Supplementary Information

How Will Geopolitical Risk Play Its Role in the Global Value Chain?

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A.1   Quality Preference

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

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

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:

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

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}:

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

Then, the Lagrange multiplier can be expressed as:

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

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

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

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

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

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:

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

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:

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

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

A.2 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 $\alpha, \beta, \zeta > 0$. By assuming the constant returns to scale in the production process, the firm's production function of quantity-producing process can be expressed as $Y = f(K, L, M) = \phi K^{\alpha} L^{\beta} M^{\zeta}$. 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:

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

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

where K, L, and M denote capital, labor force and intermediate input, respectively; p_K, p_L, and p_M denote the price of each factor; α, β, and ζ denote the output elasticity of each factor, meeting $\alpha, \beta, \zeta > 0$.

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

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

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

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

which will make the following equations hold:

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

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

$$Y = \phi K^{\alpha+\beta+\zeta} \left(\frac{p_K}{\alpha}\right)^{\beta+\zeta} \left(\frac{\beta}{p_L}\right)^{\beta} \left(\frac{\zeta}{p_M}\right)^{\zeta}$$

$$= \phi L^{\alpha+\beta+\zeta} \left(\frac{p_L}{\beta}\right)^{\alpha+\zeta} \left(\frac{\alpha}{p_K}\right)^{\alpha} \left(\frac{\zeta}{p_M}\right)^{\zeta} \tag{A.14}$$

$$= \phi M^{\alpha+\beta+\zeta} \left(\frac{p_M}{\zeta}\right)^{\beta+\zeta} \left(\frac{\mu_k}{p_K}\right)^{\alpha} \left(\frac{\beta}{p_L}\right)^{\beta}$$

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

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

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:

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

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

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

A.3 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, $\xi = f(K, L, M)$, also takes the Cobb-Douglas form. The output elasticities with respect to each factor, α, β, and ζ, 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 $\xi = g(K, L, M) = \left(\varphi K^{\alpha} L^{\beta} M^{\zeta}\right)^{\frac{1}{\iota}}$. 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:

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

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

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

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

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

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

which will make the following equations hold:

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

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

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

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

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

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:

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

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

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

A.4 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:

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

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

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

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

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

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

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

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

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

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

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

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

A.5 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 ξ, which means that:

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

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 $\pi(p,\xi)$ with respect to ξ, and subsequently let it be 0:

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

$$\text{(A.33)}$$

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

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

$$\text{(A.34)}$$

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

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

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

$$\text{(A.35)}$$

or in the logged form:

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

$$\text{(A.36)}$$

We can investigate how geo-political shocks will affect the product quality by conducting the

implicit differentiation for Eq.(A.36) with respect to γ:

$$[\eta - (1-\mu)(\sigma-1)]\frac{1}{\xi}\frac{\partial\xi}{\partial\gamma} = (1-\sigma)\frac{\partial}{\partial\gamma}\ln(\Theta\kappa(\gamma)) + \frac{1-\sigma}{\delta(\xi)}\frac{\partial\delta(\xi)}{\partial\xi}\frac{\partial\xi}{\partial\gamma} + \frac{1}{1-\mu+\varepsilon(\xi)}\frac{\partial\varepsilon(\xi)}{\partial\xi}\frac{\partial\xi}{\partial\gamma}$$

(A.37a)

$$\implies (1-\sigma)\frac{\partial}{\partial\gamma}\left[\ln\Theta\kappa(\gamma)\right] = \underbrace{\left\{[\eta - (1-\mu)(\sigma-1)]\frac{1}{\xi} - \frac{1-\sigma}{\delta}\delta' - \frac{1}{1-\mu+\varepsilon}\varepsilon'\right\}}_{positive}\frac{\partial\xi}{\partial\gamma}$$

(A.37b)

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

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

(A.38)

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

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

(A.39)

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

$$\frac{\partial\xi}{\partial\gamma} \propto \underbrace{-\frac{\kappa'(\gamma)}{\kappa(\gamma)}}_{negative} + \underbrace{\frac{\psi}{\psi+(1-\psi)\vartheta}\frac{\vartheta'(\gamma)}{\vartheta(\gamma)}}_{negative} < 0$$

(A.40)

A.6 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 $\frac{\partial\xi}{\partial\gamma}$ with respect to s_d, namely:

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

(A.41)

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

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

(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:

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

(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:

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

(A.44)

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

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

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

(A.45)

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

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

(A.46)

A.7 Direct External Moderation

The role of external forces in shaping firms' product quality decisions under geopolitical conflict can likewise be examined by taking partial derivations with respect to ϑ_f. First, the direct moderating effect of external forces on the negative impact of geo-political conflict on firms' product quality decisions can be analyzed by differentiating $\frac{\partial\xi}{\partial\gamma}$ with respect to ϑ_f, namely:

$$\frac{\partial^2\xi}{\partial\gamma\partial\vartheta_f}\propto\frac{\partial}{\partial\vartheta_f}\left[-\frac{\kappa'(\gamma)}{\kappa(\gamma)}+\frac{\psi}{\psi+(1-\psi)(\hat{\vartheta}_d(\gamma)s_d+\vartheta_f)}\frac{\hat{\vartheta}'_d(\gamma)s_d+\vartheta'_f}{\hat{\vartheta}_d(\gamma)s_d+\vartheta_f}\right]$$

(A.47)

Here, the term associated with the firm's operational management cost $\kappa(\gamma)$ should have a zero partial derivative with respect to ϑ_f, since this article assumes the exogeneity of external forces and considers that operational management is, to a considerable extent, independent of foreign factors outside the firm's host country:

$$\frac{\partial}{\partial\vartheta_f}\left[\frac{\kappa'(\gamma)}{\kappa(\gamma)}\right]=0$$

(A.48)

By expanding Eq.(A.47), we have:

$$\frac{\partial}{\partial \vartheta_f} \left[-\frac{\kappa'(\gamma)}{\kappa(\gamma)} + \frac{\psi}{\psi + (1-\psi)(\hat{\vartheta}_d(\gamma)s_d + \vartheta_f)} \frac{\hat{\vartheta}'_d(\gamma)s_d + \vartheta'_f}{\hat{\vartheta}_d(\gamma)s_d + \vartheta_f} \right]$$

$$= \frac{\partial}{\partial \vartheta_f} \left[-\frac{\kappa'(\gamma)}{\kappa(\gamma)} + \frac{\psi}{\psi + (1-\psi)(\hat{\vartheta}_d(\gamma)s_d + \vartheta_f)} \frac{\hat{\vartheta}'_d(\gamma)s_d + \vartheta'_f}{\hat{\vartheta}_d(\gamma)s_d + \vartheta_f} \right] \tag{A.49}$$

According to the Chain Rule, the partial deviation of the first product term on the right-hand side of Eq.(A.49) is negative:

$$\frac{\partial}{\partial \vartheta_f} \left[\frac{\psi}{\psi + (1-\psi)(\hat{\vartheta}_d(\gamma)s_d + \vartheta_f)} \right] = \frac{-\psi(1-\psi)}{\left[\psi + (1-\psi)(\hat{\vartheta}_d(\gamma)s_d + \vartheta_f)\right]^2} < 0 \tag{A.50}$$

since $0 < \phi < 1$.

Then, the partial deviation of the second product term on the right-hand side of Eq.(A.49) is positive:

$$\frac{\hat{\vartheta}'_d(\gamma)s_d + \vartheta'_f}{\hat{\vartheta}_d(\gamma)s_d + \vartheta_f} = \frac{-\left(\hat{\vartheta}'_d(\gamma)s_d + \vartheta'_f\right)}{\left[\hat{\vartheta}_d(\gamma)s_d + \vartheta_f\right]^2} > 0 \tag{A.51}$$

since $\hat{\theta}'_d, \theta'_f < 0$, and $s_d > 0$.

By combining Eq.(A.50) and Eq.(A.51), the following equation can be obtained:

$$\frac{\partial}{\partial \vartheta_f} \left[-\frac{\kappa'(\gamma)}{\kappa(\gamma)} + \frac{\psi}{\psi + (1-\psi)(\hat{\vartheta}_d(\gamma)s_d + \vartheta_f)} \frac{\hat{\vartheta}'_d(\gamma)s_d + \vartheta'_f}{\hat{\vartheta}_d(\gamma)s_d + \vartheta_f} \right]$$

$$= \underbrace{\frac{-\psi(1-\psi)}{\left[\psi + (1-\psi)(\hat{\vartheta}_d(\gamma)s_d + \vartheta_f)\right]^2}}_{negative} \underbrace{\frac{\hat{\vartheta}'_d(\gamma)s_d + \vartheta'_f}{\hat{\vartheta}_d(\gamma)s_d + \vartheta_f}}_{negative}$$

$$+ \underbrace{\frac{\psi}{\psi + (1-\psi)(\hat{\vartheta}_d(\gamma)s_d + \vartheta_f)}}_{positive} \underbrace{\frac{-\left(\hat{\vartheta}'_d(\gamma)s_d + \vartheta'_f\right)}{\left[\hat{\vartheta}_d(\gamma)s_d + \vartheta_f\right]^2}}_{positive} \tag{A.52}$$

Thus, $\frac{\partial^2 \xi}{\partial \gamma \partial \vartheta_f} > 0$, namely, as the accessibility of external funds through cross-border channels increases, the negative impact of geo-political risks on product quality decisions also diminishes, similar to the role of financing convenience.

A.8   Indirect External Moderation

Finally, how external forces indirectly moderate the relationship between geo-political risk and product quality decisions, by the way of influencing the effect of domestic financial convenience — can be examined by taking the partial derivative of $\frac{\partial^2 \xi}{\partial \gamma, \partial s_d}$ with respect to ϑ_f:

$$\frac{\partial^3 \xi}{\partial \gamma \partial s_d \partial \vartheta_f} \propto \frac{\partial}{\partial s_d \partial \vartheta_f} \left[-\frac{\kappa'(\gamma)}{\kappa(\gamma)} + \frac{\psi}{\psi + (1-\psi)\vartheta} \frac{\vartheta'(\gamma)}{\vartheta(\gamma)} \right] \tag{A.53}$$

Of course, here we calculate the partial derivative of $\frac{\partial^2 \xi}{\partial \gamma \partial s_d}$ with respect to s_f, rather than calculating the partial derivative of $\frac{\partial^2 \xi}{\partial \gamma \partial s_d}$ with respect to ϑ_f directly, in order to demonstrate how $\frac{\partial^3 \xi}{\partial \gamma \partial s_d \partial \vartheta_f}$ will be greater or less than 0 (i.e., the indirect moderating effect of external forces), for there existing some kind of displacement symmetry between s_d and s_f:

$$\frac{\partial^3 \xi}{\partial \gamma \partial s_d \partial s_f} \propto \frac{\partial}{\partial s_d \partial s_f} \left[-\frac{\kappa'(\gamma)}{\kappa(\gamma)} + \frac{\psi}{\psi + (1-\psi)\vartheta} \frac{\vartheta'(\gamma)}{\vartheta(\gamma)} \right] \tag{A.54}$$

Of course, the implicit assumption here is that external forces affect the securable fraction of external financing, s_f, rather than the accessible fraction one, $\hat{\vartheta}_f$. We consider this assumption reasonable because the impact of external forces on firm financing should be localized, namely, it should influence only specific financing channels targeted at the firm, rather than spilling over to the overall external financing environment.

Under this assumption, computing the partial derivative of $\frac{\partial^2 \xi}{\partial \gamma \partial s_d}$ with respect to s_f and computing it with respect to ϑ_f are equivalent, since

$$\frac{\partial \vartheta_f}{\partial s_f} = \hat{\vartheta}_f.$$

Therefore,

$$\frac{\partial^3 \xi}{\partial \gamma \partial s_d \partial \vartheta_f} = \frac{\partial^3 \xi}{\partial \gamma \partial s_d \partial s_f} \cdot \frac{\partial s_f}{\partial \vartheta_f} = \frac{1}{\hat{\vartheta}_f} \frac{\partial^3 \xi}{\partial \gamma \partial s_d \partial s_f}.$$

By expanding Eq.(A.54), we have:

$$\frac{\partial^3 \xi}{\partial \gamma \partial s_d \partial s_f} \propto \frac{\partial}{\partial s_f} \left\{ \frac{-\psi(1-\psi)\,\hat{\vartheta}_d(\gamma)}{\left[\psi + (1-\psi)\left(\hat{\vartheta}_d(\gamma)s_d + \hat{\vartheta}_f(\gamma)s_f \right) \right]^2} \frac{\hat{\vartheta}'_d(\gamma)s_d + \hat{\vartheta}'_f(\gamma)s_f}{\hat{\vartheta}_d(\gamma)s_d + \hat{\vartheta}_f(\gamma)s_f} \right\}$$

$$+ \frac{\partial}{\partial s_f} \left\{ \frac{\psi}{\psi + (1-\psi)\left(\hat{\vartheta}_d(\gamma)s_d + \hat{\vartheta}_f(\gamma)s_f \right)} \frac{\hat{\vartheta}'_d(\gamma)\vartheta_f(\gamma) - \hat{\vartheta}_d(\gamma)\vartheta'_f(\gamma)}{\left[\hat{\vartheta}_d(\gamma)s_d + \hat{\vartheta}_f(\gamma)s_f \right]^2} \right\}$$
$$\tag{A.55}$$

According to the Chain Rule, the partial deviation of the first product term in the first term on the right-hand side of Eq.(A.55) will be:

$$\frac{\partial}{\partial s_f} \left\{ \frac{-\psi(1-\psi)\,\hat{\vartheta}_d(\gamma)}{\left[\psi + (1-\psi)\left(\hat{\vartheta}_d(\gamma)s_d + \hat{\vartheta}_f(\gamma)s_f \right) \right]^2} \right\} = \frac{2\psi(1-\psi)^2 \hat{\vartheta}_d(\gamma)\hat{\vartheta}_f(\gamma)}{\left[\psi + (1-\psi)\left(\hat{\vartheta}_d(\gamma)s_d + \hat{\vartheta}_f(\gamma)s_f \right) \right]^3}$$
$$\tag{A.56}$$

The partial deviation of the second product term in the first term on the right-hand side of Eq.(A.55) will be:

$$\frac{\partial}{\partial s_f} \left\{ \frac{\hat{\vartheta}'_d(\gamma)s_d + \hat{\vartheta}'_f(\gamma)s_f}{\hat{\vartheta}_d(\gamma)s_d + \hat{\vartheta}_f(\gamma)s_f} \right\} = \frac{\hat{\vartheta}'_f(\gamma)\vartheta - \vartheta'\hat{\vartheta}_f(\gamma)}{\left[\hat{\vartheta}_d(\gamma)s_d + \hat{\vartheta}_f(\gamma)s_f \right]^2} \tag{A.57}$$

The partial deviation of the first product term in the second term on the right-hand side of

Eq.(A.55) will be:

$$\frac{\partial}{\partial s_f}\left\{\frac{\psi}{\psi + (1-\psi)\left(\hat{\vartheta}_d(\gamma)s_d + \hat{\vartheta}_f(\gamma)s_f\right)}\right\} = -\frac{\psi(1-\psi)\hat{\vartheta}_f(\gamma)}{\left[\psi + (1-\psi)\left(\hat{\vartheta}_d(\gamma)s_d + \hat{\vartheta}_f(\gamma)s_f\right)\right]^2}$$

(A.58)

The partial deviation of the second product term in the second term on the right-hand side of Eq.(A.55) will be:

$$\frac{\partial}{\partial s_f}\left\{\frac{\hat{\vartheta}'_d(\gamma)\vartheta_f(\gamma) - \hat{\vartheta}_d(\gamma)\vartheta'_f(\gamma)}{\left[\hat{\vartheta}_d(\gamma)s_d + \hat{\vartheta}_f(\gamma)s_f\right]^2}\right\}$$

$$=\frac{\left[\hat{\vartheta}'_d(\gamma)\hat{\vartheta}_f(\gamma) - \hat{\vartheta}_d(\gamma)\hat{\vartheta}'_f(\gamma)\right]\vartheta^2 - \left[\hat{\vartheta}'_d(\gamma)\vartheta_f(\gamma) - \hat{\vartheta}_d(\gamma)\vartheta'_f(\gamma)\right]2\vartheta\hat{\vartheta}_f(\gamma)}{\left[\psi + (1-\psi)\left(\hat{\vartheta}_d(\gamma)s_d + \hat{\vartheta}_f(\gamma)s_f\right)\right]^4}$$

(A.59)

By combining Eq.(A.56), Eq.(A.57), Eq.(A.58) and Eq.(A.59), we have:

$$\frac{\partial}{\partial s_d \partial s_f}\left[-\frac{\kappa'(\gamma)}{\kappa(\gamma)} + \frac{\psi}{\psi + (1-\psi)\vartheta}\frac{\vartheta'(\gamma)}{\vartheta(\gamma)}\right]$$

$$=\frac{2\psi(1-\psi)^2\hat{\vartheta}_d\hat{\vartheta}_f}{\Delta^3}\frac{\vartheta'}{\vartheta} - \frac{\psi(1-\psi)\hat{\vartheta}_d}{\Delta^2}\frac{\hat{\vartheta}'_f\vartheta - \vartheta'\hat{\vartheta}_f}{\vartheta^2}$$

$$- \frac{\psi(1-\psi)\hat{\vartheta}_f}{\Delta^2}\frac{\hat{\vartheta}'_d\vartheta - \hat{\vartheta}_d\vartheta'}{\vartheta^2} + \frac{\psi}{\Delta}\frac{\left(\hat{\vartheta}'_d\hat{\vartheta}_f - \hat{\vartheta}_d\hat{\vartheta}'_f\right)\left(\hat{\vartheta}_d s_d - \hat{\vartheta}_f s_f\right)}{\vartheta^3}$$

(A.60)

where $\Delta = \psi + (1-\psi)(\hat{\vartheta}_d(\gamma)s_d + \hat{\vartheta}_f(\gamma)s_f)$.

By simplifying Eq.(A.60), we have:

$$\frac{\partial^3\xi}{\partial\gamma\partial s_d\partial s_f} \propto \frac{\psi}{\vartheta B}\left[\frac{2(1-\psi)^2\hat{\vartheta}_d\hat{\vartheta}_f\vartheta'}{B^2} + \left(\frac{1-\psi}{B\vartheta} + \frac{1}{\vartheta^2}\right)\left(\hat{\vartheta}'_d\hat{\vartheta}_f - \hat{\vartheta}_d\hat{\vartheta}'_f\right)\left(\hat{\vartheta}_d s_d - \hat{\vartheta}_f s_f\right)\right]$$

(A.61)

which can be further expressed as:

$$\frac{\partial^3\xi}{\partial\gamma\partial s_d\partial s_f} \propto \frac{\psi}{\vartheta B}\left[2\hat{\vartheta}_d\hat{\vartheta}_f\vartheta'\left(\frac{1}{\vartheta^2} + \frac{1-\psi}{\vartheta B} + \frac{(1-\psi)^2}{B^2}\right) - \left(\hat{\vartheta}_d\hat{\vartheta}'_f + \hat{\vartheta}'_d\hat{\vartheta}_f\right)\left(\frac{1}{\vartheta} + \frac{1-\psi}{B}\right)\right]$$

(A.62)

In fact, Eq.(A.62) tells us that when domestic financing channels are not readily accessible (i.e., $\hat{\vartheta}_d$ is relatively small), the right-hand side of Eq.(A.62) will be positive.[1]

---

[1]It can be proved that the boundary condition on $\hat{\vartheta}_d$ that makes the right-hand side of Eq. (A.62) positive is:

$$\begin{cases} \hat{\vartheta}_d < \dfrac{|\hat{\vartheta}'_d|\hat{\vartheta}_f\mathcal{A}}{2\hat{\vartheta}_f|\vartheta'|\mathcal{B} - |\hat{\vartheta}'_f|\mathcal{A}}, & \text{while } 2\hat{\vartheta}_f|\vartheta'|\mathcal{B} > |\hat{\vartheta}'_f|\mathcal{A} \\ \forall\hat{\vartheta}_d \in (0,1), & \text{while } 2\hat{\vartheta}_f|\vartheta'|\mathcal{B} \le |\hat{\vartheta}'_f|\mathcal{A} \end{cases}$$

(A.63)

where $\mathcal{A} = \frac{1}{\vartheta} + \frac{1-\psi}{\Delta}$, and $\mathcal{B} = \frac{1}{\vartheta^2} + \frac{1-\psi}{\vartheta\Delta} + \frac{(1-\psi)^2}{\Delta^2}$.

Consider the case in which accessible domestic funds are extremely limited, i.e., $\hat{\vartheta}_d$ approaches 0. In this situation, the first term inside the brackets on the right-hand side of Eq.(A.62) will also approach zero:

$$2\hat{\vartheta}_d\hat{\vartheta}_f\vartheta'\left(\frac{1}{\vartheta^2} + \frac{1-\psi}{\vartheta B} + \frac{(1-\psi)^2}{B^2}\right) \simeq 0 \tag{A.64}$$

for $\hat{\vartheta}_d \simeq 0$. The second term inside the brackets on the right-hand side of Eq.(A.62), however, will be positive:

$$\left(\hat{\vartheta}_d\hat{\vartheta}'_f + \hat{\vartheta}'_d\hat{\vartheta}_f\right)\left(\frac{1}{\vartheta} + \frac{1-\psi}{B}\right) > 0 \tag{A.65}$$

for $\hat{\vartheta}_d\hat{\vartheta}'_f \simeq 0$; while $\hat{\vartheta}'_d\hat{\vartheta}_f < 0$, since $\hat{\vartheta}'_d < 0$ and $\hat{\vartheta}_f > 0$).

Therefore,

$$\frac{\partial^3\xi}{\partial\gamma\partial s_d\partial s_f} > 0 \tag{A.66}$$

Appendix B   GVC Participation

B.1   Basic Structure of ICIO Table

Table B.1: OECD ICIO table

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

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 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:

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

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. $\hat{\boldsymbol{D}} = \left[\sum_{c'}^N \boldsymbol{D}_{1,c'}, \sum_{c'}^N \boldsymbol{D}_{2,c'} \ldots, \sum_{c'}^N \boldsymbol{D}_{N,c'}\right]^T$ denotes the aggregated final demand,

$\hat{D}^D = [D_{1,1}, D_{2,2}..., D_{N,N}]^T$ denotes domestic final demand, and $\hat{D}^F = \hat{D} - \hat{D}^D$ denotes inter-country final demand. Based on the Leontief inverse matrix, the total output X can be further expressed as:

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

Where, $L = (I - A^D)^{-1} = \begin{bmatrix} I - A_{1,1} & 0 & \cdots & 0 \\ 0 & I - A_{2,2} & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & I - A_{N,N} \end{bmatrix}^{-1}$ is the pure do-

mestic Leontief inverse matrix which takes only the domestic value chains into account, and $B =$

$(I - A)^{-1} = \begin{bmatrix} I - A_{1,1} & -A_{1,2} & \cdots & -A_{1,N} \\ -A_{2,1} & I - A_{2,2} & \cdots & -A_{2,N} \\ \vdots & \vdots & \ddots & \vdots \\ -A_{N,1} & -A_{N,2} & \cdots & I - A_{N,N} \end{bmatrix}^{-1}$ is the global matrix for the entire inter-

country value chain.

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

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

where $V_c = u_G(I - \sum_{c'}^N A_{c'c})$ 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, u_N is a $1 \times G$ unit vector. Worthy mentioning, for any given generic vector X with length n, namely, $X = [x_1, x_2, ..., x_n]$ or $X = [x_1, x_2, ..., x_n]^T$, the overbrace-formed $\overbrace{X}$ denotes its is its $n \times n$ diagonal form, namely, $\overbrace{X} = \begin{bmatrix} x_1 & 0 & \cdots & 0 \\ 0 & x_2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & x_n \end{bmatrix}$

B.2 Trade-related GVC participation

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

$$davaE_{cc'} = \overbrace{V_cL_{cc}} D_{cc'} + \overbrace{V_cL_{cc}} A_{cc'}L_{c'c'}D_{cc'} \tag{B.4}$$

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, $davaE$:

$$\begin{aligned} trGVC\_pf_{cc'} &= \overbrace{V_cL_{cc}} E_{cc'} - davaE_{cc'} \\ &= \overbrace{V_cL_{cc}} A_{cc'}L_{c'c'}\left(\sum_{i \neq c'}^N D_{c'i} + \sum_{i \neq c'}^N A_{c'i} \sum_j^N \sum_k^N B_{ij}D_{jk} \right) \end{aligned} \tag{B.5}$$

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

$$
\begin{aligned}
trGVC\_pb_{cc'} &= \sum_{i \neq c}^{N} \overbrace{u_N A_{ic} L_{cc}} (D_{cc'} + A_{cc'} L_{c'c'} D_{c'c'}) \\
&= \left(\sum_{t \neq c}^{N} \widehat{V_t B_{tc}} + \overbrace{V_c L_{cc} \sum_{i \neq c}^{N} A_{ci} B_{ic}} \right) (D_{cc'} + A_{cc'} L_{c'c'} D_{c'c'})
\end{aligned}
\tag{B.6}
$$

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:

$$
\begin{aligned}
trGVC\_ts_{cc'} &= \sum_{i \neq c}^{N} \overbrace{u_N A_{ic} L_{cc}} \left(A_{cc'} L_{c'c'} \sum_{i \neq c'}^{N} E_{c'i} \right) \\
&= \overbrace{V_c L_{cc} \sum_{i \neq c}^{N} A_{ci} B_{ic}} \left[A_{cc'} L_{c'c'} \sum_{i \neq c'}^{N} \left(D_{c'i} + A_{ci} \sum_{j}^{N} \sum_{k \neq c}^{N} B_{ij} D_{jk} \right) \right]
\end{aligned}
\tag{B.7}
$$

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:

$$
trGVC_{cc'} = trGVC\_pf_{cc'} + trGVC\_pb_{cc'} + trGVC\_ts_{cc'}
\tag{B.8}
$$

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:

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

where reE_c is the output of country c further re-exported, namely, $reE_c = X_c - L_{cc} D_{cc}$.

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:

$$
orGVC\_pb_c = \sum_{i}^{N} \left(\overbrace{V_i L_{ii} \sum_{j \neq i}^{N} A_{ij} B_{jc}} \sum_{k}^{N} D_{ck} \right) - \sum_{i \neq c}^{N} \overbrace{V_i L_{ii} A_{ic} L_{cc}} D_{cc}
\tag{B.10}
$$

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:

$$
orGVC\_ts_c = impGVC\_ts_c + domGVC\_ts_c
\tag{B.11}
$$

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):

$$\boldsymbol{impGVC\_ts_c} = \sum_i^N \left(\overbrace{\boldsymbol{V_i L_{ii}} \sum_{j \neq i}^N \boldsymbol{A_{ij} B_{jc}} \boldsymbol{X_c}} \right) - \sum_{i \neq c}^N \overbrace{\boldsymbol{V_i L_{ii} A_{ic} L_{cc}}} \boldsymbol{L_{cc} D_{cc}} - \boldsymbol{orGVC\_pb_c}$$

(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):

$$\boldsymbol{domGVC\_ts_c} = \overbrace{\boldsymbol{V_c L_{cc} A_{cc}}} \sum_{c' \neq c}^N (\boldsymbol{A_{cc'} reE_{c'}} + \boldsymbol{A_{cc} L_{cc} A_{cc'} reE_{c'}})$$

(B.13)

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

$$\boldsymbol{orGVC_c} = \boldsymbol{orGVC\_pf_c} + \boldsymbol{orGVC\_pb_c} + \boldsymbol{orGVC\_ts_c}$$

(B.14)

Appendix C Complexity in the bipartite network

C.1 Bipartite Network Framework

Before calculating complexity, constructing the bipartite network based on the 2-mode data with two dimensions is indispensable. Based on risk assessment data provided by ICRG, this article first applies Max-Min standardization to each item. And then, this article calculates the ratio of each country to the average in terms of risk assessment scores, for each item and year, as follows:

$$R_{ict} = \frac{A_{ict}}{\sum_c A_{ict}}$$

(C.1)

where A_{ict} denotes the risk assessment score of country c for item i in year t.

Within the the bipartite network, issues on "complicacy" can be divided into two dimensions, namely, discussing the complexity of two objects corresponding to the two types of vertexes (Sciarra et al., 2020; Tacchella et al., 2012). In the context of this article, the "complicacy" of countries can be interpreted as "value" a country gaining from geopolitical stability, and the "complicacy" of items can be seen as "value" of a item contributing to countries. As for a bipartite network consists of two type vertexes representing the countries and the items respectively, issues of complexity can be described by determining two properties — X_c and Y_p, which represent the complexity properties of counties and items, respectively. Quantifying complexity is just equal to solving the coupled equations below:

$$\begin{cases} X_c = f(Y_1, Y_2, \ldots, Y_t, M_{cp}) \\ Y_p = g(X_1, X_2, \ldots, X_c, M_{cp}) \end{cases}$$

(C.2)

The two functions in Eq.(C.2) allows one to recast the determination of X_c and Y_p as the solutions of an eigen-problem of a suitable transformation matrix $\boldsymbol{W}$.

$$\begin{cases} X_c = \frac{1}{\sqrt{\lambda}} \sum_p W_{cp} Y_p \\ Y_p = \frac{1}{\sqrt{\lambda}} \sum_c W_{cp} X_c \end{cases} \Leftrightarrow \begin{cases} X_c = \frac{1}{\lambda} \sum_p \sum_{c'} W_{cp} W_{c'p} X_{c'} = \frac{1}{\lambda} \sum_{c'} N_{cc'} X_{c'} \\ Y_p = \frac{1}{\lambda} \sum_c \sum_{p'} W_{cp} W_{cp'} Y_{p'} = \frac{1}{\lambda} \sum_{p'} G_{pp'} Y_{p'} \end{cases}$$

(C.3)

where, W_{cp} can be calculated from M_{cp} by some kind of algorithm; λ is eigenvalue. $N_{cc'} = (\boldsymbol{WW}^T)_{cc'}$ and $G_{pp'} = (\boldsymbol{W}^T\boldsymbol{W})_{pp'}$ are symmetrical square matrixes; thereinto, $\boldsymbol{N}$ and $\boldsymbol{G}$ can be explained as the proximity matrix of countries and items respectively.

C.2 Fitness and Complexity Algorithm

To obtain W_{cp}, the Fitness and Complexity algorithm recast Eq.(C.3) by determining two complexities — fitness F_c for countries, and complexity Q_p for technologies (Tacchella et al., 2012):

$$
\begin{cases} \widetilde{F}_c^{(n)} = \sum_p M_{cp} Q_p^{(n-1)}, & \forall c \\ \widetilde{Q}_p^{(n)} = \frac{1}{\sum_c M_{cp} \frac{1}{F_c^{(n-1)}}}, & \forall t \end{cases} \Leftrightarrow \begin{cases} F_c^{(n)} = \frac{\widetilde{F}_c^{(n)}}{\sum_c \widetilde{F}_c^{(n)}/C} \\ Q_p^{(n)} = \frac{\widetilde{Q}_p^{(n)}}{\sum_p \widetilde{Q}_p^{(n)}/P} \end{cases} \tag{C.4}
$$

and the initial conditions are: $\begin{cases} \widetilde{F}_c^{(0)} = 1, & \forall c \\ \widetilde{Q}_p^{(0)} = 1, & \forall p \end{cases}$.

In Eq.(C.4), the intermediations of fitness and complexity, $\widetilde{F}_c^{(n)}$ and $\widetilde{Q}_p^{(n)}$, are all standardized in each step, which make $\widetilde{F}_c^{(n)}$ and $\widetilde{Q}_p^{(n)}$ tend to be converged. Therefore, the equations in iterative form can be expressed as non-iterative form, by introducing rescaling factors $c_F = C/\sum_p Q_p s_p$ and $c_Q = \sum_p Q_p s_p / P$:

$$
\begin{cases} F_c = c_F \sum_p M_{cp} Q_p \\ Q_p = c_Q \frac{1}{\sum_c M_{cp} \frac{1}{F_c}} \end{cases} \tag{C.5}
$$

where s_p is the weight of technology vertex, namely $s_p = \sum_c M_{cp}$. In Eq.(C.5), Q_p is expressed as a non-linear function $f_{non-linear}(F_1, F_2, \ldots, F_c, M_{cp})$. Based on the Taylor Expansion (Sciarra et al., 2020), Eq.(C.5) can be approximatively expressed in a linear form:

$$
\begin{cases} F_c \simeq c_F \sum_p M_{cp} Q_p \\ Q_p \simeq \frac{c_Q}{(s'_p)^2} \sum_c \frac{M_{cp} F_c}{s_c^2} \end{cases} \tag{C.6}
$$

where s_c is the weight of country vertex, namely $s_c = \sum_p M_{cp}$ and $s'_p = \sum_c M_{cp}/s_c$.

Eq.(C.5) is a linear form of Eq.(C.2) based on the FC algorithm, let $\begin{cases} X_c = F_c/s_c \\ Y_p = Q_p/s_{p'} \end{cases}$, and $\boldsymbol{N/G}$ can be expressed as:

$$
\begin{cases} N_{cc'} = \frac{\sum_{c'} M_{cp} M_{c'p}}{(s'_p)^2 s_{c'} s_c} \\ G_{pp'} = \frac{\sum_{p'} M_{cp} M_{cp'}}{(s_p)^2 s_{p'} s_p} \end{cases} \tag{C.7}
$$

C.3 Matrix-Estimation Exercise

Because it is inevitable for the FC algorithm to generate ad hoc assumptions for their purpose of calculating the Eigenvector Centrality to some extent, which will make the results lack of effectiveness (Sciarra et al., 2018), conducting modification by the matrix-estimation exercise will be helpful. In terms of an adjacency matrix $\boldsymbol{A}$, the matrix estimator $\hat{A}_{ij}$ will depend on the centrality of vertex i and j, namely:

$$
\hat{A}_{ij}(s) = f(x_i, x_j) = \sum_{t=1}^{s} \gamma_t x_{i,t} x_{j,t} = \gamma_1 x_{i,1} x_{j,1} + \gamma_2 x_{i,2} x_{j,2} + \ldots + \gamma_s x_{i,s} x_{j,s} \tag{C.8}
$$

The same as OLS, $\hat{A}_{ij}$ can be estimated by minimizing its Squared Error (SE). Actually, SE be partitioned into SE_0 and SE_k; thereinto SE_0 is independent of x_k, and SE_k depending on x_k:

$$
SE = SE_0 + SE_k = \sum_i \sum_j (A_{ij} - \hat{A}_{ij})^2 = \sum_i \sum_j (A_{ij} - f(x_i, x_j))^2 \tag{C.9}
$$

Because of SE_0 being independent of x_k, minimizing SE just equal to minimizing SE_k, which means that the derivate of SE_k should be equal to 0, namely:

$$\frac{\partial SE}{\partial x_k} = \frac{\partial SE_k}{\partial x_k} = 0 \tag{C.10}$$

And based on the concept of unique contribution of commonality analysis, the unique contribution of the vertex k can be expressed as:

$$UC_k = R_N^2 - R_{N\setminus k}^2 == \frac{SE_{N\setminus k} - SE_N}{\sum_i \sum_j A_{ij}(1 - \frac{\sum_i \sum_j A_{ij}}{N^2})} \tag{C.11}$$

where R_N^2 denotes the goodness of the estimation $\hat{A}_{ij}$ by considering all centrality of vertexes, and $R_{N\setminus k}^2$ denotes that by excluding vertex k. Since invariance of TSS whether excluding vertex k or not, UC_k just depends on $\Delta SE = SE_{N\setminus k} - SE_N$:

$$\Delta SE(s) = -2\sum_{t=1}^{s} \gamma_t^2 x_{k,t}^2 \sum_i x_{i,t}^2 + 4\sum_{t=1}^{s} \gamma_t x_{k,t} \sum_i A_{ik} x_{i,t} + \left(\sum_{t=1}^{s} \gamma_t x_{k,t}^2\right)^2 \tag{C.12}$$

The unique contribution UC_k of vertex k can be expressed as:

$$UC_k(s) = 2\sum_{t=1}^{s} \gamma_t^2 x_{k,t}^2 + \left(\sum_{t=1}^{s} \gamma_t x_{k,t}^2\right)^2 \tag{C.13}$$

Unique contribution UC_k represents the importance of a vertex derived from rectification of eigenvector centrality.

Thus, based on combining the FC algorithm and the unique contribution in the matrix-estimation exercise with $s = 2$, indicators for measuring the complexity of countries and items can be constructed, namely, CCOMP for countries and PCOMP for items respectively:

$$\begin{cases} CCOMP_c = \left(\sum_{i=1}^{2} \lambda_i^N \left(v_{c,i}^N\right)^2\right)^2 + 2\sum_{i=1}^{2} \left(\lambda_i^N\right)^2 \left(v_{c,i}^N\right)^2 \\ PCOMP_p = \left(\sum_{i=1}^{2} \lambda_i^G \left(v_{p,i}^G\right)^2\right)^2 + 2\sum_{i=1}^{2} \left(\lambda_i^G\right)^2 \left(v_{p,i}^G\right)^2 \end{cases} \tag{C.14}$$

where λ_1^N/λ_2^N and λ_1^G/λ_2^G are the largest 2 eigenvalues of the modified proximity matrixes $\boldsymbol{N} = \begin{cases} N_{cc'} = \frac{\sum_{c'} M_{cp} M_{c'p}}{(s_p')^2 s_{c'} s_c}, & \forall c' \neq c \\ N_{cc'} = 0, & c' = c \end{cases}$ and $\boldsymbol{G} = \begin{cases} G_{pp'} = \frac{\sum_{p'} M_{cp} M_{cp'}}{(s_p)^2 s_{p'} s_p}, & \forall p' \neq p \\ G_{pp'} = 0, & p' = p \end{cases}$. $v_{c,1}^N/v_{c,2}^N$ and $v_{p,1}^G/v_{p,2}^G$ are the eigenvectors corresponding to λ_1^N/λ_2^N and λ_1^G/λ_2^G respectively.

Appendix D   Other Research Design Specification

D.1   Core Explanatory Variable

As mentioned in the main text, before constructing the geopolitical risk indicator based on the bipartite network, we select 6 indicators relevant to geopolitical risk from the ICRG dataset. The 6 related indicators are:

- Socioeconomic conditions. Risk of government actions constraint by socioeconomic pressure that may result in fueling social dissatisfaction, with lower ratings suggesting higher pressure.

- Investment profile. Risk of investment not disclosed by political assessment, with higher ratings suggesting a higher risk of concealment.

- External conflict. Risk of government undergoing foreign action, including non-violent pressure, e.g., diplomatic pressures, territorial disputes, etc., and violent pressure, e.g., cross-border conflicts, war, etc., with lower ratings indicating exposure to high external pressure.

- Military in politics. Risk of military-related government policies distorted for resettling external threats, e.g., increasing the armament budget at the expense of other budget allocations, with lower ratings indicating greater militarily participating in politics.

- Religious tensions. Risk of a single religious group seeking to politically exclude other religions from the social process, with lower ratings meaning such a group being aggressive to impose inappropriate policies through civil dissent to civil war.

- Ethnic tensions. Risk within a country attributable to tensions related to racial, nationality, or language divisions, with lower ratings meaning opposing groups being intolerant and unwilling to compromise.

It is worth noting that, according to the ICRG methodology, higher scores on each item indicate lower risk.

D.2 Control Variables

The abbreviations, names, and measurements of all control variables used in regressions, together with their descriptive statistics are provided here.

Table D.1: Abbreviations, names, and measurements of each variable.

Abbr.	Name	Measurements (used in regressions)
growth	GDP per capita growth	Annual growth of GDP per capita (in %/100)
hightech	High-tech exports	Share of medium and high-tech manufacturing value added to total manufactured exports (in %/100)
patent	Patent application	Number of patent applications per million people (in log form)
FDI	FDI net inflow	Share of foreign direct investment net inflows to GDP (in %/100)
GFCF	Gross fixed capital formation	Share of Gross fixed capital formation to GDP (in %/100)
government	Government consumption	Share of government final consumption expenditure to GDP (in %/100)
resource	Natural resource	Share of total natural resources rents to GDP (in %/100)
corruption	Corruption risk	Assessment of risk on some major scandal being revealed resulting in a fall or overthrow of government (in estimated point)
education	Education expenditure	Share of Government expenditure on education to GDP (in %/100)
employment	Employment rate	Participation rate of labor force participation to total population estimated by ILO (in %/100)

Abbr.	Name	Measurements (used in regressions)
enrollment	Advanced education enrollment	Proportion of people enrolled in tertiary education to total population of the right age (in %/100)
liquidity	Net international liquidity	Estimated months of imports can be financed with reserves, including official holdings of gold (in log + 1 form)

Table D.2: Descriptive statistics of each variable.

Statistic	N	Mean	St. Dev.	Min	Max	VIF
oGVC	988	8.248	1.223	5.270	10.959	
pb-oGVC	988	6.755	1.212	3.842	9.514	
pf-oGVC	988	6.790	1.215	4.004	9.500	
ts-oGVC	988	7.588	1.265	4.427	10.236	
geo-polit	1011	0.313	0.044	0.256	0.498	1.214
GDPg	982	0.027	0.036	-0.098	0.104	1.367
hightech	988	0.378	0.112	0.135	0.626	1.782
patent	965	3.984	1.980	-0.005	8.008	3.384
FDI	982	0.038	0.062	-0.044	0.375	1.088
GFCF	977	0.229	0.050	0.143	0.426	1.551
government	982	0.171	0.049	0.078	0.264	2.876
resource	982	0.038	0.066	0.000	0.393	1.536
corruption	1014	-0.424	1.013	-2.338	1.454	2.292
education	831	0.049	0.013	0.023	0.082	2.557
employment	988	0.615	0.058	0.480	0.774	1.243
enrollment	807	0.554	0.236	0.077	1.094	2.124
liquidity	972	0.709	0.296	0.158	1.482	1.867

D.3 Econometric Model

As mentioned in the main text, we employ the TWFE-OLS estimation as the baseline specification, for investigating the role of geopolitical risk on GVC participation. And we also investigate the moderating effect of internal and external forces by incorporating dual and triple interaction terms into the baseline model.

Here, we show the model specifications for each type of moderating variables. First, to investigate the role of financing convenience playing between geopolitical risk and GVC participation, this article constructs the following model to test the moderating effect:

$$
\begin{aligned}
GVC_{it} = & \alpha + \beta_1 geo\text{-}polit_{it} + \beta_2 fin\text{-}conve + \gamma geo\text{-}polit_{it} \times fin\text{-}conve_{it} \\
& + \sum_{k=1}^{K} \theta_k X_{k,it} + \lambda_t + \mu_i + \varepsilon_{it}
\end{aligned}
\tag{D.1}
$$

where $fin\text{-}conve$ denotes domestic financing convenience, which is the moderating variable; $geo\text{-}polit_{it} \times fin\text{-}conve_{it}$ denotes the interaction, which are the core explanatory variables. If expectations met, the coefficient γ of $geo\text{-}polit_{it} \times fin\text{-}conve_{it}$ will reflect the alleviating effect of financing convenience on geopolitical risk impeding GVC participation, meaning that it will be a significantly positive value, i.e., $\hat{\gamma} > 0$.

For further investigation, we consider estimating the following econometric model to examine the direct moderating effects of external forces on relationships between geopolitical risk and GVC participation:

$$GVC_{it} = \alpha + \beta_1 geo\text{-}polit_{it} + \beta_2 ext\text{-}force_{it} + \gamma geo\text{-}polit_{it} \times ext\text{-}force_{it}$$
$$+ \sum_{k=1}^{K} \theta_k X_{k,it} + \lambda_t + \mu_i + \varepsilon_{it} \tag{D.2}$$

and estimating the following econometric model to examine the indirect moderating effects, via the interaction between financing convenience and geopolitical risk:

$$GVC_{it} = \alpha + \beta_1 geo\text{-}polit_{it} + \beta_2 fin\text{-}conve + \beta_3 ext\text{-}force_{it}$$
$$+ \gamma_1 geo\text{-}polit_{it} \times fin\text{-}conve + \gamma_2 geo\text{-}polit_{it} \times ext\text{-}force_{it}$$
$$+ \gamma_3 fin\text{-}conve \times ext\text{-}force_{it} + \delta geo\text{-}polit_{it} \times fin\text{-}conve \times ext\text{-}force_{it} \tag{D.3}$$
$$+ \sum_{k=1}^{K} \theta_k X_{k,it} + \lambda_t + \mu_i + \varepsilon_{it}$$

where $ext\text{-}force_{it}$ denotes the external forces countries confronted with (this article will investigate two external forces — political alignment and media attention); $geo\text{-}polit_{it} \times ext\text{-}force_{it}$ and $geo\text{-}polit_{it} \times fin\text{-}conve_{it} \times ext\text{-}force_{it}$ denote the interactions of external forces with geopolitical risk and its interaction with financing convenience, which are used to investigate the direct and indirect moderating effect, respectively.

For testing whether there exists moderating effects with regard to external forces, we focus on the coefficients of dual and triple interactions of external forces, namely, γ in Eq.(D.2) and δ in Eq.(D.3). Thereinto, γ captures the direct moderation of external forces on the relationships between geopolitical risk and GVC participation; and δ represents the indirect moderation of external forces on the alleviating effect of financing convenience. If expectations met, we can obtain significant estimates of γ or δ that share the same sign — either positive or negative, i.e., $\hat{\gamma}, \hat{\delta} < 0$ or $\hat{\gamma}, \hat{\delta} > 0$.

Appendix E   Baseline Result and Robustness Check

E.1   Baseline Result

Table E.1: Results of robustness checks based on explained variable replacement.

| Variable | GVC participation | | | |
| | oGVC | pb-oGVC | pf-oGVC | ts-oGVC |
	(1)	(2)	(3)	(4)
geo-polit	-1.704***	-1.568***	-1.627***	-1.662***
	(0.238)	(0.240)	(0.259)	(0.258)
growth	0.283***	0.335***	0.271***	0.277***
	(0.054)	(0.054)	(0.058)	(0.058)
hightech	-0.142	-0.245*	-0.269*	-0.128
	(0.138)	(0.139)	(0.150)	(0.150)
patent	0.119***	0.064***	0.190***	0.110***
	(0.014)	(0.014)	(0.015)	(0.015)
FDI	0.079	0.084	0.135	0.052
	(0.093)	(0.094)	(0.101)	(0.101)
GFCF	1.807***	2.525***	1.076***	1.740***
	(0.241)	(0.243)	(0.262)	(0.261)
government	-2.028***	-1.048*	-2.952***	-2.014***
	(0.558)	(0.563)	(0.608)	(0.606)
resource	2.351***	1.313***	2.952***	1.871***
	(0.346)	(0.348)	(0.376)	(0.375)
corruption	0.040**	0.015	0.047**	0.051***
	(0.018)	(0.018)	(0.019)	(0.019)
education	3.436***	3.885***	2.841**	3.526***
	(1.104)	(1.112)	(1.201)	(1.197)
employment	-1.153***	-2.367***	0.235	-1.378***
	(0.369)	(0.372)	(0.402)	(0.400)
enrollment	0.513***	0.605***	0.408***	0.576***
	(0.081)	(0.081)	(0.088)	(0.087)
liquidity	0.079***	0.099***	0.041**	0.089***
	(0.017)	(0.017)	(0.019)	(0.018)
Observation	687	687	687	687
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
Adjusted R^2	0.496	0.499	0.495	0.445
F statistic	48.3***	48.9***	48.1***	39.5***
	[0.000]	[0.000]	[0.000]	[0.000]

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

E.2   Research Design for Robustness Check

The specific procedures for each robustness check are as follows:

- **Explained Variable Replacement.** As mentioned above, output-based GVC metrics are constructed by applying the method of tripartite decomposition to the entire sectoral outputs,

which were initially proposed for considering export activities in the GVC. Here, this article resets traditional trade-based GVC participation (tGVC), along with its 3 subsets — pure backward (pb_tGVC), pure forward (pf_tGVC), and two-sided (ts_tGVC) trade-based GVC metrics — as dependent variables, and conducts regressions.

- **Data Imputation.** The geo-polit indicator used in the baseline regression is constructed based on the combination of the bipartite network framework and the nonlinear FC algorithm. Given that the algorithm may be sensitive to missing values in the original multi-dimensional data, this article conducts data imputation on the raw data and reconstructs the geo-polit indicator based on the imputed dataset for further regressions.

- **Time-lag Effect.** Considering that the production and trade of intermediate goods often exhibit inertia, any changes in GVC participation caused by geopolitical risk should also present some continuity. Therefore, this article replaces the core explanatory variable geo-polit with its lagged values (including lagged 1, lagged 2 and pressures) to test for the delayed impact of geopolitical risk on GVC participation.

- **Additional Fixed Effects.** While the baseline regressions include year and country fixed effects to eliminate time-invariant and individual-invariant unobserved factors, multi-dimensional unobserved heterogeneity may still exist, e.g., the same risk might affect countries differently within the same period. To further control for residual bias, more stringent interactive fixed effects are introduced. Given that GVC formation and evolution tend to display regional patterns, the model incorporates additional year-region interactive fixed effects. Specifically, these include year–region (as defined by WDI) fixed effects and year–region (as defined by the UN) fixed effects.

- **Additional Control Variables.** Although the baseline regression already includes a variety of controls to reduce confounding bias, omitted variable bias may still be present. To indirectly assess the adequacy of baseline controls, this article introduces additional covariates: Current Account (CA)[2], Economic Freedom (EFW)[3], Human Development Index (HDI)[4], and law situation (law)[5]

- **PSM Procedure.** Considering the potential self-selection bias, systematic differences may exist among individuals ex ante, resulting in omitted confounding. Therefore, this article conducts Propensity Score Matching (PSM), followed by regressions based on the matched sample. Specifically, this article employs Caliper-Nearest Matching as the matching method, and the Generalized Linear Model (GLM) as the distance measurement.[6]

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[2]Measured by the share of current account balance in % of GDP.

[3]From the Index of Economic Freedom provided by The Heritage Foundation and The Wall Street Journal

[4]A summary measure of average achievement in key dimensions of human development, provided by the United Nations Development Programme (UNDP)

[5]Measured by the point estimate of the Rule of Law from the Worldwide Governance Indicators (WGI), which reflects the extent to which agents have confidence in and abide by societal rules.

[6]Propensity scores are calculated based on logit regression represented as follows:

$$\log \frac{P_r(high\_geo\text{-}polit_{it} = 1|\boldsymbol{X}_{it})}{1 - P_r(high\_geo\text{-}polit_{it} = 1|\boldsymbol{X}_{it})} = \alpha + \boldsymbol{\beta X}_{it} + \lambda_t + \mu_i \tag{E.1}$$

where $\boldsymbol{X}_{it}$ denotes covariates using for matching; λ_t and μ_i denote time and individual fixed effects respectively; and $high\_geo\text{-}polit_{it} = 1$ denotes whether the value of geo-polit of a certain individual is larger than the median value or not.

- **Period Adjustment.** The baseline sample covers the years 1995–2020. Given the long time span, major economic events during this period may introduce confounding factors, potentially biasing the regression results. Here, this article conducts three period adjustments: (a) samples prior to the year 2000 are removed, considering the impact of the 1997 Asian Financial Crisis on Southeast Asian countries, which play an important role in GVCs as fast-growing developing economies; (b) samples from 2008–2010 are removed, in light of the 2008 Global Financial Crisis and its afterrisk; (c) samples prior to 2015 are excluded, considering the launch of China's "Belt and Road" Initiative (BRI) and the establishment of the Asian Infrastructure Investment Bank (AIIB) in that year, which may have lowered geopolitical risk in participating countries.

- **Country Adjustment.** The baseline sample includes 77 countries from the ICIO database. Given the wide variation in industrial structures and development levels across countries, potential unobserved heterogeneity may lead to differing effects of geopolitical risk. Therefore, three country adjustments are implemented: (a) exclusion of countries experiencing continuous geopolitical conflicts during 1995–2020; (b) exclusion of countries that were prospective founding members or early participants in BRI and AIIB; (c) exclusion of countries whose geopolitical risk ranked in the top 20% during 1995–2020.

- **Placebo Test.** Finally, a placebo test is conducted for the core explanatory variable by performing 500 times of Bootstrap resampling. Each resampled geo-polit variable is used to re-estimate the regression, and a distribution of 500 point estimates is obtained.

E.3 Explained Variable Replacement

Table E.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	-1.872***	-1.441***	-1.979***	-1.526***
	(0.296)	(0.299)	(0.319)	(0.316)
growth	0.230***	0.240***	0.267***	0.210***
	(0.067)	(0.067)	(0.072)	(0.071)
hightech	0.111	0.148	-0.278	0.248
	(0.171)	(0.173)	(0.184)	(0.183)
patent	0.151***	0.117***	0.195***	0.157***
	(0.017)	(0.017)	(0.019)	(0.018)
FDI	0.160	0.114	0.177	0.019
	(0.116)	(0.117)	(0.125)	(0.124)
GFCF	0.968***	0.981***	0.817**	0.991***
	(0.299)	(0.302)	(0.322)	(0.320)
government	-4.159***	-2.947***	-4.389***	-3.052***
	(0.693)	(0.701)	(0.747)	(0.741)
resource	3.674***	2.760***	3.900***	3.473***
	(0.429)	(0.434)	(0.462)	(0.459)
corruption	0.030	0.042*	0.042*	0.067***
	(0.022)	(0.022)	(0.024)	(0.023)
education	4.254***	4.177***	3.539**	3.724**
	(1.371)	(1.386)	(1.476)	(1.465)
employment	-1.086**	-2.434***	0.327	-1.599***
	(0.458)	(0.464)	(0.494)	(0.490)
enrollment	0.648***	0.842***	0.405***	0.774***
	(0.100)	(0.101)	(0.108)	(0.107)
liquidity	0.070***	0.086***	0.056**	0.070***
	(0.021)	(0.021)	(0.023)	(0.023)
Observation	687	687	687	687
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
Adjusted R^2	0.457	0.423	0.438	0.426
F statistic	41.4***	36.3***	38.4***	36.6***
	[0.000]	[0.000]	[0.000]	[0.000]

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

E.4 Data Imputation

Table E.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: Predictive Mean Matching (PMM)

Variable	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
geo-polit	-1.492**	-2.417***	-1.546**	-1.154**
	(0.550)	(0.642)	(0.727)	(0.526)
growth	0.289***	0.338***	0.276***	0.283***
	(0.064)	(0.080)	(0.062)	(0.067)
hightech	-0.149	-0.206	-0.271*	-0.149
	(0.150)	(0.174)	(0.156)	(0.147)
patent	0.140***	0.088***	0.210***	0.129***
	(0.015)	(0.013)	(0.014)	(0.017)
FDI	-0.014	0.009	0.048	-0.042
	(0.103)	(0.108)	(0.088)	(0.113)
GFCF	1.722***	2.397***	0.989***	1.672***
	(0.178)	(0.167)	(0.279)	(0.204)
government	-1.669*	-0.568	-2.591***	-1.707*
	(0.821)	(0.919)	(0.681)	(0.900)
resource	2.480***	1.488***	3.082***	1.980***
	(0.438)	(0.388)	(0.530)	(0.382)
corruption	0.048**	0.026	0.055**	0.057**
	(0.020)	(0.016)	(0.023)	(0.025)
education	3.836***	4.262***	3.224***	3.914***
	(1.123)	(1.304)	(1.051)	(1.249)
employment	-1.212***	-2.422***	0.178	-1.435***
	(0.312)	(0.317)	(0.351)	(0.339)
enrollment	0.490***	0.569***	0.385***	0.558***
	(0.086)	(0.078)	(0.070)	(0.106)
liquidity	0.071**	0.101***	0.035	0.079***
	(0.026)	(0.028)	(0.026)	(0.026)
Observation	687	687	687	687
Adjusted R^2	0.459	0.477	0.467	0.410
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	91***	90***	196***	77.1***
	[0.000]	[0.000]	[0.000]	[0.000]

Panel B: Random Forest (RF)

Variable	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
geo-polit	-1.785***	-2.861***	-1.854**	-1.365**
	(0.630)	(0.729)	(0.823)	(0.605)
growth	0.287***	0.335***	0.274***	0.282***
	(0.063)	(0.079)	(0.062)	(0.067)
hightech	-0.144	-0.199	-0.265	-0.145
	(0.150)	(0.174)	(0.156)	(0.147)
patent	0.141***	0.089***	0.211***	0.130***
	(0.014)	(0.013)	(0.014)	(0.017)

	(1)	(2)	(3)	(4)
FDI	-0.015	0.007	0.046	-0.043
	(0.103)	(0.108)	(0.088)	(0.112)
GFCF	1.712***	2.383***	0.979***	1.665***
	(0.179)	(0.166)	(0.281)	(0.203)
government	-1.658*	-0.553	-2.579***	-1.700*
	(0.820)	(0.920)	(0.677)	(0.899)
resource	2.479***	1.486***	3.081***	1.979***
	(0.436)	(0.386)	(0.529)	(0.381)
corruption	0.048**	0.027*	0.056**	0.058**
	(0.019)	(0.016)	(0.023)	(0.025)
education	3.849***	4.284***	3.238***	3.924***
	(1.119)	(1.304)	(1.042)	(1.247)
employment	-1.210***	-2.419***	0.180	-1.434***
	(0.312)	(0.317)	(0.352)	(0.339)
enrollment	0.490***	0.570***	0.385***	0.558***
	(0.086)	(0.078)	(0.070)	(0.106)
liquidity	0.077***	0.111***	0.041	0.083***
	(0.027)	(0.029)	(0.028)	(0.028)
Observation	687	687	687	687
Adjusted R^2	0.459	0.479	0.468	0.411
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	89.8***	89.3***	198***	76.7***
	[0.000]	[0.000]	[0.000]	[0.000]

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

E.5 Time-lag Effect

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

	GVC participation			
Variable	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: ~ geo-polit (lagged 1)				
geo-polit (lagged 1)	-1.611***	-1.610***	-1.580***	-1.521***
	(0.291)	(0.290)	(0.364)	(0.284)
growth	0.261***	0.311***	0.252***	0.254***
	(0.054)	(0.075)	(0.056)	(0.058)
hightech	-0.166	-0.267	-0.300*	-0.144
	(0.155)	(0.186)	(0.151)	(0.155)
patent	0.116***	0.063***	0.190***	0.105***
	(0.012)	(0.012)	(0.012)	(0.014)
FDI	0.073	0.082	0.136	0.044
	(0.107)	(0.116)	(0.089)	(0.116)
GFCF	1.675***	2.495***	0.916**	1.571***
	(0.190)	(0.184)	(0.385)	(0.185)

	(1)	(2)	(3)	(4)
government	-2.381***	-1.098	-3.017***	-2.578***
	(0.732)	(0.770)	(0.714)	(0.818)
resource	2.309***	1.358***	2.977***	1.789***
	(0.484)	(0.458)	(0.614)	(0.411)
corruption	0.039**	0.018	0.046*	0.047**
	(0.017)	(0.018)	(0.024)	(0.018)
education	4.399***	4.570***	3.479**	4.720***
	(1.272)	(1.525)	(1.382)	(1.360)
employment	-1.320***	-2.526***	0.024	-1.517***
	(0.304)	(0.313)	(0.350)	(0.344)
enrollment	0.521***	0.613***	0.445***	0.578***
	(0.112)	(0.106)	(0.101)	(0.132)
liquidity	0.085***	0.105***	0.048***	0.093***
	(0.019)	(0.023)	(0.016)	(0.020)
Observation	662	662	662	662
Adjusted R^2	0.454	0.464	0.467	0.396
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	174***	150***	202***	119***
	[0.000]	[0.000]	[0.000]	[0.000]

Panel B: ~ geo-polit (lagged 2)

	(1)	(2)	(3)	(4)
geo-polit (lagged 2)	-1.116***	-1.111***	-1.080***	-1.041***
	(0.270)	(0.293)	(0.279)	(0.284)
growth	0.232***	0.272***	0.234***	0.225***
	(0.050)	(0.074)	(0.059)	(0.052)
hightech	-0.175	-0.261	-0.339**	-0.144
	(0.154)	(0.182)	(0.148)	(0.155)
patent	0.109***	0.059***	0.184***	0.094***
	(0.014)	(0.014)	(0.015)	(0.016)
FDI	0.057	0.058	0.121	0.034
	(0.101)	(0.110)	(0.080)	(0.112)
GFCF	1.692***	2.644***	0.762*	1.605***
	(0.249)	(0.241)	(0.426)	(0.247)
government	-2.651***	-1.201**	-3.213***	-2.952***
	(0.519)	(0.572)	(0.634)	(0.583)
resource	2.244***	1.319***	2.894***	1.721***
	(0.490)	(0.455)	(0.620)	(0.415)
corruption	0.036**	0.012	0.042*	0.045**
	(0.017)	(0.017)	(0.023)	(0.018)
education	4.833***	4.789***	3.617**	5.370***
	(1.184)	(1.379)	(1.408)	(1.371)
employment	-1.134***	-2.393***	0.319	-1.360***
	(0.294)	(0.355)	(0.294)	(0.335)
enrollment	0.478***	0.566***	0.401***	0.541***
	(0.107)	(0.103)	(0.096)	(0.130)
liquidity	0.091***	0.108***	0.054***	0.102***
	(0.020)	(0.024)	(0.017)	(0.021)
Observation	641	641	641	641

	(1)	(2)	(3)	(4)
Adjusted R^2	0.420	0.431	0.435	0.365
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	107***	121***	199***	86.6***
	[0.000]	[0.000]	[0.000]	[0.000]

Panel C: ~ geo-polit (lagged 3)

	(1)	(2)	(3)	(4)
geo-polit (lagged 3)	-0.953***	-0.886***	-0.969***	-0.865**
	(0.308)	(0.285)	(0.265)	(0.364)
growth	0.214***	0.242***	0.222***	0.210***
	(0.046)	(0.072)	(0.056)	(0.051)
hightech	-0.152	-0.229	-0.332**	-0.114
	(0.145)	(0.169)	(0.140)	(0.149)
patent	0.108***	0.059***	0.186***	0.091***
	(0.015)	(0.015)	(0.014)	(0.018)
FDI	0.033	0.031	0.096	0.013
	(0.101)	(0.109)	(0.077)	(0.112)
GFCF	1.654***	2.626***	0.659	1.585***
	(0.244)	(0.251)	(0.420)	(0.251)
government	-2.506***	-1.035*	-2.997***	-2.870***
	(0.570)	(0.568)	(0.720)	(0.613)
resource	2.309***	1.397***	2.950***	1.790***
	(0.487)	(0.444)	(0.614)	(0.412)
corruption	0.023	-0.004	0.032	0.033*
	(0.015)	(0.013)	(0.022)	(0.017)
education	5.174***	5.100***	3.723**	5.847***
	(1.058)	(1.309)	(1.324)	(1.307)
employment	-1.057***	-2.260***	0.355	-1.281***
	(0.278)	(0.313)	(0.284)	(0.336)
enrollment	0.465***	0.546***	0.394***	0.529***
	(0.107)	(0.102)	(0.097)	(0.131)
liquidity	0.090***	0.103***	0.055***	0.101***
	(0.022)	(0.029)	(0.019)	(0.023)
Observation	634	634	634	634
Adjusted R^2	0.418	0.425	0.440	0.361
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	98.6***	138***	218***	159***
	[0.000]	[0.000]	[0.000]	[0.000]

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

E.6 Additional Fixed Effect

Table E.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 effect				
geo-polit	-1.770***	-1.614***	-1.585***	-1.834***
	(0.324)	(0.317)	(0.389)	(0.326)
growth	0.192**	0.227**	0.183**	0.170*
	(0.089)	(0.109)	(0.083)	(0.095)
hightech	0.096	-0.015	-0.020	0.172
	(0.206)	(0.223)	(0.184)	(0.247)
patent	0.097***	0.037*	0.158***	0.093***
	(0.020)	(0.019)	(0.020)	(0.023)
FDI	0.084	0.093	0.088	0.087
	(0.135)	(0.140)	(0.116)	(0.143)
GFCF	2.191***	2.778***	1.347***	2.203***
	(0.324)	(0.234)	(0.438)	(0.364)
government	-2.496**	-1.420	-3.940***	-2.323**
	(0.946)	(1.137)	(0.764)	(1.121)
resource	2.289***	0.987	3.121***	1.723***
	(0.596)	(0.626)	(0.777)	(0.507)
corruption	0.060***	0.034	0.067**	0.071***
	(0.020)	(0.025)	(0.028)	(0.019)
education	2.648	3.324	2.534	2.504
	(2.172)	(2.424)	(1.835)	(2.369)
employment	-0.830*	-2.208***	0.623	-1.024**
	(0.424)	(0.394)	(0.550)	(0.436)
enrollment	0.441***	0.585***	0.357***	0.483***
	(0.137)	(0.113)	(0.127)	(0.163)
liquidity	0.112***	0.128***	0.059**	0.128***
	(0.022)	(0.026)	(0.022)	(0.022)
Observation	687	687	687	687
Adjusted R^2	0.450	0.474	0.426	0.408
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
Year-Region FEs	✓	✓	✓	✓
F statistic	115***	96.9***	72.7***	61.2***
	[0.000]	[0.000]	[0.000]	[0.000]
Panel B: Year-(UN-)Region fixed effect				
geo-polit	-1.320***	-1.042***	-1.344***	-1.274***
	(0.361)	(0.291)	(0.425)	(0.383)
growth	0.287**	0.413***	0.197	0.283**
	(0.107)	(0.128)	(0.117)	(0.122)
hightech	0.238*	0.142	0.052	0.302*
	(0.121)	(0.125)	(0.209)	(0.155)
patent	0.095***	0.046	0.179***	0.074**

	(1)	(2)	(3)	(4)
	(0.033)	(0.030)	(0.043)	(0.034)
FDI	0.136	0.086	0.148	0.130
	(0.125)	(0.126)	(0.119)	(0.127)
GFCF	2.126***	3.005***	1.249***	2.113***
	(0.367)	(0.418)	(0.389)	(0.394)
government	-1.446	1.036	-3.374***	-1.588
	(1.051)	(1.110)	(0.864)	(1.432)
resource	3.022***	2.059***	3.641***	2.356***
	(0.489)	(0.469)	(0.742)	(0.423)
corruption	0.080***	0.037	0.085**	0.099***
	(0.027)	(0.028)	(0.033)	(0.028)
education	-0.408	-0.976	0.157	-0.379
	(1.951)	(1.828)	(1.203)	(2.634)
employment	-1.276**	-2.734***	0.590	-1.645***
	(0.545)	(0.445)	(0.733)	(0.581)
enrollment	0.338**	0.370***	0.224	0.404**
	(0.139)	(0.099)	(0.142)	(0.169)
liquidity	0.042**	0.031	0.000	0.064***
	(0.019)	(0.019)	(0.029)	(0.021)
Observation	687	687	687	687
Adjusted R^2	0.445	0.489	0.430	0.388
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
Year-Region FEs	✓	✓	✓	✓
F statistic	19***	24.3***	9.44***	10***
	[0.000]	[0.000]	[0.000]	[0.000]

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

E.7 Additional Control Variable

Table E.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	-1.414***	-1.264***	-1.330***	-1.462***
	(0.345)	(0.348)	(0.379)	(0.352)
growth	0.244***	0.316***	0.212***	0.233***
	(0.057)	(0.081)	(0.051)	(0.063)
hightech	-0.188	-0.198	-0.366**	-0.141
	(0.132)	(0.148)	(0.143)	(0.139)
patent	0.091***	0.034**	0.162***	0.087***
	(0.015)	(0.014)	(0.015)	(0.017)
FDI	0.022	0.034	0.071	0.007
	(0.100)	(0.104)	(0.083)	(0.109)

	(1)	(2)	(3)	(4)
GFCF	1.698***	2.258***	1.057***	1.695***
	(0.158)	(0.181)	(0.264)	(0.168)
government	-0.115	0.678	-0.753	-0.235
	(0.626)	(0.648)	(0.670)	(0.756)
resource	2.459***	1.732***	3.005***	2.200***
	(0.419)	(0.441)	(0.556)	(0.416)
corruption	0.042***	0.023*	0.045***	0.051**
	(0.012)	(0.012)	(0.014)	(0.018)
education	2.932**	3.112**	2.296*	3.062**
	(1.107)	(1.243)	(1.139)	(1.236)
employment	-1.518***	-2.799***	-0.107	-1.657***
	(0.355)	(0.355)	(0.393)	(0.389)
enrollment	0.544***	0.634***	0.445***	0.600***
	(0.081)	(0.072)	(0.084)	(0.101)
liquidity	0.058***	0.074***	0.022	0.072***
	(0.017)	(0.022)	(0.014)	(0.019)
CA	0.014**	-0.005	0.026***	0.016**
	(0.006)	(0.007)	(0.006)	(0.007)
freedom	0.168***	0.177***	0.179***	0.154***
	(0.022)	(0.023)	(0.030)	(0.022)
Observation	675	675	675	675
Adjusted R^2	0.532	0.552	0.526	0.479
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	184***	270***	127***	118***
	[0.000]	[0.000]	[0.000]	[0.000]

Panel B: Set II

	(1)	(2)	(3)	(4)
geo-polit	-1.433***	-1.280***	-1.373***	-1.465***
	(0.346)	(0.349)	(0.393)	(0.348)
growth	0.243***	0.316***	0.217***	0.228***
	(0.056)	(0.081)	(0.053)	(0.061)
hightech	-0.143	-0.163	-0.328**	-0.093
	(0.128)	(0.142)	(0.148)	(0.133)
patent	0.091***	0.034**	0.168***	0.083***
	(0.016)	(0.015)	(0.017)	(0.017)
FDI	0.020	0.033	0.073	0.003
	(0.101)	(0.107)	(0.084)	(0.110)
GFCF	1.667***	2.234***	1.041***	1.655***
	(0.154)	(0.175)	(0.252)	(0.172)
government	-0.028	0.736	-0.877	-0.007
	(0.620)	(0.640)	(0.683)	(0.756)
resource	2.587***	1.831***	3.066***	2.370***
	(0.442)	(0.454)	(0.554)	(0.466)
corruption	0.040***	0.022*	0.043***	0.049**
	(0.013)	(0.012)	(0.014)	(0.018)
education	2.957**	3.147**	2.600**	2.895**
	(1.093)	(1.205)	(1.199)	(1.232)
employment	-1.196***	-2.547***	0.126	-1.284***

	(1)	(2)	(3)	(4)
	(0.383)	(0.386)	(0.442)	(0.405)
enrollment	0.515***	0.611***	0.423***	0.567***
	(0.082)	(0.076)	(0.089)	(0.098)
liquidity	0.049***	0.067***	0.025*	0.055***
	(0.017)	(0.023)	(0.014)	(0.018)
CA	0.012**	-0.007	0.024***	0.015**
	(0.006)	(0.007)	(0.006)	(0.006)
freedom	0.185***	0.189***	0.167***	0.190***
	(0.023)	(0.025)	(0.031)	(0.022)
HDI	-0.416	-0.337	-0.510	-0.338
	(0.355)	(0.360)	(0.322)	(0.393)
law	0.044***	0.031**	-0.024	0.089***
	(0.012)	(0.015)	(0.017)	(0.012)
Observation	675	675	675	675
Adjusted R^2	0.537	0.554	0.528	0.493
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	253***	382***	211***	309***
	[0.000]	[0.000]	[0.000]	[0.000]

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

E.8 PSM Procedure

Table E.7: Balance test result for PSM procedure.

Variable	Overall	Subsample		p value
		0	1	
(Observation)	328	164	164	
growth	0.755 (0.190)	0.745 (0.190)	0.765 (0.190)	[0.356]
hightech	0.393 (0.115)	0.389 (0.129)	0.397 (0.098)	[0.486]
patent	3.628 (1.964)	3.810 (2.035)	3.446 (1.879)	[0.093]
FDI	0.049 (0.103)	0.051 (0.085)	0.047 (0.119)	[0.713]
GFCF	0.232 (0.054)	0.228 (0.056)	0.237 (0.051)	[0.144]
government	0.158 (0.052)	0.159 (0.048)	0.158 (0.055)	[0.861]
resource	0.038 (0.059)	0.035 (0.041)	0.041 (0.073)	[0.336]
corruption	-0.305 (1.026)	-0.329 (1.022)	-0.280 (1.031)	[0.666]
education	0.046 (0.013)	0.046 (0.012)	0.046 (0.014)	[0.912]
employment	0.625 (0.056)	0.625 (0.052)	0.624 (0.059)	[0.809]
enrollment	0.484 (0.207)	0.505 (0.222)	0.462 (0.189)	[0.062]
liquidity	-0.273 (0.652)	-0.227 (0.626)	-0.319 (0.676)	[0.200]

Table E.8: Results of robustness check based on PSM procedure.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
geo-polit	-1.142**	-1.139	-1.109***	-0.922**
	(0.451)	(0.675)	(0.390)	(0.409)
growth	0.284**	0.386***	0.168	0.325**
	(0.104)	(0.104)	(0.109)	(0.119)
hightech	-0.072	-0.191	-0.053	-0.184
	(0.124)	(0.181)	(0.165)	(0.122)
patent	0.102***	0.062**	0.170***	0.083***
	(0.024)	(0.025)	(0.027)	(0.028)
FDI	-0.038	-0.058	0.077	-0.086
	(0.093)	(0.085)	(0.109)	(0.101)
GFCF	1.688***	2.596***	1.158**	1.426***
	(0.327)	(0.395)	(0.424)	(0.354)
government	-2.928***	-1.790**	-4.098***	-2.875***
	(0.758)	(0.768)	(0.840)	(0.982)
resource	2.578***	1.391**	3.404***	1.870***
	(0.526)	(0.562)	(0.588)	(0.527)
corruption	0.013	0.003	0.023	0.019
	(0.022)	(0.021)	(0.033)	(0.024)
education	3.643	5.017**	3.456	3.394
	(2.139)	(2.142)	(2.113)	(2.316)
employment	-1.285	-2.934***	0.138	-1.337
	(0.798)	(0.738)	(0.791)	(0.864)
enrollment	0.701***	0.848***	0.610**	0.756**
	(0.249)	(0.234)	(0.248)	(0.274)
liquidity	0.047	0.046	-0.011	0.069
	(0.045)	(0.054)	(0.040)	(0.048)
Observation	327	327	327	327
Adjusted R^2	0.436	0.466	0.462	0.347
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	22.4***	27.5***	35.1***	11***
	[0.000]	[0.000]	[0.000]	[0.000]

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

E.9   Period Adjustment

Table E.9: 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	-2.311**	-2.552**	-2.064**	-2.177*
	(0.994)	(1.099)	(0.741)	(1.065)
growth	0.227***	0.258***	0.274***	0.201***
	(0.056)	(0.078)	(0.070)	(0.058)
hightech	-0.242**	-0.341**	-0.371**	-0.181
	(0.115)	(0.127)	(0.153)	(0.125)
patent	0.093***	0.042**	0.187***	0.069***
	(0.018)	(0.016)	(0.021)	(0.020)
FDI	0.079	0.076	0.161*	0.049
	(0.103)	(0.113)	(0.087)	(0.107)
GFCF	1.443***	2.480***	0.129	1.548***
	(0.209)	(0.258)	(0.363)	(0.228)
government	-2.418***	-0.910	-3.837***	-2.129***
	(0.720)	(0.812)	(0.722)	(0.739)
resource	1.592***	0.890*	2.075***	1.177***
	(0.438)	(0.445)	(0.551)	(0.403)
corruption	0.026	0.002	0.015	0.049**
	(0.017)	(0.016)	(0.019)	(0.020)
education	4.023***	4.188**	4.620***	3.498**
	(1.324)	(1.686)	(1.162)	(1.511)
employment	-0.906***	-2.363***	0.319	-0.827**
	(0.315)	(0.395)	(0.298)	(0.357)
enrollment	0.379***	0.498***	0.360***	0.405***
	(0.116)	(0.113)	(0.094)	(0.140)
liquidity	0.086***	0.106***	0.054***	0.093***
	(0.022)	(0.026)	(0.018)	(0.025)
Observation	590	590	590	590
Adjusted R^2	0.301	0.362	0.347	0.238
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	55.2***	132***	184***	73***
	[0.000]	[0.000]	[0.000]	[0.000]
Panel B: Adjustment II				
geo-polit	-1.738***	-1.618***	-1.674***	-1.697***
	(0.310)	(0.332)	(0.349)	(0.309)
growth	0.290***	0.343***	0.282***	0.274***
	(0.070)	(0.092)	(0.070)	(0.071)
hightech	-0.202	-0.317	-0.293*	-0.212
	(0.154)	(0.186)	(0.166)	(0.154)
patent	0.116***	0.060***	0.189***	0.106***
	(0.012)	(0.011)	(0.012)	(0.014)

	(1)	(2)	(3)	(4)
FDI	0.067	0.081	0.131	0.035
	(0.111)	(0.119)	(0.095)	(0.120)
GFCF	1.780***	2.462***	1.077***	1.721***
	(0.211)	(0.166)	(0.308)	(0.240)
government	-2.348***	-1.533*	-3.100***	-2.365***
	(0.716)	(0.770)	(0.663)	(0.800)
resource	2.263***	1.132**	2.833***	1.788***
	(0.470)	(0.466)	(0.576)	(0.414)
corruption	0.049***	0.026	0.054**	0.062***
	(0.016)	(0.015)	(0.022)	(0.021)
education	3.562**	4.070**	2.452*	3.744**
	(1.346)	(1.470)	(1.186)	(1.495)
employment	-1.218***	-2.462***	0.242	-1.471***
	(0.350)	(0.354)	(0.381)	(0.381)
enrollment	0.556***	0.656***	0.466***	0.621***
	(0.107)	(0.094)	(0.097)	(0.128)
liquidity	0.083***	0.103***	0.042**	0.095***
	(0.019)	(0.023)	(0.017)	(0.020)
Observation	607	607	607	607
Adjusted R^2	0.504	0.508	0.504	0.456
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	164***	166***	242***	132***
	[0.000]	[0.000]	[0.000]	[0.000]

Panel C: Adjustment III

	(1)	(2)	(3)	(4)
geo-polit	-1.236***	-1.086***	-1.323***	-1.099***
	(0.246)	(0.241)	(0.302)	(0.250)
growth	0.271***	0.366***	0.188**	0.295***
	(0.071)	(0.084)	(0.078)	(0.071)
hightech	0.056	-0.039	0.021	-0.041
	(0.161)	(0.193)	(0.140)	(0.169)
patent	0.159***	0.097***	0.226***	0.155***
	(0.015)	(0.018)	(0.017)	(0.018)
FDI	0.034	0.030	0.084	-0.015
	(0.124)	(0.121)	(0.137)	(0.123)
GFCF	1.919***	2.690***	1.589***	1.628***
	(0.203)	(0.226)	(0.194)	(0.284)
government	-2.114**	-0.870	-3.312***	-2.171*
	(0.981)	(1.067)	(0.847)	(1.132)
resource	2.378***	1.281**	2.982***	1.838***
	(0.515)	(0.500)	(0.689)	(0.439)
corruption	0.015	-0.002	0.029	0.020
	(0.017)	(0.017)	(0.024)	(0.019)
education	3.373**	4.035**	3.179**	3.334**
	(1.418)	(1.491)	(1.459)	(1.530)
employment	-0.546	-1.891***	1.139**	-0.878
	(0.458)	(0.507)	(0.429)	(0.528)
enrollment	0.638***	0.818***	0.364***	0.717***

	(1)	(2)	(3)	(4)
	(0.113)	(0.117)	(0.101)	(0.133)
liquidity	0.056**	0.058*	0.027	0.069**
	(0.025)	(0.030)	(0.020)	(0.028)
Observation	483	483	483	483
Adjusted R^2	0.549	0.545	0.536	0.494
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	231***	301***	256***	119***
	[0.000]	[0.000]	[0.000]	[0.000]

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

E.10 Country Adjustment

Table E.10: Results of robustness check based on country adjustments.

	GVC participation			
Variable	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: Adjustment I				
geo-polit	-1.426***	-1.228***	-1.503***	-1.351***
	(0.254)	(0.276)	(0.248)	(0.270)
growth	0.390***	0.461***	0.323***	0.422***
	(0.058)	(0.077)	(0.062)	(0.067)
hightech	0.164	0.082	0.009	0.190
	(0.166)	(0.185)	(0.183)	(0.167)
patent	0.063***	0.038***	0.124***	0.048***
	(0.012)	(0.012)	(0.017)	(0.014)
FDI	0.061	0.042	0.110	0.057
	(0.093)	(0.102)	(0.082)	(0.100)
GFCF	1.367***	2.506***	0.499**	1.138***
	(0.229)	(0.313)	(0.225)	(0.269)
government	-0.211	1.848*	-1.706**	-0.326
	(0.953)	(1.041)	(0.736)	(1.216)
resource	3.068***	2.402***	3.401***	3.048***
	(0.319)	(0.323)	(0.495)	(0.307)
corruption	0.025	0.007	0.022	0.033**
	(0.015)	(0.014)	(0.023)	(0.016)
education	2.309	2.136	1.348	2.598
	(1.640)	(1.795)	(1.125)	(1.881)
employment	0.232	-1.241***	1.966***	-0.027
	(0.385)	(0.329)	(0.351)	(0.464)
enrollment	0.452***	0.633***	0.385***	0.476***
	(0.099)	(0.098)	(0.077)	(0.118)
liquidity	0.060***	0.067***	-0.003	0.082***
	(0.018)	(0.019)	(0.024)	(0.018)
Observation	506	506	506	506

	(1)	(2)	(3)	(4)
Adjusted R^2	0.352	0.459	0.396	0.291
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	46.9***	59.2***	35.9***	47.9***
	[0.000]	[0.000]	[0.000]	[0.000]

Panel B: Adjustment II

	(1)	(2)	(3)	(4)
geo-polit	-1.635***	-1.529***	-1.487***	-1.593***
	(0.257)	(0.262)	(0.237)	(0.291)
growth	0.307***	0.364***	0.296***	0.306***
	(0.082)	(0.096)	(0.074)	(0.091)
hightech	-0.024	-0.157	-0.120	-0.007
	(0.124)	(0.140)	(0.129)	(0.135)
patent	0.061***	0.026*	0.089***	0.068***
	(0.015)	(0.013)	(0.014)	(0.021)
FDI	0.084	0.079	0.145*	0.066
	(0.093)	(0.100)	(0.074)	(0.102)
GFCF	1.092***	2.142***	0.240	1.001***
	(0.290)	(0.277)	(0.373)	(0.336)
government	-2.736***	-1.539*	-3.292***	-2.870***
	(0.712)	(0.860)	(0.624)	(0.762)
resource	1.686***	0.506	2.798***	0.949*
	(0.511)	(0.506)	(0.598)	(0.466)
corruption	0.030	0.003	0.043*	0.034
	(0.021)	(0.019)	(0.025)	(0.025)
education	4.493***	4.220**	4.105***	4.380**
	(1.533)	(1.793)	(1.403)	(1.653)
employment	1.251***	-0.095	2.803***	1.058**
	(0.333)	(0.336)	(0.331)	(0.418)
enrollment	0.541***	0.626***	0.472***	0.589***
	(0.091)	(0.080)	(0.067)	(0.117)
liquidity	0.096***	0.124***	0.058***	0.107***
	(0.017)	(0.019)	(0.016)	(0.019)
Observation	571	571	571	571
Adjusted R^2	0.408	0.410	0.441	0.353
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	66.6***	45.9***	143***	35.8***
	[0.000]	[0.000]	[0.000]	[0.000]

Panel C: Adjustment III

	(1)	(2)	(3)	(4)
geo-polit	-2.087***	-2.032***	-2.061***	-2.048***
	(0.438)	(0.418)	(0.567)	(0.408)
growth	0.277***	0.296***	0.303***	0.257***
	(0.074)	(0.086)	(0.074)	(0.079)
hightech	-0.194	-0.196	-0.351**	-0.140
	(0.165)	(0.174)	(0.170)	(0.173)
patent	0.152***	0.096***	0.213***	0.153***
	(0.015)	(0.015)	(0.011)	(0.019)

	(1)	(2)	(3)	(4)
FDI	0.084	0.221	0.062	0.080
	(0.191)	(0.158)	(0.170)	(0.213)
GFCF	1.838***	2.510***	1.045**	1.879***
	(0.279)	(0.203)	(0.387)	(0.290)
government	-3.292***	-2.603***	-3.881***	-3.209***
	(0.827)	(0.892)	(0.829)	(0.888)
resource	1.374*	0.399	2.490***	0.973
	(0.677)	(0.626)	(0.827)	(0.677)
corruption	0.023	-0.007	0.037	0.029
	(0.019)	(0.017)	(0.026)	(0.022)
education	5.347***	5.300***	4.767***	5.327***
	(1.348)	(1.521)	(1.458)	(1.410)
employment	-0.083	-1.132***	0.970**	-0.176
	(0.380)	(0.319)	(0.438)	(0.453)
enrollment	0.430***	0.517***	0.353***	0.472***
	(0.089)	(0.089)	(0.071)	(0.111)
liquidity	0.113***	0.142***	0.082***	0.122***
	(0.017)	(0.019)	(0.014)	(0.019)
Observation	569	569	569	569
Adjusted R^2	0.533	0.542	0.523	0.493
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	117***	125***	234***	97***
	[0.000]	[0.000]	[0.000]	[0.000]

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

Appendix F   Endogeneity Handling

F.1   Two-Stage Least Square

Table F.1: Results of TSLS regressions.

Variable	First Stage	Second Stage			
		GVC participation			
	geo-polit	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)	(5)
Panel A: exposure as IV					
exposure	3.557***				
	(0.900)				
geo-polit (fitted)		-6.172***	-5.042***	-8.514***	-5.353***
		(1.793)	(1.792)	(2.362)	(1.562)
growth	-0.008	0.259***	0.316***	0.232***	0.257***
	(0.007)	(0.048)	(0.064)	(0.064)	(0.049)
hightech	0.042**	0.047	-0.098	0.022	0.028
	(0.016)	(0.175)	(0.214)	(0.198)	(0.158)

	(1)	(2)	(3)	(4)	(5)
patent	-0.008**	0.080***	0.034**	0.130***	0.078***
	(0.003)	(0.017)	(0.016)	(0.030)	(0.015)
FDI	0.059**	0.362	0.305	0.572**	0.286
	(0.026)	(0.215)	(0.207)	(0.266)	(0.195)
GFCF	0.041	1.843***	2.553***	1.131**	1.769***
	(0.058)	(0.318)	(0.226)	(0.506)	(0.300)
government	-0.099	-2.408***	-1.343*	-3.537***	-2.328***
	(0.089)	(0.604)	(0.771)	(0.549)	(0.717)
resource	-0.015	2.225***	1.215***	2.758***	1.767***
	(0.057)	(0.374)	(0.394)	(0.528)	(0.349)
corruption	0.000	0.037	0.013	0.043	0.049**
	(0.005)	(0.024)	(0.025)	(0.041)	(0.019)
education	-0.265	2.419	3.094*	1.273	2.686*
	(0.165)	(1.448)	(1.518)	(1.661)	(1.468)
employment	-0.029	-1.001**	-2.249***	0.468	-1.253***
	(0.041)	(0.405)	(0.390)	(0.517)	(0.416)
enrollment	0.008	0.518***	0.609***	0.416**	0.580***
	(0.016)	(0.136)	(0.111)	(0.167)	(0.146)
liquidity	0.010*	0.135***	0.143***	0.128**	0.135***
	(0.005)	(0.034)	(0.035)	(0.048)	(0.029)
Observation	687	687	687	687	687
Adjusted R^2	0.109	0.206	0.327	-0.088	0.260
Year FEs	✓	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓	✓
F statistic	19.1***	102***	99.5***	118***	87.8***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

Panel B: pressure as IV

	(1)	(2)	(3)	(4)	(5)
pressure	0.151**				
	(0.067)				
geo-polit (fitted)		-8.929**	-6.449	-7.783*	-9.693**
		(4.039)	(3.900)	(4.337)	(4.251)
growth	-0.006	0.243***	0.308***	0.237***	0.232***
	(0.007)	(0.055)	(0.065)	(0.066)	(0.054)
hightech	0.043**	0.163	-0.038	-0.009	0.211
	(0.016)	(0.247)	(0.252)	(0.228)	(0.256)
patent	-0.009**	0.056	0.022	0.137***	0.041
	(0.003)	(0.037)	(0.034)	(0.039)	(0.039)
FDI	0.065**	0.537	0.394	0.526	0.561
	(0.027)	(0.390)	(0.358)	(0.355)	(0.419)
GFCF	0.009	1.865***	2.564***	1.126**	1.804***
	(0.051)	(0.443)	(0.283)	(0.478)	(0.491)
government	-0.077	-2.642***	-1.463*	-3.475***	-2.696**
	(0.106)	(0.822)	(0.828)	(0.732)	(0.969)
resource	-0.040	2.147***	1.175**	2.779***	1.645***
	(0.057)	(0.486)	(0.473)	(0.578)	(0.535)
corruption	-0.001	0.035	0.012	0.043	0.046
	(0.006)	(0.038)	(0.032)	(0.038)	(0.038)
education	-0.229*	1.791	2.774	1.439	1.698

	(1)	(2)	(3)	(4)	(5)
	(0.120)	(1.565)	(1.630)	(1.499)	(1.706)
employment	0.024	-0.908	-2.201***	0.443	-1.106*
	(0.055)	(0.544)	(0.455)	(0.545)	(0.601)
enrollment	0.000	0.521***	0.611***	0.416**	0.585***
	(0.017)	(0.173)	(0.127)	(0.153)	(0.201)
liquidity	0.013**	0.169**	0.160**	0.118*	0.190**
	(0.006)	(0.065)	(0.060)	(0.064)	(0.070)
Observation	687	687	687	687	687
Adjusted R^2	0.076	-0.263	0.160	0.029	-0.432
Year FEs	✓	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓	✓
F statistic	8.64***	124***	74.8***	110***	111***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

$^*\ p < 0.1,\ ^{**}\ p < 0.05,\ ^{***}\ p < 0.01$

F.2 IV Diagnoses

Table F.2: Diagnoses for instrument variables.

	GVC participation			
Variable	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: exposure as IV				
Durbin–Wu–Hausman	14.686***	8.658***	30.184***	8.434***
(p value)	(0.000)	(0.003)	(0.000)	(0.004)
Anderson–Rubin F	11.847***	12.863***	15.496***	7.507***
(p value)	(0.001)	(0.000)	(0.000)	(0.006)
Bootstrap F	3.681*	3.661*	3.804*	3.467*
(p value)	(0.056)	(0.056)	(0.052)	(0.063)
Montiel-Olea–Pflueger effective F	4.393**	4.393**	4.393**	4.393**
(p value)	(0.036)	(0.036)	(0.036)	(0.036)
Conditional Likelihood Ratio	25.308***	16.613***	42.506***	16.191***
CLR confidence interval	[-8.659,-3.685]	[-7.356,-2.729]	[-11.679,-5.350]	[-7.835,-2.872]
H_0: relative OLS bias > 5% (p value)	(0.000)	(0.000)	(0.000)	(0.000)
H_0: relative OLS bias > 10% (p value)	(0.000)	(0.000)	(0.000)	(0.000)
H_0: relative OLS bias > 20% (p value)	(0.000)	(0.000)	(0.000)	(0.000)
Panel B: pressure as IV				
Durbin–Wu–Hausman	3.201*	1.434	1.958	3.363*
WH_p	(0.074)	(0.232)	(0.162)	(0.067)

	(1)	(2)	(3)	(4)
Anderson–Rubin F	7.846***	3.274*	3.550*	10.991***
AR_p	(0.005)	(0.071)	(0.060)	(0.001)
Bootstrap F	4.330**	4.468**	4.509**	4.410**
boot_p	(0.048)	(0.045)	(0.044)	(0.046)
Montiel-Olea–Pflueger effective F	5.369**	5.369**	5.369**	5.369**
MOP_p	(0.029)	(0.029)	(0.029)	(0.029)
Conditional Likelihood Ratio	4.513**	2.339	2.939*	4.589**
CLR confidence interval	[-15.216,-2.642]	[-12.519,-0.378]	[-14.534,-1.032]	[-16.310,-3.077]
H_0: relative OLS bias $>$ 5% (p value)	(0.035)	(0.130)	(0.089)	(0.034)
H_0: relative OLS bias $>$ 10% (p value)	(0.040)	(0.142)	(0.100)	(0.039)
H_0: relative OLS bias $>$ 20% (p value)	(0.049)	(0.160)	(0.115)	(0.048)

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

F.3 Research Design for Exclusion Restriction Test

As mentioned in the main text, we employ four exclusion restriction tests for two IVs, including:

- First, we include the IVs themselves directly as covariates in the second-stage regression[7] to test whether they exert any independent influence on the outcome variable other than through the endogenous regressor Acemoglu et al. (2001). A valid IV satisfying the exclusion restriction should have an insignificant coefficient; the essence of such an approach is similar to an "intermediary procedure".

- Second, we test the exclusion restriction by reconstructing the sample. Specifically, if the first-stage effect is theoretically absent in a given subsample (i.e., the IV should have no predictive power over the endogenous regressor), then the reduced-form regression[8] of the IV on the explained variable should also yield an insignificant coefficient Nunn and Wantchekon (2011). In our context, we restrict the sample to EU member states whose neighboring countries are also all within the EU (as the "EU sample"). Given the EU's high degree of political and economic integration (even approximating a political union), we argue that geopolitical risks are unlikely to be transmitted through exposure to neighboring conflicts within the EU; in other words, a political union should not exhibit internal geopolitical risks.

- Third, we exclude all control variables in the TSLS regressions and;

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[7]The econometric model can be expressed as:

$$GVC_{it} = \alpha + \beta geo\text{-}polit_{it} + +\gamma IV + \sum_{k=1}^{K} \theta_k X_{k,it} + \lambda_t + \mu_i + \varepsilon_{it} \tag{F.1}$$

[8]The econometric model can be expressed as:

$$GVC_{it} = \alpha + \beta IV + \sum_{k=1}^{K} \theta_k X_{k,it} + \lambda_t + \mu_i + \varepsilon_{it} \tag{F.2}$$

- Add additional control variables to assess whether omitted factors regarding the IV causality path might bias the results.

F.4 Intermediary Procedure

Table F.3: Results of exclusion restriction tests based on intermediary procedure.

| Variable | GVC participation | | | |
| | oGVC | pb-oGVC | pf-oGVC | ts-oGVC |
	(1)	(2)	(3)	(4)
Panel A: exposure as IV				
geo-polit	-1.792***	-1.658***	-1.656***	-1.756***
	(0.509)	(0.524)	(0.574)	(0.488)
growth	0.295***	0.349***	0.290***	0.290***
	(0.058)	(0.083)	(0.072)	(0.080)
hightech	-0.035	-0.168	-0.165	-0.019
	(0.245)	(0.244)	(0.257)	(0.246)
patent	0.123***	0.073**	0.206***	0.096**
	(0.040)	(0.035)	(0.047)	(0.039)
FDI	0.235	0.242	0.267	0.220
	(0.225)	(0.175)	(0.202)	(0.247)
GFCF	1.728***	2.466***	1.032**	1.598***
	(0.411)	(0.473)	(0.470)	(0.446)
government	-2.259**	-1.266	-3.316***	-2.085*
	(1.004)	(1.202)	(0.882)	(1.094)
resource	2.125**	1.056	2.764**	1.859
	(1.027)	(0.993)	(1.025)	(1.140)
corruption	0.031	0.008	0.040	0.037
	(0.024)	(0.023)	(0.028)	(0.026)
education	4.290	4.864*	4.223*	3.985
	(2.608)	(2.554)	(2.247)	(2.830)
employment	-1.385	-2.608***	0.087	-1.455*
	(0.811)	(0.793)	(0.946)	(0.846)
enrollment	0.449*	0.545***	0.342	0.521*
	(0.240)	(0.187)	(0.232)	(0.266)
liquidity	0.089**	0.111**	0.065**	0.092**
	(0.034)	(0.046)	(0.024)	(0.041)
exposure	-3.803	-6.250	-11.460	2.101
	(6.326)	(6.519)	(8.334)	(6.658)
Observation	687	687	687	687
Adjusted R^2	0.499	0.515	0.505	0.426
Year FEs	TRUE	TRUE	TRUE	TRUE
Country FEs	TRUE	TRUE	TRUE	TRUE
F statistic	40.5***	23.4***	17.1***	26.1***
	[0.000]	[0.000]	[0.000]	[0.000]
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

	(1)	(2)	(3)	(4)
Panel B: pressure as IV				
geo-polit	-1.805***	-1.703***	-1.744***	-1.711***
	(0.476)	(0.509)	(0.569)	(0.458)
growth	0.295***	0.345***	0.283***	0.295***
	(0.059)	(0.084)	(0.076)	(0.079)
hightech	-0.034	-0.164	-0.157	-0.024
	(0.251)	(0.249)	(0.259)	(0.252)
patent	0.121***	0.071*	0.201***	0.096**
	(0.039)	(0.035)	(0.047)	(0.038)
FDI	0.216	0.228	0.246	0.202
	(0.230)	(0.176)	(0.210)	(0.251)
GFCF	1.746***	2.496***	1.085**	1.589***
	(0.408)	(0.463)	(0.476)	(0.440)
government	-2.336**	-1.340	-3.440***	-2.127*
	(1.028)	(1.258)	(0.925)	(1.087)
resource	2.234**	1.132	2.885***	1.964*
	(1.006)	(0.983)	(1.026)	(1.100)
corruption	0.029	0.007	0.038	0.036
	(0.024)	(0.023)	(0.029)	(0.026)
education	4.221	4.753*	4.021*	4.019
	(2.552)	(2.577)	(2.309)	(2.684)
employment	-1.349	-2.615***	0.061	-1.368
	(0.818)	(0.778)	(0.972)	(0.857)
enrollment	0.467*	0.565***	0.378	0.526**
	(0.229)	(0.190)	(0.225)	(0.251)
liquidity	0.086**	0.107**	0.058**	0.093**
	(0.033)	(0.045)	(0.024)	(0.039)
pressure	-1.040	-0.610	-0.910	-1.190
	(1.608)	(1.241)	(1.774)	(1.655)
Observation	687	687	687	687
Adjusted R^2	0.501	0.514	0.503	0.429
Year FEs	TRUE	TRUE	TRUE	TRUE
Country FEs	TRUE	TRUE	TRUE	TRUE
F statistic	394***	35***	23.2***	24.9***
	[0.000]	[0.000]	[0.000]	[0.000]
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

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

F.5 EU Sample

Table F.4: Results of exclusion restriction tests based on EU sample.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: exposure as IV				
geo-polit	-	-	-	-
	-	-	-	-
growth	0.316	0.636	-0.040	0.329
	(0.267)	(0.391)	(0.248)	(0.259)
hightech	-0.427	-0.058	-0.365	-0.537
	(0.321)	(0.435)	(0.330)	(0.324)
patent	-0.089	-0.151	-0.014	-0.098
	(0.046)	(0.063)	(0.039)	(0.052)
FDI	-0.009	0.034	-0.043	-0.010
	(0.042)	(0.062)	(0.044)	(0.041)
GFCF	0.007	-0.892	-0.165	0.354
	(1.033)	(1.610)	(1.223)	(0.753)
government	-0.115	0.532	1.677	-1.133
	(1.483)	(2.225)	(1.816)	(1.193)
resource	-11.852**	-12.233*	-3.421	-14.651***
	(1.957)	(3.968)	(4.873)	(1.359)
corruption	0.094	0.059	0.012	0.134*
	(0.037)	(0.055)	(0.046)	(0.032)
education	-4.548	-3.170	-4.015	-5.368
	(2.146)	(3.267)	(1.842)	(2.213)
employment	-2.134	-1.951	-0.635	-2.909
	(1.511)	(2.288)	(1.828)	(1.189)
enrollment	0.604**	0.579	0.604	0.695**
	(0.130)	(0.220)	(0.217)	(0.132)
liquidity	-0.041	0.019	0.111	-0.095
	(0.113)	(0.140)	(0.105)	(0.120)
Observation	54	54	54	54
Adjusted R^2	0.817	0.745	0.659	0.880
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	24.7***	304***	9.8***	309***
	[0.000]	[0.000]	[0.000]	[0.000]
Panel B: pressure as IV				
pressure	-1.522	-2.940	-0.633	-1.749
	(1.239)	(1.630)	(1.408)	(1.126)
growth	0.375	0.750	-0.015	0.397
	(0.251)	(0.366)	(0.261)	(0.236)
hightech	-0.384	0.026	-0.347	-0.487
	(0.248)	(0.307)	(0.267)	(0.259)
patent	-0.067	-0.109	-0.005	-0.073
	(0.048)	(0.051)	(0.058)	(0.053)

	(1)	(2)	(3)	(4)
FDI	-0.006	0.040	-0.042	-0.007
	(0.033)	(0.045)	(0.038)	(0.033)
GFCF	0.480	0.021	0.031	0.897
	(1.331)	(2.030)	(1.610)	(0.973)
government	-0.919	-1.020	1.343	-2.056
	(1.472)	(2.437)	(1.872)	(1.187)
resource	-10.659*	-9.927	-2.925	-13.280**
	(3.156)	(5.847)	(5.616)	(1.920)
corruption	0.114	0.098	0.020	0.157**
	(0.043)	(0.059)	(0.062)	(0.033)
education	-4.097	-2.298	-3.828	-4.850
	(1.857)	(2.644)	(1.837)	(2.003)
employment	-2.242	-2.160	-0.680	-3.033
	(1.586)	(2.370)	(1.937)	(1.225)
enrollment	0.487**	0.355	0.555*	0.561**
	(0.112)	(0.203)	(0.187)	(0.120)
liquidity	-0.083	-0.063	0.093	-0.144
	(0.114)	(0.121)	(0.132)	(0.115)
Observation	54	54	54	54
Adjusted R^2	0.818	0.760	0.638	0.886
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	94.9***	7.41***	9.07***	225***
	[0.000]	[0.000]	[0.000]	[0.000]

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

F.6 Without Control Variables

Table F.5: Results of exclusion restriction tests based on excluding all control variables.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: exposure as IV				
geo-polit (fitted)	-9.115**	-8.424**	-10.835***	-8.335**
	(3.436)	(3.308)	(3.860)	(3.202)
Observation	687	687	687	687
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
Panel B: pressure as IV				
geo-polit (fitted)	-6.198*	-7.894**	-1.077	-8.655***
	(3.624)	(3.693)	(6.580)	(2.778)
Observation	687	687	687	687
Year FEs	✓	✓	✓	✓

	(1)	(2)	(3)	(4)
Country FEs	✓	✓	✓	✓

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

F.7   Additional Control Variables

Table F.6: Results of exclusion restriction tests based on including additional control variables.

	GVC participation			
Variable	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: exposure as IV				
geo-polit (fitted)	-5.108***	-3.836***	-6.994***	-4.545***
	(1.338)	(1.291)	(1.956)	(1.140)
growth	0.144***	0.209***	0.120**	0.130**
	(0.047)	(0.065)	(0.058)	(0.051)
hightech	-0.059	-0.171	-0.164	-0.055
	(0.156)	(0.176)	(0.163)	(0.152)
patent	0.112***	0.058***	0.173***	0.107***
	(0.014)	(0.013)	(0.020)	(0.015)
FDI	0.367*	0.296	0.545**	0.304
	(0.197)	(0.179)	(0.255)	(0.182)
GFCF	1.856***	2.313***	1.327***	1.794***
	(0.308)	(0.229)	(0.392)	(0.350)
government	-1.735**	-0.650	-2.761***	-1.742**
	(0.642)	(0.770)	(0.641)	(0.802)
resource	2.380***	1.799***	2.552***	1.933***
	(0.352)	(0.375)	(0.546)	(0.306)
corruption	0.020	0.009	0.016	0.033
	(0.024)	(0.024)	(0.032)	(0.024)
education	3.609**	4.266***	2.620*	3.842**
	(1.370)	(1.418)	(1.426)	(1.477)
employment	-0.563	-1.712***	0.501	-0.601
	(0.406)	(0.369)	(0.557)	(0.413)
enrollment	0.502***	0.597***	0.406**	0.551***
	(0.127)	(0.101)	(0.166)	(0.138)
liquidity	0.106**	0.098**	0.112**	0.103***
	(0.038)	(0.040)	(0.050)	(0.034)
CA	0.018**	-0.004	0.034***	0.019**
	(0.008)	(0.008)	(0.008)	(0.008)
TFP	0.835***	0.968***	0.797***	0.838***
	(0.161)	(0.150)	(0.186)	(0.189)
law_order	0.018	0.007	-0.047**	0.062***
	(0.012)	(0.012)	(0.021)	(0.012)
governance	-0.100	-0.016	-0.197*	-0.078
	(0.064)	(0.060)	(0.101)	(0.055)
Observation	653	653	653	653

	(1)	(2)	(3)	(4)
Adjusted R^2	0.389	0.501	0.204	0.393
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	1020***	458***	133***	609***
	[0.000]	[0.000]	[0.000]	[0.000]

Panel B: pressure as IV

	(1)	(2)	(3)	(4)
geo-polit (fitted)	-10.367**	-8.599*	-9.884*	-10.576**
	(4.738)	(4.360)	(4.973)	(4.849)
growth	0.131***	0.197***	0.113*	0.115***
	(0.045)	(0.052)	(0.066)	(0.041)
hightech	0.121	-0.008	-0.065	0.151
	(0.275)	(0.268)	(0.254)	(0.274)
patent	0.082**	0.031	0.157***	0.073**
	(0.032)	(0.028)	(0.033)	(0.034)
FDI	0.789	0.678	0.776	0.787
	(0.541)	(0.486)	(0.520)	(0.559)
GFCF	1.920***	2.371***	1.362**	1.868***
	(0.578)	(0.450)	(0.545)	(0.644)
government	-2.402*	-1.254	-3.127**	-2.507*
	(1.167)	(1.201)	(1.153)	(1.257)
resource	1.810**	1.282	2.239**	1.279
	(0.844)	(0.818)	(0.966)	(0.874)
corruption	-0.001	-0.011	0.004	0.008
	(0.052)	(0.049)	(0.050)	(0.052)
education	2.597	3.350*	2.064	2.681
	(1.707)	(1.730)	(1.442)	(1.916)
employment	-0.730	-1.863***	0.409	-0.793
	(0.613)	(0.553)	(0.652)	(0.640)
enrollment	0.498**	0.594***	0.404*	0.547**
	(0.205)	(0.170)	(0.213)	(0.220)
liquidity	0.184*	0.168*	0.155	0.192*
	(0.094)	(0.088)	(0.091)	(0.098)
CA	0.028**	0.005	0.040***	0.031**
	(0.013)	(0.012)	(0.012)	(0.014)
TFP	0.843***	0.976***	0.802***	0.848***
	(0.213)	(0.191)	(0.226)	(0.230)
law_order	0.029	0.016	-0.041	0.074***
	(0.022)	(0.017)	(0.028)	(0.022)
governance	-0.257	-0.159	-0.283*	-0.259
	(0.161)	(0.147)	(0.161)	(0.168)
Observation	653	653	653	653
Adjusted R^2	-0.526	-0.140	-0.282	-0.560
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
F statistic	221***	447***	74.5***	162***
	[0.000]	[0.000]	[0.000]	[0.000]

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

F.8 Nagar Bias-corrected TSLS

Table F.7: Results of Nagar bias-corrected TSLS regressions.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: exposure as IV				
geo-polit	-6.012***	-4.918***	-8.267***	-5.221***
	(1.596)	(1.601)	(2.089)	(1.397)
growth	0.259***	0.317***	0.234***	0.257***
	(0.047)	(0.062)	(0.061)	(0.048)
hightech	0.040	-0.103	0.012	0.022
	(0.167)	(0.204)	(0.188)	(0.151)
patent	0.082***	0.035**	0.132***	0.079***
	(0.016)	(0.014)	(0.027)	(0.014)
FDI	0.352*	0.297	0.556**	0.277
	(0.201)	(0.194)	(0.247)	(0.183)
GFCF	1.841***	2.552***	1.129**	1.768***
	(0.303)	(0.215)	(0.482)	(0.287)
government	-2.394***	-1.333*	-3.516***	-2.316***
	(0.583)	(0.744)	(0.521)	(0.695)
resource	2.229***	1.218***	2.765***	1.771***
	(0.363)	(0.382)	(0.510)	(0.339)
corruption	0.037	0.013	0.043	0.049**
	(0.023)	(0.023)	(0.039)	(0.018)
education	2.455*	3.123**	1.329	2.716*
	(1.402)	(1.477)	(1.588)	(1.427)
employment	-1.007**	-2.253***	0.460	-1.257***
	(0.390)	(0.376)	(0.495)	(0.401)
enrollment	0.518***	0.609***	0.416**	0.580***
	(0.131)	(0.107)	(0.158)	(0.140)
liquidity	0.133***	0.141***	0.125**	0.134***
	(0.032)	(0.032)	(0.045)	(0.027)
Observation	687	687	687	687
k class	0.999	0.999	0.999	0.999
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
Panel B: pressure as IV				
geo-polit	-6.784***	-5.000**	-5.956***	-7.309***
	(1.798)	(1.829)	(2.088)	(1.807)
growth	0.255***	0.316***	0.247***	0.246***
	(0.047)	(0.063)	(0.057)	(0.045)
hightech	0.073	-0.100	-0.086	0.110
	(0.174)	(0.193)	(0.163)	(0.177)
patent	0.075***	0.035**	0.152***	0.061***
	(0.017)	(0.016)	(0.020)	(0.018)

	(1)	(2)	(3)	(4)
FDI	0.401*	0.302	0.410**	0.410
	(0.226)	(0.216)	(0.198)	(0.240)
GFCF	1.848***	2.553***	1.111***	1.785***
	(0.335)	(0.217)	(0.396)	(0.372)
government	-2.460***	-1.340*	-3.319***	-2.494***
	(0.608)	(0.709)	(0.522)	(0.735)
resource	2.208***	1.216***	2.830***	1.712***
	(0.396)	(0.406)	(0.509)	(0.406)
corruption	0.037	0.013	0.044	0.047*
	(0.027)	(0.024)	(0.029)	(0.026)
education	2.279	3.104**	1.855	2.240
	(1.343)	(1.459)	(1.232)	(1.465)
employment	-0.981**	-2.251***	0.381	-1.187**
	(0.432)	(0.379)	(0.441)	(0.483)
enrollment	0.519***	0.609***	0.414***	0.583***
	(0.139)	(0.108)	(0.124)	(0.164)
liquidity	0.142***	0.142***	0.096**	0.160***
	(0.034)	(0.034)	(0.034)	(0.037)
Observation	687	687	687	687
k class	0.999	0.999	0.999	0.999
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

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

F.9 Donald-Newey Bias-corrected TSLS

Table F.8: Results of Donald-Newey bias-corrected TSLS regressions.

	GVC participation			
Variable	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: exposure as IV				
geo-polit	-6.012***	-4.918***	-8.268***	-5.221***
	(1.596)	(1.602)	(2.089)	(1.397)
growth	0.259***	0.317***	0.234***	0.257***
	(0.047)	(0.062)	(0.061)	(0.048)
hightech	0.040	-0.103	0.012	0.022
	(0.167)	(0.204)	(0.188)	(0.151)
patent	0.082***	0.035**	0.132***	0.079***
	(0.016)	(0.014)	(0.027)	(0.014)
FDI	0.352*	0.297	0.556**	0.277
	(0.201)	(0.194)	(0.247)	(0.183)
GFCF	1.841***	2.552***	1.129**	1.768***
	(0.303)	(0.215)	(0.482)	(0.287)
government	-2.394***	-1.333*	-3.516***	-2.316***
	(0.583)	(0.744)	(0.521)	(0.695)

	(1)	(2)	(3)	(4)
resource	2.229***	1.218***	2.765***	1.771***
	(0.363)	(0.382)	(0.510)	(0.339)
corruption	0.037	0.013	0.043	0.049**
	(0.023)	(0.023)	(0.039)	(0.018)
education	2.455*	3.123**	1.329	2.716*
	(1.402)	(1.477)	(1.588)	(1.427)
employment	-1.007**	-2.253***	0.460	-1.257***
	(0.390)	(0.376)	(0.495)	(0.401)
enrollment	0.518***	0.609***	0.416**	0.580***
	(0.131)	(0.107)	(0.158)	(0.140)
liquidity	0.133***	0.141***	0.125**	0.134***
	(0.032)	(0.032)	(0.045)	(0.027)
Observation	687	687	687	687
k class	0.999	0.999	0.999	0.999
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

Panel B: pressure as IV

	(1)	(2)	(3)	(4)
geo-polit	-6.787***	-5.001**	-5.958***	-7.312***
	(1.799)	(1.831)	(2.090)	(1.809)
growth	0.255***	0.316***	0.247***	0.246***
	(0.047)	(0.063)	(0.057)	(0.045)
hightech	0.073	-0.100	-0.086	0.110
	(0.174)	(0.193)	(0.163)	(0.177)
patent	0.075***	0.035**	0.152***	0.061***
	(0.017)	(0.016)	(0.020)	(0.018)
FDI	0.401*	0.302	0.410**	0.410
	(0.226)	(0.216)	(0.198)	(0.241)
GFCF	1.848***	2.553***	1.111***	1.785***
	(0.335)	(0.217)	(0.396)	(0.372)
government	-2.460***	-1.340*	-3.320***	-2.494***
	(0.608)	(0.709)	(0.522)	(0.735)
resource	2.208***	1.216***	2.830***	1.712***
	(0.396)	(0.406)	(0.509)	(0.407)
corruption	0.037	0.013	0.044	0.047*
	(0.027)	(0.024)	(0.029)	(0.026)
education	2.279	3.104**	1.855	2.240
	(1.343)	(1.459)	(1.232)	(1.465)
employment	-0.981**	-2.250***	0.381	-1.187**
	(0.432)	(0.379)	(0.441)	(0.483)
enrollment	0.519***	0.609***	0.414***	0.583***
	(0.139)	(0.108)	(0.124)	(0.164)
liquidity	0.142***	0.142***	0.096**	0.160***
	(0.034)	(0.034)	(0.034)	(0.037)
Observation	687	687	687	687
k class	0.999	0.999	0.999	0.999
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

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

F.10 Fuller-k Estimation

Table F.9: Results of Fuller-k Estimation.

| Variable | GVC participation | | | |
| | oGVC | pb-oGVC | pf-oGVC | ts-oGVC |
	(1)	(2)	(3)	(4)
Panel A: exposure as IV				
geo-polit	-5.993***	-4.903***	-8.238***	-5.205***
	(1.595)	(1.601)	(2.086)	(1.397)
growth	0.260***	0.317***	0.234***	0.257***
	(0.045)	(0.061)	(0.059)	(0.047)
hightech	0.039	-0.104	0.010	0.021
	(0.162)	(0.199)	(0.182)	(0.147)
patent	0.082***	0.035**	0.133***	0.079***
	(0.016)	(0.014)	(0.027)	(0.014)
FDI	0.351*	0.296	0.554**	0.276
	(0.196)	(0.189)	(0.241)	(0.179)
GFCF	1.841***	2.552***	1.129**	1.768***
	(0.293)	(0.208)	(0.467)	(0.278)
government	-2.392***	-1.331*	-3.513***	-2.315***
	(0.568)	(0.725)	(0.505)	(0.677)
resource	2.230***	1.219***	2.766***	1.771***
	(0.353)	(0.371)	(0.494)	(0.329)
corruption	0.037*	0.013	0.043	0.049***
	(0.022)	(0.023)	(0.038)	(0.017)
education	2.459*	3.126**	1.336	2.719**
	(1.362)	(1.433)	(1.546)	(1.385)
employment	-1.008***	-2.254***	0.459	-1.258***
	(0.378)	(0.365)	(0.479)	(0.389)
enrollment	0.518***	0.609***	0.416***	0.580***
	(0.127)	(0.104)	(0.153)	(0.136)
liquidity	0.133***	0.141***	0.124***	0.133***
	(0.031)	(0.032)	(0.044)	(0.026)
Observation	687	687	687	687
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
Kappa	0.998	0.998	0.998	0.998
Panel B: pressure as IV				
geo-polit	-6.606***	-4.879**	-5.804**	-7.111***
	(2.385)	(2.434)	(2.785)	(2.388)
growth	0.256***	0.317***	0.248***	0.247***
	(0.047)	(0.063)	(0.057)	(0.045)
hightech	0.065	-0.105	-0.092	0.102
	(0.176)	(0.196)	(0.167)	(0.179)
patent	0.076***	0.036*	0.154***	0.063***
	(0.020)	(0.020)	(0.024)	(0.021)

	(1)	(2)	(3)	(4)
FDI	0.390	0.294	0.400*	0.397
	(0.238)	(0.236)	(0.221)	(0.250)
GFCF	1.846***	2.552***	1.110***	1.784***
	(0.317)	(0.206)	(0.379)	(0.352)
government	-2.444***	-1.329*	-3.307***	-2.477***
	(0.615)	(0.710)	(0.541)	(0.737)
resource	2.213***	1.219***	2.834***	1.718***
	(0.388)	(0.400)	(0.500)	(0.398)
corruption	0.037	0.013	0.045	0.047**
	(0.025)	(0.023)	(0.028)	(0.024)
education	2.320*	3.132**	1.890	2.285*
	(1.266)	(1.399)	(1.210)	(1.370)
employment	-0.987**	-2.255***	0.376	-1.193***
	(0.413)	(0.367)	(0.431)	(0.460)
enrollment	0.519***	0.609***	0.413***	0.582***
	(0.133)	(0.103)	(0.118)	(0.157)
liquidity	0.140***	0.141***	0.094**	0.157***
	(0.038)	(0.039)	(0.040)	(0.039)
Observation	687	687	687	687
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
Kappa	0.998	0.998	0.998	0.998

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

F.11 Limited Information Maximum Likelihood Estimation

Table F.10: Results of Limited Information Maximum Likelihood Estimation.

	GVC participation			
Variable	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: exposure as IV				
geo-polit	-6.172***	-5.042***	-8.514***	-5.353***
	(1.695)	(1.693)	(2.232)	(1.476)
growth	0.259***	0.316***	0.232***	0.257***
	(0.045)	(0.061)	(0.061)	(0.046)
hightech	0.047	-0.098	0.022	0.028
	(0.165)	(0.202)	(0.187)	(0.149)
patent	0.080***	0.034**	0.130***	0.078***
	(0.016)	(0.015)	(0.028)	(0.014)
FDI	0.362*	0.305	0.572**	0.286
	(0.203)	(0.195)	(0.251)	(0.184)
GFCF	1.843***	2.553***	1.131**	1.769***
	(0.300)	(0.213)	(0.478)	(0.284)
government	-2.408***	-1.343*	-3.537***	-2.328***
	(0.571)	(0.728)	(0.518)	(0.678)

	(1)	(2)	(3)	(4)
resource	2.225***	1.215***	2.758***	1.767***
	(0.353)	(0.372)	(0.499)	(0.330)
corruption	0.037	0.013	0.043	0.049***
	(0.023)	(0.023)	(0.039)	(0.018)
education	2.419*	3.094**	1.273	2.686*
	(1.368)	(1.434)	(1.569)	(1.387)
employment	-1.001***	-2.249***	0.468	-1.253***
	(0.383)	(0.369)	(0.489)	(0.393)
enrollment	0.518***	0.609***	0.416***	0.580***
	(0.129)	(0.105)	(0.157)	(0.138)
liquidity	0.135***	0.143***	0.128***	0.135***
	(0.032)	(0.033)	(0.046)	(0.027)
Observation	687	687	687	687
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
Kappa	1.000	1.000	1.000	1.000

Panel B: pressure as IV

	(1)	(2)	(3)	(4)
geo-polit	-8.929**	-6.449*	-7.783*	-9.693**
	(3.817)	(3.685)	(4.098)	(4.016)
growth	0.243***	0.308***	0.237***	0.232***
	(0.052)	(0.061)	(0.063)	(0.051)
hightech	0.163	-0.038	-0.009	0.211
	(0.234)	(0.239)	(0.216)	(0.242)
patent	0.056	0.022	0.137***	0.041
	(0.035)	(0.032)	(0.037)	(0.037)
FDI	0.537	0.394	0.526	0.561
	(0.369)	(0.339)	(0.335)	(0.396)
GFCF	1.865***	2.564***	1.126**	1.804***
	(0.419)	(0.267)	(0.452)	(0.464)
government	-2.642***	-1.463*	-3.475***	-2.696***
	(0.777)	(0.782)	(0.692)	(0.916)
resource	2.147***	1.175***	2.779***	1.645***
	(0.459)	(0.447)	(0.546)	(0.506)
corruption	0.035	0.012	0.043	0.046
	(0.036)	(0.030)	(0.036)	(0.036)
education	1.791	2.774*	1.439	1.698
	(1.479)	(1.540)	(1.417)	(1.612)
employment	-0.908*	-2.201***	0.443	-1.106*
	(0.514)	(0.430)	(0.515)	(0.568)
enrollment	0.521***	0.611***	0.416***	0.585***
	(0.163)	(0.120)	(0.145)	(0.190)
liquidity	0.169***	0.160***	0.118**	0.190***
	(0.061)	(0.057)	(0.060)	(0.066)
Observation	687	687	687	687
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

	(1)	(2)	(3)	(4)
Kappa	1.000	1.000	1.000	1.000

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

F.12 Two-Step FoD GMM

Table F.11: Results of Two-Step FoD GMM estimations.

	GVC participation			
Variable	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: exposure as IV				
geo-polit	-6.172***	-5.042***	-8.514***	-5.353***
	(1.728)	(1.727)	(2.276)	(1.505)
growth	0.259***	0.316***	0.232***	0.257***
	(0.046)	(0.062)	(0.062)	(0.047)
hightech	0.047	-0.098	0.022	0.028
	(0.169)	(0.206)	(0.190)	(0.152)
patent	0.080***	0.034**	0.130***	0.078***
	(0.017)	(0.015)	(0.029)	(0.015)
FDI	0.362*	0.305	0.572**	0.286
	(0.207)	(0.199)	(0.256)	(0.188)
GFCF	1.843***	2.553***	1.131**	1.769***
	(0.306)	(0.217)	(0.487)	(0.289)
government	-2.408***	-1.343*	-3.537***	-2.328***
	(0.582)	(0.743)	(0.529)	(0.691)
resource	2.225***	1.215***	2.758***	1.767***
	(0.360)	(0.380)	(0.509)	(0.337)
corruption	0.037	0.013	0.043	0.049***
	(0.023)	(0.024)	(0.040)	(0.018)
education	2.419*	3.094**	1.273	2.686*
	(1.395)	(1.463)	(1.600)	(1.414)
employment	-1.001**	-2.249***	0.468	-1.253***
	(0.391)	(0.376)	(0.499)	(0.401)
enrollment	0.518***	0.609***	0.416***	0.580***
	(0.131)	(0.107)	(0.161)	(0.140)
liquidity	0.135***	0.143***	0.128***	0.135***
	(0.033)	(0.034)	(0.047)	(0.028)
Observation	687	687	687	687
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
Panel B: pressure as IV				
geo-polit	-8.929**	-6.449*	-7.783*	-9.693**
	(3.892)	(3.758)	(4.179)	(4.096)
growth	0.243***	0.308***	0.237***	0.232***

	(1)	(2)	(3)	(4)
	(0.053)	(0.063)	(0.064)	(0.052)
hightech	0.163	-0.038	-0.009	0.211
	(0.238)	(0.243)	(0.220)	(0.247)
patent	0.056	0.022	0.137***	0.041
	(0.036)	(0.032)	(0.038)	(0.038)
FDI	0.537	0.394	0.526	0.561
	(0.376)	(0.345)	(0.342)	(0.404)
GFCF	1.865***	2.564***	1.126**	1.804***
	(0.427)	(0.272)	(0.461)	(0.474)
government	-2.642***	-1.463*	-3.475***	-2.696***
	(0.792)	(0.798)	(0.706)	(0.934)
resource	2.147***	1.175***	2.779***	1.645***
	(0.468)	(0.456)	(0.557)	(0.516)
corruption	0.035	0.012	0.043	0.046
	(0.037)	(0.031)	(0.037)	(0.037)
education	1.791	2.774*	1.439	1.698
	(1.508)	(1.571)	(1.445)	(1.644)
employment	-0.908*	-2.201***	0.443	-1.106*
	(0.524)	(0.439)	(0.525)	(0.580)
enrollment	0.521***	0.611***	0.416***	0.585***
	(0.166)	(0.123)	(0.148)	(0.194)
liquidity	0.169***	0.160***	0.118*	0.190***
	(0.062)	(0.058)	(0.062)	(0.067)
Observation	687	687	687	687
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

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

Appendix G   Financial Convenience

G.1   Moderating Effect of Financial Convenience

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

| Variable | GVC participation | | | |
| | oGVC | pb-oGVC | pf-oGVC | ts-oGVC |
	(1)	(2)	(3)	(4)
geo-polit	-6.302***	-5.992***	-5.818**	-6.567***
	(1.661)	(1.704)	(2.028)	(1.647)
fin-conve	-0.087***	-0.075***	-0.134***	-0.078***
	(0.021)	(0.023)	(0.034)	(0.021)
geo-polit×fin-conve	0.261***	0.225**	0.420***	0.232***
	(0.074)	(0.082)	(0.120)	(0.075)
growth	0.150***	0.195***	0.226***	0.109**
	(0.047)	(0.052)	(0.065)	(0.039)
hightech	-0.164	-0.352**	-0.237	-0.044
	(0.147)	(0.138)	(0.200)	(0.146)
patent	0.031*	0.012	0.049**	0.037
	(0.017)	(0.017)	(0.019)	(0.023)
FDI	0.099	-0.038	0.224**	0.101
	(0.088)	(0.090)	(0.093)	(0.095)
GFCF	1.765***	2.719***	0.152	1.975***
	(0.261)	(0.254)	(0.366)	(0.327)
government	-1.851***	0.293	-2.824***	-1.710**
	(0.605)	(0.566)	(0.872)	(0.720)
resource	2.053***	1.168***	3.156***	1.952***
	(0.380)	(0.327)	(0.792)	(0.387)
corruption	0.023	0.015	0.001	0.037**
	(0.016)	(0.015)	(0.024)	(0.017)
education	-1.984**	-3.188**	0.452	-2.683**
	(0.882)	(1.144)	(1.652)	(1.266)
employment	-0.304	-1.058**	0.707*	-0.343
	(0.399)	(0.496)	(0.391)	(0.434)
enrollment	0.149*	0.069	0.281**	0.176**
	(0.084)	(0.066)	(0.119)	(0.083)
liquidity	-0.073***	-0.035**	-0.078**	-0.078***
	(0.021)	(0.016)	(0.029)	(0.022)
Observation	396	396	396	396
Adjusted R^2	0.412	0.402	0.336	0.381
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

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

G.2   Robustness Checks

Table G.2: Robustness check results of moderating effect.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: ∼ incorporating fin-conve				
geo-polit	-3.177**	-3.303**	-0.492	-3.611***
	(1.183)	(1.483)	(1.182)	(1.139)
fin-conve	-0.013***	-0.010**	-0.014***	-0.012***
	(0.004)	(0.004)	(0.004)	(0.004)
growth	0.199***	0.250***	0.275***	0.149***
	(0.052)	(0.055)	(0.064)	(0.047)
hightech	-0.190	-0.283*	-0.207	-0.129
	(0.114)	(0.142)	(0.155)	(0.112)
patent	0.014	0.017	0.038*	0.018
	(0.018)	(0.016)	(0.021)	(0.029)
FDI	0.116	-0.096	0.243***	0.148
	(0.119)	(0.124)	(0.077)	(0.144)
GFCF	1.661***	2.570***	-0.087	1.957***
	(0.266)	(0.254)	(0.417)	(0.325)
government	-2.158***	-0.300	-3.606***	-1.808***
	(0.375)	(0.436)	(0.684)	(0.521)
resource	2.073***	1.115**	3.128***	2.119***
	(0.444)	(0.423)	(0.721)	(0.514)
corruption	0.028*	0.056**	0.022	0.028
	(0.016)	(0.025)	(0.021)	(0.019)
education	-1.075	-3.160**	1.271	-1.847
	(0.752)	(1.165)	(1.619)	(1.109)
employment	0.351	-0.327	1.656***	0.111
	(0.348)	(0.456)	(0.504)	(0.386)
enrollment	0.117	-0.077	0.251**	0.196**
	(0.081)	(0.083)	(0.117)	(0.085)
liquidity	-0.059*	-0.037	-0.056	-0.056*
	(0.031)	(0.023)	(0.038)	(0.030)
Observation	396	396	396	396
Adjusted R^2	0.386	0.356	0.314	0.356
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
Panel B: ∼ excluding omitted data				
geo-polit	-4.060***	-4.005**	-1.456	-4.465***
	(1.057)	(1.404)	(1.123)	(1.038)
growth	0.174**	0.231***	0.247***	0.125**
	(0.064)	(0.061)	(0.078)	(0.056)
hightech	-0.303**	-0.373**	-0.331**	-0.239**
	(0.109)	(0.138)	(0.157)	(0.101)
patent	0.028	0.028*	0.053**	0.031
	(0.019)	(0.015)	(0.024)	(0.029)

	(1)	(2)	(3)	(4)
FDI	0.183	-0.043	0.316***	0.213
	(0.106)	(0.111)	(0.071)	(0.132)
GFCF	1.603***	2.524***	-0.149	1.901***
	(0.292)	(0.274)	(0.457)	(0.336)
government	-2.143***	-0.288	-3.589***	-1.793***
	(0.476)	(0.486)	(0.786)	(0.567)
resource	1.782***	0.883**	2.810***	1.837***
	(0.429)	(0.375)	(0.722)	(0.503)
corruption	0.046***	0.070**	0.042*	0.045**
	(0.016)	(0.025)	(0.021)	(0.018)
education	-1.367	-3.392**	0.951	-2.130*
	(0.878)	(1.237)	(1.647)	(1.191)
employment	0.467	-0.234	1.783***	0.223
	(0.371)	(0.438)	(0.548)	(0.402)
enrollment	0.197***	-0.013	0.339***	0.274***
	(0.060)	(0.069)	(0.098)	(0.064)
liquidity	-0.043	-0.024	-0.039	-0.041
	(0.028)	(0.022)	(0.034)	(0.027)
Observation	396	396	396	396
Adjusted R^2	0.339	0.330	0.281	0.316
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

Panel C: ~ fin-conve imputation

	(1)	(2)	(3)	(4)
geo-polit	-2.650***	-2.438***	-3.595***	-2.272***
	(0.442)	(0.538)	(0.456)	(0.494)
fin-conve (imputed)	-0.049***	-0.044***	-0.078***	-0.041***
	(0.011)	(0.012)	(0.011)	(0.012)
geo-polit×fin-conve (imputed)	0.111***	0.101**	0.204***	0.082**
	(0.033)	(0.037)	(0.035)	(0.038)
growth	0.295***	0.344***	0.279***	0.288***
	(0.061)	(0.078)	(0.060)	(0.064)
hightech	-0.058	-0.175	-0.161	-0.056
	(0.132)	(0.165)	(0.129)	(0.136)
patent	0.104***	0.052***	0.178***	0.095***
	(0.015)	(0.014)	(0.014)	(0.017)
FDI	0.025	0.034	0.097	-0.014
	(0.101)	(0.106)	(0.086)	(0.110)
GFCF	1.776***	2.502***	1.053***	1.728***
	(0.153)	(0.137)	(0.263)	(0.178)
government	-1.823**	-0.896	-2.510***	-1.951**
	(0.663)	(0.770)	(0.605)	(0.759)
resource	2.696***	1.618***	3.444***	2.190***
	(0.444)	(0.414)	(0.571)	(0.388)
corruption	0.031	0.007	0.032	0.048**
	(0.019)	(0.018)	(0.024)	(0.022)
education	3.767***	4.228***	3.473***	3.849**
	(1.222)	(1.462)	(0.859)	(1.393)

	(1)	(2)	(3)	(4)
employment	-1.443***	-2.649***	-0.200	-1.586***
	(0.276)	(0.297)	(0.290)	(0.312)
enrollment	0.371***	0.489***	0.269***	0.425***
	(0.117)	(0.104)	(0.089)	(0.137)
liquidity	0.057***	0.080***	0.021	0.066***
	(0.018)	(0.021)	(0.016)	(0.019)
Observation	676	676	676	676
Adjusted R^2	0.528	0.525	0.533	0.475
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

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

G.3 Anticipation and Time-lag Effect of Financial Convenience

Table G.3: Results of time-lag effect of financial convenience.

	GVC participation			
Variable	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: ~ fin-conve (lead 2)				
geo-polit	-4.145***	-5.093***	-2.299***	-4.510***
	(0.673)	(0.686)	(0.807)	(0.725)
fin-conve	-0.025	-0.038*	-0.037	-0.021
	(0.018)	(0.019)	(0.028)	(0.016)
geo-polit×fin-conve	0.037	0.086	0.075	0.020
	(0.060)	(0.066)	(0.093)	(0.056)
growth	0.202***	0.220***	0.318***	0.147***
	(0.045)	(0.047)	(0.059)	(0.040)
hightech	-0.216*	-0.363**	-0.325**	-0.067
	(0.106)	(0.128)	(0.148)	(0.115)
patent	0.060***	0.029	0.099***	0.060**
	(0.020)	(0.018)	(0.027)	(0.021)
FDI	0.071	-0.019	0.172**	0.069
	(0.088)	(0.097)	(0.066)	(0.102)
GFCF	1.334***	2.451***	-0.341	1.540***
	(0.146)	(0.253)	(0.233)	(0.190)
government	-2.479***	-0.271	-3.279***	-2.500***
	(0.694)	(0.794)	(1.078)	(0.635)
resource	1.833***	1.090***	2.768***	1.656***
	(0.355)	(0.288)	(0.606)	(0.335)
corruption	0.010	-0.001	-0.011	0.026**
	(0.010)	(0.012)	(0.015)	(0.012)
education	-0.225	-2.071	2.291	-0.809
	(1.080)	(1.533)	(1.416)	(1.234)
employment	-1.347***	-2.232***	-0.018	-1.464***
	(0.312)	(0.422)	(0.450)	(0.327)

	(1)	(2)	(3)	(4)
enrollment	0.216**	0.171**	0.329**	0.228**
	(0.094)	(0.069)	(0.123)	(0.098)
liquidity	-0.036**	-0.006	-0.042*	-0.043***
	(0.016)	(0.017)	(0.022)	(0.014)
Observation	441	441	441	441
Adjusted R^2	0.418	0.438	0.346	0.392
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

Panel B: $\sim$ fin-conve (lead 1)

	(1)	(2)	(3)	(4)
geo-polit	-4.861***	-5.309***	-3.600**	-5.203***
	(0.964)	(0.922)	(1.316)	(1.047)
fin-conve	-0.047**	-0.050***	-0.071**	-0.041**
geo-polit×fin-conve	0.114*	0.133**	0.198	0.095
	(0.065)	(0.056)	(0.116)	(0.068)
	(0.019)	(0.016)	(0.034)	(0.019)
growth	0.206***	0.245***	0.289***	0.164***
	(0.038)	(0.043)	(0.046)	(0.040)
hightech	-0.169	-0.332***	-0.282**	-0.024
	(0.100)	(0.112)	(0.134)	(0.114)
patent	0.037*	0.015	0.072***	0.038
	(0.019)	(0.016)	(0.022)	(0.023)
FDI	0.086	-0.025	0.205**	0.084
	(0.089)	(0.087)	(0.084)	(0.103)
GFCF	1.459***	2.435***	-0.255	1.703***
	(0.227)	(0.238)	(0.311)	(0.279)
government	-2.496***	-0.348	-3.503***	-2.359***
	(0.618)	(0.616)	(0.849)	(0.585)
resource	1.910***	1.081***	2.887***	1.795***
	(0.351)	(0.259)	(0.655)	(0.369)
corruption	0.019	0.007	0.000	0.032**
	(0.013)	(0.015)	(0.018)	(0.013)
education	-0.251	-1.926	2.791*	-1.068
	(0.930)	(1.400)	(1.425)	(0.964)
employment	-0.799**	-1.658***	0.374	-0.860**
	(0.312)	(0.416)	(0.329)	(0.342)
enrollment	0.192*	0.130**	0.313**	0.210**
	(0.092)	(0.060)	(0.129)	(0.096)
liquidity	-0.042**	-0.007	-0.045*	-0.051***
	(0.018)	(0.018)	(0.025)	(0.018)
Observation	420	420	420	420
Adjusted R^2	0.406	0.410	0.315	0.386
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

Panel C: $\sim$ fin-conve (lagged 1)

	(1)	(2)	(3)	(4)
geo-polit	-5.981***	-6.768**	-4.485**	-6.290***
	(1.883)	(2.396)	(1.857)	(1.780)
fin-conve	-0.099***	-0.097***	-0.142***	-0.090***

	(1)	(2)	(3)	(4)
	(0.023)	(0.030)	(0.026)	(0.024)
geo-polit×fin-conve	0.308***	0.309***	0.448***	0.279***
	(0.083)	(0.106)	(0.092)	(0.085)
growth	0.158***	0.187***	0.224***	0.116***
	(0.036)	(0.045)	(0.059)	(0.028)
hightech	-0.109	-0.296**	-0.165	0.003
	(0.145)	(0.128)	(0.242)	(0.126)
patent	0.032*	0.011	0.032	0.043*
	(0.018)	(0.018)	(0.020)	(0.022)
FDI	0.101	-0.024	0.183**	0.116
	(0.081)	(0.088)	(0.065)	(0.094)
GFCF	1.633***	2.948***	-0.183	1.857***
	(0.235)	(0.263)	(0.337)	(0.274)
government	-1.877**	0.323	-2.830***	-1.781**
	(0.697)	(0.534)	(0.909)	(0.778)
resource	2.051***	1.204***	3.196***	1.897***
	(0.354)	(0.323)	(0.737)	(0.402)
corruption	0.029	0.017	0.005	0.041**
	(0.019)	(0.015)	(0.028)	(0.018)
education	-1.721	-2.976**	0.096	-2.077*
	(1.021)	(1.168)	(1.508)	(1.192)
employment	0.127	-0.979	1.479***	-0.024
	(0.482)	(0.580)	(0.476)	(0.503)
enrollment	0.100	0.047	0.187*	0.139
	(0.090)	(0.086)	(0.107)	(0.090)
liquidity	-0.093***	-0.059***	-0.101***	-0.090***
	(0.021)	(0.013)	(0.028)	(0.022)
Observation	370	370	370	370
Adjusted R^2	0.433	0.413	0.381	0.386
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

Panel D: ∼ fin-conve (lagged 2)

	(1)	(2)	(3)	(4)
geo-polit	-4.589**	-5.804*	-3.556**	-4.713**
	(1.882)	(2.871)	(1.638)	(1.776)
fin-conve	-0.083**	-0.087*	-0.132***	-0.069**
	(0.030)	(0.042)	(0.026)	(0.031)
geo-polit×fin-conve	0.257**	0.280*	0.417***	0.211*
	(0.105)	(0.149)	(0.089)	(0.111)
growth	0.156***	0.178***	0.201***	0.128***
	(0.039)	(0.039)	(0.057)	(0.043)
hightech	-0.019	-0.267	0.047	0.065
	(0.135)	(0.174)	(0.198)	(0.119)
patent	0.032	0.019	0.040	0.037*
	(0.021)	(0.022)	(0.038)	(0.020)
FDI	0.056	-0.037	0.134***	0.061
	(0.064)	(0.093)	(0.042)	(0.078)
GFCF	1.672***	3.020***	-0.327	1.921***
	(0.284)	(0.332)	(0.385)	(0.345)

	(1)	(2)	(3)	(4)
government	-1.119	0.085	-2.030	-0.775
	(1.058)	(0.459)	(1.223)	(1.280)
resource	2.368***	1.145**	3.940***	2.155***
	(0.527)	(0.429)	(0.631)	(0.638)
corruption	0.033	0.024	0.010	0.044*
	(0.024)	(0.025)	(0.027)	(0.023)
education	-1.881**	-2.533*	0.790	-2.804**
	(0.866)	(1.208)	(1.517)	(1.058)
employment	0.330	-0.966	1.603**	0.276
	(0.476)	(0.592)	(0.561)	(0.485)
enrollment	-0.004	-0.030	0.034	0.040
	(0.083)	(0.087)	(0.117)	(0.085)
liquidity	-0.087***	-0.049**	-0.086***	-0.093***
	(0.020)	(0.023)	(0.029)	(0.014)
Observation	345	345	345	345
Adjusted R^2	0.390	0.362	0.348	0.346
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

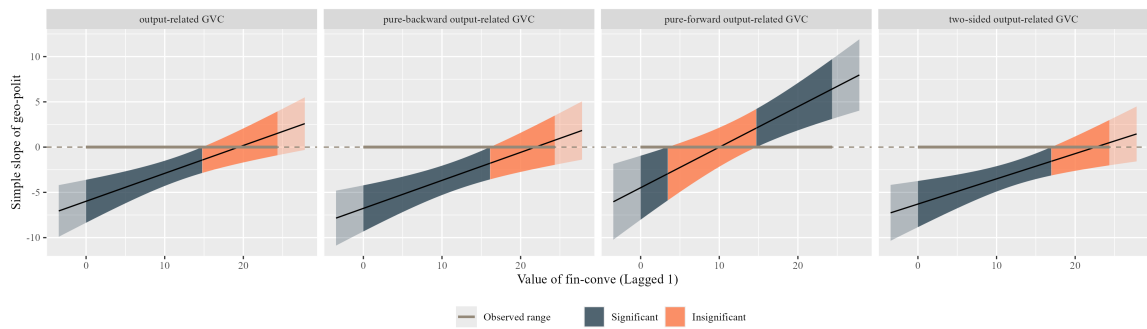* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
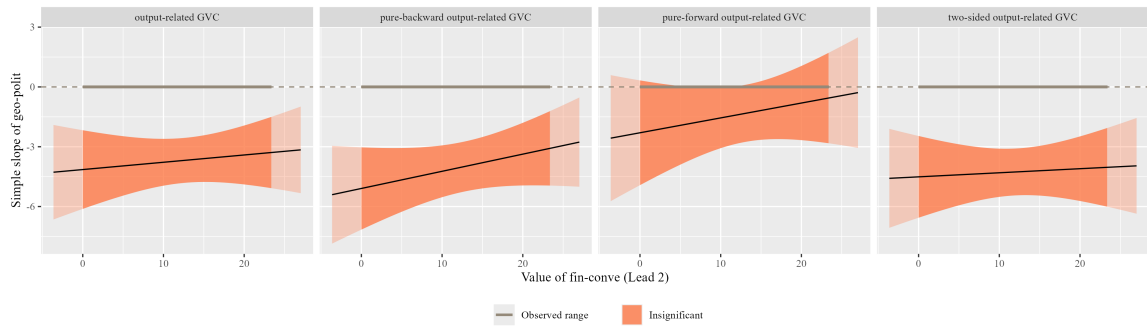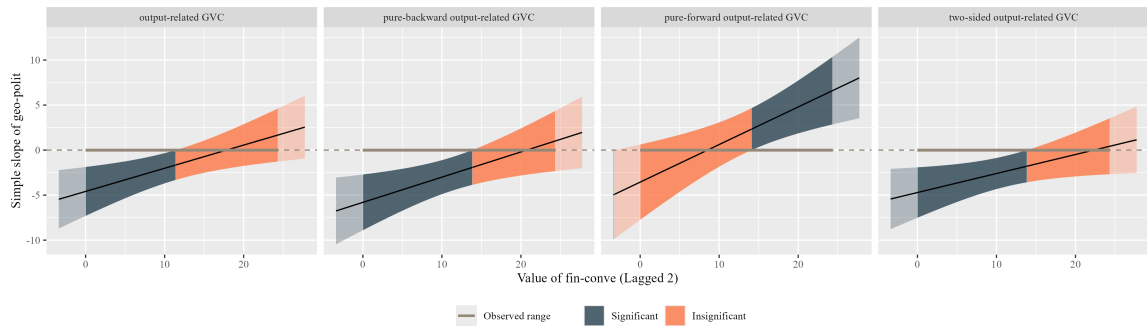
(a) Marginal effect of fin-conve (Lead 2 term)
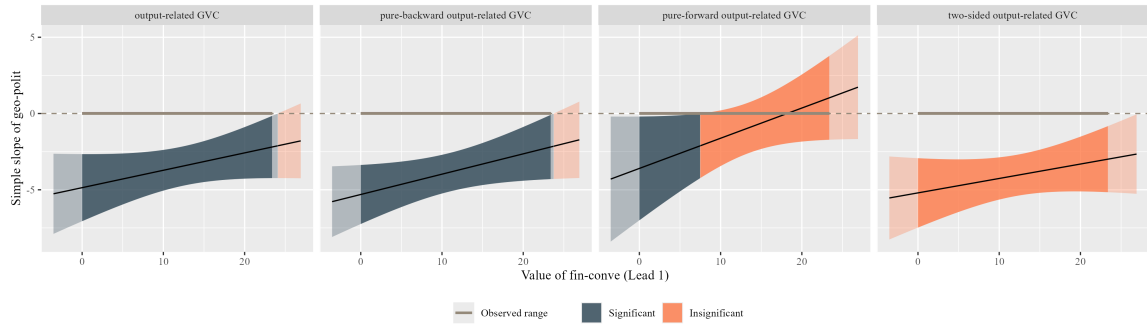
(b) Marginal effect of fin-conve (Lead 1 term)

(c) Marginal effect of fin-conve (Lagged 1 term)

(d) Marginal effect of fin-conve (Lagged 2 term)

Figure G.1: Marginal effects of financial convenience.

Appendix H Political Alignment

H.1 Direct Moderating effect

Table H.1: Results of moderating effect of political alignment (on geo-political risk) with its time-lag effect.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: ~ pol-align (current)				
geo-polit	-2.224***	-1.982***	-2.099***	-2.243***
	(0.342)	(0.362)	(0.346)	(0.367)
pol-align	-0.208**	-0.140	-0.153*	-0.250**
	(0.087)	(0.088)	(0.076)	(0.104)
geo-polit×pol-align	0.721***	0.620***	0.660**	0.776***
	(0.209)	(0.205)	(0.242)	(0.226)
growth	0.259***	0.314***	0.244***	0.253***
	(0.057)	(0.074)	(0.054)	(0.062)
hightech	-0.133	-0.236	-0.300*	-0.117
	(0.155)	(0.197)	(0.159)	(0.158)
patent	0.102***	0.044***	0.171***	0.095***
	(0.015)	(0.014)	(0.016)	(0.016)
FDI	0.248**	0.166	0.291***	0.238**
	(0.097)	(0.114)	(0.071)	(0.107)
GFCF	1.851***	2.557***	1.158***	1.777***
	(0.242)	(0.168)	(0.331)	(0.275)
government	-1.843**	-0.954	-2.736***	-1.865**
	(0.761)	(0.813)	(0.597)	(0.901)
resource	2.343***	1.166**	2.944***	1.865***
	(0.434)	(0.432)	(0.535)	(0.394)
corruption	0.028*	0.004	0.035	0.040**
	(0.015)	(0.015)	(0.023)	(0.017)
education	1.262	2.587	0.987	1.140
	(1.300)	(1.524)	(1.148)	(1.405)
employment	-1.224***	-2.416***	0.173	-1.458***
	(0.283)	(0.310)	(0.307)	(0.315)
enrollment	0.747***	0.745***	0.598***	0.831***
	(0.077)	(0.081)	(0.086)	(0.091)
liquidity	0.072***	0.095***	0.037**	0.081***
	(0.016)	(0.020)	(0.015)	(0.017)
Observation	663	663	663	663
Adjusted R^2	0.558	0.525	0.537	0.513
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓
Panel B: ~ pol-align (lagged 1)				
geo-polit	-2.426***	-2.288***	-2.317***	-2.400***

	(1)	(2)	(3)	(4)
	(0.354)	(0.383)	(0.427)	(0.378)
pol-align	-0.247**	-0.170*	-0.184**	-0.296***
	(0.089)	(0.093)	(0.086)	(0.099)
geo-polit×pol-align	0.739***	0.629***	0.583**	0.858***
	(0.220)	(0.207)	(0.232)	(0.245)
growth	0.253***	0.306***	0.244***	0.244***
	(0.058)	(0.075)	(0.058)	(0.064)
hightech	-0.093	-0.181	-0.257	-0.076
	(0.157)	(0.204)	(0.150)	(0.160)
patent	0.101***	0.042***	0.177***	0.089***
	(0.015)	(0.014)	(0.016)	(0.016)
FDI	0.261**	0.180	0.315***	0.245**
	(0.101)	(0.120)	(0.074)	(0.111)
GFCF	1.605***	2.393***	0.885**	1.506***
	(0.236)	(0.193)	(0.402)	(0.236)
government	-2.261***	-1.322*	-2.992***	-2.338***
	(0.676)	(0.738)	(0.657)	(0.754)
resource	2.172***	1.037**	2.870***	1.652***
	(0.470)	(0.482)	(0.584)	(0.411)
corruption	0.026	0.008	0.036	0.031*
	(0.017)	(0.017)	(0.025)	(0.018)
education	1.744	3.141*	1.306	1.677
	(1.359)	(1.572)	(1.368)	(1.443)
employment	-1.255***	-2.452***	0.084	-1.445***
	(0.288)	(0.335)	(0.282)	(0.328)
enrollment	0.764***	0.747***	0.637***	0.848***
	(0.098)	(0.106)	(0.104)	(0.111)
liquidity	0.069***	0.095***	0.036**	0.077***
	(0.016)	(0.021)	(0.015)	(0.016)
Observation	639	639	639	639
Adjusted R^2	0.522	0.489	0.509	0.473
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

Panel C: ∼ pol-align (lagged 2)

	(1)	(2)	(3)	(4)
geo-polit	-2.237***	-2.466***	-1.873***	-2.150***
	(0.421)	(0.482)	(0.443)	(0.460)
pol-align	-0.155	-0.136	-0.056	-0.187
	(0.133)	(0.122)	(0.116)	(0.151)
geo-polit×pol-align	0.638**	0.736***	0.374	0.694**
	(0.289)	(0.255)	(0.261)	(0.325)
growth	0.239***	0.290***	0.233***	0.227***
	(0.058)	(0.076)	(0.061)	(0.065)
hightech	-0.045	-0.119	-0.214	-0.027
	(0.165)	(0.213)	(0.151)	(0.168)
patent	0.103***	0.042***	0.178***	0.091***
	(0.014)	(0.012)	(0.014)	(0.016)
FDI	0.250**	0.169	0.304***	0.236**
	(0.103)	(0.125)	(0.072)	(0.112)

	(1)	(2)	(3)	(4)
GFCF	1.536***	2.371***	0.690	1.469***
	(0.272)	(0.229)	(0.427)	(0.287)
government	-2.423***	-1.407**	-3.158***	-2.517***
	(0.510)	(0.596)	(0.601)	(0.558)
resource	2.161***	0.954*	2.856***	1.678***
	(0.494)	(0.479)	(0.625)	(0.436)
corruption	0.025	0.006	0.037	0.030
	(0.016)	(0.016)	(0.024)	(0.019)
education	2.517*	3.985**	1.928	2.504*
	(1.283)	(1.500)	(1.403)	(1.366)
employment	-1.266***	-2.499***	0.192	-1.485***
	(0.293)	(0.375)	(0.278)	(0.318)
enrollment	0.732***	0.713***	0.601***	0.821***
	(0.101)	(0.111)	(0.100)	(0.117)
liquidity	0.073***	0.099***	0.041**	0.079***
	(0.017)	(0.022)	(0.016)	(0.018)
Observation	619	619	619	619
Adjusted R^2	0.491	0.473	0.476	0.440
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

* p < 0.1, ** p < 0.05, *** p < 0.01
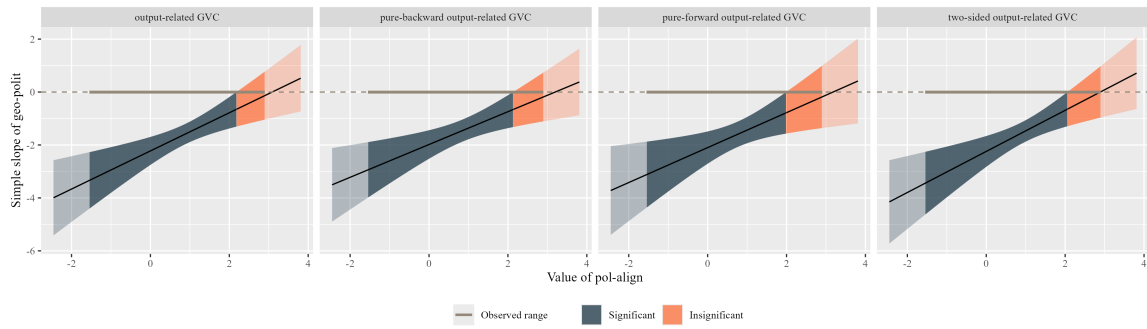
(a) Marginal effect of pol-align (Current)
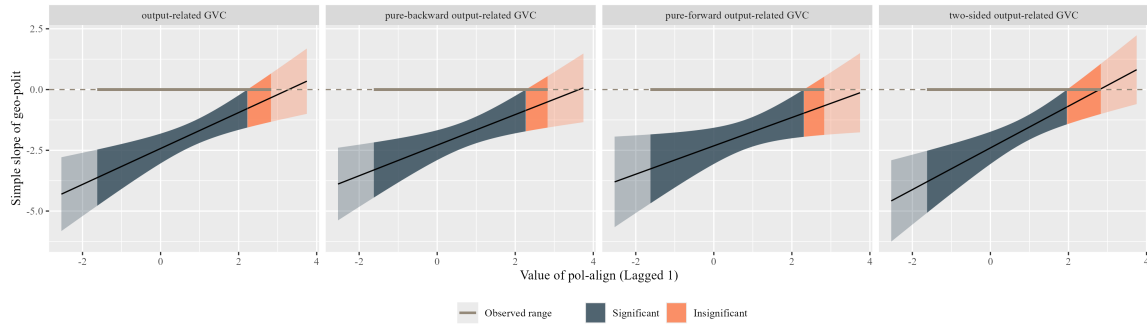
(b) Marginal effect of pol-align (Lagged 1 term)
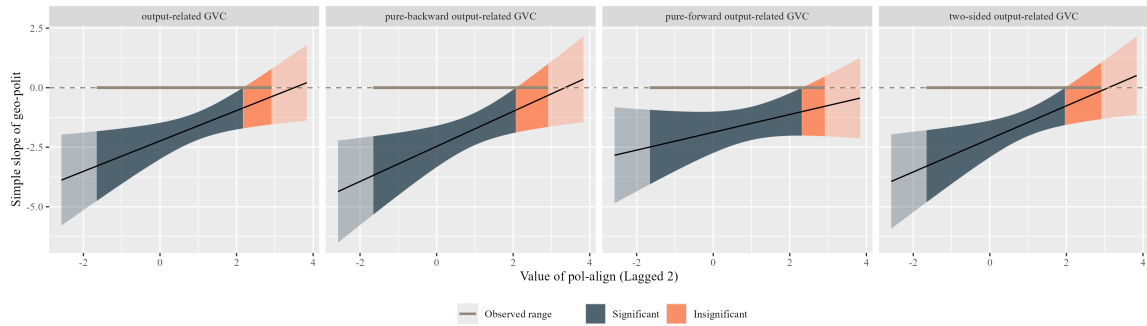
(c) Marginal effect of pol-align (lagged 2 term)

Figure H.1: Marginal effects of political alignment.

H.2   Inirect Moderating effect

Table H.2: Results of moderating effect of political alignment (on financial convenience) with its time-lag effect.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: ∼ pol-align (current)				
geo-polit	1.063	-0.601	3.745	-1.138
	(2.492)	(2.514)	(2.448)	(3.114)
fin-conve	0.054	0.030	0.070	0.012

	(1)	(2)	(3)	(4)
	(0.055)	(0.054)	(0.070)	(0.066)
pol-align	2.516***	1.900**	3.063***	1.995**
	(0.732)	(0.694)	(0.905)	(0.879)
geo-polit×fin-conve	-0.194	-0.125	-0.227	-0.063
	(0.178)	(0.170)	(0.225)	(0.217)
geo-polit×pol-align	-8.338***	-6.606***	-9.506***	-6.801**
	(2.361)	(2.195)	(2.885)	(2.855)
fin-conve×pol-align	-0.153**	-0.120*	-0.180**	-0.111
	(0.060)	(0.062)	(0.072)	(0.069)
geo-polit×fin-conve×pol-align	0.497**	0.404*	0.556**	0.370
	(0.194)	(0.197)	(0.232)	(0.224)
growth	0.166***	0.205***	0.210***	0.131***
	(0.037)	(0.050)	(0.058)	(0.032)
hightech	-0.309*	-0.470***	-0.331	-0.193
	(0.148)	(0.150)	(0.214)	(0.149)
patent	0.049***	0.023	0.041**	0.059***
	(0.014)	(0.015)	(0.019)	(0.017)
FDI	0.141*	-0.003	0.228**	0.157*
	(0.078)	(0.071)	(0.094)	(0.089)
GFCF	1.511***	2.521***	0.313	1.619***
	(0.305)	(0.277)	(0.387)	(0.363)
government	-1.912**	-0.118	-3.635***	-1.461
	(0.799)	(0.585)	(0.927)	(1.006)
resource	2.199***	0.982**	3.349***	2.112***
	(0.407)	(0.382)	(0.750)	(0.442)
corruption	0.017	0.001	0.001	0.031
	(0.018)	(0.016)	(0.021)	(0.020)
education	-2.559**	-3.305**	0.561	-3.387**
	(1.076)	(1.241)	(1.471)	(1.552)
employment	-0.067	-0.922	0.612	-0.007
	(0.503)	(0.561)	(0.484)	(0.551)
enrollment	0.145	0.027	0.235*	0.191**
	(0.085)	(0.065)	(0.124)	(0.088)
liquidity	-0.085***	-0.034**	-0.106***	-0.085***
	(0.015)	(0.012)	(0.023)	(0.017)
Observation	385	385	385	385
Adjusted R^2	0.444	0.421	0.364	0.411
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

Panel B: ~ pol-align (lagged 1)

	(1)	(2)	(3)	(4)
geo-polit	0.603	-0.405	2.142	-1.388
	(2.398)	(2.498)	(2.223)	(2.996)
fin-conve	0.044	0.032	0.029	0.011
	(0.049)	(0.049)	(0.061)	(0.061)
pol-align	2.382***	1.966***	2.589***	1.925**
	(0.661)	(0.603)	(0.866)	(0.813)
geo-polit×fin-conve	-0.162	-0.130	-0.096	-0.060
	(0.162)	(0.156)	(0.196)	(0.202)

	(1)	(2)	(3)	(4)
geo-polit×pol-align	-7.929***	-6.834***	-8.164***	-6.515**
	(2.183)	(1.942)	(2.829)	(2.675)
fin-conve×pol-align	-0.141**	-0.115**	-0.138*	-0.110*
	(0.051)	(0.054)	(0.068)	(0.060)
geo-polit×fin-conve×pol-align	0.460**	0.387**	0.427*	0.366*
	(0.167)	(0.172)	(0.219)	(0.196)
growth	0.167***	0.204***	0.217***	0.130***
	(0.034)	(0.048)	(0.057)	(0.031)
hightech	-0.313**	-0.476***	-0.357	-0.182
	(0.142)	(0.130)	(0.207)	(0.149)
patent	0.050***	0.023	0.047**	0.059***
	(0.014)	(0.015)	(0.021)	(0.017)
FDI	0.135*	-0.012	0.232**	0.149
	(0.077)	(0.071)	(0.094)	(0.088)
GFCF	1.511***	2.553***	0.207	1.646***
	(0.325)	(0.284)	(0.400)	(0.384)
government	-1.813**	-0.101	-3.447***	-1.376
	(0.806)	(0.578)	(0.898)	(1.031)
resource	2.210***	1.000**	3.391***	2.100***
	(0.400)	(0.368)	(0.768)	(0.423)
corruption	0.018	0.000	0.006	0.031
	(0.018)	(0.016)	(0.022)	(0.020)
education	-2.763**	-3.572**	0.512	-3.554**
	(1.180)	(1.305)	(1.422)	(1.653)
employment	-0.018	-0.882	0.765	-0.005
	(0.478)	(0.533)	(0.466)	(0.529)
enrollment	0.151*	0.029	0.241*	0.198**
	(0.082)	(0.063)	(0.124)	(0.084)
liquidity	-0.083***	-0.035**	-0.099***	-0.085***
	(0.016)	(0.014)	(0.025)	(0.017)
Observation	385	385	385	385
Adjusted R^2	0.441	0.422	0.355	0.405
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

Panel C: ∼ pol-align (lagged 2)

	(1)	(2)	(3)	(4)
geo-polit	0.414	-0.991	1.917	-1.321
	(2.202)	(2.133)	(2.365)	(2.884)
fin-conve	0.041	0.018	0.030	0.012
	(0.051)	(0.048)	(0.070)	(0.062)
pol-align	2.408***	1.961***	2.558**	1.992**
	(0.689)	(0.587)	(0.988)	(0.847)
geo-polit×fin-conve	-0.151	-0.085	-0.100	-0.062
	(0.165)	(0.150)	(0.223)	(0.202)
geo-polit×pol-align	-7.882***	-6.571***	-7.890**	-6.674**
	(2.206)	(1.825)	(3.182)	(2.745)
fin-conve×pol-align	-0.144**	-0.105*	-0.152*	-0.114*
	(0.054)	(0.055)	(0.074)	(0.063)
geo-polit×fin-conve×pol-align	0.472**	0.359*	0.474*	0.384*

	(1)	(2)	(3)	(4)
	(0.174)	(0.176)	(0.237)	(0.204)
growth	0.156***	0.189***	0.202***	0.123***
	(0.034)	(0.049)	(0.058)	(0.030)
hightech	-0.304*	-0.465***	-0.352	-0.176
	(0.155)	(0.145)	(0.216)	(0.158)
patent	0.049***	0.020	0.047**	0.059***
	(0.014)	(0.015)	(0.020)	(0.017)
FDI	0.144*	-0.003	0.234**	0.158
	(0.082)	(0.075)	(0.098)	(0.092)
GFCF	1.496***	2.547***	0.210	1.622***
	(0.311)	(0.264)	(0.401)	(0.370)
government	-1.748**	-0.032	-3.282***	-1.362
	(0.805)	(0.561)	(0.938)	(1.013)
resource	2.165***	0.962**	3.322***	2.071***
	(0.396)	(0.373)	(0.743)	(0.420)
corruption	0.017	0.000	0.005	0.030
	(0.017)	(0.016)	(0.020)	(0.019)
education	-2.586**	-3.130**	0.595	-3.476**
	(1.194)	(1.360)	(1.445)	(1.654)
employment	-0.058	-0.959	0.712	-0.019
	(0.507)	(0.568)	(0.461)	(0.557)
enrollment	0.157*	0.042	0.247*	0.202**
	(0.081)	(0.063)	(0.118)	(0.085)
liquidity	-0.086***	-0.040***	-0.100***	-0.087***
	(0.013)	(0.014)	(0.023)	(0.015)
Observation	385	385	385	385
Adjusted R^2	0.440	0.418	0.355	0.406
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
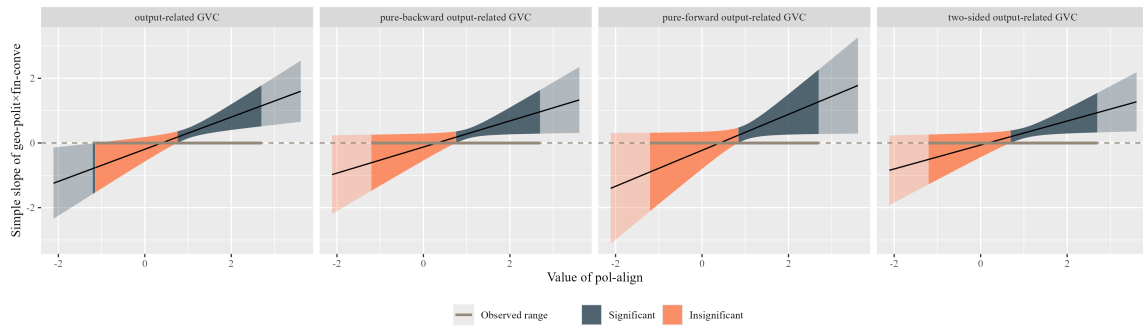
(a) Marginal effect of pol-align×fin-conve (Current)
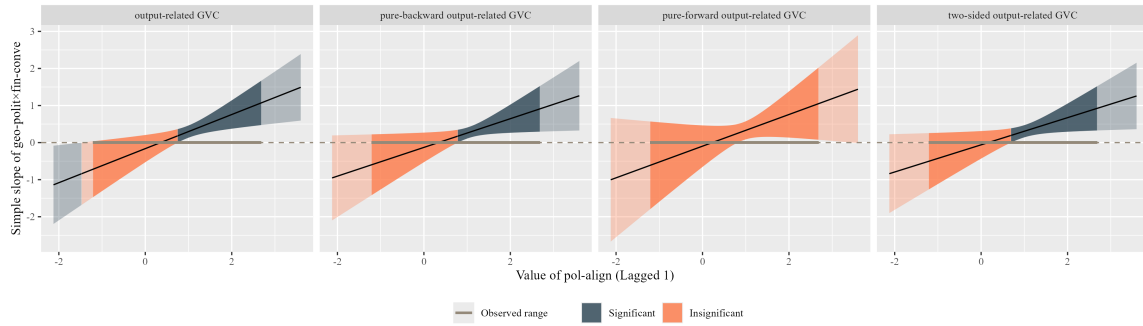
(b) Marginal effect of pol-align×fin-conve (Lagged 1 term)
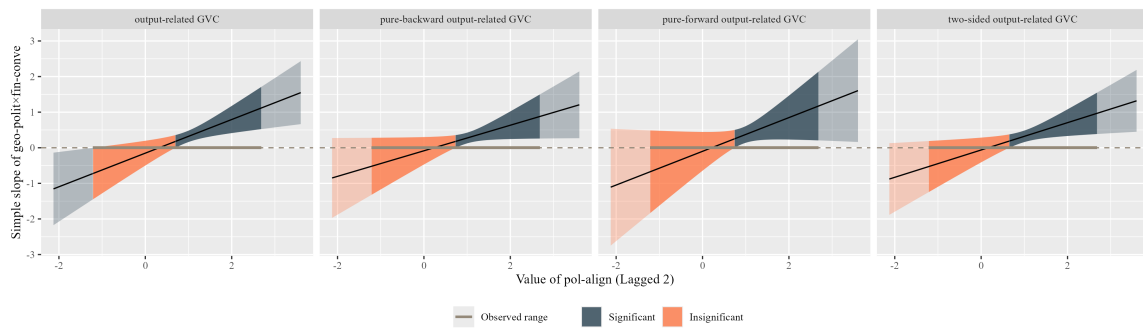
(c) Marginal effect of pol-align×fin-conve (lagged 2 term)

Figure H.2: Marginal effects of interaction between political alignment and financial convenience.

Appendix I   Media Attention

I.1   Direct Moderating Effect

Table I.1: Results of moderating effect of media attention (on geo-political risk) with its time-lag effect.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: ∼ attention (current)				
geo-polit	-1.499***	-1.339***	-1.424***	-1.462***

	(1)	(2)	(3)	(4)
	(0.284)	(0.276)	(0.312)	(0.296)
attention	0.169***	0.187***	0.173***	0.160***
	(0.039)	(0.039)	(0.052)	(0.046)
geo-polit×attention	-0.578***	-0.636***	-0.607***	-0.530***
	(0.130)	(0.130)	(0.169)	(0.154)
growth	0.281***	0.333***	0.267***	0.276***
	(0.056)	(0.073)	(0.059)	(0.059)
hightech	-0.136	-0.239	-0.258*	-0.127
	(0.136)	(0.166)	(0.140)	(0.137)
patent	0.122***	0.068***	0.193***	0.114***
	(0.013)	(0.011)	(0.012)	(0.015)
FDI	0.085	0.091	0.141	0.057
	(0.103)	(0.111)	(0.084)	(0.113)
GFCF	1.746***	2.457***	1.018***	1.678***
	(0.194)	(0.154)	(0.309)	(0.219)
government	-2.111***	-1.141	-3.028***	-2.100**
	(0.694)	(0.794)	(0.551)	(0.804)
resource	2.411***	1.377***	3.021***	1.920***
	(0.430)	(0.408)	(0.543)	(0.377)
corruption	0.045***	0.020	0.054**	0.054**
	(0.016)	(0.015)	(0.021)	(0.020)
education	3.704***	4.183***	3.108***	3.785***
	(1.195)	(1.396)	(1.051)	(1.329)
employment	-1.202***	-2.419***	0.174	-1.415***
	(0.309)	(0.300)	(0.370)	(0.338)
enrollment	0.515***	0.607***	0.412***	0.577***
	(0.090)	(0.082)	(0.076)	(0.110)
liquidity	0.083***	0.103***	0.047***	0.091***
	(0.017)	(0.021)	(0.014)	(0.018)
Observation	687	687	687	687
Adjusted R^2	0.500	0.504	0.499	0.447
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

Panel B: ~ attention (lagged 1)

	(1)	(2)	(3)	(4)
geo-polit	-1.774***	-1.611***	-2.140***	-1.447***
	(0.482)	(0.394)	(0.723)	(0.369)
attention	0.004	0.080	-0.045	0.049
	(0.137)	(0.114)	(0.193)	(0.135)
geo-polit×attention	0.025	-0.228	0.133	-0.090
	(0.459)	(0.382)	(0.651)	(0.452)
growth	0.292***	0.276***	0.285***	0.273***
	(0.066)	(0.079)	(0.059)	(0.073)
hightech	0.262	0.017	0.291	0.166
	(0.176)	(0.186)	(0.182)	(0.163)
patent	0.090***	0.061***	0.193***	0.071***
	(0.020)	(0.017)	(0.022)	(0.020)
FDI	0.871***	0.876***	0.707***	0.981***
	(0.234)	(0.259)	(0.231)	(0.279)

	(1)	(2)	(3)	(4)
GFCF	1.485***	2.631***	0.564	1.396***
	(0.313)	(0.345)	(0.455)	(0.272)
government	0.180	0.529	-0.160	0.410
	(0.678)	(0.572)	(0.727)	(0.657)
resource	0.881	0.785	0.850	0.926
	(0.676)	(0.649)	(0.818)	(0.644)
corruption	0.023	0.012	0.015	0.042*
	(0.021)	(0.021)	(0.024)	(0.022)
education	1.575	2.145*	-0.531	2.191*
	(0.952)	(1.201)	(1.054)	(1.268)
employment	0.246	-1.566***	1.840***	-0.010
	(0.497)	(0.515)	(0.539)	(0.449)
enrollment	0.140	0.266**	-0.080	0.204
	(0.110)	(0.107)	(0.074)	(0.142)
liquidity	0.082***	0.088***	0.035	0.109***
	(0.021)	(0.021)	(0.023)	(0.020)
Observation	663	663	663	663
Adjusted R^2	0.221	0.303	0.267	0.193
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

Panel C: ∼ attention (lagged 2)

	(1)	(2)	(3)	(4)
geo-polit	-1.687***	-1.606***	-1.790**	-1.434***
	(0.538)	(0.512)	(0.677)	(0.428)
attention	0.096	0.149	0.163	0.118
	(0.121)	(0.136)	(0.146)	(0.134)
geo-polit×attention	-0.330	-0.493	-0.601	-0.370
	(0.404)	(0.457)	(0.488)	(0.443)
growth	0.260***	0.246***	0.268***	0.233***
	(0.068)	(0.080)	(0.059)	(0.078)
hightech	0.242	0.031	0.205	0.177
	(0.184)	(0.194)	(0.173)	(0.173)
patent	0.077***	0.052**	0.175***	0.060**
	(0.025)	(0.022)	(0.029)	(0.025)
FDI	0.873***	0.877***	0.689***	0.985***
	(0.243)	(0.268)	(0.241)	(0.284)
GFCF	1.494***	2.661***	0.433	1.448***
	(0.349)	(0.381)	(0.473)	(0.300)
government	0.036	0.286	-0.254	0.230
	(0.701)	(0.554)	(0.754)	(0.681)
resource	0.832	0.657	0.851	0.827
	(0.675)	(0.657)	(0.834)	(0.650)
corruption	0.028	0.015	0.022	0.047**
	(0.020)	(0.022)	(0.022)	(0.023)
education	1.541	2.572**	-0.905	2.508*
	(1.081)	(1.143)	(1.169)	(1.315)
employment	0.395	-1.532***	2.157***	0.099
	(0.507)	(0.509)	(0.542)	(0.458)
enrollment	0.150	0.264**	-0.041	0.202

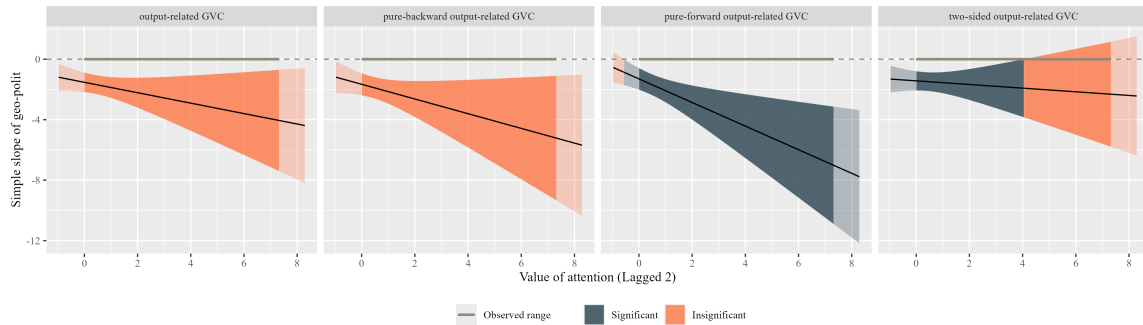|	(1)	(2)	(3)	(4)
	(0.115)	(0.110)	(0.077)	(0.150)
liquidity	0.083***	0.092***	0.034	0.106***
	(0.024)	(0.023)	(0.024)	(0.023)
Observation	643	643	643	643
Adjusted R^2	0.197	0.292	0.237	0.169
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
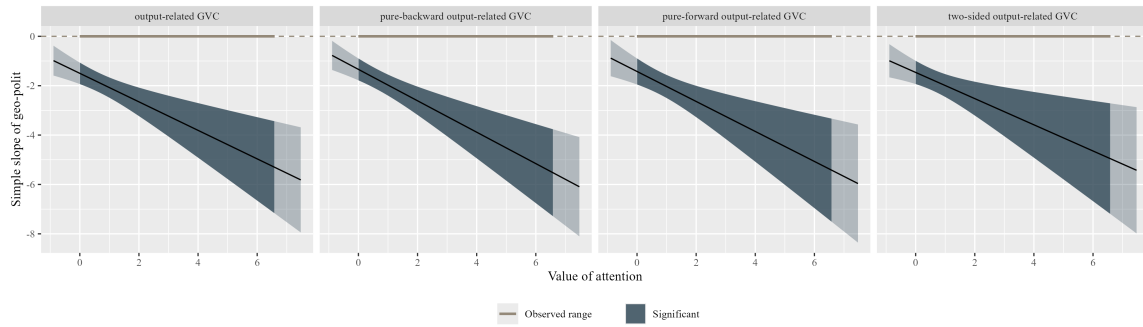
(a) Marginal effect of attention (Current)
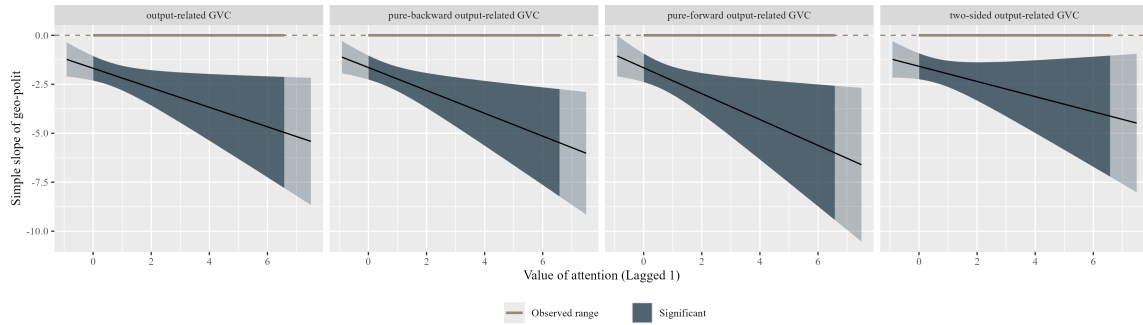
(b) Marginal effect of attention (Lagged 1 term)

(c) Marginal effect of attention (Lagged 2 term)

Figure I.1: Marginal effects of media attention.

I.2 Indirect Moderating Effect

Table I.2: Results of moderating effect of media attention (on financial convenience) with its time-lag effect.

Variable	GVC participation			
	oGVC	pb-oGVC	pf-oGVC	ts-oGVC
	(1)	(2)	(3)	(4)
Panel A: ~ attention (current)				
geo-polit	-4.962***	-6.111***	-3.231*	-5.234***
	(1.446)	(1.837)	(1.641)	(1.411)
fin-conve	0.063**	0.077***	0.095**	0.050**
	(0.023)	(0.021)	(0.037)	(0.023)
attetion	0.600**	0.004	0.913**	0.687**
	(0.257)	(0.152)	(0.333)	(0.312)
geo-polit×fin-conve	-0.180**	-0.233***	-0.284**	-0.141*
	(0.078)	(0.076)	(0.127)	(0.079)
geo-polit×attetion	-1.876**	0.040	-2.988**	-2.135**
	(0.818)	(0.539)	(1.092)	(0.998)
fin-conve×attetion	0.048**	0.003	0.059*	0.061**
	(0.022)	(0.011)	(0.030)	(0.027)
geo-polit×fin-conve×attetion	-0.154**	-0.012	-0.190*	-0.192**
	(0.069)	(0.038)	(0.096)	(0.083)
growth	0.150***	0.194***	0.230***	0.107***
	(0.043)	(0.051)	(0.061)	(0.035)
hightech	-0.169	-0.391***	-0.188	-0.060
	(0.129)	(0.125)	(0.200)	(0.124)
patent	0.029	0.021	0.032	0.038
	(0.018)	(0.018)	(0.023)	(0.024)
FDI	0.140	0.008	0.205**	0.166*
	(0.085)	(0.090)	(0.090)	(0.095)
GFCF	1.601***	2.541***	0.148	1.770***
	(0.264)	(0.301)	(0.374)	(0.321)
government	-2.148***	0.153	-3.013***	-2.087**
	(0.734)	(0.634)	(0.994)	(0.870)
resource	1.762***	0.901**	2.971***	1.612***
	(0.413)	(0.368)	(0.879)	(0.369)
corruption	0.017	0.013	-0.007	0.030*
	(0.014)	(0.016)	(0.019)	(0.015)
education	-2.100**	-3.254***	0.325	-2.817*
	(0.960)	(1.120)	(1.706)	(1.434)
employment	-0.303	-1.188**	0.886*	-0.376
	(0.459)	(0.545)	(0.467)	(0.506)
enrollment	0.175*	0.079	0.295**	0.208**
	(0.094)	(0.079)	(0.119)	(0.093)
liquidity	-0.091***	-0.043***	-0.097***	-0.098***
	(0.013)	(0.011)	(0.025)	(0.014)
Observation	396	396	396	396
Adjusted R^2	0.436	0.420	0.353	0.416
Year FEs	✓	✓	✓	✓

	(1)	(2)	(3)	(4)
Country FEs	✓	✓	✓	✓

Panel B: ~ attention (lagged 1)

	(1)	(2)	(3)	(4)
geo-polit	-6.369***	-6.862***	-4.878***	-6.774***
	(1.313)	(1.471)	(1.268)	(1.408)
fin-conve	0.085***	0.083***	0.128***	0.074***
	(0.016)	(0.022)	(0.025)	(0.017)
attetion	0.198	0.068	0.045	0.347
	(0.500)	(0.363)	(0.549)	(0.609)
geo-polit×fin-conve	-0.254***	-0.254***	-0.394***	-0.218***
	(0.059)	(0.079)	(0.090)	(0.061)
geo-polit×attetion	-0.700	-0.282	-0.240	-1.174
	(1.627)	(1.183)	(1.841)	(1.975)
fin-conve×attetion	0.016	0.010	-0.016	0.034
	(0.039)	(0.028)	(0.042)	(0.047)
geo-polit×fin-conve×attetion	-0.056	-0.041	0.047	-0.115
	(0.126)	(0.092)	(0.138)	(0.152)
growth	0.153***	0.200***	0.233***	0.108**
	(0.046)	(0.049)	(0.068)	(0.039)
hightech	-0.173	-0.384**	-0.198	-0.068
	(0.145)	(0.135)	(0.188)	(0.145)
patent	0.037**	0.029*	0.042**	0.046*
	(0.017)	(0.016)	(0.019)	(0.024)
FDI	0.112	0.010	0.179**	0.127
	(0.078)	(0.072)	(0.074)	(0.087)
GFCF	1.782***	2.706***	0.160	2.011***
	(0.281)	(0.257)	(0.369)	(0.346)
government	-1.882***	0.167	-2.784***	-1.739**
	(0.597)	(0.533)	(0.913)	(0.728)
resource	1.966***	0.940**	3.244***	1.829***
	(0.422)	(0.370)	(0.874)	(0.400)
corruption	0.024	0.014	0.002	0.037**
	(0.016)	(0.015)	(0.025)	(0.017)
education	-1.967**	-2.993**	0.526	-2.757*
	(0.862)	(1.252)	(1.624)	(1.321)
employment	-0.373	-1.319**	0.841**	-0.436
	(0.401)	(0.501)	(0.390)	(0.461)
enrollment	0.143*	0.062	0.263**	0.174**
	(0.082)	(0.067)	(0.114)	(0.082)
liquidity	-0.075***	-0.039**	-0.079**	-0.080***
	(0.021)	(0.014)	(0.029)	(0.021)
Observation	396	396	396	396
Adjusted R^2	0.407	0.414	0.339	0.380
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

Panel C: ~ attention (lagged 2)

	(1)	(2)	(3)	(4)
geo-polit	-6.849***	-6.584***	-5.702**	-7.377***
	(2.181)	(2.084)	(2.474)	(2.148)

|	(1)	(2)	(3)	(4)
fin-conve	0.086***	0.074**	0.131***	0.078**
	(0.029)	(0.027)	(0.038)	(0.029)
attetion	0.133	0.192	0.088	0.165
	(0.301)	(0.293)	(0.503)	(0.293)
geo-polit×fin-conve	-0.260**	-0.222**	-0.410***	-0.233**
	(0.104)	(0.099)	(0.133)	(0.102)
geo-polit×attetion	-0.476	-0.672	-0.278	-0.603
	(0.976)	(0.956)	(1.686)	(0.950)
fin-conve×attetion	0.021	0.024	0.009	0.027
	(0.023)	(0.021)	(0.039)	(0.023)
geo-polit×fin-conve×attetion	-0.072	-0.086	-0.029	-0.097
	(0.074)	(0.069)	(0.131)	(0.075)
growth	0.147***	0.191***	0.225***	0.105**
	(0.045)	(0.050)	(0.066)	(0.037)
hightech	-0.184	-0.374**	-0.240	-0.072
	(0.143)	(0.135)	(0.196)	(0.142)
patent	0.042**	0.025	0.049**	0.052**
	(0.017)	(0.015)	(0.019)	(0.025)
FDI	0.138*	0.011	0.226**	0.155*
	(0.077)	(0.063)	(0.087)	(0.089)
GFCF	1.815***	2.782***	0.147	2.048***
	(0.275)	(0.267)	(0.366)	(0.348)
government	-1.913***	0.176	-2.812***	-1.795**
	(0.626)	(0.595)	(0.905)	(0.754)
resource	1.986***	1.073***	3.153***	1.858***
	(0.383)	(0.328)	(0.786)	(0.376)
corruption	0.024	0.015	0.001	0.038**
	(0.017)	(0.016)	(0.024)	(0.018)
education	-2.058**	-3.228***	0.445	-2.794**
	(0.795)	(1.044)	(1.667)	(1.187)
employment	-0.462	-1.276**	0.708	-0.565
	(0.385)	(0.476)	(0.420)	(0.421)
enrollment	0.153*	0.073	0.282**	0.180**
	(0.087)	(0.069)	(0.125)	(0.084)
liquidity	-0.074***	-0.037**	-0.078**	-0.079***
	(0.021)	(0.017)	(0.029)	(0.021)
Observation	396	396	396	396
Adjusted R^2	0.417	0.412	0.328	0.395
Year FEs	✓	✓	✓	✓
Country FEs	✓	✓	✓	✓

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
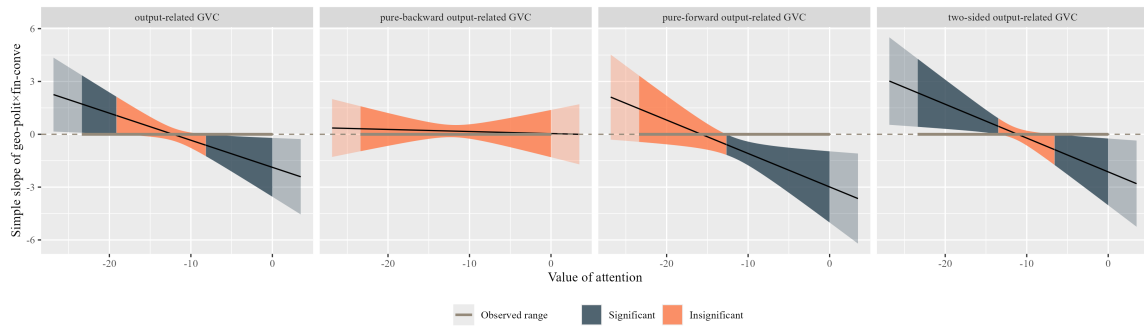
(a) Marginal effect of attention×fin-conve (Current)
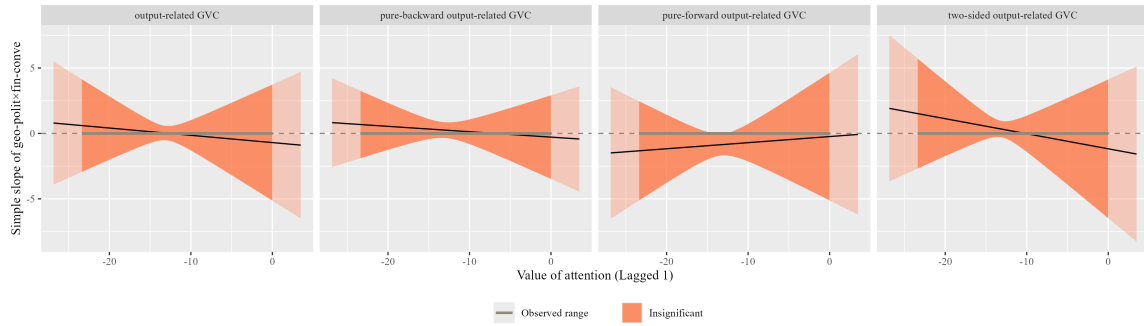
(b) Marginal effect of attention×fin-conve (Lagged 1 term)
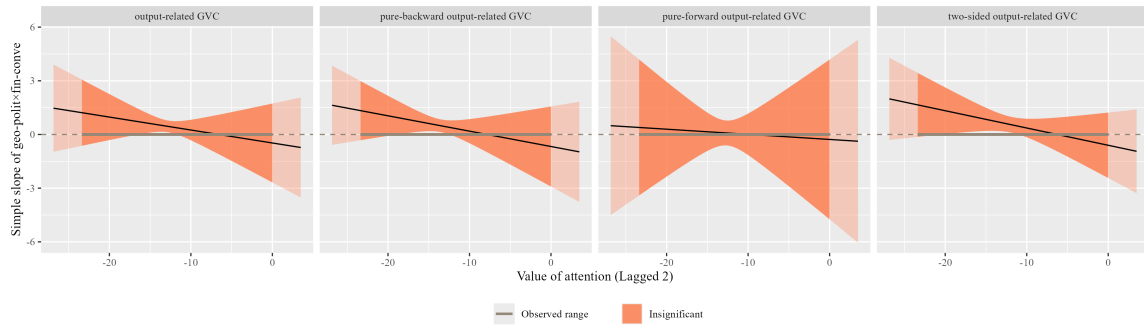
(c) Marginal effect of attention×fin-conve (lagged 2 term)

Figure I.2: Marginal effects of interaction between media attention and financial convenience.

References

Acemoglu, D., Johnson, S., and Robinson, J. A. (2001). The colonial origins of comparative development: An empirical investigation. *American economic review*, 91(5):1369–1401.

Ding, H., Fan, H., and Lin, S. (2018). Connect to trade. *Journal of International Economics*, 110:50–62.

Feenstra, R. C., Li, Z., and Yu, M. (2014). Exports and credit constraints under incomplete information: Theory and evidence from china. *Review of Economics and Statistics*, 96(4):729–744.

Hallak, J. C. and Sivadasan, J. (2009). Firms' exporting behavior under quality constraints. Technical report, National Bureau of Economic Research.

Hallak, J. C. and Sivadasan, J. (2013). Product and process productivity: Implications for quality choice and conditional exporter premia. *Journal of International Economics*, 91(1):53–67.

Nunn, N. and Wantchekon, L. (2011). The slave trade and the origins of mistrust in africa. *American economic review*, 101(7):3221–3252.

Sciarra, C., Chiarotti, G., Laio, F., and Ridolfi, L. (2018). A change of perspective in network centrality. *Scientific reports*, 8(1):15269.

Sciarra, C., Chiarotti, G., Ridolfi, L., and Laio, F. (2020). Reconciling contrasting views on economic complexity. *Nature communications*, 11(1):3352.

Tacchella, A., Cristelli, M., Caldarelli, G., Gabrielli, A., and Pietronero, L. (2012). A new metrics for countries' fitness and products' complexity. *Scientific reports*, 2(1):723.