The Rise of Innovation-Driven Relocation: Evidence from China's Reshoring and Re-offshoring

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***Abstract*:** The global manufacturing location is a dynamic result of competing relocation patterns (i.e., offshoring, re-shoring, and re-offshoring). This study adopts the systematic measurement constructed by Gao et al. (2022), which is based on inter-country input-output framework. Using the 2024 edition of ADB-MRIO, the paper quantifies the magnitude of three primary modes of international industry relocation—offshoring, reshoring, and re-offshoring—from 2017 to 2023. Leveraging the measurement results, we employ a two-way fixed effects model to empirically analyze the key factors driving the reshoring of manufacturing from China to home countries, as well as China's re-offshoring to third countries. The empirical evidence prior to 2023 confirms that: 1) re-shoring has emerged as the most dominating pattern in recent years; 2) China remains the most critical node in global industrial restructuring, serving as the dominant origin for reshoring and the primary locus for re-offshoring dynamics; 3) the case of China demonstrates that innovation capacity has superseded cheap labor as the decisive factor in industrial relocation.

***Keyword*:** Production Location Re-configuration; Offshoring; Re-shoring; Re-offshoring; Industry Relocation; China; innovation

JEL classifications: L16, M11, F23, C67

Introduction

The Covid-19 pandemic and the associated disruption in the global value chain has highlighted the importance of supply-chain resilience, pushed the re-configuration of many global value chains, and re-focused attention on the location (and re-location) of production (Brakman et al., 2020). While the previous era was defined by the massive offshoring of production from advanced economies to low-cost destinations, recent years have witnessed a complex reversal of this trend, manifested through reshoring and re-offshoring patterns(Gray J V.,2013). The traditional logic governing Global Value Chains (GVCs), which prioritized labor arbitrage and cost minimization, is undergoing a fundamental transformation(Witt M A.,2019). In the previous wave of globalization, the spatial fragmentation of production was primarily driven by the pursuit of comparative advantages in labor costs, positioning China as the "world's factory" (Lardy N R.,2004). However, recent years have witnessed a paradigm shift toward "resilience-seeking" and "innovation-led" reconfiguration, catalyzed by escalating geopolitical risks and the rapid adoption of digital technologies (Gereffi, 2020; Dachs B,et al.,2019). In this new landscape, the deterministic role of labor cost differentials is being superseded by the necessity for technological integration, supply chain security, and proximity to advanced innovation ecosystems.

Against this global backdrop, China serves as a critical and illustrative case for observing these shifting dynamics. For decades, China's unparalleled labor cost advantages and extensive industrial clusters made it the dominant destination for global offshoring(Amiti M and Freund C.,2010). However, the current era marks a significant inflection point: China is increasingly transitioning from a primary recipient of global production to a central point of origin for both reshoring and re-offshoring activities.

This dual flow of industrial relocation presents a unique empirical puzzle. While traditional economic logic would suggest that rising costs in China should drive production toward lower-cost neighbors, the observed reality reveals a more complex pattern where manufacturing also moves back to high-income home countries or toward third-party nations with advanced innovation ecosystems. This phenomenon suggests that early offshoring decisions may have been biased by an overemphasis on short-term labor savings (Gray J V. et al., 2013), and the current wave of relocation represents a strategic realignment toward high-tech environments.

The emergence of Industry 4.0 and automation technologies has further enabled this shift, allowing firms to offset labor cost disadvantages through increased capital intensity (Dachs B and Kinkel S. et al., 2019). Consequently, the Chinese case challenges the conventional "cost-centric" narrative and necessitates a deeper investigation into whether innovation capacity has emerged as the true anchor of modern industrial spatial distribution. As emerging economies like China move up the value chain, their original low-end manufacturing segments inevitably undergo re-offshoring to seek new technical standard systems or market potentials (Kinkel S., 2014; Kinkel, S.,et al. ,2023;Nguyen T.H. et al.,2025).

To address this empirical puzzle, the present study systematically investigates the mechanisms underlying China's manufacturing relocation. Utilizing the latest Asian Development Bank Multi-Regional Input-Output (ADB MRIO, 2024 edition) tables, we employ a systematic measurement framework to quantify the magnitude and direction of three distinct relocation patterns—offshoring, reshoring, and re-offshoring—covering the period from 2017 to 2023. Following the quantification of these patterns, a two-way fixed effects model is constructed to rigorously analyze the determinants driving reshoring from China to home countries and re-offshoring to third-party nations. This approach allows us to disentangle the impact of innovation capacity from traditional factor endowments, while further exploring industry-level heterogeneity across fourteen manufacturing sectors to capture the nuanced decision-making processes of multinational corporations.

The marginal contributions of this paper are manifested in two principal aspects. First, this paper provides a timely and comprehensive mapping of the most recent shifts in global industrial relocation, specifically focusing on China's transition in the post-pandemic era. Second, and more importantly, our findings provide robust evidence that innovation capacity has emerged as the definitive driver of modern reshoring and re-offshoring, effectively challenging the long-standing consensus that cheap labor remains the primary catalyst for industrial migration. By revealing how technological standards and market-seeking motives supersede traditional wage differentials—particularly in capital- and technology-intensive sectors—this study offers a fresh theoretical perspective for understanding the dynamics of global supply chain reconfiguration within the context of technological globalization.

Literature Review

Offshoring denotes the relocation of production to foreign economies [1] (Wan *et al*., 2019). This phenomenon could be traced back to the 1960-1970s, as a prominent pattern of manufacturing location that

[1] The scope of offshoring differs in the different research areas. In the "supply-chain management" literature, offshoring usually focuses on the multinational enterprises moving their whole or partial production capacity to their overseas subsidiaries, which is closely related to the international investment. While, in the GVC papers, the offshoring also includes changing from domestic suppliers to foreign suppliers (Feenstra and Hanson, 1999). This can be realized by global trade even when no international investment exists and is determined by the dynamic competitive advantages of different economies across the world. In this paper, we adopted the latter definition that has a broader scope.

saw production activity move from the developed economies towards low-cost economies (with an earlier period in which production moved within countries, such as in the US, with relocation from the Midwest and Northeast to the south). The process has accelerated since the beginning of the 21st century, driven by the rapid development of the Global Value Chain (GVC or Global Production Network, GPN; Coe *et al.*, 2008). The opening of national markets in low-cost and high-growth economies provided the most prominent, attractive destinations for manufacturing offshoring. Some countries benefited significantly from this process; in particular, for example, the well-known depiction of India as "the back-office of the world" (Dossani & Kenny, 2007; Jensen & Pedersen, 2011) and China as "the factory of the world" (Lemoine & Ünal-Kesenci, 2004).

Although the advocates assert that offshoring would offer mutual benefits between home and host economy (Farrell & Angrawal, 2003; Farrell, 2005), there exist increasingly widespread concerns associated with offshoring, centring on job losses (Levy, 2005; Metters & Verma, 2008), quality risk (Gray *et al.*, 2011) and logistical risk (Ritter & Sternfels, 2004). After experiencing sequential shocks generated by the global financial crisis in 2008, the "Brexit" process, the US-China trade war, and (in particular) the most recent Covid-19 pandemic, increasing uncertainties in the efficient functioning of GVCs have challenged some of the earlier expectations about global production location. Part of the previously offshored production has been relocated to the home economies since reliability was often valued more highly even if it costs more. This phenomenon is referred as "re-shoring" (or "on-shoring", "back-shoring," Delis *et al*., 2019; Ellram, 2013; Joubioux & Vanpoucke, 2016). The political economy dimension has seen re-shoring as an approach to enhance domestic economic recovery and restore industrial competitiveness, especially in Western Europe and the US. The drivers of manufacturing reshoring encompass a complex interplay between internal strategic realignments and external environmental shifts. Early research identifies managerial miscalculations during the initial offshoring phase—such as inadequate locational planning, a lack of local market knowledge, and the "bandwagon effect"—as primary internal catalysts for returning production to the home country (Ancarani et al., 2015; Kinkel & Zanker, 2013; Gray et al., 2013). Externally, the erosion of traditional comparative advantages in host countries, including rising labor and logistics costs (Simchi-Levi et al., 2012; Stentoft et al., 2016), insufficient infrastructure (Srai & Ané, 2016), and a lack of innovation capacity (Gray et al., 2013; Kinkel, 2014), has further incentivized firms to retreat from offshore locations. Conversely, the home country's attraction is bolstered by labor market flexibility (Wiesmann et al., 2017), proximity to final consumer markets (Wu & Zhang, 2014; Moradlou et al., 2021), and the presence of advanced technological clusters and supportive subsidy policies (Tate, 2014; Brandon-Jones et al., 2017). Furthermore, reshoring is increasingly utilized as a strategic mechanism to mitigate systemic risks, such as exchange rate volatility and global supply chain disruptions (Gylling et al., 2015; Ellram et al., 2013). More recently, scholarship has begun to emphasize the role of Industry 4.0 and domestic technological progress in neutralizing the labor cost advantages of offshore production (Dachs et al., 2019). However, despite the growing theoretical focus on the intersection of technological advancement and reshoring (Faber, M.,2020; Stentoft & Rajkumar, 2020; Kinkel et al., 2023; Nguyen et al., 2025), empirical evidence remains relatively limited, with only a small proportion of reshoring activities currently attributed to the adoption of advanced digital manufacturing (Ancarani & Di Mauro, 2018).

However, the previously offshored production can also choose to move towards third economies. On the one hand, faced with the diminishing cost advantage in the host economies (especially China), the offshored production might move to the third economy where the cost advantage can be maintained or enhanced, a process referred to as "far-shoring" by Gadde & Jonsson (2019). On the other hand, considering the quality risk and supply chain inflexibility caused by greater distance, the offshored production might move to the third economy that is much closer to the home economy. This relocation pattern is referred to as "near-shoring" (De Backer *et al*., 2016; Ellram *et al*., 2013). In this paper, both the "far-shoring" and the "near-shoring" are collectively referred to as "re-offshoring," namely changing the host economy of offshoring rather than moving back to the home economy. In recent years, the abundant labour resources, flexible investment environment, and desire for rapid development has made the Global South a more attractive destination for offshoring or re-offshoring (Meng *et al*., 2018). At the same time, China, the primary host economy of manufacturing offshoring before the global financial crisis in 2008, has been confronted with the rapid increase in production factor prices, the tightening of environmental protection policies, and the trade protection issues that are pushing production outside of China. Both tendencies have generated a trend of re-offshoring, although such a trend had already begun earlier in the past decade. The determinants of near-shoring parallel those of near-shoring, particularly regarding the sensitivity of firm location to labor and logistics cost structures (Bock, 2008; Malos, 2010; Tate et al., 2014; Fratocchi et al., 2014; Della Posta, 2023; Zhang & Huang, 2012; Van Hassel et al., 2022). Beyond cost-based rationales, a significant body of literature examines the role of geographic proximity as a primary antecedent to operational responsiveness across the supply chain. From a supply-side perspective, firms navigate the strategic trade-off between low-cost, distant offshore suppliers and higher-cost, near-shore alternatives that offer superior agility (Allon & Van Mieghem, 2010; Gadde & Jonsson, 2019). This spatial proximity facilitates more effective strategic partnerships and regional resource integration, which in turn supports broader sustainability objectives (Tate et al., 2014; Ashby, 2016; Bettiol et al., 2023). Simultaneously, geographic distance dictates the efficacy of demand-side consumer responses, where localized production allows for more precise alignment with market demand. Furthermore, internal organizational decision-making frameworks (Huq et al., 2021) and the necessity to mitigate supply chain vulnerabilities (Ersahin et al., 2024) constitute significant factors for near-shoring. These relocations are often accelerated by exogenous shocks, including heightened geopolitical risks (Khorana et al., 2022; Yücesan, 2025) and the systemic disruptions induced by the COVID-19 pandemic (Barbieri et al., 2020; Van Hassel et al., 2022). Nevertheless, empirical inquiry into how the innovation advantages of third-party nations influence re-offshoring remains relatively sparse within the current literature (Kumar et al., 2010).

Taken overall, global production location is likely to change profoundly in the coming years (Brakman *et al.*, 2020; Gereffi, 2020), but how it will change is becoming an increasingly important question. Addressing this question requires first and foremost the development of quantitative measures of the magnitude of the three relocation patterns (i.e., offshoring, re-shoring, re-offshoring) so that there is a basis on which to view current changes in the light of global production location re-configuration in the recent past. This study adopts the systematic measurement framework constructed by Gao et al. (2022), which is based on the Multi-Regional Input-Output Table (MRIO) provided by the Asian Development Bank (ADB,2024 edition), to quantify the magnitude of three primary modes of international industry relocation—offshoring, reshoring, and re-offshoring—from 2017 to 2023, and shed light on the *process-*

specific, *industry-specific*, and *country-specific* features in manufacturing re-shoring or re-offshoring. Leveraging the measurement results, we employ a two-way fixed effects model to empirically analyze the key factors driving the reshoring of manufacturing from China to home countries, as well as China's re-offshoring to third countries.

The paper is organized as follows: the next section provides the systematic measurement framework constructed by Gao et al. (2022), and then provides the two-way fixed effects model to explore the driving factors of industrial relocation. The empirical analysis section is based on the Multi-Regional Input-Output Table (MRIO) provided by the Asian Development Bank (ADB,2024 edition). In this section, the analyses in *process-specific*, *industry-specific*, and *country-specific* dimensions are conducted, and the re-configuration of global production location during the period 2007-2023 is revealed. The next section presents the case study of China's reshoring and re-offshoring dynamics, providing an empirical analysis of the critical determinants driving the relocation of manufacturing from China back to home countries (reshoring), as well as the transition of production from China to third-party nations (re-offshoring). To ensure the validity and depth of the findings, the study further executes comprehensive robustness tests and sectoral group regressions to examine industry-specific heterogeneity. In the final section. the paper concludes with a discussion of the results and their implications.

Methodology

Measurement of Global Industry Relocation

The starting point of the methodology is a newly proposed measure of global industry relocation using the inter-country input-output tables (Gao *et al.* 2022).[2] This measure subdivides the industry relocation into three components: (1) industry relocation driven by intermediate inputs, (2) by final products, and (3) indirect intermediates relocation driven by final products. The simplified modelling processes drawn from Gao *et al.* (2018) based, for illustration, on a two-economy world are presented as follows.[3]

Table 1. World input-output table with two economies

		Intermediate use		Final demand		Gross output
		Economy *r*	Economy *s*	Economy *r*	Economy *s*	
Intermediate inputs	Economy *r*	$\boldsymbol{Z}_{rr}$	$\boldsymbol{Z}_{rs}$	$\boldsymbol{f}_{rr}$	$\boldsymbol{f}_{rs}$	$\boldsymbol{x}_r$
	Economy *s*	$\boldsymbol{Z}_{sr}$	$\boldsymbol{Z}_{ss}$	$\boldsymbol{f}_{sr}$	$\boldsymbol{f}_{ss}$	$\boldsymbol{x}_s$
Value added		$\boldsymbol{v'}_r$	$\boldsymbol{v'}_s$			
Total input		$\boldsymbol{x'}_r$	$\boldsymbol{x'}_s$			

Note: where $'$ denotes transpose of vector x and v

Assuming a two-economy (economy r and economy s) world, of which the input-output flows are recorded as in table 1, and each economy has *N* industries. Then, in table 1, $\boldsymbol{Z}_{rs}$ is an $N \times N$ matrix of intermediates delivered from economy *r* to economy *s*; $\boldsymbol{f}_{rs}$ denotes an $N \times 1$ vector of the final products produced in economy r and consumed in economy s; $\boldsymbol{v}_r$ denotes an $N \times 1$ vector of the sectoral value

[2] The methodology section is focusing on the measurement of production relocation, rather than the mechanism and reasons why such production relocations might take place. A strand of literature has discussed the latter issue based on the theoretical framework, such as Baldwin and Venables (2013), Fujita and Thisse (2013), and Antràs and De Gortari (2020).

[3] The modelling process of the case with more than two economies is similar with that presented in this section. The following notation is used for easier understanding: upper case bold letters are matrices, lower case bold letters are vectors, and lower case nonbold letters are scalars. $\boldsymbol{I}$ denotes the identity matrix.

added for economy r while $'$ denotes the transposition of a vector; $\boldsymbol{x}_r$ is an $N \times 1$ vector giving the gross output in economy r, which equals its total input.

The Industry Relocation Driven by Intermediate Inputs

The industry relocation driven by intermediate inputs (denoted by $re^1_{ri,sj}$)[4] denotes the relocated intermediate production of industry i (in economy r) that is caused by the changes of spatial supply-shares in the intermediates used by industry j (in economy s).

Calculating the direct input coefficients from economy r to economy s as[5] $\boldsymbol{A}_{rs} = \boldsymbol{Z}_{rs}\hat{\boldsymbol{x}}_s^{-1}$, $\boldsymbol{A}_{rs}$ denotes an $N \times N$ matrix of the inputs from economy r for per unit sectoral output of economy s. Define $\boldsymbol{A} = \begin{pmatrix} \boldsymbol{A}_{rr} & \boldsymbol{A}_{rs} \\ \boldsymbol{A}_{sr} & \boldsymbol{A}_{ss} \end{pmatrix}$ as a $2N \times 2N$ matrix of global direct input coefficients and $\boldsymbol{f} = \begin{pmatrix} \boldsymbol{f}_{rr} + \boldsymbol{f}_{rs} \\ \boldsymbol{f}_{sr} + \boldsymbol{f}_{ss} \end{pmatrix}$ as a $2N \times 1$ vector of the final products produced in each economy. Denote 0 as the start year and 1 as the end year of the period. If the final products of the end year ($\boldsymbol{f}_1$) are produced in the start year, then according to classic Leontief input-output equation (Leontief, 1986), the hypothetical intermediate inputs can be calculated as:

$$\boldsymbol{C}_0 = [(\boldsymbol{I} - \boldsymbol{A}_0)^{-1} - \boldsymbol{I}]\hat{\boldsymbol{f}}_1 \tag{1}$$

where, $\boldsymbol{C}_0 = (c^0_{ri,sj})$ is a $2N \times 2N$ matrix that denotes the hypothetical intermediates supplied from industry i (in economy r) for producing the final products of industry j (in economy s) under the global direct input coefficients $\boldsymbol{A}_0$. Similarly, let:

$$\boldsymbol{C}_1 = [(\boldsymbol{I} - \boldsymbol{A}_1)^{-1} - \boldsymbol{I}]\hat{\boldsymbol{f}}_1 \tag{2}$$

where, $\boldsymbol{C}_1 = (c^1_{ri,sj})$ is a $2N \times 2N$ matrix that denotes the real intermediates supplied from industry i (in

[4] Hereinafter, the subscript i and j denotes the industry sectors.

[5] The hat symbol (^) indicates the diagonalization of a vector.

economy r) for producing the final products of industry j (in economy s) under the global direct input coefficients $\boldsymbol{A}_1$. Then, $\boldsymbol{C}_1 - \boldsymbol{C}_0$ denotes the changes of total intermediate inputs used for producing $\boldsymbol{f}_1$, a result driven by the evolution of global direct input coefficients from $\boldsymbol{A}_0$ to $\boldsymbol{A}_1$.

The evolution of direct input coefficients may originate from two causes. The first results from substitution between different inputs. For example, the automation equipment substitutes the labour input, and the nuclear energy substitutes the fossil energy. The second is the spatial change of the supplier for a specific intermediate input, e.g., the coal supplier of the steel-making industry in economy r may change from economy r to s, leading to the industry relocation driven by intermediate inputs. Therefore, one needs to extract the impact of the second cause from $\boldsymbol{C}_1 - \boldsymbol{C}_0$.

In the two-economy world case, $\boldsymbol{C}_t$ $(t = 0\ or\ 1)$ can be represented as $\begin{pmatrix} \boldsymbol{C}_{tr} \\ \boldsymbol{C}_{ts} \end{pmatrix}$, where the $N \times 2N$ sub-matrix $\boldsymbol{C}_{tr}$ denotes the intermediate inputs from economy r for producing the final products $\boldsymbol{f}_1$ under the global direct input coefficients $\boldsymbol{A}_t$. Hence, $\boldsymbol{C}_t^* = \boldsymbol{C}_{tr} + \boldsymbol{C}_{ts}$, where $\boldsymbol{C}_t^*$ is a $N \times 2N$ matrix, denoting the intermediate inputs from the whole world for producing the final products $\boldsymbol{f}_1$. Thereafter, we can show that: [6]

$$\boldsymbol{R}_{tr} = \boldsymbol{C}_{tr}./\boldsymbol{C}_t^* \quad t = 0{,}1 \tag{3}$$

where $\boldsymbol{R}_{tr}$ is a $N \times 2N$ matrix denotes the shares of intermediate inputs supplied by economy r under

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[6] In equation (3), by employing the form of Hadamard product, $./$ denotes the elementwise division for two matrixes with the same dimensions. For example, if $\boldsymbol{C}_{tr} = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ and $\boldsymbol{C}_t^* = \begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix}$, then $r_{tr} = c_{tr}./c_t^* = \begin{pmatrix} \frac{1}{2} & \frac{2}{3} \\ \frac{3}{4} & \frac{4}{5} \end{pmatrix}$.

the global direct input coefficients $\boldsymbol{A}_t$. The $2N \times 2N$ matrix $\boldsymbol{R}_t = \begin{pmatrix} \boldsymbol{R}_{tr} \\ \boldsymbol{R}_{ts} \end{pmatrix}$ denotes the shares of each economy of the world total. Hence, $\boldsymbol{C}_1 - \boldsymbol{C}_0$ can be decomposed as:[7]

$$\boldsymbol{C}_1 - \boldsymbol{C}_0 = \begin{pmatrix} (\boldsymbol{C}_1^* - \boldsymbol{C}_0^*) \circ \boldsymbol{R}_{0r} \\ (\boldsymbol{C}_1^* - \boldsymbol{C}_0^*) \circ \boldsymbol{R}_{0s} \end{pmatrix} + \left[\boldsymbol{C}_1 - \begin{pmatrix} \boldsymbol{C}_1^* \circ \boldsymbol{R}_{0r} \\ \boldsymbol{C}_1^* \circ \boldsymbol{R}_{0s} \end{pmatrix}\right] \tag{4}$$

where the first term $\begin{pmatrix} (\boldsymbol{C}_1^* - \boldsymbol{C}_0^*) \circ \boldsymbol{R}_{0r} \\ (\boldsymbol{C}_1^* - \boldsymbol{C}_0^*) \circ \boldsymbol{R}_{0s} \end{pmatrix}$ corresponds to the impact of substitutions between different inputs, and the second term $\left[\boldsymbol{C}_1 - \begin{pmatrix} \boldsymbol{C}_1^* \circ \boldsymbol{R}_{0r} \\ \boldsymbol{C}_1^* \circ \boldsymbol{R}_{0s} \end{pmatrix}\right] = \begin{pmatrix} \boldsymbol{C}_1^* \circ (\boldsymbol{R}_{1r} - \boldsymbol{R}_{0r}) \\ \boldsymbol{C}_1^* \circ (\boldsymbol{R}_{1s} - \boldsymbol{R}_{0s}) \end{pmatrix}$ corresponds to the impact caused by the change of the supplier, which is the measurement of the industry relocation driven by intermediate inputs. Thus:

$$\boldsymbol{RE1} = (re_{ri,sj}^1)_{\boldsymbol{2N \times 2N}} = \left[\boldsymbol{C}_1 - \begin{pmatrix} \boldsymbol{C}_1^* \circ \boldsymbol{R}_{0r} \\ \boldsymbol{C}_1^* \circ \boldsymbol{R}_{0s} \end{pmatrix}\right] \tag{5}$$

where $re_{ri,sj}^1$ denotes the relocated intermediate production of industry *i* (in economy *r*) that is caused by the changes of spatial supply-shares in the intermediates used by industry *j* (in economy *s*). If $re_{ri,sj}^1 > 0$ (<0), it implies that changes in the intermediates used by industry *j* (in economy *s*) relocate the intermediate production of industry *i* into (out from) economy *r*.

The Industry Relocation Driven by Final Products

The industry relocation driven by final products (denoted by $re_{ri,sj}^2$) denotes the relocated final-product production of industry *i* (in economy *r*) that is caused by the changes of spatial supply-shares in the final products consumed in economy *s*.

Define $\boldsymbol{ff} = \begin{pmatrix} \boldsymbol{ff}_r \\ \boldsymbol{ff}_s \end{pmatrix} = \begin{pmatrix} \boldsymbol{f}_{rr} + \boldsymbol{f}_{sr} \\ \boldsymbol{f}_{rs} + \boldsymbol{f}_{ss} \end{pmatrix}$ as a $2N \times 1$ vector that denotes the final products *consumed* in each economy.[8] Define $\boldsymbol{FC}$ as a $2N \times 2N$ matrix giving the share of the final products supplied by each

[7] In equation (4), $\circ$ denotes the Hadamard product of elementwise multiplication for two matrixes with the same dimensions.

[8] Note that the vector $\boldsymbol{ff}$ is distinguished from $\boldsymbol{f} = \begin{pmatrix} \boldsymbol{f}_{rr} + \boldsymbol{f}_{rs} \\ \boldsymbol{f}_{sr} + \boldsymbol{f}_{ss} \end{pmatrix}$. The latter is the vector of the final products

economy. In the two-economy world case:

$$\boldsymbol{FC} = \begin{pmatrix} \boldsymbol{f}_{rr}\cdot/\widehat{\boldsymbol{ff}}_r & \boldsymbol{f}_{rs}\cdot/\widehat{\boldsymbol{ff}}_s \\ \boldsymbol{f}_{sr}\cdot/\widehat{\boldsymbol{ff}}_r & \boldsymbol{f}_{ss}\cdot/\widehat{\boldsymbol{ff}}_s \end{pmatrix} \tag{6}$$

Then, the industry relocation driven by final products is measured as:

$$\boldsymbol{RE2} = (re^2_{ri,sj})_{\boldsymbol{2N}\times\boldsymbol{2N}} = (\boldsymbol{FC}_1 - \boldsymbol{FC}_0) * \widehat{\boldsymbol{ff}}_1 \tag{7}$$

where, $re^2_{ri,sj}$ denotes the relocated final-product production of industry *i* (in economy *r*) that is caused by the changes of spatial supply-shares in industry *j*'s final products consumed in economy *s*. If $re^2_{ri,sj} > 0$ (<0), it means such changes in industry *j*'s final products consumed in economy *s* relocate the final-products' production of industry *i* into (out from) economy *r*. Obviously, when industry *i* and industry *j* are not the same, $re^2_{ri,sj} = 0$.

The Indirect Intermediates Relocation Driven by Final Products

The final-products production in different locations relies on different domestic and international supply chains; the industry relocation driven by final products affects the location of their intermediate inputs. Based on the Leontief input-output model, the industry relocation of final products will lead to the change of intermediate inputs as:

$$\boldsymbol{RE3} = (re^3_{ri,sj})_{\boldsymbol{2N}\times\boldsymbol{2N}} = ((\boldsymbol{I} - \boldsymbol{A}_0)^{-1} - \boldsymbol{I}) * (\boldsymbol{RE2}) \tag{8}$$

where $re^3_{ri,sj}$ denotes the relocated intermediate production of industry *i* (in economy *r*) that is caused by the changes of spatial supply-shares in industry *j*'s final products consumed in economy *s*. This is the indirect intermediates relocation driven by final products. If $re^3_{ri,sj} > 0$ (<0), it means such changes in industry *j*'s final products consumed in economy *s* relocate the intermediates production of industry *i* into

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produced in each economy.

(out from) economy r. Appendix A provides three numerical examples corresponding to the three types of industry relocation, to enhance the economic intuition for the measurement.

Measurement of Global Offshoring, Re-shoring, and Re-offshoring

In this section, the paper will develop an algorithm to classify the results of global industry relocation into three relocation patterns, i.e., offshoring, re-shoring, and re-offshoring. Considering that an offshoring activity must have occurred before the corresponding re-shoring or re-offshoring activities (Gray *et al.*, 2013), this algorithm presumes a benchmark period when offshoring dominates the relocation patterns, and then identifies different relocation patterns in the reporting period by comparing the results of global industry relocation between two periods.[9] The algorithm is presented in 5 steps as follows:

Step 1: Measure the global industry relocation in the benchmark period.

Denote $re_{ri,sj}^{k,0}$ for the result in the benchmark period, where k = 1,2,3 corresponding to the industry relocation driven by intermediate inputs, by final products, and indirect intermediates relocation driven by final products, respectively; if $re_{ri,sj}^{k,0} > 0$, then economy r is the destination of industry i's offshoring driven by the changes from the industry j in economy s[10]. Otherwise, if $re_{ri,sj}^{k,0} < 0$, then economy r is the home economy of industry i's offshoring. Note that, for each offshoring activity, there will be a positive result for the host economy and, at the same time, a negative result for the home economy.[11]

[9] This paper sets the period 2000-2007 as the benchmark period and period 2007-2014 as the reporting period since several relevant papers have suggested that offshoring was the most prominent relocation pattern before the financial crisis in 2008. For example, Delis *et al.* (2019) showed that the increase in re-shoring activity was triggered by the financial crisis beginning around 2008.

[10] The type of change depends on the type of industry relocation. For the industry relocation driven by intermediate inputs (k=1), it corresponds to the change of spatial supply-shares in the intermediates used by industry j, which happens in the production process. For the other two types of industry relocation (k=2, 3), it corresponds to the change of spatial supply-shares in industry j's final products consumed in economy s, which happens in the final consumption side.

[11] Although the measurements can indicate where the production relocates to or where it comes from, unfortunately, it cannot connect the destination and its corresponding origins.

Step 2: Measure the global industry relocation in the reporting period.

If $re_{ri,sj}^{k,1}$ is the result in the reporting period, by comparing $re_{ri,sj}^{k,1}$ and $re_{ri,sj}^{k,0}$, the economy *r* can be classified into four mutual exclusive sets:

1) $\{++|s,i,j\} = \{r|s,i,j,re_{ri,sj}^{k,0} > 0 \; \& \; re_{ri,sj}^{k,1} > 0\}$, in which industry *i*'s production is relocated into economy *r* in both periods driven by the changes from the industry *j* in economy *s*;

2) $\{+-|s,i,j\} = \{r|s,i,j,re_{ri,sj}^{k,0} > 0 \; \& \; re_{ri,sj}^{k,1} < 0\}$, in which industry *i*'s production is relocated into economy *r* in the benchmark period, but out from there in the reporting period;

3) $\{-+|s,i,j\} = \{r|s,i,j,re_{ri,sj}^{k,0} < 0 \; \& \; re_{ri,sj}^{k,1} > 0\}$, in which industry *i*'s production is relocated out from economy *r* in the benchmark period, but back to there in the reporting period;

4) $\{--|s,i,j\} = \{r|s,i,j,re_{ri,sj}^{k,0} < 0 \; \& \; re_{ri,sj}^{k,1} < 0\}$, in which industry *i*'s production is relocated out from economy *r* in both periods.

Thus, the industry relocation in the reporting period can be classified into three relocation patterns, as shown in figure 2.

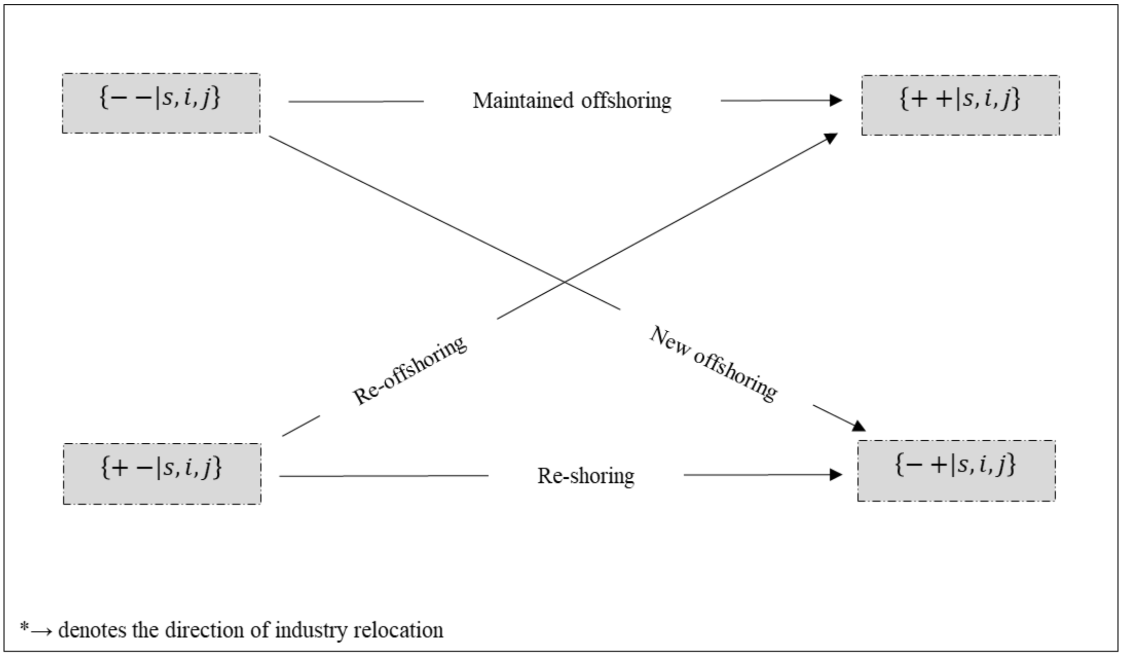


Figure 1. The relocation patterns in the reporting period.

Step 3: Measure the magnitude of re-shoring in the reporting period.

The re-shoring means moving the previously offshored production back to the home economies. Thus, for each specific s, i, j, re-shoring must correspond to the industry relocation from $\{+ - | s, i, j\}$ to $\{- + | s, i, j\}$. If $\sum_{r \in \{- + | s, i, j\}} \left| re_{ri,sj}^{k,1} \right| \leq \sum_{r \in \{+ - | s, i, j\}} \left| re_{ri,sj}^{k,1} \right|$, it means the production relocated out from the host economy (where the offshoring relocates in during the benchmark period) exceeds the production relocated into the home economy. Thus, for $r \in \{- + | s, i, j\}$ (the home economy), the magnitude of re-shoring is $reshoring_{ri,sj}^{k,1} = re_{ri,sj}^{k,1}$; for $r \in \{+ - | s, i, j\}$ (the host economy), the magnitude of re-shoring is $reshoring_{ri,sj}^{k,1} = \frac{\left(\sum_{p \in \{- + | s, i, j\}} \left| re_{pi,sj}^{k,1} \right| \right) * re_{ri,sj}^{k,1}}{\sum_{q \in \{+ - | s, i, j\}} \left| re_{qi,sj}^{k,1} \right|}$. Further, the "surplus" (i.e., $\sum_{r \in \{+ - | s, i, j\}} \left| re_{ri,sj}^{k,1} \right| - \sum_{r \in \{- + | s, i, j\}} \left| re_{ri,sj}^{k,1} \right|$) should be recorded as the re-offshoring. Otherwise, if $\sum_{r \in \{- + | s, i, j\}} \left| re_{ri,sj}^{k,1} \right| > \sum_{r \in \{+ - | s, i, j\}} \left| re_{ri,sj}^{k,1} \right|$, it means the production relocated out from the host economy is less than the production relocated into the home economy. Then, for $r \in \{- + | s, i, j\}$, the magnitude of re-shoring is $reshoring_{ri,sj}^{k,1} = \frac{\left(\sum_{q \in \{+-|s,i,j\}} \left|re_{qi,sj}^{k,1}\right|\right) * re_{ri,sj}^{k,1}}{\sum_{p \in \{-+|s,i,j\}} \left|re_{pi,sj}^{k,1}\right|}$; for $r \in \{+-|s,i,j\}$, the magnitude of re-shoring is $reshoring_{ri,sj}^{k,1} = re_{ri,sj}^{k,1}$. And the "deficit" (i.e., $\sum_{r \in \{-+|s,i,j\}} \left|re_{ri,sj}^{k,1}\right| - \sum_{r \in \{+-|s,i,j\}} \left|re_{ri,sj}^{k,1}\right|$) should be recorded as the new offshoring generated in the reporting period.

Step 4: Measure the magnitude of re-offshoring in the reporting period.

The re-offshoring means moving the previously offshored production to third economies except home. Thus, it corresponds to the industry relocation from $\{+-|s,i,j\}$ to $\{++|s,i,j\}$ (all that to $\{-+|s,i,j\}$ are counted in re-shoring). According to step 3, when $\sum_{r \in \{-+|s,i,j\}} \left|re_{ri,sj}^{k,1}\right| \leq \sum_{r \in \{+-|s,i,j\}} \left|re_{ri,sj}^{k,1}\right|$, then for $r \in \{++|s,i,j\}$, the magnitude of re-offshoring is $reoffshoring_{ri,sj}^{k,1} = \frac{\left(\sum_{q \in \{+-|s,i,j\}} \left|re_{qi,sj}^{k,1}\right| - \sum_{p \in \{-+|s,i,j\}} \left|re_{pi,sj}^{k,1}\right|\right) * re_{ri,sj}^{k,1}}{\sum_{u \in \{++|s,i,j\}} \left|re_{ui,sj}^{k,1}\right|}$; for $r \in \{+-|s,i,j\}$, the magnitude of re-offshoring is $reoffshoring_{ri,sj}^{k,1} = re_{ri,sj}^{k,1} - reshoring_{ri,sj}^{k,1}$.

Step 5: Measure the magnitude of offshoring in the reporting period.

There are two kinds of offshoring in the reporting period. The first is the new offshoring generated in the reporting period, which corresponds to the industry relocation from $\{--|s,i,j\}$ to $\{-+|s,i,j\}$. The second is the offshoring maintained from the benchmark period, which corresponds to the industry relocation from $\{--|s,i,j\}$ to $\{++|s,i,j\}$. Thus, for $r \in \{++|s,i,j\}$, the magnitude of the offshoring is $offshoring_{ri,sj}^{k,1} = re_{ri,sj}^{k,1} - reoffshoring_{ri,sj}^{k,1}$; for $r \in \{-+|s,i,j\}$, when $\sum_{r \in \{-+|s,i,j\}} \left|re_{ri,sj}^{k,1}\right| > \sum_{r \in \{+-|s,i,j\}} \left|re_{ri,sj}^{k,1}\right|$, the magnitude of the offshoring is $offshoring_{ri,sj}^{k,1} = \frac{\left(\sum_{p \in \{-+|s,i,j\}} \left|re_{pi,sj}^{k,1}\right| - \sum_{q \in \{+-|s,i,j\}} \left|re_{qi,sj}^{k,1}\right|\right) * re_{ri,sj}^{k,1}}{\sum_{p \in \{-+|s,i,j\}} \left|re_{pi,sj}^{k,1}\right|}$; for $r \in \{--|s,i,j\}$, the magnitude of the offshoring is $offshoring_{ri,sj}^{k,1} = re_{ri,sj}^{k,1}$. Appendix-B summarizes the equations measuring the magnitude of different relocation patterns.

In summary, the systematic measurement framework constructed by Gao et al. (2022) has three advantages relative to the existing measurements. First, it is a systematic approach to simultaneously measuring the magnitude of all relocation patterns. Secondly, considering that the advanced economies usually offshore the low-value-added processes while they are more likely to re-shore the high-value-added processes, the value-added re-distribution may bias the magnitude of relocation patterns. Thus the measurement is from the perspective of production to avoid such bias. Thirdly, the results provide information for the economy (*r*), industry (*i*) and process (*k*) that are involved in different relocation patterns. Thus, it establishes a data foundation for capturing the *process-specific*, *industry-specific*, and *country-specific* features in different relocation patterns (for example, a *country-specific* analysis of offshoring can be conducted based on $\sum_i \sum_k \sum_s \sum_j offshoring_{ri,sj}^{k,1}$). In the next section, the paper will empirically measure the magnitude of the three relocation patterns between 2007-2023 based on this systematic measurement framework.

The Baseline Regression Equation of two-way fixed effects model

This paper employs a two-way fixed effects model to explore the driving factors of industrial relocation. The baseline regression equation is as follows:

$$Y_{it} = \beta_0 + \beta_1 Innovation_{it} + \beta_2 X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \tag{9}$$

Where Y_{it} represents the scale of re-shore and re-offshore; the explanatory variable is the level of technological innovation, $Innovation_{it}$; X_{it} are the other control variables; μ_i represents the individual fixed effect; λ_t represents the time fixed effect.

Empirical Analysis

The empirical analysis relies on Multi-Regional Input-Output Table (MRIO) provided by the Asian Development Bank (ADB,2024 edition),[12] that contains annual time series multi-economy input–output tables covering the time frame from 2000 to 2023. Each MRIO provides the value of transactions among 35 industries in 63 economies plus the "rest of the world (ROW)". The paper focuses on 14 manufacturing sectors, the so-called "foot-loose" industries (Ge, 2009), to conduct the analysis on production location re-configuration during 2007-2023.

The Process-specific Analysis

As shown in table 2, the magnitude of global manufacturing relocation during the period 2007-2023 reached \$10.423 trillion U.S. dollars, of which 33.99% is offshoring (\$3.5 trillion), 40.28% is re-shoring (\$4.2 trillion), and 25.73% is re-offshoring (\$2.7trillion). This result is different from the conclusion of Gao, X. (2022) study. As of 2023, re-shoring has become the dominant relocation pattern. In detail, 33.31% of the industry relocation driven by intermediate inputs (*M4M*) is characterized as offshoring (\$1.8 trillion), 40.6% as re-shoring (\$2.2 trillion) and the remainder, 26.08%, is the re-offshoring (\$1.4 trillion). The percentage of offshore (34.98%) and re-shoring (42.43%) industrial relocation driven by final products (*F4F*) is slightly higher than that driven by intermediate inputs (*M4M*), but the percentage of re-offshore (22.59%) industrial relocation driven by final products (*F4F*) is lower than that driven by intermediate inputs (*M4M*), indicating that final stages of production

[12] https://kidb.adb.org/globalization/current

are more likely to be relocated through the offshoring and re-shoring pattern[13]. However, the percentage of re-offshoring (30.04%) in the indirect intermediates' relocation driven by final products (*F4M*) is evidently higher than that in *F4F*, while the corresponding percentage of re-shoring (35.7%) is evidently lower. This is because the Intermediate goods industries are positioned in the midstream of the global value chain, and their location choices are closely tied to downstream final goods production centers. Driven by the reshoring of final goods production, intermediate goods industries exhibit a trend toward reshoring; however, influenced by reshoring costs, some industries have shifted toward re-offshoring.

Table 2. The magnitude of each relocation pattern and its percentage in each type of industry relocation during 2007-2023.

Billion U.S. Dollar		**Magnitude of each relocation pattern and its percentage**					
		Offshore	%	**Re-shore**	%	**Re-offshore**	%
M4M	5373	1790	33.31%	2181	**40.60%**	1402	26.08%
F4F	3178	1112	34.98%	1349	**42.43%**	718	22.59%
F4M	1873	641	34.27%	668	**35.70%**	562	30.04%
Total	10423	3543	33.99%	4198	**40.28%**	2682	25.73%

Note: 1. Hereinafter, M4M denotes the industry relocation driven by intermediate inputs; F4F denotes the industry relocation driven by final products; F4M denotes the indirect intermediates' relocation driven by final products.

The Industry-specific Analysis

When it comes to the manufacturing with different dominant factor inputs, i.e., labour-intensive, capital-intensive, and technology-intensive manufacturing, as shown in figure 2 (panel A), one can find that the largest

[13] This result is drawn by the comparison of relocation-pattern-preference only between *M4M* and *F4F*, because these two types of industry relocation happen in an active manner (the producers or consumers change the choice between different suppliers). On the contrary, the indirect intermediates' relocation driven by final products happens in a passive manner, which is dependent on the occurrence of *F4F*.

effect of the industry relocation during 2007-2023 occurs in Capital-intensive Manufacturing, followed by Technology-intensive Manufacturing, two types of industries characterized by a high degree of fragmentation. The relocation-pattern-preference in capital- intensive manufacturing is significantly different from that in labour- or technology-intensive manufacturing. As shown in figure 2 (panel B), 66.2% of the industry relocation in labour-intensive manufacturing corresponds to offshoring, which is more than ten percentage points higher than that of capital- (55.1%) or technology-intensive (54.5%) manufacturing. On the other hand, 18.7% of the industry relocation in labour-intensive manufacturing corresponds to re-shoring, which is more than ten percentage points lower than that of capital- (30.6%) or technology-intensive (30.3%) manufacturing. This result confirms that, no matter whether expressed in terms of magnitude or percentage, the re-shoring in capital-intensive manufacturing is more likely to be adopted than that in labour or technology--intensive manufacturing. The most probable explanation is that Labor-intensive industries are highly sensitive to overall costs—especially labor costs — almost entirely favor offshoring and re-offshoring when facing relocation pressures. For technology-intensive industries, due to the global dispersion of the manufacturing and assembly processes, it features the coexistence of multiple relocation patterns and re-shore is not the dominant mode. But for Capital-intensive industries, characterized by economies of scale, are more sensitive to economic conditions and policy continuity; Driven by technological advances like artificial intelligence and the current trend of anti-globalization, capital-intensive industries are increasingly inclined to reshore to their home countries. This strategy not only reduces exposure to geopolitical risks but also enables firms to leverage the domestic innovation advantages to expand scale economies.

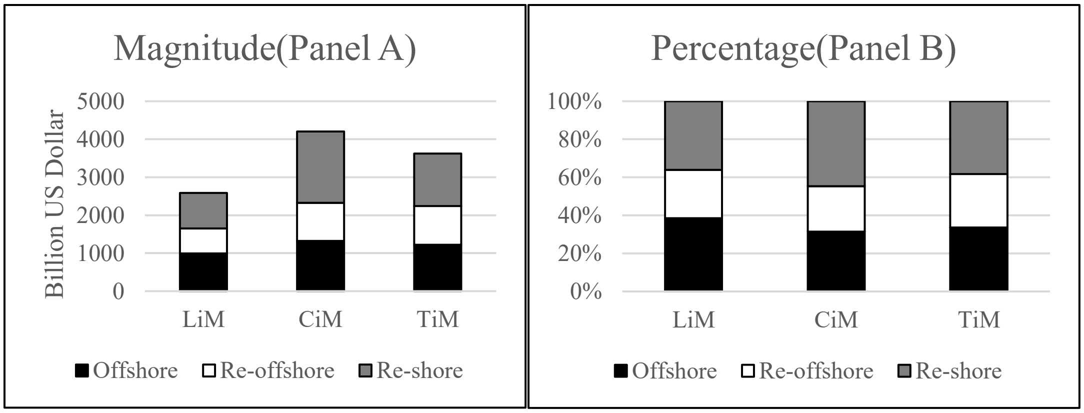


Figure 2. The magnitude of each relocation pattern and its percentage in manufacturing with different dominant factor inputs.

(1)LiM denotes the Labour-intensive Manufacturing; CiM denotes the Capital-intensive Manufacturing; TiM denotes the Technology-intensive Manufacturing.(2)The classification of industries is presented in Supplementary Appendix C.

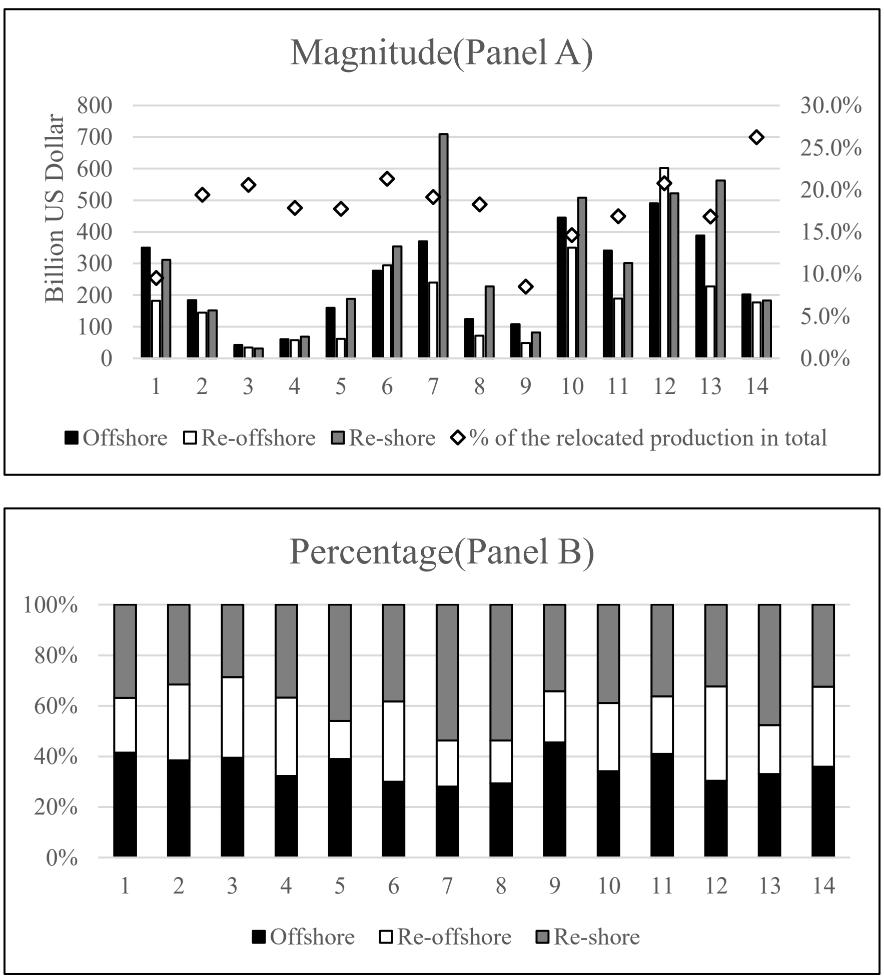


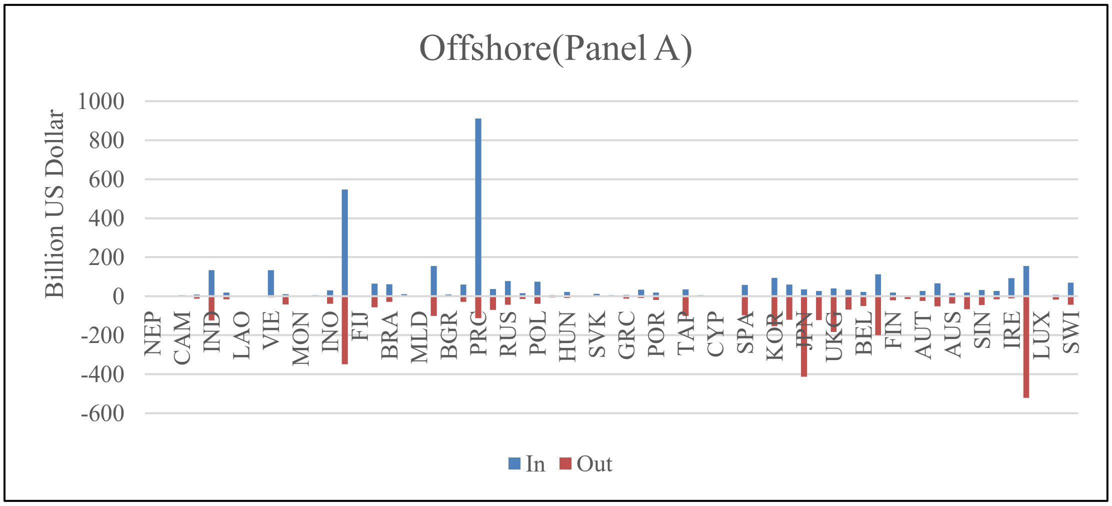
Figure 3. The magnitude of each relocation pattern and its percentage in different industries.

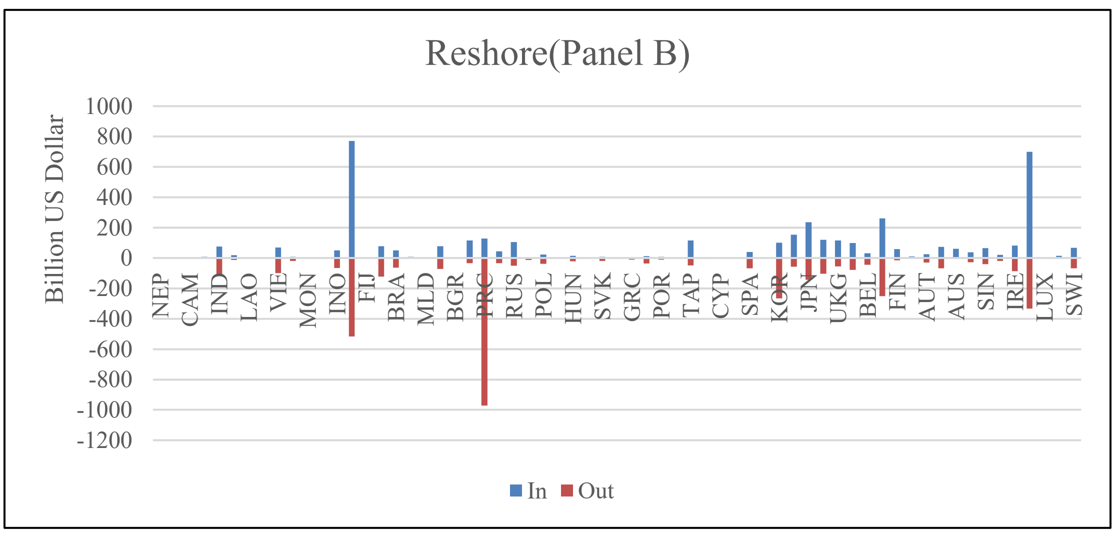
(1) The numbers in the X-axis are sectoral index of manufacturing industries, their corresponding names are listed in Supplementary Appendix C. (2) The industry 1 – 5 and 14 belong to labour-intensive manufacturing; industry 6 – 10 belong to capital-intensive manufacturing; and industry 11 – 13 belong to technology intensive manufacturing.

At the industry level, as shown in figure 3 (panel A), "*Electrical and optical equipment*" (industry 12) has the highest magnitude of both offshoring, re-offshoring and "*Chemicals and chemical products*" (industry 7) has the highest magnitude of re-shoring. Over the period 2007-2023, 20.7% of "*Electrical and optical equipment*" (industry 12) gross production has been relocated, which is the highest among all manufacturing industries. As for the shares of each relocation pattern, as shown in figure 3 (panel B), "*Chemicals and chemical products*" (industry 7), "*Rubber and plastics*" (industry 8), "*Transport equipment*" (industry 13), and "*Pulp, paper, paper products, printing, and publishing*" (industry 5) are the industries that have the highest percentage of re-shoring in gross industry relocation. Over the period 2007-2023, 53.8%, 53.7%, 47.7% and 46% respectively of their industry relocation was accounted for by re-shoring. This result also indicates that re-shoring is more likely to happen in capital-intensive industries. Meanwhile, "*Electrical and optical equipment*" (industry 12), "*Leather, leather products, and footwear*" (industry 3), "*Coke, refined petroleum, and nuclear fuel*" (industry 6), "*Wood and products of wood and cork*" (industry 4),and "*Textiles and textile products*" (industry 2) are the industries with the highest percentage of re-offshoring. During 2007-2023, 37.3%, 31.9%, 31.8%,31%,and 30% respectively of their industry relocation fit into the re-offshoring.

The Economy-specific Analysis

Most economies exhibit both relocation directions (in or out) in different relocation patterns, as shown in figure 4. For offshoring, as shown in figure 4 (panel A), China (PRC) is still the most dominating country receiving offshoring during 2017-2023. During this period, 25.7% of the world offshoring relocated to China, and other destinations are India (IND; 3.8%),Vietnam (VIE; 3.7%) and Mexico (MEX; 4.4%). The typical developed economies (e.g., G7 countries) remain the dominant sources of global offshoring, accounting for 46% of the total volume. Even though the re-shoring pattern is currently dominant, China and some developing countries are still the main destinations for the offshoring of industries from high-income countries.z





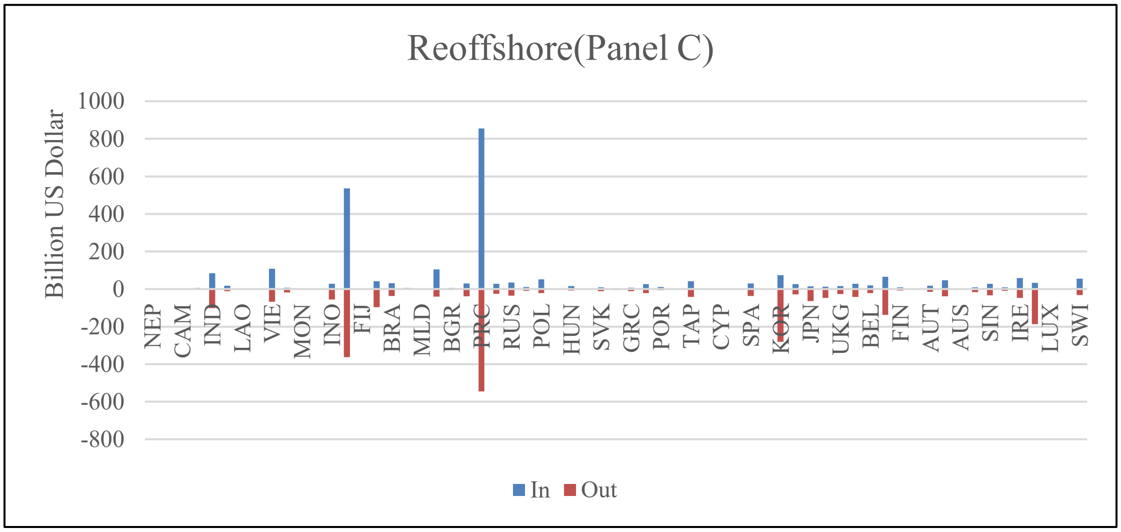


Figure 4. The magnitude of each relocation pattern in different economies.

(1) in this figure, ‘in’ denotes the production relocated into the economy through the corresponding relocation pattern, while ‘out’ denotes the production relocated out from the economy. In panel A, the blue bar (‘in’) denotes the magnitude of production offshored to the corresponding economy (as the host economy); while the red bar (‘out’) denotes the magnitude of production offshored out from it (as the home economy). In panel B, the blue bar (‘in’) denotes the magnitude of production re-shored to the corresponding economy (as the home economy); while the red bar (‘out’) denotes the magnitude of production re-shored out from it (as the host economy). In panel C, the blue bar (‘in’) denotes the magnitude of production re-offshored to the corresponding economy (as the third economy); while the red bar (‘out’) denotes the magnitude of production re-shored out from it (as the host economy). (2) The Upper letters in the X-axis are economy codes, their corresponding economy names are listed in Supplementary Appendix C. (3) The economies in the X-axis are ascending sorted by their GDP per capita published by the World Bank. (4) The magnitude of ‘Rest of World’ region is not presented in this figure.

When it comes to re-shoring, as shown in figure 4 (panel B), China accounts for the largest share of global reshoring, with 23.1% of the world's reshored industries originating from the country. In addition to China, most of the re-shoring happened between the high-income economies. During the study period, Specifically, G7 countries serve as the destination for 40.1% of global reshoring, while simultaneously accounting for 31.8% of the origin for reshored production (excluding China). The USA has the highest magnitude of re-shoring-in(other than the rest of the world(ROW)). In fact, this result is because the impact of geopolitical conflicts and the re-shore policies of some industries in the high-income developed economies have led to the relocation of industries to their home country .

As for re-offshoring, as shown in figure 4 (panel C), China played the most dominant role both in the origin and destinations of re-offshoring. During the period of analysis, 20.3% of the global re-offshoring has came out from China, and 31.9% of the world re-offshoring has moved to China. The extraordinary magnitude of offshoring, re-shoring, and re-offshoring received by China supports the conclusion from Guilhoto *et al.* (2019) that the continuous growth of China and its trade volume strongly strengthen its role as a supplier to the world (including China itself).[14] Apart from China, the other major destinations of re-offshoring are Vietnam (VIE, 4.1%), India (IND,3.1%),Mexico (MEX, 3.9%) and rest of the world(RoW,20.0%). The high-income economies were also the major source of re-offshoring. For example, between 2007-2023, in addition to China, 25.0% of the world re-offshoring was from the G7 economies. Thus, the manufacturing production that previously offshored to the high-income economies is much more locationally flexible than the others after the global financial crisis. To sum up, facing the policy uncertainties, the imposition of tariffs by the United States, and other shocks, the high-income economies prefer to move back the high-end production from other high-income economies for rebuilding their own industrial competitiveness, while, at the same time, retaining the cost advantages of a global fragmented network through the low-end production offshoring or re-offshoring. A summary of locational preference in different relocation patterns is presented in table 3.

Table 3. The percentages of economies with different income level in different relocation patterns.

[14] Guilhoto *et al.* (2019)'s conclusion is draw from an analysis covering the period 2005-2015, which is slightly wider than the period focused by this paper – 2007-2014.

Relocation pattern		% of economies with different income level		
		High-income developed economy	**China**	**Others**
Offshore	in	35.2%	25.7%	39.1%
	out	70.2%	3.2%	26.6%
Re-shore	in	61.4%	3.1%	35.5%
	out	47.2%	23.1%	29.7%
Re-offshore	in	27.6%	31.9%	40.5%
	out	45.5%	20.3%	34.2%

Note :The 'in' and 'out' in this table have the same meaning as that in Figure 4. (ii) The high-income economies are according to the classification of the World bank. While the Taiwan region is also classified as high-income economy since its GDP per capita falls in this range. And the 'Rest of World' is classified in 'Others'. The detail classification of economies is presented in Supplementary Appendix C. (iii) The percentage China is separately presented in this table simply because of its extraordinary magnitude.

The Evidence from China's Reshoring and Re-offshoring

The Scale of China's Offshoring, Reshoring, and Re-offshoring

Given that China is both the dominant destination for offshoring and re-offshoring, and the primary source of reshoring and re-offshoring, this study takes China as a case to analyze industry relocation patterns and their respective destinations across sectors. Figure 5 and Figure 6 indicates the scale of migration to China, and Figure 7 and Figure 8 indicates the scale of migration from China.

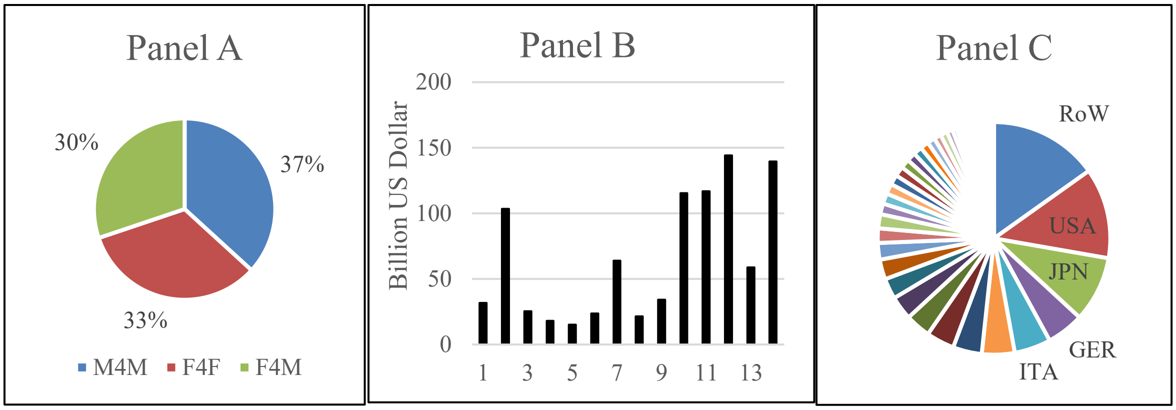


Figure 5：The scale of offshore outsourcing transferred from home countries to China

Figure 5 presents the scale of offshore outsourcing transferred from other countries to China. As shown in figure 5 (panel A),for China, 37% of the offshore volume is driven by intermediate products, 33% by final products, and the 30% rest is the indirect intermediates relocation driven by final products. The proportion of intermediate-product-driven industries moving their production offshore to China is the highest. This is because China has deeply integrated into the vertical production links of the global supply chain and has become a major supplier of raw materials or components for the global supply chain. However, the proportion of the indirect intermediate goods relocation driven by final products offshore to China is the lowest. Because for other countries, it is necessary to relocate component suppliers to locations that align with final product assembly but are outside of China. The panel B of figure 5 indicates that the scale of technology-intensive industries that moved in was the highest, while “Textiles and Textile Products” (industry 2) also exceed most other industries in offshoring volume. Furthermore, rest of the world (ROW), the United States (USA), Japan (JPN), Germany (GER) and Italy (ITA) are the main source countries for offshore relocation to China, as shown in figure 5 (panel C). This result indicates that China is transitioning from low-end processing industries to high-value-added manufacturing, making it a conducive platform for the development of high-end industries.

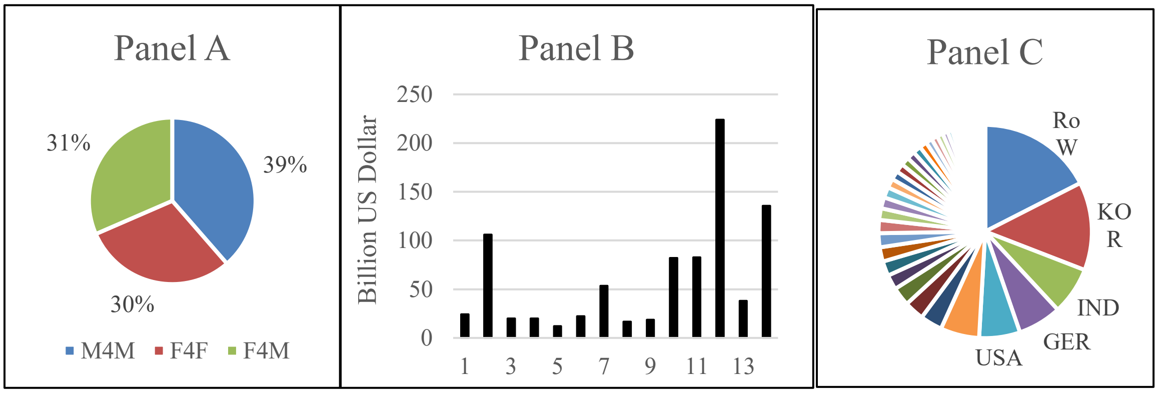


Figure 6：The scale of re-offshore transferred from third countries to China

Figure 6 presents the scale of re-offshore outsourcing transferred from third countries to China. As shown in figure 6 (panel A),for China, 39% of the re-offshore volume is driven by intermediate products, 30% by final products, and the 31% rest is the indirect intermediates relocation driven by final products. The proportion of intermediate-product-driven industries moving their production re-offshore to China is also the highest. The panel B of figure 6 indicates that among all industries, technology-intensive ones show the greatest scale of re-offshoring to China, while “Textiles and Textile Products” (industry 2) also exceed most other industries in re-shoring volume. Furthermore, rest of the world (ROW), South Korea (KOR), India (IND), Germany (GER), and the United States (USA) are the main source countries for re-offshore relocation to China, as shown in figure 6 (panel C).

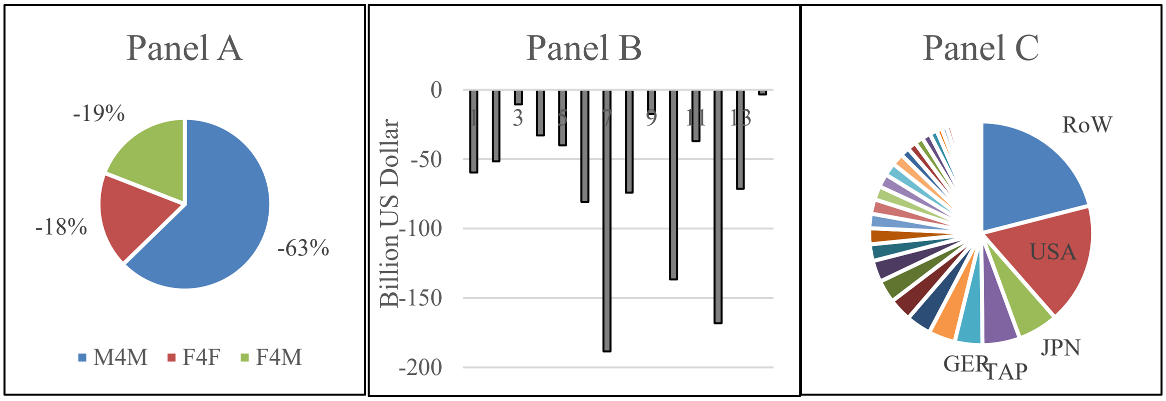


Figure 7：The scale of re-shore transferred from China to home countries

Figure 7 presents the scale of re-shore transferred from China to home countries. As shown in figure 7 (panel A), 63% of the re-shore volume is driven by intermediate products, accounting for highest proportion of re-shore from China, 18% by final products, and the 19% rest is the indirect intermediates relocation driven by final products. The proportion of re-shoring driven by intermediate products is much higher than that of the other two channels because it is necessary to insulate the value chains from global volatility. The panel B of figure 7 indicates that the scale of capital- and technology-intensive industries that re-shoring to home countries was the highest. Furthermore, rest of the world (ROW), the United States (USA), Japan (JPN), the Asia-Pacific region (excluding main countries) (TAP) and Germany (GER) are the main destination for re-shore relocation from China, as shown in figure 7 (panel C). This result indicates that the substantial migration of intermediate, capital-intensive, and technology-intensive goods—primarily toward developed economies—indicates that firms are increasingly deprioritizing labor-cost arbitrage in favor of mitigating geopolitical and operational risks.

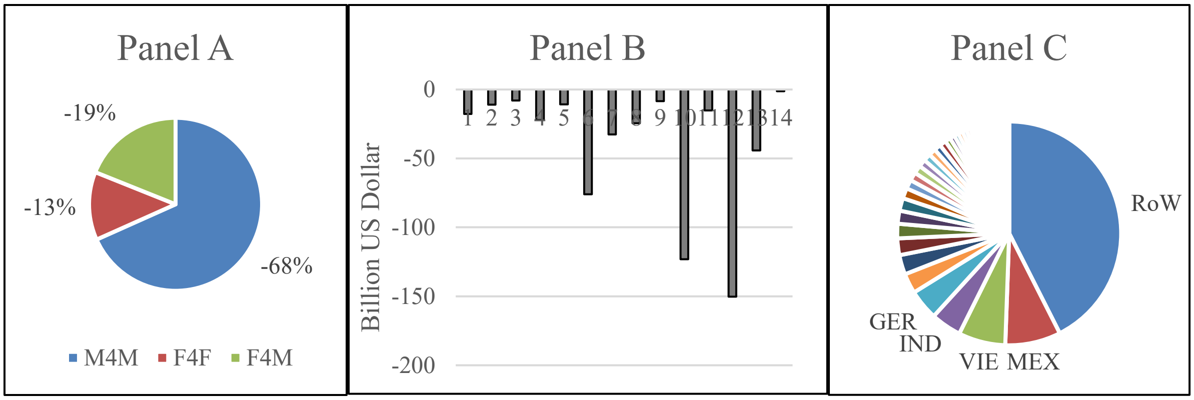


Figure 8：The scale of re-offshore transferred from China to third countries

Figure 8 presents the scale of re-offshore transferred from China to third countries. As shown in figure 8 (panel A), 68% of the re-offshore volume is driven by intermediate products, also accounting for highest proportion of re-offshore from China, and the proportions driven by final products are 13% for direct relocation and 19% for indirect intermediate goods relocation, respectively. The panel B of figure 8 indicates that the scale of capital- and technology-intensive industries that re-offshoring to home countries was also the highest, consistent with the pattern of overall re-shoring activity. Furthermore, rest of the world (ROW), Mexico (MEX), Vietnam (VIE), India (IND) and Germany (GER) are the main destination for re-offshore relocation from China, as shown in figure 8 (panel C).

Descriptive Statistics of Explanatory Variables

This section examines the key drivers behind the reshoring of manufacturing industries from China back to their home countries, as well as the subsequent re-offshoring to alternative destinations. Specifically, it analyzes the domestic factors within the home countries that have influenced the relocation of industrial production away from China. The study encompasses a diverse sample of 57 representative countries, including major developed economies—such as the United States, Japan, Australia, Canada, Switzerland, Germany, Denmark, the United

Kingdom, France, and South Korea—as well as several less developed economies, such as India, Vietnam, Laos, the Philippines, and Bangladesh (see Appendix D). The analysis focuses on the determinants of industry relocation within the manufacturing sector; the specific industries under consideration are detailed in Appendix D.

The measurement of reshoring and re-offshoring scales in this paper draws on the methodology established by Gao Xiang et al.(2022). To investigate the phased nature of industrial relocation, the study period is set from 2007 to 2023, divided into four distinct stages: the first stage (2007–2011) corresponds to the post-global financial crisis period; the second stage (2011–2015) represents the recovery phase following the crisis; the third stage (2015–2019) is characterized by escalating geopolitical tensions and the intensification of Sino-US trade frictions; and the fourth stage (2019–2023) covers the post-pandemic era.

In accordance with traditional theories of industrial transfer, the determinants of cross-country industrial relocation are categorized into three dimensions: micro-level firm decision-making, market strategy, and macro-level policies and institutions. For micro-level firm decisions, which are grounded in comparative advantage theory, this study selects labor costs and transportation infrastructure as key variables. Regarding market strategy factors, drawing on new economic geography theory, the analysis incorporates regional economic development levels, industrial agglomeration, and technological innovation capacity. At the macro policy and institutional level, considerations include government credibility and the degree of openness to foreign trade. The specific indicators selected for the baseline regression are the mean values of these variables across each stage.

(1)Labor cost: Labor costs are calculated by dividing total annual employee compensation by the number of labor force participants. Data on annual employee compensation are sourced from the International Labour

Organization (ILO), while labor force figures are obtained from the World Bank database.

(2)Infrastructure: Logistics performance index . Data sourced from World Bank database .

(3)Innovation: Global Innovation Index. Data sourced from World Intellectual Property Organization (WIPO) .

(4)Openness: It is calculated as the ratio of net foreign direct investment (FDI) inflows to gross domestic product (GDP). Data sourced from World Bank database .

(5)GDP per capital : Calculated based on the data from the World Bank database .

(6)Manufacturing agglomeration: It is derived by dividing the output of the manufacturing sector by the total output.Data sourced from ADB-IO.

(7)Government Credibility: Corruption Perceptions Index . Data sourced from Transparency International .

Empirical Regression Results and Interpretation

1. Baseline Two-Way Fixed Effects Regression

The baseline regression results for **reshoring** and **re-offshoring** are presented in Table 1. In Column (1), the coefficients for the home country's **innovation level** are significantly positive at the 1% level, identifying technological advancement as the core determinant of reshoring. As the home country progresses in automation and AI, traditional offshore production lines reliant on cheap labor are increasingly replaced by intelligent factories. Conversely, the coefficient for **infrastructure** (measured by the Logistics Performance Index) is significantly negative. This counter-intuitive result suggests that high logistics efficiency in the home country facilitates imports and distribution rather than incentivizing the physical return of production. Effectively, high-efficiency infrastructure reduces the "friction costs" of the "offshore production + efficient import" model, thereby inhibiting reshoring. Regarding the statistically insignificant variables in the reshoring model, we found that the insignificance of Labor Cost coefficient suggests that low labor costs in the home country are no longer a decisive factor in attracting manufacturing back. Second for Manufacturing Agglomeration, the lack of significance indicates that existing domestic industrial clusters may not provide the necessary specialized support or integrated supply chain benefits required to effectively pull industries back. Measured by the Corruption Perceptions Index, Government Credibility’s insignificance shows that the level of government transparency or integrity does not exert a primary influence on the reshoring decisions of firms in this sample. The explanatory power of trade openness is insufficient likely because high openness simultaneously facilitates both capital reshoring and further offshoring, leading to a neutralizing effect where the two opposing forces cancel each other out.

In Column (2), the results for **re-offshoring** reveal that the **innovation capacity** and **GDP per capita** of third-party countries are the primary pull factors attracting industry away from China. The innovation coefficient is significantly positive at the 5% level, indicating that as third-party countries develop mature industrial ecosystems, they reduce the technical friction for multinational corporations (MNCs) to relocate complex manufacturing stages. Furthermore, the growth in GDP per capita reflects expanded market capacity and improved business environments, triggering a **"market-seeking" FDI effect**. Notably, labor costs and infrastructure levels remain insignificant in the baseline model, suggesting that MNC decisions have shifted from "absolute cost" toward "total factor efficiency" and "strategic alignment". While innovation and GDP per capita serve as the primary "pull" factors for third-party countries, the statistical insignificance of other traditional determinants reveals a shift in multinational corporation (MNC) strategy. First, both of the Labor

Costs and Infrastructure are statistically insignificant, suggesting that when firms consider re-offshoring from China, the decision-making process has shifted from "absolute cost" seeking to "total factor efficiency" and "strategic matching". Firms prioritize a country's ability to provide superior technological ecosystems and market synergies over mere low wages or basic physical infrastructure. Second, the insignificance of domestic industrial clusters suggests that existing concentrations of manufacturing do not currently provide a strong enough "pull" or specialized support to attract re-offshoring activities in the aggregate model. Third, the lack of significance for institutional integrity implies that as long as a third-party country's institutional environment meets a certain "threshold" of viability, minor differences in transparency or corruption levels do not play a decisive role in the final relocation choice. Instead, firms pivot their focus toward more differentiated advantages like innovation capacity. And for the Openness, similar to the reshoring results, trade openness does not show a significant impact on re-offshoring, likely due to its role in simultaneously facilitating various forms of capital movement which may neutralize its individual explanatory power.

These results collectively underscore a "post-industrial" transition where the explanatory power of traditional factor endowments has weakened. The decision to re-offshore is no longer a simple response to cheap labor, but rather a strategic realignment driven by technical standard systems and market potential.

Table 1: Baseline Two-Way Fixed Effects Regression Results for Drivers of Reshoring and Re-offshoring

	（1）	（2）
VARIABLES	Reshore	Reoffshore
Labor cost	5.819	0.207
	(1.54)	(0.07)
Infrastructure	-9034.700**	-2926.687
	(-2.07)	(-0.95)
Innovation	1695.562***	286.448**
	(2.78)	(2.03)
Openness	1645.053	107.450

	(1.09)	(0.12)
GDP per capita	0.348	0.162*
	(1.12)	(1.73)
Manufacturing agglomeration	-6276.887	-6328.411
	(-0.93)	(-1.37)
Government credibility	-219.218	94.667
	(-1.62)	(0.93)
Constant	-37574.565*	-9307.197
	(-1.89)	(-0.67)
Observations	224	224
R-squared	0.709	0.566
Adjusted R-squared	0.590	0.388

t statistics in parentheses(Clustered t-statistics)
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2. Robustness Checks

To ensure the validity of the baseline findings, several robustness tests were conducted, including trend extrapolation for missing data and subsample regressions based on income levels. Robustness checks are conducted as follows:

First, to address the missing innovation data from 2008 to 2010 in the baseline model, a trend extrapolation method was employed to fill the gaps. The mean value of the completed dataset was utilized as the innovation variable for the initial stage of industrial transfer in the two-way fixed effects regression. Compared to the baseline approach of using the 2011 observed values, this mean-based treatment ensures consistency across data scales and enhances the reliability of the regression results. Second, recognizing the structural differences in destination countries—where reshoring typically flows toward advanced economies while re-offshoring targets developing nations—the sample was partitioned based on the median GDP per capita of the total sample. Nations with a GDP per capita above the median were exclusively included in the reshoring analysis, while those below the median were assigned to the re-offshoring analysis. Separate two-way fixed effects regressions were then performed to account for this developmental heterogeneity. Third, building upon the subsample regressions, a further examination was conducted to observe the combined impact of the extrapolated innovation data within these specific country groups. This step serves as a final verification to confirm that the core findings remain stable across different data processing methods and sample compositions. The robustness regression results for reshoring and re-offshoring are reported in **Table 2** and **Table 3**, respectively.

Table 2 presents the results of the robustness checks for manufacturing reshoring. Column (1) serves as the baseline model, while Column (2) utilizes the interpolated innovation index. Column (3) restricts the sample to countries with a GDP per capita above the median, and Column (4) combines this subsample restriction with the interpolated innovation data. A comparative analysis between the baseline model and the robustness specifications (2–4) yields the following conclusions: First, the coefficient for **Innovation** remains positive and significant at the 5% level across all models. Notably, in the high-income subsamples (Columns 3 and 4), the coefficients (3135.003 and 2410.709, respectively) are substantially higher than in the baseline. This reinforces that technological innovation is the primary catalyst for reshoring, with its impact being particularly pronounced in advanced economies. Additionally, the **Infrastructure** index is consistently negative and significant across all four specifications. This confirms the robustness of the "logistics-induced path dependency" logic, suggesting that high logistics efficiency facilitates offshore production and imports rather than production return. Second, a significant shift in the significance of **Labor Cost** is observed when adjusting the sample scope. While insignificant in the full samples (Columns 1 and 2), labor costs become significantly positive at the 5% and 10% levels in the high-income groups. Although this appears to deviate from classical cost theory, it strongly supports the **factor substitution hypothesis**: in high-income nations, firms utilize automation to offset rising labor costs, thereby neutralizing the cost advantages of offshore production and incentivizing the return of capital-intensive industries. Third, in the model utilizing interpolated data (Column 2), the coefficient for **Government Credibility** is significantly negative at the 10% level. This implies that, within a more complete dataset, enhanced institutional credibility and policy stability may reduce reshoring fluctuations previously driven by hedging or risk-aversion motives. Lastly, the R^2 improves from 0.709 in the baseline to 0.781 and 0.772 in the high-income subsamples. This indicates that the selected economic indicators possess stronger explanatory power when the analysis is focused on high-income economies. In summary, the core independent variables maintain high logical consistency in both sign and significance, regardless of the innovation measurement method or the exclusion of low-income sample interference. In summary, the core independent variables maintain high logical consistency in both sign and significance, regardless of the innovation measurement method or the exclusion of low-income sample interference.

Table 2: Robustness Tests for the Determinants of Manufacturing Reshoring (Two-Way Fixed Effects)

VARIABLES	（1） Baseline	（2） Interpolated	（3） High-Income	（4） High-Income (Int.)
Labor cost	5.819	5.295	7.673**	6.610*
	(1.54)	(1.62)	(2.35)	(1.97)
Infrastructure	-9034.700**	-9255.817**	-15409.863**	-15995.378*
	(-2.07)	(-2.11)	(-2.09)	(-1.96)
Innovation	1695.562***	1411.701***	3135.003**	2410.709**
	(2.78)	(2.73)	(2.77)	(2.61)
Openness	1645.053	1663.246	1266.371	861.923
	(1.09)	(1.10)	(0.71)	(0.46)
GDP per capita	0.348	0.352	0.431	0.420
	(1.12)	(1.12)	(1.43)	(1.39)
Manufacturing agglomeration	-6276.887	-9575.435	-172302.640	-228329.100
	(-0.93)	(-1.41)	(-1.33)	(-1.61)

Government credibility	-219.218	-227.843*	-91.620	-46.246
	(-1.62)	(-1.68)	(-0.36)	(-0.17)
Constant	-37574.565*	-23544.076	-93591.370***	-48073.710**
	(-1.89)	(-1.55)	(-3.03)	(-2.47)
Observations	224	224	112	112
R-squared	0.709	0.706	0.781	0.772
Adjusted R-squared	0.590	0.585	0.672	0.659

t statistics in parentheses(Clustered t-statistics)

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

Table 3: Robustness Tests for the Determinants of Manufacturing Re-offshoring (Two-Way Fixed Effects)

	（1）	（2）	（3）	（4）
VARIABLES	Baseline	Interpolated	Low-Income	Low-Income (Int.)
Labor cost	0.207	0.097	-2.113	-0.204
	(0.07)	(0.03)	(-0.23)	(-0.02)
Infrastructure	-2926.687	-3137.213	-4714.221	-4491.229
	(-0.95)	(-1.06)	(-0.60)	(-0.58)
Innovation	286.448**	292.285**	465.798	404.187
	(2.03)	(2.41)	(1.64)	(1.65)
Openness	107.450	140.064	10172.038	11607.741
	(0.12)	(0.16)	(0.84)	(0.91)
GDP per capita	0.162*	0.164*	-0.634*	-0.650*
	(1.73)	(1.77)	(-1.76)	(-1.76)
Manufacturing agglomeration	-6328.411	-6339.268	-12274.586*	-12664.647**
	(-1.37)	(-1.40)	(-1.96)	(-2.15)
Government credibility	94.667	94.130	37.940	58.170
	(0.93)	(0.94)	(0.15)	(0.23)
Constant	-9307.197	-8872.592	5926.468	6727.643
	(-0.67)	(-0.68)	(0.22)	(0.25)
Observations	224	224	112	112
R-squared	0.566	0.570	0.551	0.552
Adjusted R-squared	0.388	0.393	0.327	0.327

t statistics in parentheses(Clustered t-statistics)

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

Table 3 presents the robustness test results for manufacturing re-offshoring, where Column (1) represents the baseline model, Column (2) utilizes the interpolated innovation index, Column (3) focuses on countries with a GDP per capita below the median, and Column (4) applies the interpolated index to this low-income subsample.

A comparative analysis reveals that while the re-offshoring mechanism maintains some stability, it exhibits significant heterogeneity across different economic environments, with the driving logic for low-income nations differing markedly from the global sample. Specifically, the innovation variable becomes statistically insignificant in the low-income subsample, suggesting that the "innovation dividend" is ineffective in these regions and that industrial relocation is primarily cost-driven rather than technology-led, largely because industries in these nations remain in low-end processing stages. Furthermore, while GDP per capita shows a positive correlation with re-offshoring in the baseline model, it exerts a significant negative impact in the low-income subsample. This shift occurs because the core appeal of low-income nations is their "extreme low-cost" advantage; as their GDP per capita rises, their marginal cost advantage relative to even lower-income competitors erodes, leading to a decline in industrial inflow. Additionally, the coefficient for manufacturing agglomeration is significantly negative in the low-income sample, indicating that existing industrial clusters in nations with weak manufacturing foundations may exert a "crowding-out" effect that inhibits further re-offshoring. In conclusion, these robustness checks demonstrate that the significance of key indicators fluctuates according to the economic gradient of the destination country, confirming that re-offshoring decisions are driven by highly differentiated mechanisms.

3. Industry-Level Heterogeneity

Sectoral regressions reveal that the impact of economic determinants varies according to a sector's position in the value chain and its market proximity.

Table 4(a):
Sectoral Group Regression Results for Drivers of Reshoring (Two-Way Fixed Effects): Industries 1–7

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Ind_1	Ind_2	Ind_3	Ind_4	Ind_5	Ind_6	Ind_7
laborcost	0.76	0.38	0.07	0.30	0.28	0.58	0.39

	(1.05)	(0.49)	(0.23)	(0.56)	(0.43)	(0.52)	(0.36)
infrastructure	-752.09	-471.77	-182.01	-262.72	-421.69	-865.13	-1,257.59
	(-1.93)*	(-1.14)	(-1.09)	(-0.92)	(-1.20)	(-1.43)	(-2.16)**
innovation	88.79	80.17	26.48	59.68	58.41	150.00	183.15
	(3.66)***	(3.09)***	(2.55)**	(3.36)***	(2.66)***	(3.99)***	(5.05)***
openness	41.24	17.64	2.10	100.57	94.14	54.69	200.94
	(0.25)	(0.10)	(0.03)	(0.84)	(0.63)	(0.21)	(0.82)
pergdp	0.02	0.01	0.00	0.01	0.02	0.04	0.04
	(2.21)**	(0.92)	(0.55)	(2.03)**	(2.48)**	(2.56)**	(2.82)***
manu_density	-961.18	-746.58	-262.80	-642.18	-786.25	-2,251.86	-17.39
	(-0.70)	(-0.51)	(-0.44)	(-0.63)	(-0.63)	(-1.05)	(-0.01)
governmentcredibility	-21.23	2.77	9.01	-22.11	-20.02	2.18	-22.72
	(-1.64)	(0.20)	(1.63)	(-2.33)**	(-1.71)*	(0.11)	(-1.17)
Constant	-502.07	-2,000.24	-996.61	-721.57	-355.40	-4,252.69	-3,387.55
	(-0.31)	(-1.14)	(-1.42)	(-0.60)	(-0.24)	(-1.68)*	(-1.39)
Observations	224	224	224	224	224	224	224
R-squared	0.58	0.54	0.52	0.51	0.55	0.54	0.60
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

t-statistics in parentheses

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

Table 4(b):

Sectoral Group Regression Results for Drivers of Reshoring (Two-Way Fixed Effects): Industries 8–14

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Ind_8	Ind_9	Ind_10	Ind_11	Ind_12	Ind_13	Ind_14
laborcost	0.33	0.42	0.87	0.29	0.42	0.72	0.02
	(0.35)	(0.77)	(0.64)	(0.39)	(0.19)	(0.87)	(0.07)
infrastructure	-692.33	-178.25	-1,293.58	-645.73	-1,454.57	-578.89	21.64
	(-1.37)	(-0.60)	(-1.77)*	(-1.62)	(-1.19)	(-1.30)	(0.13)
innovation	130.35	29.41	253.78	122.23	405.12	113.29	-5.28
	(4.13)***	(1.59)	(5.57)***	(4.93)***	(5.30)***	(4.07)***	(-0.53)
openness	107.32	-10.84	300.27	165.20	480.20	99.67	-8.08
	(0.50)	(-0.09)	(0.97)	(0.98)	(0.93)	(0.53)	(-0.12)
pergdp	0.03	0.01	0.01	0.02	0.11	0.02	-0.00
	(2.65)***	(0.77)	(0.76)	(1.73)*	(3.60)***	(1.65)	(-0.88)
manu_density	-360.56	-332.14	1,600.55	319.91	-1,837.20	80.82	-80.02
	(-0.20)	(-0.32)	(0.62)	(0.23)	(-0.42)	(0.05)	(-0.14)
governmentcredibility	-10.96	-13.66	-39.40	-16.67	-43.37	-23.45	0.42
	(-0.65)	(-1.38)	(-1.62)	(-1.26)	(-1.06)	(-1.58)	(0.08)

Constant	-3,478.66	8.85	-4,895.29	-2,642.75	-12,591.62	-2,074.35	315.37
	(-1.63)	(0.01)	(-1.59)	(-1.58)	(-2.44)**	(-1.11)	(0.47)
Observations	224	224	224	224	224	224	224
R-squared	0.58	0.37	0.61	0.53	0.63	0.66	0.47
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4(a) and (b) present the results of sectoral group regressions examining the drivers of reshoring, based on two-way fixed effects models. The results of the sectoral group regressions indicate that a nation's **innovation capacity** serves as the primary determinant for the reshoring of various industries, with statistically significant effects observed across the majority of sectors. This consistency suggests that advancements in innovation facilitate the expansion of reshoring scales. Conversely, **labor costs** remain statistically insignificant across all industries, aligning with the aggregate regression findings and reinforcing the conclusion that reshoring is primarily motivated by technology-driven upgrades rather than simple factor substitution.

Notably, **GDP per capita**, while insignificant in the aggregate model, exhibits a significant positive effect in the sectoral regressions, highlighting profound **industry heterogeneity** in the reshoring process. This variance is determined less by traditional factor intensity and more by a sector's position within the value chain and its **market proximity**. Industries directly interfacing with end-consumer markets—such as food, beverages, and electrical equipment—demonstrate a strong dependency on the home country's GDP, validating the existence of a **"market-seeking" reshoring mechanism**. In contrast, mid-stream industries involved in raw materials and intermediate goods, such as chemicals and metals, are less sensitive to domestic consumption shifts as their locational decisions are anchored in resource endowments and production costs. This divergence reveals two distinct dynamics: a demand-driven "pull" effect for consumer-facing sectors and a cost-and-efficiency-based "optimization" for intermediate sectors. Specifically, GDP per capita shows significant positive correlations in sectors including Food and Beverages (Ind 1), Wood Products (Ind 4), Paper and Publishing (Ind 5), Petroleum (Ind 6), Chemicals (Ind 7), Rubber and Plastics (Ind 8), Machinery (Ind 11), and Electrical Equipment (Ind 12).

Furthermore, **infrastructure levels** (logistics efficiency) yield significantly negative coefficients for Food and Beverages (Ind 1), Chemicals (Ind 7), and Basic Metals (Ind 10). This suggests that advanced infrastructure may paradoxically inhibit the reshoring of labor- and capital-intensive industries. These low-margin sectors typically require expansive, low-cost warehousing and rudimentary transportation. In highly efficient logistics environments, such "extensive" needs often encounter high entry barriers or prohibitive costs, placing these industries at a competitive disadvantage and weakening the incentive to reshore.

Government credibility (institutional environment) is significantly negative only for the Wood (Ind 4) and Paper (Ind 5) sectors, indicating that labor-intensive manufacturing is more susceptible to institutional constraints. Higher transparency and stricter regulation often entail rigorous environmental compliance, labor standards, and tax obligations. Compared to regions with laxer oversight, these low-value-added firms—characterized by high product homogeneity and thin profit margins—face intensified production pressure in highly transparent home countries, which may suppress reshoring intentions in the short term.

Finally, **manufacturing agglomeration** and **trade openness** remain statistically insignificant across all sectors. This suggests that domestic industrial clusters may have reached a state of "high saturation," creating congestion effects—such as inflated land prices and intensified talent competition—that prevent reshored firms from effectively embedding into existing zones. Moreover, high openness reflects deep global supply chain integration, where multinational corporations may prefer "global sourcing" over "domestic production" to serve the home market more cost-effectively through imports.

Table 5(a):

Sectoral Group Regression Results for Drivers of Reoffshoring (Two-Way Fixed Effects): Industries 1–7

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Ind_1	Ind_2	Ind_3	Ind_4	Ind_5	Ind_6	Ind_7
laborcost	0.20	0.13	0.08	0.17	-0.57	0.50	-0.27
	(0.56)	(0.49)	(0.40)	(0.81)	(-0.88)	(0.67)	(-0.57)
infrastructure	-7.71	-1.66	-22.02	64.76	-670.50	136.47	-137.99
	(-0.04)	(-0.01)	(-0.20)	(0.58)	(-1.93)*	(0.34)	(-0.53)
innovation	-4.53	2.96	-0.25	4.43	-3.28	36.34	57.93
	(-0.37)	(0.32)	(-0.04)	(0.64)	(-0.15)	(1.44)	(3.56)***
openness	-18.27	0.73	-12.98	7.31	-112.93	-32.47	20.39
	(-0.22)	(0.01)	(-0.28)	(0.16)	(-0.77)	(-0.19)	(0.18)
pergdp	-0.00	-0.00	0.00	0.00	0.06	0.01	0.03
	(-0.03)	(-0.27)	(0.28)	(0.61)	(7.25)***	(0.62)	(4.17)***
manu_density	-682.37	61.50	-230.75	-593.61	525.49	-1,075.41	439.84
	(-0.99)	(0.12)	(-0.59)	(-1.50)	(0.43)	(-0.75)	(0.47)
governmentcredibility	-0.40	3.59	2.49	-4.29	12.35	-5.13	1.92
	(-0.06)	(0.73)	(0.68)	(-1.16)	(1.07)	(-0.38)	(0.22)
Constant	428.64	-229.81	-12.06	-78.92	51.72	-1,643.33	-2,774.99
	(0.52)	(-0.37)	(-0.03)	(-0.17)	(0.04)	(-0.97)	(-2.53)**
Observations	224	224	224	224	224	224	224
R-squared	0.45	0.54	0.48	0.53	0.53	0.43	0.59
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

t-statistics in parentheses

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

Table 5(b):

Sectoral Group Regression Results for Drivers of Reoffshoring (Two-Way Fixed Effects): Industries 8–14

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Ind_8	Ind_9	Ind_10	Ind_11	Ind_12	Ind_13	Ind_14
laborcost	0.17	-0.06	0.10	0.10	-0.72	0.34	0.04
	(0.50)	(-0.51)	(0.09)	(0.29)	(-0.26)	(0.53)	(0.23)
infrastructure	-171.25	-6.13	-32.42	-158.30	-1,408.99	-463.41	-47.53
	(-0.94)	(-0.09)	(-0.06)	(-0.89)	(-0.95)	(-1.32)	(-0.50)
innovation	16.81	5.03	72.14	19.15	60.00	15.68	4.03
	(1.49)	(1.18)	(1.98)**	(1.72)*	(0.65)	(0.71)	(0.68)

openness	19.89	2.76	75.58	-16.88	127.16	60.76	-13.61
	(0.26)	(0.10)	(0.31)	(-0.22)	(0.20)	(0.41)	(-0.34)
pergdp	-0.00	-0.00	-0.01	0.00	0.08	-0.01	0.00
	(-0.66)	(-0.42)	(-0.96)	(0.74)	(2.21)**	(-0.86)	(1.31)
manu_density	-417.08	-73.47	-3,013.95	-347.75	-632.73	-274.18	-13.96
	(-0.65)	(-0.30)	(-1.45)	(-0.55)	(-0.12)	(-0.22)	(-0.04)
governmentcredibility	2.96	2.06	28.35	1.04	52.78	-2.59	-0.46
	(0.49)	(0.90)	(1.46)	(0.18)	(1.07)	(-0.22)	(-0.15)
Constant	-88.48	-230.30	-3,390.38	-316.86	-2,395.04	1,409.77	-37.18
	(-0.12)	(-0.80)	(-1.38)	(-0.42)	(-0.39)	(0.95)	(-0.09)
Observations	224	224	224	224	224	224	224
R-squared	0.44	0.39	0.52	0.45	0.40	0.54	0.41
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5(a) and (b) present the results of sectoral group regressions examining the drivers of reoffshoring, based on two-way fixed effects models. In the sectoral regressions for **re-offshoring**, innovation and economic development (GDP per capita) remain the core determinants of industrial relocation. Specifically, the re-offshoring of capital- and technology-intensive sectors, such as Chemicals and Chemical Products (Ind 7), Basic Metals (Ind 10), and Machinery (Ind 11), is primarily driven by the **innovation capacity** of third-party countries. In this context, innovation levels represent the availability of specialized R&D support, quality control systems, and technical standards, suggesting that firms relocate to these nations to embed themselves in ecosystems capable of sustaining high-level technical parameters.

Simultaneously, the economic development of third-party countries, proxied by **GDP per capita**, serves as a primary pull factor for **consumer-linked industries**, including Pulp and Paper (Ind 5), Chemicals (Ind 7), and Electrical and Optical Equipment (Ind 12). The re-offshoring behavior in these sectors exhibits a distinct **"market-seeking" motivation**. While intermediate goods like paper and chemicals must be positioned near downstream manufacturing plants, electrical equipment requires proximity to the end-consumer. Consequently, GDP growth acts as a proxy for market potential, incentivizing firms to relocate toward nations with rapid income growth and significant market scale.

Consistent with the aggregate findings, **labor costs** remain statistically insignificant across all industries. This reinforces the thesis that re-offshoring is a consequence of technology-driven strategic realignment rather than mere factor substitution. The traditional focus on factor endowments has weakened in modern high-end manufacturing; any gains from labor cost differentials are often offset by the systemic costs of establishing new logistics and management frameworks. This indicates that re-offshoring represents a **reconfiguration of market strategy** rather than a simple search for lower wages.

Other variables, including trade openness, manufacturing agglomeration, and government credibility, are also insignificant across all sectors. This suggests that once a third-party country's institutional environment meets a fundamental "threshold" of viability, minor differences in these indicators no longer influence specific relocation decisions. Instead, decision-makers prioritize differentiated competitive advantages such as innovation capacity or market potential. Finally, the relative immobility of **basic labor-intensive industries** (Industries 1–4) may be attributed to high **sunk costs**, including machinery, specialized labor training, and supply chain lock-in effects, which effectively anchor these firms within China or drive them toward micro-regions with extreme cost advantages not captured by the current model.

Overall, these findings characterize a "post-industrial" shift in global supply chains: **"Innovation-led, Cost-faded"**. The traditional reliance on labor cost differentials is being superseded by a decentralized asset reorganization strategy highly sensitive to technological variables.

Conclusions and Discussions

This study adopts the systematic measurement framework constructed by Gao et al. (2022), which is based on the Multi-Regional Input-Output Table (MRIO) provided by the Asian Development Bank (ADB,2024 edition), to quantify the magnitude of three primary modes of international industry relocation—offshoring, reshoring, and re-offshoring—from 2017 to 2023. Leveraging the measurement results, we employ a two-way fixed effects model to empirically analyze the key factors driving the reshoring of manufacturing from China to home countries, as well as China's re-offshoring to third countries.

The empirical results show that, during 2007-2023, 33.99%, 40.28%, and 25.73% of the magnitude of global manufacturing relocation correspond to offshoring, re-shoring, and re-offshoring, respectively, supporting the common view that re-shoring has emerged as the most dominating pattern prior to 2023. Second, the industry-specific results confirm that Labor-intensive industries exhibited a stronger preference for offshoring, while capital-intensive industries favored re-shoring. Technology-intensive industries displayed a dual tendency, engaging in both re-shoring and off-shoring. Third, the world is experiencing a multi-globalization, in which distinctive features exit in different relocation patterns. For offshoring, its feature remains in relocating from high-income countries to middle- & low-income countries, especially China. For re-shoring, it has the opposite feature that production mainly moves from China and back to the high-income countries. For re-offshoring, China is simultaneously the country with highest magnitude of the relocation-in (receiving the production) and relocation-out (production moving out). In addition to China, manufacturing production previously offshored to the high-income economies is much more locationally flexible.

The empirical results from the two-way fixed effects model are as follows: First, the innovation level in home country significantly increase its manufacturing reshoring from China. This effect is more pronounced when focusing on the country group with higher income. Second, the innovation capacity in destination country also promotes the manufacturing re-offshoring from China. However, this effect will be diminished when focusing on the country group with lower income. Third, labor cost is not a significant factor in either reshoring or re-offshoring, indicating that low labor costs are no longer a key determinant of industry relocation.

Empirical analysis of industry heterogeneity shows that: First, the innovation level of the home country drives the re-shoring of most industries from China back to the home country and also re-offshoring of some capital-intensive manufacturing to third countries. Labor costs are not significant in any industry, consistent with the overall regression results. Second, capital- and technology-intensive manufacturing exhibit high sensitivity to economic development levels in their relocation decisions: they are not only more likely to be attracted by the higher economic development of the home country and reshore, but also tend to re-offshore from China to third countries with higher economic development levels in pursuit of larger market scales (e.g., Pulp, paper, paper products, printing, and publishing, Chemicals and chemical products). Third, the relocation logic of labor-intensive manufacturing differs from that of capital- and technology-intensive manufacturing. They focus more on the stability of the Government Credibility in the destination to ensure supply chain continuity, rather than directly pursuing innovation resources or market expansion.

The marginal contributions of this paper are manifested in two principal aspects. First, this paper displays the most recent patterns of global industry relocation, with a particular attention to China, the previous dominating destination that absorbing the global production. By applying the useful measurement framework developed by Gao et al. (2022), which is based on Multi-Regional Input-Output Table (MRIO), the paper effectively quantifies the magnitude and direction of different industry relocation patterns across countries from 2017 to 2023. Second, our case study of China reveals that the innovation capacity has emerged as a core driver of reshoring and re-offshoring in the current era. This finding challenges the conventional consensus that cheap labor is the primary driver, offering a new theoretical perspective for understanding the dynamics of industry relocation in the context of technological globalization.

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Appendix A – Examples for interpreting the economic intuition of the global industry relocation measurement

The economic intuition of the global industry relocation measurement is similar with the counterfactual analysis. For the industry relocation driven by intermediate inputs, as shown in figure S1, assume in t_0, the U.S. Car Manufacturing produces \$100 billion U.S. dollar worth of cars. The production requires \$30 billion worth of metal parts intermediate inputs, of which 60% are supplied by the USA itself, 10% by China, 10% by Mexico and the other 20% by Germany. Assume in t_1, the U.S. Car Manufacturing again produces \$100 billion U.S. dollar worth of cars. However, due to the technological evolution (the substitution between different inputs) the production now requires \$20 billion worth of metal parts intermediate inputs. As a result of industry relocation, now, 30% of metal parts used for U.S car manufacturing are supplied by the USA itself, 25% by China, 30% by Mexico and the other 15% by Germany. In the hypothetical situation in t_1 (H. t_1), set the supplier of metal parts required in the production of the U.S. car manufacturing keeping constant as in t_0, while maintain all other changes. According to the methodology section, in this example, the industry relocation driven by intermediate inputs denotes the relocated intermediates' production of metal parts (in the USA, Germany, China, and Mexico) that is caused by the changes of spatial supply-shares in the metal parts inputted to Car Manufacturing in the USA. Thus, the results are equal to the difference between the real situation in t_1 and the hypothetical one (H.t_1).

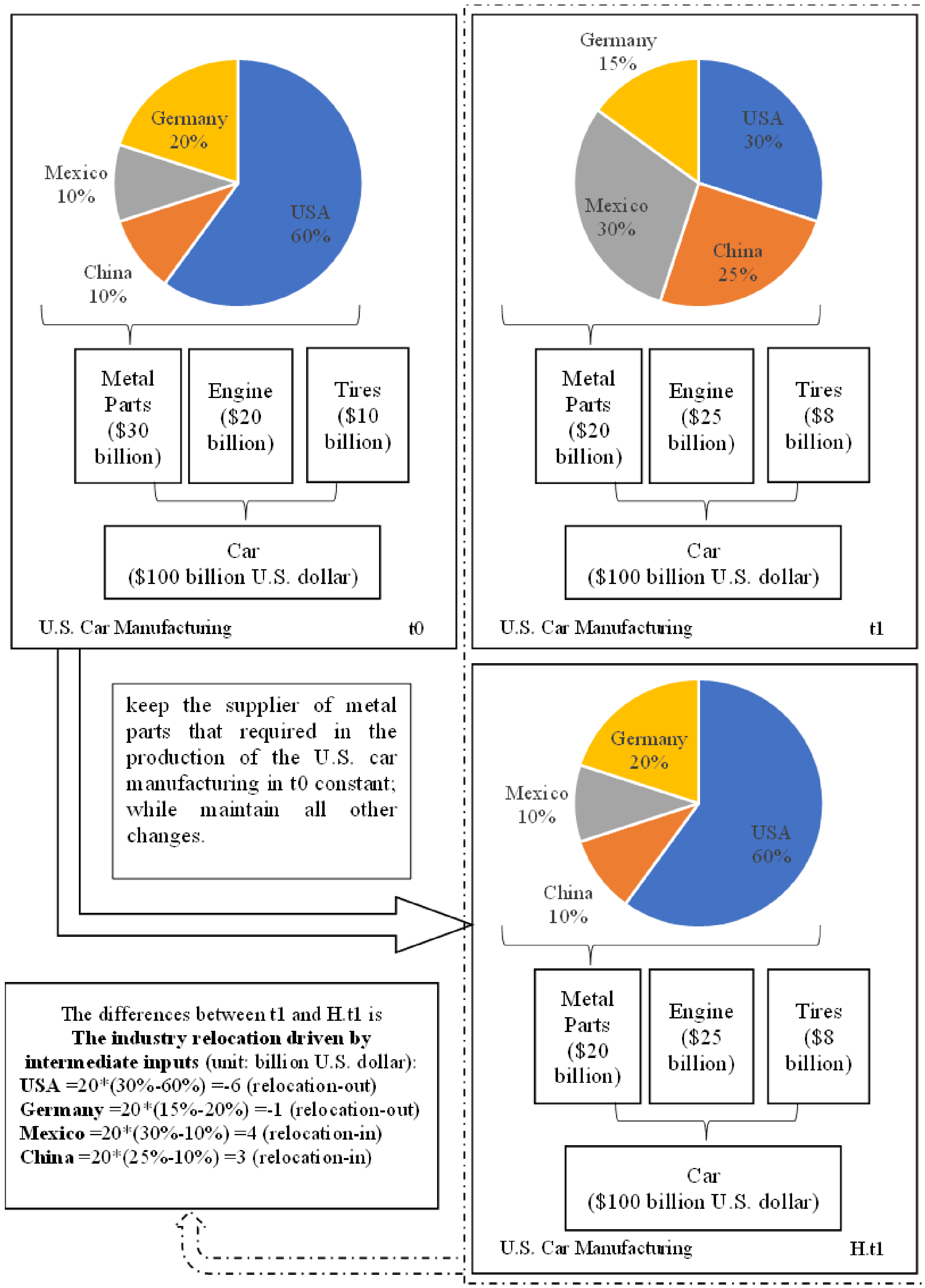

FIGURE S1: The example of industry relocation driven by intermediate inputs

For the industry relocation driven by final products, as shown in figure S2, assume in t_0 the USA consumed \$100 billion U.S. dollar worth of cars, in which 50% are supplied by the USA producers, 30% are imported from Germany and 20% from Mexico. In t_1, due to the economic development, the car-consumption in the USA increases to \$200 billion U.S. dollar. As a result of industry relocation, 20% of the cars are now supplied by the USA producers, 20% are imported from Germany and 60% from Mexico. In the hypothetical situation in t_1 (H. t_1), again, set the supplier in the U.S. Car market constant as in t_0, while maintain all other changes (i.e., the growth of car consumption). Then, in this example, the industry relocation driven by final products denotes the relocated final-products' production of cars (in the USA, Germany, and Mexico) that is caused by the changes of spatial supply-shares in cars consumed in the USA, which equals the difference between the real situation in t_1 and the hypothetical one (H.t_1).

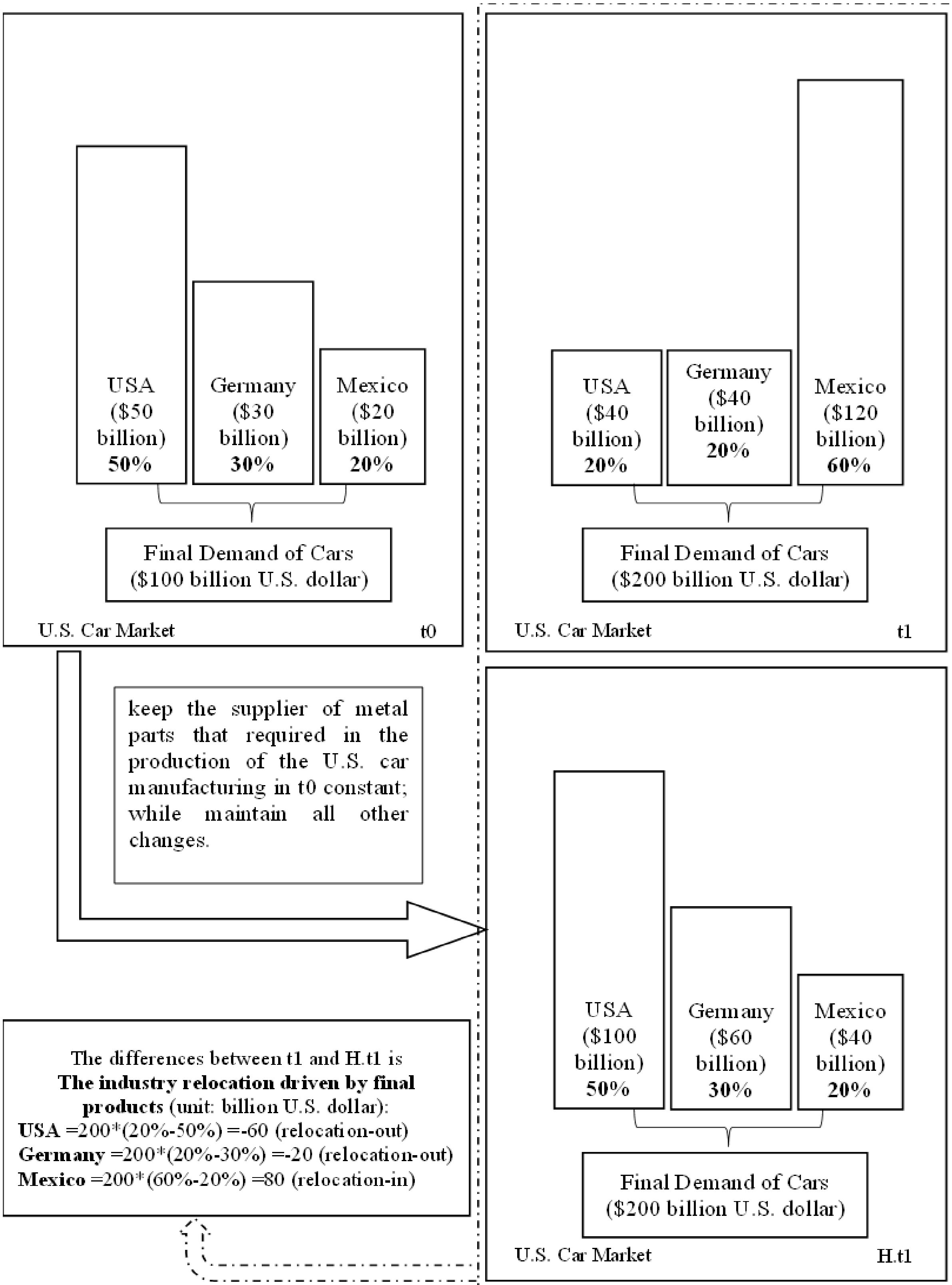

FIGURE S2: The example of industry relocation driven by final products

The example of the indirect intermediates relocation driven by final products is connected to the example of the industry relocation driven by final products. In the second example, as presented in figure S2, the change of spatial supply-shares in the U.S. car market leads to \$60 and \$20 billion U.S. dollar worth of car production relocated out from the USA and Germany, respectively, while \$80 billion U.S. dollar worth of car production is relocated into Mexico. Moreover, as shown in figure S3, the per billion car productions in the USA totally requires \$0.01 billion U.S. dollar worth of metal parts intermediate inputs from China, while that in Germany and Mexico requires \$0.02 and \$0.03, respectively. Thus, the car production relocated out from the USA and Germany will decrease the requirement of China's metal parts, while the car production relocated into Mexico will increase it. In total, the industry relocation driven by the U.S. car market indirectly leads to a \$1.4 billion U.S. dollar worth of metal parts intermediate production relocated into China.

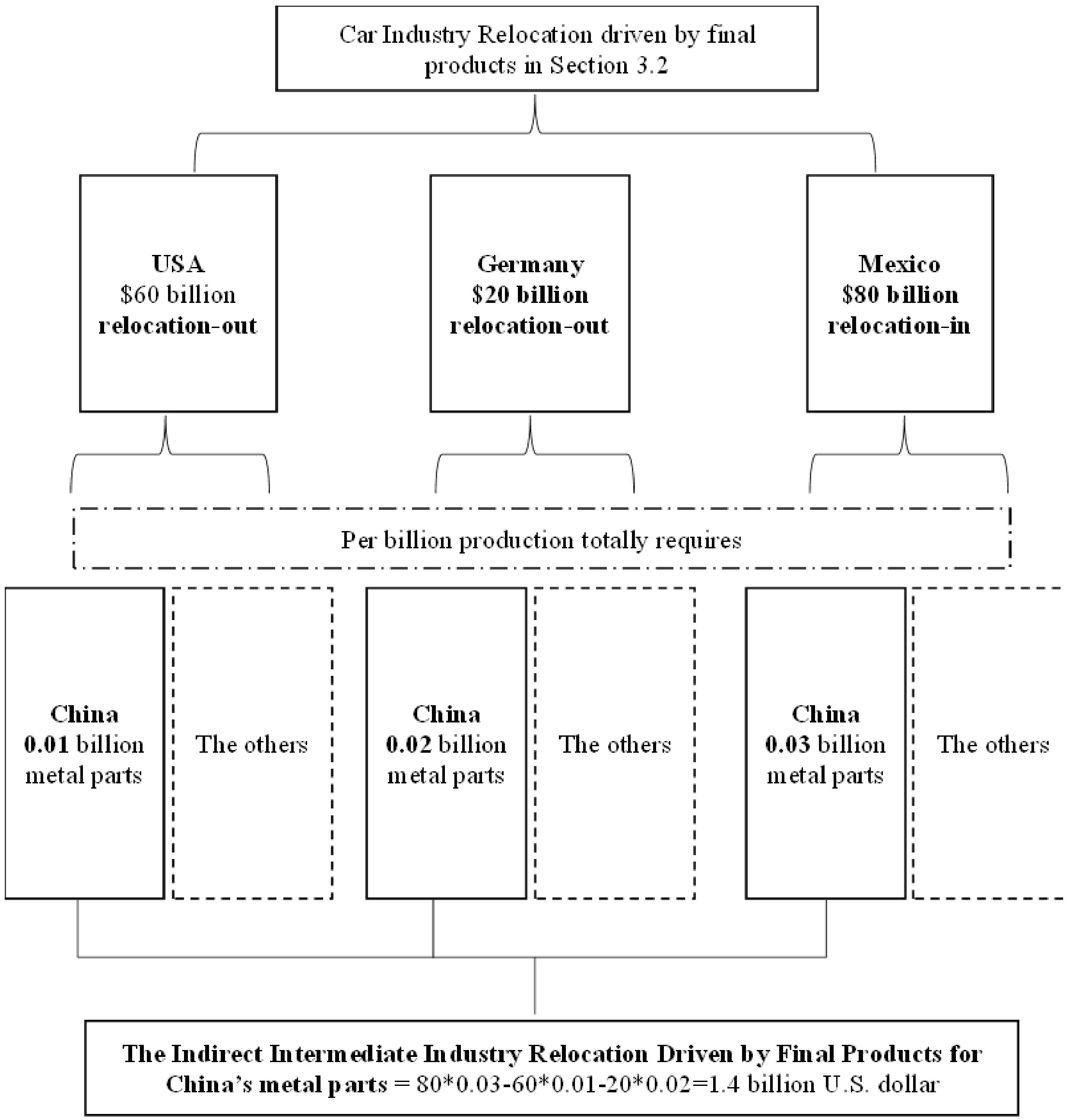

FIGURE S3: The example of the indirect intermediate industry relocation driven by final products

Appendix C – The list of industries and economies.

TABLE S1: The list of industries

Index	Manufacture	Dominating Primary input
1	Manufacture of food products, beverages and tobacco products	Labour
2	Manufacture of textiles and textile products	Labour
3	Manufacture of Leather, leather products, and footwear	Labour
4	Manufacture of Wood and products of wood and cork	Labour
5	Pulp, paper, paper products, printing, and publishing	Labour
6	Manufacture of Coke, refined petroleum, and nuclear fuel	Capital
7	Manufacture of chemicals and chemical products	Capital
8	Manufacture of rubber and plastic products	Capital
9	Other nonmetallic minerals	Capital
10	Basic metals and fabricated metal	Capital
11	Machinery, nec	Technology
12	Electrical and optical equipment	Technology
13	Transport equipment	Technology
14	Manufacturing, nec; recycling	Labour

Appendix D – List of Countries Related to China's reshore and re-offshore

num	country_id	country_en
1	AUS	Australia
2	AUT	Austria
3	BEL	Belgium
4	BGR	Bulgaria
5	BRA	Brazil
6	CAN	Canada
7	SWI	Switzerland
8	PRC	China
9	CYP	Cyprus
10	CZE	Czechia
11	GER	Germany
12	DEN	Denmark

13	SPA	Spain
14	EST	Estonia
15	FIN	Finland
16	FRA	France
17	UKG	United Kingdom
18	GRC	Greece
19	HRV	Croatia
20	HUN	Hungary
21	INO	Indonesia
22	IND	India
23	IRE	Ireland
24	ITA	Italy
25	JPN	Japan
26	KOR	Korea, Rep.
27	LTU	Lithuania
28	LUX	Luxembourg
29	LVA	Latvia
30	MEX	Mexico
31	MLT	Malta
32	NET	Netherlands
33	NOR	Norway
34	POL	Poland
35	POR	Portugal
36	ROM	Romania
37	RUS	Russian Federation
38	SVK	Slovak Republic
39	SVN	Slovenia
40	SWE	Sweden
41	TUR	Turkiye
42	USA	United States
43	BAN	Bangladesh
44	MAL	Malaysia
45	PHI	Philippines
46	THA	Thailand
47	VIE	Viet Nam
48	KAZ	Kazakhstan
49	MON	Mongolia
50	SRI	Sri Lanka
51	PAK	Pakistan
52	LAO	Lao PDR

53	BRU	Brunei Darussalam
54	KGZ	Kyrgyz Republic
55	CAM	Cambodia
56	NEP	Nepal
57	SIN	Singapore