200)	(0.186)	(0.167)
openness	-0.067	0.105	-0.540***	-0.004
	(0.116)	(0.145)	(0.141)	(0.116)
service	0.639	0.183	1.608**	0.247
	(0.575)	(0.637)	(0.644)	(0.565)
resource	2.770***	0.789	4.382***	2.440***
	(0.526)	(0.691)	(0.630)	(0.505)
employment	-3.133***	-4.029***	-2.137***	-3.324***
	(0.559)	(0.549)	(0.580)	(0.576)
enrollment	1.017***	0.869***	1.050***	1.097***
	(0.118)	(0.112)	(0.106)	(0.140)
CA	-0.002	-0.024**	0.023***	-0.003
	(0.007)	(0.009)	(0.008)	(0.008)
polity	0.013	0.014	0.016	0.007
	(0.015)	(0.015)	(0.015)	(0.015)
Observation	573	573	573	573
Adjusted R^2	0.339	0.334	0.338	0.317
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	26.8***	30.7***	31.4***	27.6***
	[0.000]	[0.000]	[0.000]	[0.000]

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table E.5: Results of moderating effect with financial system deposits as moderating variable.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
geo-polit	-1.767***	-2.198***	-1.627***	-1.562***
	(0.199)	(0.228)	(0.248)	(0.209)
fin-depos	-0.355***	-0.433***	-0.443***	-0.266**
	(0.114)	(0.110)	(0.120)	(0.115)
geo-polit×fin-depos	2.148***	2.352***	2.153***	2.006***
	(0.281)	(0.298)	(0.329)	(0.278)
growth	-0.036	-0.033	-0.040	-0.040
	(0.034)	(0.027)	(0.042)	(0.034)
high-tech	-0.342*	-0.439*	-0.447**	-0.299*
	(0.173)	(0.217)	(0.181)	(0.167)
openness	-0.172	-0.074	-0.597***	-0.063
	(0.114)	(0.129)	(0.131)	(0.119)
service	0.334	0.191	1.145*	-0.007
	(0.510)	(0.557)	(0.601)	(0.496)
resource	2.369***	0.895	3.704***	1.978***
	(0.456)	(0.623)	(0.551)	(0.420)
employment	-3.558***	-4.399***	-2.464***	-3.769***
	(0.497)	(0.487)	(0.552)	(0.504)
enrollment	1.037***	0.928***	0.992***	1.131***
	(0.085)	(0.080)	(0.094)	(0.096)
CA	-0.001	-0.028***	0.029***	-0.001
	(0.008)	(0.009)	(0.008)	(0.009)
polity	0.025**	0.023**	0.034***	0.020**
	(0.009)	(0.009)	(0.010)	(0.009)
Observation	635	635	635	635
Adjusted R^2	0.329	0.362	0.291	0.311
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	115***	77.7***	102***	108***
	[0.000]	[0.000]	[0.000]	[0.000]

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table E.6: Results of moderating effect with deposit money as moderating variable.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
geo-polit	-1.827***	-2.062***	-1.628***	-1.749***
	(0.223)	(0.236)	(0.245)	(0.249)
depos-money	-0.276***	-0.258***	-0.270***	-0.292***
	(0.058)	(0.058)	(0.046)	(0.068)
geo-polit×depos-money	1.517***	1.431***	1.446***	1.570***
	(0.290)	(0.286)	(0.259)	(0.318)
growth	-0.051	-0.050*	-0.055	-0.053
	(0.034)	(0.027)	(0.041)	(0.033)
high-tech	-0.386**	-0.484**	-0.494**	-0.340*
	(0.174)	(0.219)	(0.186)	(0.168)
openness	-0.131	-0.049	-0.594***	0.004
	(0.119)	(0.143)	(0.146)	(0.113)
service	-0.075	-0.149	0.676	-0.395
	(0.384)	(0.465)	(0.488)	(0.364)
resource	2.064***	0.625	3.426***	1.653***
	(0.455)	(0.643)	(0.576)	(0.389)
employment	-3.083***	-3.979***	-2.114***	-3.211***
	(0.521)	(0.503)	(0.559)	(0.537)
enrollment	0.917***	0.849***	0.888***	0.990***
	(0.091)	(0.099)	(0.080)	(0.107)
CA	0.003	-0.023**	0.030***	0.004
	(0.008)	(0.009)	(0.008)	(0.008)
polity	0.007	0.005	0.018*	0.003
	(0.009)	(0.009)	(0.010)	(0.009)
Observation	660	660	660	660
Adjusted R^2	0.360	0.372	0.316	0.349
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	68.6***	57***	95.9***	73.7***
	[0.000]	[0.000]	[0.000]	[0.000]

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table E.7: Results of moderating effect with bank private credit as moderating variable.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
geo-polit	-1.468***	-1.761***	-1.353***	-1.338***
	(0.181)	(0.199)	(0.218)	(0.201)
priv-bank	-0.201***	-0.200***	-0.225***	-0.203**
	(0.067)	(0.070)	(0.057)	(0.076)
geo-polit×priv-bank	1.422***	1.400***	1.460***	1.409***
	(0.288)	(0.274)	(0.276)	(0.317)
growth	-0.053	-0.052*	-0.057	-0.055
	(0.035)	(0.028)	(0.043)	(0.034)
high-tech	-0.435**	-0.537**	-0.562**	-0.380**
	(0.188)	(0.230)	(0.203)	(0.179)
openness	-0.124	-0.041	-0.587***	0.010
	(0.125)	(0.146)	(0.151)	(0.118)
service	-0.013	-0.123	0.698	-0.295
	(0.376)	(0.485)	(0.459)	(0.342)
resource	2.204***	0.744	3.545***	1.811***
	(0.471)	(0.665)	(0.580)	(0.408)
employment	-3.282***	-4.147***	-2.240***	-3.437***
	(0.492)	(0.477)	(0.530)	(0.510)
enrollment	0.939***	0.859***	0.888***	1.024***
	(0.087)	(0.096)	(0.077)	(0.106)
CA	0.008	-0.017*	0.035***	0.009
	(0.008)	(0.009)	(0.009)	(0.009)
polity	0.012	0.010	0.022*	0.008
	(0.010)	(0.010)	(0.011)	(0.010)
Observation	656	656	656	656
Adjusted R^2	0.355	0.371	0.315	0.339
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	73.9***	62.5***	101***	73.4***
	[0.000]	[0.000]	[0.000]	[0.000]

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

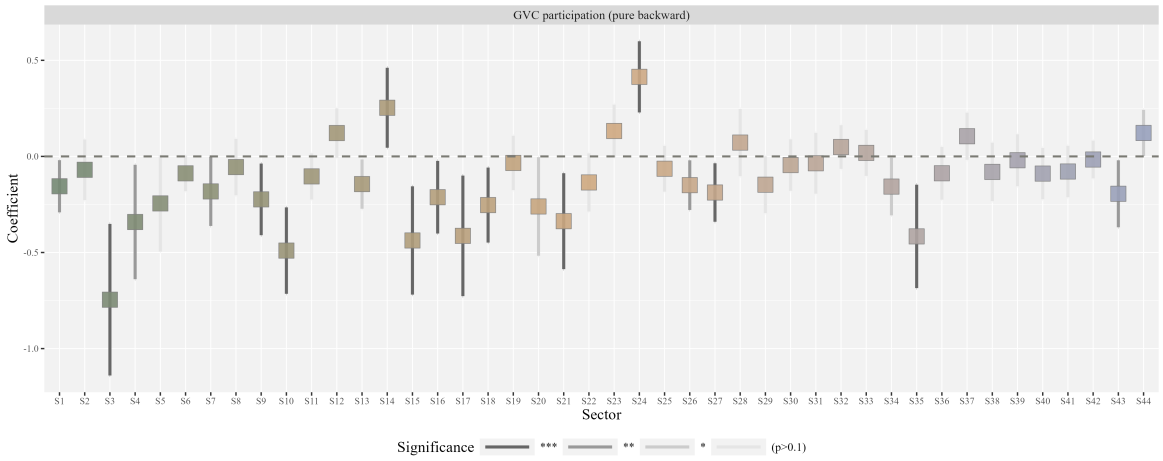
Table E.8: Results of moderating effect with financial institution private credit as moderating variable.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
geo-polit	-1.462***	-1.780***	-1.289***	-1.339***
	(0.179)	(0.199)	(0.201)	(0.204)
priv-fin	-0.191***	-0.176***	-0.202***	-0.196***
	(0.059)	(0.060)	(0.047)	(0.069)
geo-polit×priv-fin	1.335***	1.350***	1.283***	1.332***
	(0.257)	(0.244)	(0.242)	(0.286)
growth	-0.053	-0.054*	-0.056	-0.055
	(0.034)	(0.027)	(0.042)	(0.034)
high-tech	-0.466**	-0.576**	-0.558**	-0.419**
	(0.188)	(0.226)	(0.200)	(0.183)
openness	-0.128	-0.045	-0.585***	0.003
	(0.118)	(0.142)	(0.149)	(0.107)
service	0.230	0.062	0.974*	-0.054
	(0.391)	(0.469)	(0.478)	(0.370)
resource	2.246***	0.750	3.614***	1.857***
	(0.468)	(0.655)	(0.585)	(0.398)
employment	-3.085***	-3.952***	-2.126***	-3.226***
	(0.498)	(0.475)	(0.544)	(0.516)
enrollment	0.920***	0.827***	0.895***	1.002***
	(0.082)	(0.088)	(0.076)	(0.102)
CA	0.010	-0.014	0.036***	0.011
	(0.008)	(0.009)	(0.009)	(0.008)
polity	0.018*	0.017	0.028**	0.014
	(0.010)	(0.010)	(0.012)	(0.010)
Observation	657	657	657	657
Adjusted R^2	0.353	0.375	0.311	0.336
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	93.1***	93.1***	87.8***	109***
	[0.000]	[0.000]	[0.000]	[0.000]

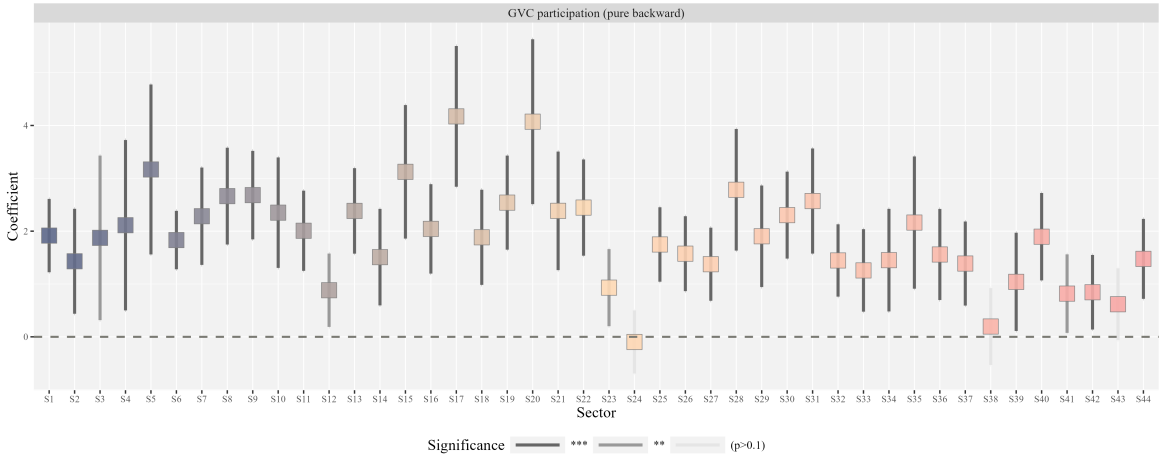
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix F Extended Analysis

F.1 Sectoral Heterogeneity

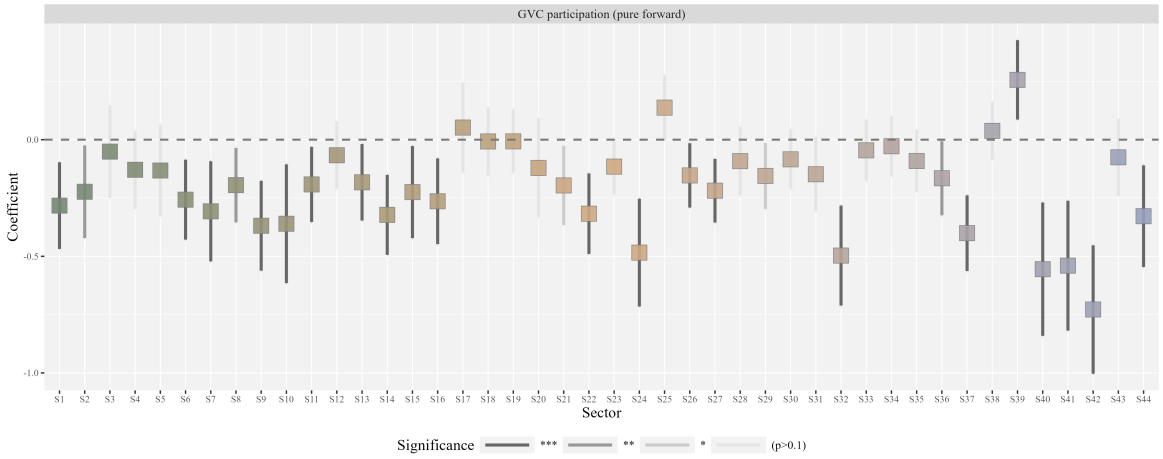


(a)

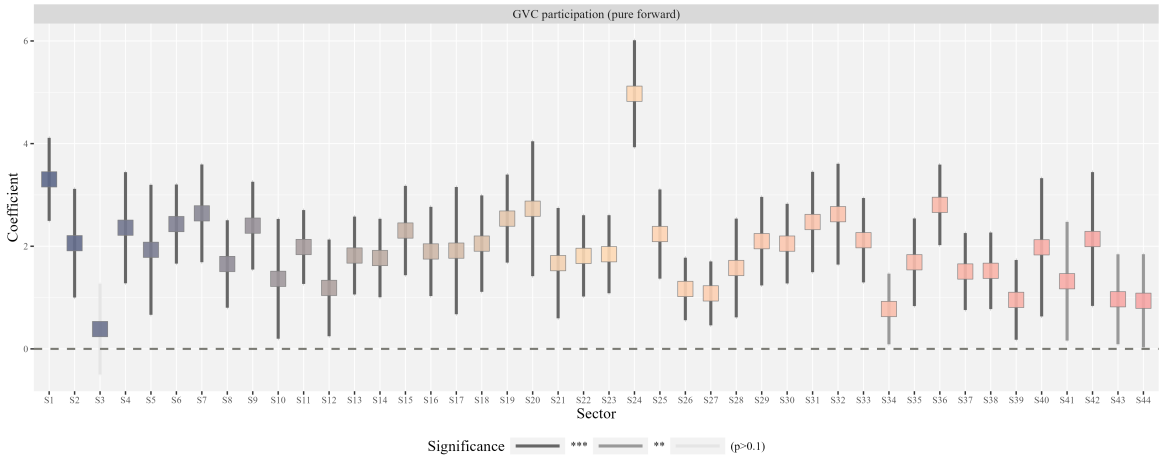


(b)

Figure F.1: Regression results under different sectors with pb-oGVC as the explained variable. *Note:* (a) shows the point estimates and confidence intervals of geo-polit within different sectors; (b) shows the results of the interaction term between geo-polit and fin-conve.

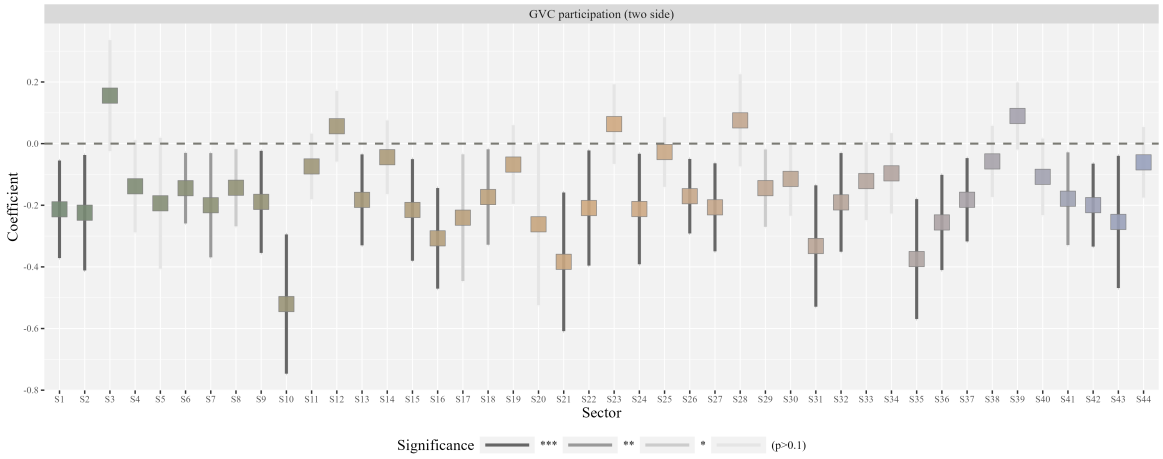


(a)

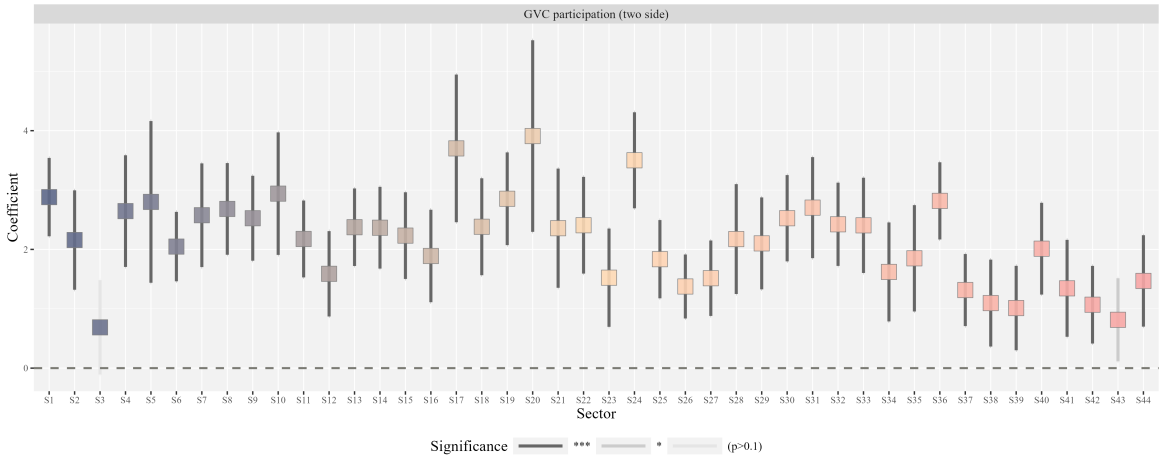


(b)

Figure F.2: Regression results under different sectors with pf-oGVC as the explained variable. *Note:* (a) shows the point estimates and confidence intervals of geo-polit within different sectors; (b) shows the results of the interaction term between geo-polit and fin-conve.



(a)



(b)

Figure F.3: Regression results under different sectors with ts-oGVC as the explained variable.

Note: (a) shows the point estimates and confidence intervals of geo-polit within different sectors; (b) shows the results of the interaction term between geo-polit and fin-conve.

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