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# China's New Growth Strategy: Implications for Middle-Income Economies

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**Abstract**

Acquiring human capital and climbing the manufacturing ladder are development policy goals shared by most middle-income countries. What happens when a large economy with active industrial policy expands into sectoral niches occupied by middle-income trade partners? We build a multi-country, multi-sector general equilibrium model and perform counterfactual experiments assessing the effects of China's human capital investments and industrial policies on trade, production, and factor returns elsewhere in the developing world. The model features skilled and unskilled labor as primary inputs as well as trade in intermediate goods. Simulation results suggest that China's growth strategy may cause middle-income economies to lose global export shares in more skill-intensive sectors and to be pushed toward blue-collar and resource-based exports. The effects are especially notable in Southeast Asia. Skill premia fall, reducing incentives to invest in human capital. In the absence of policy responses, these trends might dim long-run development prospects.

**Keywords:** Comparative advantage, skills, general equilibrium, skill premium, China

**JEL classification:** F11, F16, F17, O14, O53

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# China's New Growth Strategy: Implications for Middle-Income Economies[1]

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Acquiring human capital and climbing the ladder of manufacturing sophistication are development policy goals shared by most middle-income countries. What happens when China, a large economy with active industrial policy, begins to expand into sectoral niches formerly occupied by its middle-income trade partners? We build a multi-country, multi-sector general equilibrium model of global trade and perform counterfactual experiments aimed at assessing the effects of China's human capital investments and industrial policies on trade, production, and factor returns elsewhere in the developing world. The model features skilled and unskilled labor as primary inputs, as well as domestic and international trade in intermediate goods. Simulation results suggest that China's growth strategy may cause middle-income economies to lose global export shares in their more skill-intensive sectors and to be pushed toward blue-collar and resource-based exports. The effects are especially pronounced in Southeast Asia since that region is mostly closely linked to China. Skill premia will fall, reducing incentives to invest in human capital. In the absence of policy responses, these trends might dim long-run development prospects.

JEL codes: F11, F16, F17, 014, 053

Keywords: comparative advantage, skills, general equilibrium, skill premium, China

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Data availability statement: The data used in this study are all publicly available from the sources identified in Section 3.

## 1. Introduction

In the early 2000s, China's emergence as a global exporter of consumer goods appeared to threaten blue-collar manufacturing jobs in industrialized countries. At the same time, middle-income economies, notably in Southeast Asia, benefited as exporters of intermediate goods that complemented China's assembly-oriented manufacturing sectors. Two decades later, China's export pattern is undergoing a transition from mostly labor-intensive goods to a more capital and skill-intensive product mix. The change comes from a combination of factor endowment changes—notably, a steep increase in the tertiary-educated fraction of China's labor force—and industrial policies that have supported growth and capital deepening along China's domestic supply chain. Due to its massive economic size and high degree of Asian economic integration, such a change in China's economic structure inevitably has consequences for other regional economies. Countries like Malaysia, Thailand, and Vietnam escaped widespread poverty and attained middle-income status via manufacturing export growth. Maintaining growth momentum could become more challenging if external conditions change in ways that erode their competitiveness in skill-intensive sectors. Upskilling the production system is an important development policy target in its own right. Moreover, if changing trade patterns reduce relative returns to skilled labor, then incentives for human capital accumulation—another important development policy goal—may also diminish. China's new growth strategy may be a prominent potential driver of such changes.

Understanding the effects of changes in global trade patterns on individual economies is a general equilibrium puzzle. In this paper, we modify a well-known Ricardian trade model to analyze the effects of changes in China's endowments and policies on the export mixes and skill premia of other countries in the developing world, with a particular focus on countries in China's closest economic orbit. We modify the model to decompose total labor, the primary factor of production, into high and low skilled categories based on education. This allows us to analyze country-specific labor market consequences of increases in China's endowment of skilled workers, and of its policies promoting domestic value-added in production. We find that in the absence of policy responses, the effects of these changes on Asia's other emerging economies are likely to be both large and, in general, contradictory to the aims of upskilling either the value-added content of production or the labor force itself.

In the course of the 21st century thus far, China's export pattern has shifted from labor-intensive manufacturing like apparel and textiles to relatively more skill-intensive products, for example, electrical equipment and machinery (Figure 1 and Table 1). This change in export specialization has been contemporaneous with a dramatic accumulation of human capital, at least as measured by educational attainment. The share of China's working-age population with completed tertiary education increased from 1.2% in 1990 to 4.0% in 2015 (Barro and Lee, 2021) and continues to grow at a rate higher than nearly every other developing economy (Hanushek et al., 2023).

China's input-use composition has also changed. China is both the world's largest exporter of final products and its largest importer of intermediate products. In Figure 2, 25.4% of the value of China's electronics products exports in 2006 originated in imports. However, the foreign value-added share in China's electronics exports has declined significantly; by 2016, the import share was just 19.1%. China's backward linkages are likely to continue to attenuate in the future as a consequence of the "Made in China 2025" initiative launched in 2015. This set of industrial and trade policies aims to modernize China's manufacturing sectors via such policy tools (among others) as subsidies, foreign firm acquisitions, and domestic content requirements. While policies targeting some specific sectors, including robotics, aviation equipment, maritime equipment, electric vehicles, and renewable energy equipment, have captured headlines, the reach of industrial policy has been much broader (Wübbeke et al., 2016; US Chamber of Commerce, 2017; Naughton 2021).

China is emerging Asia's largest trade partner, so changes in China's export structure undoubtedly influence that region's economic development. Malaysia, Thailand, and Vietnam all have exports of goods and services exceeding 60% of GDP. More than a quarter of their exports are bound for China. Other exports are substitutes for Chinese products in global markets. The most direct effects of changes in China's economy will be felt in the types and quantities of goods that emerging Asia can export. Indirect effects are changes in returns to domestic factors of production, including wages and skill premia. Diminished competitiveness in manufacturing exports, if it occurs, may alter emerging Asia's prospects for continued industrial growth, and if losses are greater in more skill-intensive sectors, then lower returns to skills may also reduce returns to educational investments, even as household incomes rise (Findlay and Kierzkowski 1983; Kitayaporn 2023). As these middle-income Asian economies strive to build a more skilled workforce, they need to be mindful of trade shocks that could disincentivize investments in schooling.

The basic intuition behind this conjecture is very simple. If an economy's presence in world trade is large enough, then changes in its own resource endowments, allocations, and technologies with respect to skill-intensive goods will both increase global supply and reduce its own import demand for those goods. Both effects will lower world prices of skill-intensive goods relative to a numeraire such as low-skill products. In other countries, profits in skill-intensive sectors will fall, and so resources will be reallocated accordingly. This amounts to a relative decline in demand for skills, which lowers the skill premium. The skill premium is a meaningful signal in educational decisionmaking, most notably in school-to-work decisions made by teenagers and young adults, so in the longer run, a lower skill premium reduces incentives for human capital accumulation. Whether the net effect on educational investment is negative or positive will depend, in part, on whether any household-level income effects (assuming they are positive) outweigh the effect of a lower skill premium.

While we can be fairly confident about the *direction* of changes, however, their *magnitudes* depend on a complex set of general equilibrium adjustments occurring at both national and global scales. Within each national economy, endowments and technologies matter, of course, and so too does the extent of home market bias in the supply chain attributable to transport costs, border measures, or other less tangible factors. To figure out what will happen to the rest of the world as China's economy changes, we build a multi-country general equilibrium model with trade in both final and intermediate goods and two kinds of labor input.

For much of the twentieth century, understanding of international trade was framed mainly by the Heckscher-Ohlin-Vanek (HOV) model, which explains trade in goods in terms of implied trade in factor services, based on relative factor abundance. Empirically, the HOV model works well for North-South trade, especially where natural resources are concerned, but very poorly for other factor endowment differences (Trefler 1995; Trefler and Zhu 2010). More recently, the pendulum has swung back toward the Ricardian, or technology differences, model, which is thought to be better suited to a world in which a majority of trade takes place among countries with similar factor endowments and in which many countries may profitably produce and export similar sets of goods. Eaton and Kortum (2002) formalized a multi-country, multi-commodity Ricardian model in which trade is driven by variation in productivity over countries and within each country, over producers (e.g., sectors), subject to a degree of home-market bias attributable to geography (distance between markets matters when transportation costs are positive). Caliendo and Parro (2015) further refined our understanding of the contribution of home-market bias by modeling domestic I-O linkages and non-traded goods. They also obtained empirical estimates of a key parameter, the so-called "trade elasticity," governing the degree to which comparative, as opposed to absolute, advantage determines specialization and gains from trade.

The Ricardian model is a powerful empirical tool for understanding modern trade flows. However, the one-factor model neglects influences on trade patterns from factor endowment differentials, which were the focus of the HOV model and which are known to be important in the data (Davis and Weinstein 2001; Trefler and Zhu 2010[2]). Specifically for our research, the one-factor model abstracts from skill differences in labor input, cannot be used to study the effects of differential growth rates in a country's factor endowments, and generates no predictions about the effects of those or any other counterfactual changes on country skill premia.

In the model to be described below, we have amended a model due to Caliendo and Parro (2015) to allow for differentiated skilled and unskilled labor inputs, which are used together with intermediate inputs in production. This amendment also requires separate market-clearing conditions for labor by skill type. Those conditions determine the price of each labor type based on changes in demand and supply under the assumption of full employment. The ratio of skilled to unskilled wages is the skill premium.

Disaggregating labor inputs by skill confers two important advantages for our project relative to the one-factor Ricardian model while retaining the latter's analytical power. First, it expands the range of counterfactual experiments that we can conduct. Specifically, a two-factor model allows us to study the ceteris paribus effects in any country of changes in the skill intensity of the labor endowment in any other country (or, more generally, in any combination of other economies). Second, for each counterfactual experiment, the model yields a prediction of change in the skill premium for each country, a reflection of changes in the aggregate skill intensity of that country's trade. The extended model thus allows us to recover insights into the effects of trade on relative factor prices, analogous to the Stolper-Samuelson implication from the HOV model.[3]

Counterfactual simulations with this model reveal how an increase in China's skilled labor endowment or innovations in its industrial policies can alter the path of economic development in the most closely affected economies. We find that, as a result of these elements of China's new growth strategy, regional economies tend to lose export competitiveness in skill-intensive manufacturing industries and increase their reliance on resource-based exports instead. Their skill premia also fall in most cases, whereas real incomes may rise or fall. Nonetheless, the outcomes also depend on responses from the rest of the world. Looking beyond the ceteris paribus cases, we also find that if affected countries were to increase their pace of human capital accumulation, then they could remain

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[2] "Overall, these empirical results [in their paper] leave us much more impressed than before with the role of endowments as a source of comparative advantage" (Trefler and Zhu 2010).

[3] Other papers have presented Ricardian trade models with two kinds of primary input. These include Zhu and Trefler (2005), who studied the effects of trade on returns to skill and inequality in a two-country setting. Li and Coxhead (2011) extended this structure to three economies, modeling the Chinese economy as consisting of coastal and interior regions with limited interregional labor mobility. Caliendo, Dvorkin, and Parro (2019) also used a model with two types of primary input, to analyze the effects of China's export growth on the US job market. However, in their paper, the non-labor primary input is local housing structures, which are treated as fixed. We extend these models into a multi-country general equilibrium setting with production and trade in intermediate goods while also allowing for changes in intersectorally mobile inputs of skilled and unskilled labor and solving for both wages and the skill premium.

competitive in spite of China's growth. And, of course, if the rest of the world decides to retaliate against China's trade and industrial policies, Southeast Asia may gain due to trade and/or investment diversion (Kumagai et al., 2021).[4]

Our work contributes to the literature that studies the effects of a "China shock" by highlighting the roles of China's recent structural changes and the effects on labor markets in other economies. Several papers, notably Autor, Dorn, and Hanson (2013) and Acemoglu et al. (2016), study the effects of China's export competition on the US labor market. Other papers study the effects of China's growth on other Asian developing countries. For example, Eichengreen, Rhee, and Tong (2007) and Athukorala (2009) suggested that China's export growth was unlikely to crowd out other Asian countries' exports since their exports of capital and intermediate goods were likely to complement China's exports of (mainly) consumption goods. Conversely, Coxhead (2007) raised a concern that Southeast Asian developing countries were losing comparative advantage in manufacturing sectors to China and were being pushed towards resource-based exports. However, in more than a decade since these studies were published, China's economy and policies have undergone dramatic changes, so the present work considers the influence of a much more technologically advanced Chinese economy with very different policies. Lastly, some studies, such as Freund et al. (2020) and Park, Petri, and Plummer (2021), use computable general equilibrium (CGE) models to simulate the effects of China's trade policies on the rest of the world. We extend the empirical scope of those studies by considering the global effects of domestic policy shocks affecting China's skill endowment and industrial policies.

The findings on the skill premium in affected countries also relate to the literature on international trade and educational attainment. In a seminal theoretical contribution, Findlay and Kierzkowski (1983) suggested that international trade can influence educational attainment by altering the skill premium, which determines expected returns on educational investments. Several empirical studies, including Atkin (2016), Coxhead and Shrestha (2017), and Kitayaporn (2023), have found that when countries specialize in the export of less skill-intensive products and their skill premia fall, the pace of growth in educational attainment tends to decrease. Our study contributes to this literature by examining counterfactual general equilibrium trade shocks that can lead to a decline in skill premia.

In the next section, we develop the model that we will use to create the counterfactual simulations. Section 3 describes the data used to calibrate the model, while section 4 presents the

[4] See Mayr-Dorn et al. (2023), who find that Vietnam is a net winner from the trade war between the US and China.

simulation results. Section 5 offers some sensitivity analyses, and Section 6 draws conclusions and discusses some policy implications.

## 2. Theoretical framework

In this section, we present and modify the multi-country, multi-sector trade model of Eaton and Kortum (2002) and Caliendo and Parro (2015). As in those models, each individual country has its own overall productivity draw, while productivity over producers (sectors) within each country varies according to a Fréchet distribution. Conditional on trade barriers and transport costs, importers pick suppliers from the lowest-cost exporters. Positive trade costs create home-market bias and "gravity" in trade, so that proximity to markets becomes an important feature in this model as in the real world. We modify the model so that labor input is of two types, skilled and unskilled. Labor of each type is used in different proportions over sectors. Accordingly, in any country, a change in the endowment of labor by skills will alter the mix of goods that it produces and exports, and conversely, any country experiencing a non-uniform trade shock may see its skill premium change. This extension comes with new equilibrium conditions that clear both labor markets.

Following Caliendo and Parro (2015), we begin by deriving expressions for production cost. Then, taking into account the costs of international trade, we use the distribution of the sectoral productivity parameter to find the expenditure shares of consumers in each country. With these derived expenditure shares, we set equilibrium conditions by clearing goods and labor markets, conditional on which the trade balance condition is satisfied by Walras' law. Finally, we apply the technique of equilibrium in relative changes to obtain comparative static outcomes without the need to estimate some hard-to-observe parameters.

The model consists of $N$ countries, where importing/consuming countries are indexed by subscript $n$ and exporting/producing countries are indexed by subscript $i$. There are $S$ sectors of goods indexed by superscript $s$. In each sector, there is a continuum of varieties of intermediate goods denoted by $\omega^s$.

Consumers have a Cobb-Douglas utility function across sectors

$$u(C_n) = \Pi_{s=1}^{S} C_n^{s\,\alpha_n^s}, \tag{1}$$

where $\alpha_n^s$ denotes the sectoral expenditure share of a consumer, and $\sum_{s=1}^{S} \alpha_n^s = 1$.

The consumers' budget constraint is equal to their income of $I_n$, which comes from returns to exogenously endowed unskilled labor $L_n$ and skilled labor $H_n$ at rates $w_n$ and $r_n$ respectively, plus a lump-sum tariff transfer $T_n$ and the exogenously given trade deficit $D_n$. Formally,

$$I_n = w_n L_n + r_n H_n + T_n + D_n. \tag{2}$$

The production function also takes Cobb-Douglas form, with two primary inputs and a bundle of intermediate inputs $m_n^{r,s}(\omega^s)$ from $S$ sectors:

$$q_n^s(\omega^s) = z_n^s(\omega^s)\left[\left(l_n^s(\omega^s)\right)^{\beta_n^s}\left(h_n^s(\omega^s)\right)^{1-\beta_n^s}\right]^{\eta_n^s}\left[\prod_{r=1}^{S}[m_n^{r,s}(\omega^s)]^{\gamma_n^{r,s}}\right]^{1-\eta_n^s}. \tag{3}$$

The variable $z_n^s(\omega^s)$ represents the productivity of producing a good of variety $\omega^j$. This productivity parameter is drawn from a Fréchet distribution with cumulative distribution function $F_n^s(z) = e^{-\lambda_n^s z^{-\theta^s}}$. The stochastic nature of the productivity level allows us to generate a result where more than one country exports goods in the same sector. Here, the scale parameter $\lambda_n^s$ represents the absolute advantage of a country $n$ in sector $s$. The shape parameter $\theta^s$ represents the homogeneity of productivity and comparative advantage in this model. A smaller $\theta^s$ implies more product heterogeneity across varieties and, thus, more room for comparative advantage to drive patterns of trade. The variable $m_n^{r,s}(\omega^s)$ is the bundle of intermediate goods from sector $r$ used in production of good $\omega^s$ in sector $s$. The parameter $\gamma_n^{r,s}$ is the share of materials from sector $r$ used to produce $\omega^s$, where $\sum_{r=1}^{S}\gamma_n^{r,s} = 1$. The preference of firms for varieties of intermediate goods in each sector is assumed to be of a constant elasticity of substitution (CES) form with an elasticity of substitution of $\sigma^s > 0$. We also assume that $1 + \theta^s > \sigma^s$ to ensure that a solution exists.

The corresponding cost function from the given Cobb-Douglas production function is

$$c_n^s = \Upsilon_n^s\left(w_n^{\beta_n^s} r_n^{1-\beta_n^s}\right)^{\eta_n^s}\left(\prod_{r=1}^{S} P_n^{r\gamma_n^{r,s}}\right)^{1-\eta_n^s}, \tag{4}$$

where $P_n^r$ is the composite price of intermediate goods from sector $r$ and $\Upsilon_n^s$ is a constant.[5]

Given a constant elasticity of substitution, the quantity of composite intermediate goods is

$$Q_n^s = \left[\iint v_n^s(\omega^s)^{1-\frac{1}{\sigma^s}} d\omega^s\right]^{\frac{\sigma^s}{\sigma^s-1}}, \tag{5}$$

where $v_n^s(\omega^s)$ is the demand for an intermediate good of variety $\omega^s$ from the lowest cost supplier. The solution to the demand for an intermediate good $\omega^s$ is

[5] Specifically, $\Upsilon_n^s = (\beta_n^s\eta_n^s)^{-\beta_n^s\eta_n^s}\left((1-\beta_n^s)\eta_n^s\right)^{-(1-\beta_n^s)\eta_n^s}\prod_{r=1}^{S}\left(\gamma_n^{r,s}(1-\eta_n^s)\right)^{-\gamma_n^{r,s}(1-\eta_n^s)}$.

$$v_n^s(\omega^s) = \left(\frac{p_n^s(\omega^s)}{P_n^s}\right)^{-\sigma^s} Q_n^s. \quad (6)$$

The unit price of the composite intermediate good $P_n^s$ is calculated from an aggregation

$$P_n^s = \left[\iint p_n^s(\omega^s)^{1-\sigma^s} d\omega^s\right]^{\frac{1}{1-\sigma^s}}. \quad (7)$$

Trade costs include an iceberg shipping cost $d_{ni}^s \geq 1$ and an ad-valorem tariff $\tau_{ni}^s$ and take the form

$$\kappa_{ni}^s = (1 + \tau_{ni}^s)d_{ni}^s. \quad (8)$$

Given trade costs, buyers in a country $n$ purchase good of variety $\omega^s$ from producing country $i$ where the unit price $c_i^s \kappa_{ni}^s / z_i^s(\omega^s)$ is the lowest, and therefore

$$p_n^s(\omega^s) = \min_i \left\{\frac{c_i^s \kappa_{ni}^s}{z_i^s(\omega^s)}\right\}. \quad (9)$$

Using the property of the Fréchet distribution of the productivity parameter $z_i^s(\omega^s)$, we can follow Eaton and Kortum (2002) to find the price of composite intermediate goods of sector $s$ in country $n$ with the following equation

$$P_n^s = A^s \left[\sum_{i=1}^{N} \lambda_i^s (c_i^s \kappa_{ni}^s)^{-\theta^s}\right]^{-\frac{1}{\theta^s}}, \quad (10)$$

where $A^s$ is a constant. Because consumers have Cobb-Douglas preferences, the price index of final consumption goods is

$$P_n = \prod_{s=1}^{S} \left(\frac{P_n^s}{\alpha_n^s}\right)^{\alpha_n^s}. \quad (11)$$

Given the composite quantity and price above we can define the total expenditure of country $n$ in sector $s$ as $X_n^s = P_n^s Q_n^s$ and denote the total expenditure of country $n$ on goods from country $i$ in sector $s$ as $X_{ni}^s$. The expenditure share of country $n$ on goods from country $i$ in sector $s$ then follows as $\pi_{ni}^s = \frac{X_{ni}^s}{X_n^s}$. Using the property of the Fréchet distribution, we can derive the expenditure share

$$\pi_{ni}^s = \frac{\lambda_i^s [c_i^s \kappa_{ni}^s]^{-\theta^s}}{\sum_{h=1}^{N} \lambda_h^s [c_h^s \kappa_{nh}^s]^{-\theta^s}}. \quad (12)$$

Adding up the expenditure of firms on intermediate goods and consumers on final goods, we reach an equilibrium condition for total expenditure:

$$X_n^s = \sum_{r=1}^{S} \gamma_n^{r,s}(1-\eta_n^s)\sum_{i=1}^{N} \frac{X_i^r \pi_{in}^r}{1+\tau_{in}^r} + \alpha_n^s I_n\,. \tag{13}$$

Furthermore, we can define country $n$'s import of sector $s$ from country $i$ as $M_{ni}^s = X_n^s \frac{\pi_{ni}^s}{1+\tau_{ni}^s}$, and then find the tariff revenue of $T_n = \sum_{s=1}^{S}\sum_{i=1}^{N} \tau_{ni}^s M_{ni}^s$.

To clear the unskilled and skilled labor markets, we have, respectively,

$$L_n = \frac{\sum_{s=1}^{S}\beta_n^s\eta_n^s}{w_n}\sum_{i=1}^{N} X_i^s \frac{\pi_{in}^s}{1+\tau_{in}^s} \tag{14}$$

and

$$H_n = \frac{\sum_{s=1}^{S}(1-\beta_n^s)\eta_n^s}{r_n}\sum_{i=1}^{N} X_i^s \frac{\pi_{in}^s}{1+\tau_{in}^s}. \tag{15}$$

The trade balance condition is

$$\sum_{s=1}^{S}\sum_{i=1}^{N} X_n^s \frac{\pi_{ni}^s}{1+\tau_{ni}^s} - D_n = \sum_{s=1}^{S}\sum_{i=i}^{N} X_i^s \frac{\pi_{in}^s}{1+\tau_{in}^s}, \tag{16}$$

which follows as a consequence of Walras' law once other market-clearing conditions have been met.

Equilibrium in this model comes from the vectors of unskilled wages $\{w_n\}_{n=1}^N$, skilled wages $\{r_n\}_{n=1}^N$, and prices $\{P_n^s\}_{n=1,s=1}^{N,S}$ that satisfy the equilibrium conditions in equations (4), (10), (12), (13), (14), and (15) for all countries $n$ and sectors $s$.

Nonetheless, solving for equilibrium in levels as defined above requires knowledge of parameters such as the productivity scale parameter $\lambda_n^s$ and the iceberg trade cost $d_{ni}^s$, which are difficult to observe from data. Caliendo and Parro (2015) propose a solution to this data challenge by using the technique of equilibrium in relative changes. We will also apply this technique.

First, define the "hat" notation $\hat{x} \equiv \frac{x'}{x}$ for any variable $x$, where $x$ is the value under the baseline regime, $x'$ is the new value after the change, and $\hat{x}$ is the relative change in $x$. With this relative change notation in mind, we can find equilibrium in relative changes as vectors of relative changes in unskilled wages $\{\hat{w}_n\}_{n=1}^N$, skilled wages $\{\hat{r}_n\}_{n=1}^N$, and prices $\{\hat{P}_n^s\}_{n=1,s=1}^{N,S}$ such that the following set of equations are satisfied:

*Cost of input bundles:*

$$\hat{c}_n^s = \left(\hat{w}_n^{\beta_n^s} \hat{r}_n^{1-\beta_n^s}\right)^{\eta_n^s} \left(\prod_{r=1}^{S} \hat{P}_n^{r\,\gamma_n^{r,s}}\right)^{1-\eta_n^s}. \tag{17}$$

*Price index:*

$$\hat{P}_n^s = \left[\sum_{i=1}^{N} \pi_{ni}^s [\hat{\kappa}_{ni}^s \hat{c}_{ni}^s]^{-\theta^s}\right]^{-\frac{1}{\theta^s}}. \tag{18}$$

*Bilateral trade shares:*

$$\hat{\pi}_{ni}^s = \left[\frac{\hat{c}_i^s \hat{\kappa}_{ni}^s}{\hat{P}_n^j}\right]^{-\theta^s}. \tag{19}$$

*Total expenditure:*

$$X'^s_n = \sum_{r=1}^{S} \gamma_n^{r,s}(1-\eta_n^s) \sum_{i=1}^{N} \frac{\pi'^r_{in}}{1+\tau'^r_{in}} X_i'^r + \alpha_n^s I'_n. \tag{20}$$

*Unskilled labor market clearing:*

$$L'_n = \frac{\sum_{s=1}^{S} \beta_n^s \eta_n^s}{w'_n} \sum_{i=1}^{N} X'^s_i \frac{\pi'^s_{in}}{1+\tau'^s_{in}}. \tag{21}$$

*Skilled labor market clearing:*

$$H'_n = \frac{\sum_{s=1}^{S} (1-\beta_n^s) \eta_n^s}{r'_n} \sum_{i=1}^{N} X'^s_i \frac{\pi'^s_{in}}{1+\tau'^s_{in}}, \tag{22}$$

where $\hat{\kappa}_{ni}^s = \frac{1+\tau_{ni}'^s}{1+\tau_{ni}^s}$ and $I'_n = w'_n L'_n + r'_n H'_n + \sum_{s=1}^{S} \sum_{i=1}^{N} \tau_{ni}'^s \frac{\pi_{ni}'^s}{1+\tau_{ni}'^s} X_n'^s + D_n$.

The conditions in equations (17) through (20) are analogous to Caliendo and Parro (2015). Equations (21) and (22) depart from their model by clearing the two types of labor markets instead of balancing the trade surplus. These new labor market clearing conditions allow us to analyze changes in primary factor endowments as well as in returns to skills. However, they come with the extra cost of requiring data on skilled and unskilled worker endowments ($L_n$ and $H_n$) as well as the share of unskilled labor in value-added ($\beta_n^s$). Other data already required in Caliendo and Parro (2015) are total value-added ($w_n L_n + r_n H_n$), the share of value-added in production ($\eta_n^s$), the share of intermediate consumption in each sector ($\gamma_n^{r,s}$), bilateral tariffs ($\tau_{ni}^s$), bilateral trade shares ($\pi_{ni}^s$), and the sectoral dispersion of productivity ($\theta^s$).

To solve the model, we first make an initial guess of $\hat{w}_n$ and $\hat{r}_n$ and use equations (17) and (18) to calculate changes in input costs and price indices. Then, we calculate changes in trade shares using equation (19) and in total expenditure using equation (20). Finally, we verify the labor market clearing conditions in equations (21) and (22) and reiterate the new guesses of $\hat{w}_n$ and $\hat{r}_n$ until equilibrium is reached.

With this model, we can approximate the effects of changes in China's skilled labor endowment, its industrial policies, and its trade policies on changes in trade competitiveness and labor markets in other economies. We can also use equations (2) and (10) to find changes in welfare (i.e., real household income) $W_n = I_n/P_n$. However, this static model does not capture dynamics in capital flows and cannot endogenously determine trade surplus and deficits. The equilibrium in relative changes technique, while solving the data constraint, also prevents us from finding the actual level of wages and other outcomes of interest. Readers should bear these limitations in mind when interpreting the results.

## 3. Data

To calibrate the model described in the previous section, we require data on sectoral gross output ($Y_n^s$), value added ($V_n^s$), input-output tables, bilateral tariffs ($\tau_{ni}^s$), bilateral trade flows ($M_{ni}^s$), labor endowments ($L_n$ and $H_n$), the share of unskilled labor in value added ($\beta_n^s$), and dispersion of productivity ($\theta^s$). The remaining parameters ($\pi_{ni}^s$, $\eta_n^s$, $\gamma_n^{r,s}$, and $\alpha_n^s$) can be calculated from the data.

Our data are drawn from several sources as described below. We configure these data to represent 30 countries or country groups ($N = 30$), including the rest of the world, and 40 sectors ($S = 40$), 20 of which are tradable and the other 20 are non-tradable. Table A-1 in the appendix lists countries, and Table A-2 lists sectors with their corresponding 2-digit International Standard Industrial Classification (ISIC Rev. 4) codes. We take 2015 as the base year as it is the most recent year in which all of the abovementioned data are available.

We use input-output data from the Organization for Economic Co-operation and Development's (OECD) Inter-Country Input-Output (ICIO) database. This dataset also includes data on gross output and value-added. Hence, we can calculate value-added shares by taking the ratio of value-added to gross output, that is $\eta_n^s = V_n^s/Y_n^s$. The intermediate consumption parameter $\gamma_n^{r,s}$ is calculated from the intermediate spending of sector $r$ in sector $s$ out of total intermediate spending of sector $s$.

Bilateral trade and tariff data come from the World Bank's World Integrated Trade Solution (WITS) database. With the bilateral trade values ($M_{ni}^s$), we calculate domestic sales in each country by subtracting exports from gross output, that is $M_{nn}^s = Y_n^s - \sum_{i=1,i\neq n}^{N} M_{in}^s$. Then, we multiply imports by effective tariffs to obtain the expenditure of country $i$ on products of sector $s$ from country $n$, that is $X_{ni}^s = M_{ni}^s(1+\tau_{ni}^s)$. The bilateral trade shares naturally follow as $\pi_{ni}^s = X_{ni}^s / \sum_{i=1}^{N} X_{ni}^s$. Next, we calculate sectoral trade deficits as sectoral imports minus exports, that is $D_n^s = \sum_{i=1}^{N} M_{ni}^s - \sum_{i=1}^{N} M_{in}^s$. The total trade deficit is then the summation of sectoral deficits, that is $D_n = \sum_{s=1}^{S} D_n^s$. Finally, we can then find the final consumption share $\alpha_n^s$ as total domestic expenditure net of intermediate expenditure divided by total domestic absorption, that is $\alpha_n^s = (Y_n^s + D_n^s - \sum_{s=1}^{S} \gamma_n^{r,s} Y_n^s)/I_n$. The dispersion of productivity parameter $\theta^s$ is taken from Caliendo and Parro's (2015) estimation with minor adjustments to reflect differences in industrial classification.[6]

Skilled and unskilled labor endowments are derived from Barro and Lee's (2021) estimates of educational attainment for the population aged 15-64 from 1950 to 2015, which contain the total population and percentage of working-age adults who completed tertiary education. Total population is converted into number of workers using the World Bank's World Development Indicators (WDI) database on labor force participation rates. Workers who have completed tertiary education are labeled as skilled, while the rest are labeled as unskilled. Selected summary statistics are reported in Table 2.

The only remaining parameter is the share of unskilled labor in value-added, $\beta_n^s$. Empirically, we have very limited country-specific data on skilled and unskilled labor shares in labor inputs by sector. For OECD countries, we use sector-level data on skilled and unskilled labor inputs from the US Bureau of Labor Statistics (BLS). For non-OECD countries, we use comparable data from the 2015 Thai labor force survey.[7] We use these data to find the value-added shares of skilled and unskilled workers in each sector; that is, for individual $j$ working in sector $s$, $\beta^s = \sum_{j=1}^{J} w_j^s L_j^S / (\sum_{j=1}^{J} w_j^s L_j^S +$

[6] This paper uses ISIC revision 4 as the main industrial classification system, whereas Caliendo and Parro (2015) use ISIC revision 3. The fishing sector did not exist in their paper, so we use a parameter value of 9.11 from the agricultural sector. Likewise, the utility sector did not exist, and we use the value 8.22, which is Caliendo and Parra's default value for the non-tradable sector. Their office, communication, and medical sectors are aggregated into one electronics sector under our classification system, therefore we use the value of 8.54, which is the simple average of the three sectors.

[7] Many early empirical trade models applied production parameter values from US data to all countries; see Feenstra 2015, Table 2.4 for a survey. In their exploration of the factor content of trade, Trefler and Zhu (2010) used input-output datasets from 41 countries, including labor, capital and human capital primary factor inputs. However, those datasets were sourced from the GTAP database (the current version of which is at https://www.gtap.agecon.purdue.edu/databases/v11/). This contains country-specific skill-intensity values; however, within each country, the skill intensity of value-added is almost uniform over all manufacturing industries. In simulations using the GTAP skill-intensity dataset, our results differ only modestly from those obtained using US and Thai sectoral skill-intensity parameters as described.

$\sum_{j=1}^{J} r_j^s H_j^S$). We then assume that this sectoral share is identical for all countries in the relevant subset. Table 3 presents summary statistics of these two parameters and other variables.[8]

Because not every country reports its bilateral tariffs with all potential trade partners, we replace unavailable tariff rates using the median of rates which the reporting country collects from other trade partners with data. The bilateral trade value of the "rest of the world" is calculated using the total world trade value in each sector minus the trade values of countries for which data exist.

## 4. Counterfactual simulations

To understand the effects of China's structural transformation on export competitiveness and wages, we perform counterfactual simulations of three scenarios: (1) China accumulates more human capital by "converting" some unskilled workers into skilled workers; (2) China changes its production technology to use more domestic inputs in its strategic sectors; and (3) China imposes tariffs on imports in its strategic sectors. Table 4 presents selected baseline statistics of China. Additional simulation scenarios are also reported in the appendix. The main outcome variables of interest in each country include changes in the composition of exports, changes in real wages and skill premia, and changes in real income. While the model allows us to predict bilateral export flows of every sector from every country, we report only the most important outcomes to reduce unnecessary clutter. As indicated earlier in this paper, it is most meaningful to focus on the emerging Southeast Asian economies which, together with China and advanced economies such as Japan and Korea, form the tightly integrated Asian regional economy and trading area.

<u>Increase in tertiary-educated share of labor force</u>

The first simulation concerns China's rapid accumulation of human capital. According to Barro and Lee (2021), in 2010 just 2.62% of China's working-age population had completed tertiary education. By 2015 this percentage had risen to 3.98%, reflecting very rapid growth in tertiary enrolments in the early years of this century. We use a quadratic regression model[9] based on available data points between 1950 and 2015 to project this value in 2025. The predicted share of skilled workers in China in 2025 is 5.13%. While the accuracy of this prediction is not our main focus, the number seems to

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[8] The lack of individual country data is clearly a limitation on the empirical model. However, it is not clear how important it is in counterfactual experiments. Data on skill-intensity of production by country and sector contribute to parameter values in the initial dataset. In the proportional changes version of the model that we use, however, their contribution to variation in simulation results is much more limited. In any case, enriching this component of the model data is an ongoing project.

[9] Concretely, $h_{it} = \beta_0 + \beta_1 t + \beta_2 t^2 + \epsilon_{it}$, where $h\_it$ is the share of tertiary graduates in country $i$ and $t$ is year.

be in the plausible range given rapid growth of tertiary enrollments in recent years. For the purpose of this simulation exercise, all other variables are assumed to be unchanged.

To trace the effects of this change in China's skill endowment, Table 5, Figure 3, and Figure 4 report changes in real export values of selected countries as China increases its share of skilled workers from 3.98% to 5.13%. The vertical axis of Figure 3 represents changes in real export values, while the horizontal axis represents the skill intensity $(1-\beta^s)$ of each sector. Bubble sizes reflect a country's revealed comparative advantage in each sector ($\frac{X_i^s}{\sum_{s=1}^{S} X_i^s} / \frac{X_{World}^s}{\sum_{s=1}^{S} X_{World}^s}$). China, with increased skill abundance in this experiment, has become much more competitive in skill-intensive sectors.[10] On the other hand, developing Southeast Asian economies lose ground in skill-intensive manufacturing exports while shifting their exports towards natural resource sectors instead. The generally downward slope of points in Figure 4 clearly reflects this trend: less skill-intensive products are exported more, and more-skilled products are exported less. On the other hand, skill-abundant countries like Japan and the Republic of Korea still retain competitiveness in most of their manufacturing sectors since, in spite of domestic skill deepening, China's manufacturers still demand imports of advanced parts and components.

Besides the obvious role of $\beta^s$ in determining the skill intensity of each sector, another key parameter that heavily influences our results is the sectoral productivity dispersion parameter $\theta^s$. A higher value of $\theta^s$ implies more homogeneity in the productivity distribution and, thus, diminished potential for comparative advantage due to the lower probability of outliers that can overcome differences in trade and production costs. Hence, sectors with higher $\theta^s$ values, such as petroleum, paper, mining, and electrical equipment, tend to see more dramatic changes in trade shares when production or trade costs change.

Given these changes in the pattern of exports, what happens to prices, incomes and wages? Table 6 reports these results. Within China, as 9 million unskilled workers become skilled, skilled wages decline while unskilled wages increase, dramatically decreasing the skill premium.[11] Most other countries also experience decreases in skill premia due to the massive increase in the human capital stock of the world's largest exporter. The world average skill premium, excluding China, decreases by 0.25%. However, there is noticeable heterogeneity in outcomes (Figure 5). Countries

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[10] Large changes in exports of petroleum occur because this sector is highly skill intensive ($\beta^s = 0.11$) and has exceptionally homogenous productivity distribution ($\theta^s = 64.85$). Hence, a small change in the skilled labor endowment can have a massive effect on export competitiveness. In reality, the effects are likely to be much smaller due to the natural resource constraint, which is not a component of this model.

[11] In this experiment, China's skill premium falls by 23%. This may seem like a large number. However, after rising for a long period during the early Open Door years, Hanushek et al. (2023) report that in China the college premium (relative to high school completion) fell by one-third (from 60% to 40%) between 2007 and 2018.

such as Cambodia, Lao PDR, and Vietnam that specialize in the production and export of less-skill-intensive products see the greatest skill premium declines. Even natural resource exporters that are geographically far from China, such as Argentina, Brazil, and South Africa, also see relatively large decreases. On the other hand, technologically advanced countries, such as Japan, the European Union, and the United States, see their skill premia fall at much milder rates. Most countries experience net welfare gains because the rise in unskilled earnings outweighs losses in skilled earnings; however, aggregate welfare changes are generally very small.

The pattern of skill premium changes depicted in Figure 5 recalls predictions from a highly stylized three-economy model due to Deardorff (1987). When an economy in the middle of the global skill range becomes more advanced, less-advanced countries lose competitiveness in their most skill-intensive sectors, specialize more in labor-intensive exports, and have lower skill premia as a consequence of declining relative demand for skills. In contrast, more-advanced countries lose competitiveness in their least skill-intensive sectors, specialize more in their most advanced sectors, and have higher skill premia. Although our empirical model accommodates two-way trade and many countries, the fundamental intuition from Deardorff's heuristic model remains intact.

This simulation result sends a warning to middle-income economies that unless they keep up their own human capital investments, knowledge-intensive sectors whose expansion is considered important to the trajectory of their economic development might experience slower growth or even decline as China becomes a more skilled producer. On the other hand, if other countries also accumulate additional human capital, they can maintain their export competitiveness, even though the global skill premium will tend to fall due to the larger stock of global skilled workers. Table A-3 and Table A-4 in the appendix present counterfactual simulation results when all countries increase the skilled share of their labor force following the same quadratic model that we used to forecast China's case.

Note that our model does not account for endogenous educational decisions. The incentive for Chinese workers to pursue tertiary education might gradually decline if skill premia continue to fall—and indeed, the peak increase in tertiary enrolments was long ago, in 2003 (Hanushek et al 2023). It also omits adjustment mechanisms associated with capital movement and changes in exchange rates. In the real world, if another middle-income country's labor force were to be less competitive in the skill-intensive manufacturing sectors, then foreign direct investment inflows might also decrease.

Increase in value-added shares for Made in China industries

Next, we simulate counterfactual results when China increases its domestic value-added shares by 25% of current values (i.e., $\eta'^{s}_{CHN} = 1.25\eta^{s}_{CHN}$) in selected sectors, namely, chemicals, basic metals, fabricated metals, electronics, electrical equipment, machinery, motor vehicles, and other vehicles. These eight sectors are the primary targets for growth in the Made in China 2025 initiative. Since China aims to increase its domestic value added in these sectors via a broad range of industrial policies, the change in this production technology parameter should broadly capture the effects of this initiative. However, unlike the case of human capital accumulation in which we can predict the magnitude with a time series model, the actual sizes of these policy initiatives are difficult to quantify. Hence, we arbitrarily choose a policy shock size of 25% to maintain comparability with the case of skilled labor growth. A 25% change also roughly reflects the decline of foreign value-added in China's supply chain as seen in Figure 2. Table 7 reports changes in wages and incomes as Made in China policies redirect the manufacturing supply chain toward domestic producers. In this simulation, China demands fewer skill-intensive intermediate goods from the rest of the world. Accordingly, we again observe a decline in skill premia in most middle-income countries; their skilled wages must decline in order to clear labor markets. Even with Made in China policies, however, China must still import some high-skill products. Therefore, the most skill-abundant countries again see skill premia rise as they become even more specialized in the production of high-tech intermediate goods. Overall, however, this policy produces a net welfare gain for China at the cost of the incomes of the suppliers of intermediate goods whose access to the Chinese market has been curtailed.

Table 8 and Figure 6 report counterfactual changes in real exports. We see decreases in exports of manufacturing products from China's closest Southeast Asian trading partners and increases in that region's exports of resource-based products. The net effects on other countries' exports also depend on the percentage of their exports that are used as China's intermediate inputs. Hence, electronics and fabricated metals, which are mostly used as intermediate inputs, are sectors that take the largest hits. This result provides more evidence on how China's inward-looking policy may alter the development path of other developing countries.[12]

<u>Increase in tariff protections for Made in China industries</u>

Finally, we simulate the effects of increases in Chinese tariffs on targeted sectors such that their c.i.f. prices rise by 25% (i.e., $(1 + \tau'^{s}_{CHN}) = 1.25(1 + \tau^{s}_{CHN})$). This is a variant of the previous experiment,

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[12] Table A-5 and Table A-6 in the appendix provide additional results for the combined case, in which China both accumulates more skilled workers and increases its domestic value-added shares.

except that China chooses to pursue its industrial policy goals via border measures rather than domestic subsidies.[13]

Table 9, Table 10, and Figure 7 present results of this simulation. This protectionist policy effectively increases trade costs and so takes marginally profitable producers in other countries out of contention in China's import markets. China's main trade partners become more specialized, pushing skill premia downward in developing countries and upward in the most skill-abundant countries. In welfare terms, China gains from this policy, while the rest of the world suffers from lower incomes, with the advanced economies being the biggest losers due to the skill-intensive nature of sectors to which China's tariffs apply. This tariff increase also causes trade destruction in every country, with China suffering the largest decline in exports. The rest of the world also exports less in the now more highly protected sectors. To maintain full employment, the rest of the world now must increase production and exports in the other industries.[14]

## 5. Robustness checks

This section extends the counterfactual simulations reported above by examining variations in the sizes and nature of the shocks applied. First, we explore variations in China's skilled labor accumulation. Then, we look into different scenarios in China's curtailment of the regional supply chain, either via trade barriers or technological changes. Finally, we combine the baseline shocks presented in Section 4 to estimate the aggregate effects if China deploys multiple policies simultaneously. These supplemental exercises partially relax the ceteris paribus assumption in Section 4 and allow us to predict more realistic impacts of China's changes on neighboring economies. Nonetheless, more realistic results come with the added cost of greater difficulty in distinguishing the effect of one shock from another. To save space, we will report only changes in skill premia and real household income of selected countries in this section. More details can be found in the appendix.

<u>Skilled labor endowment</u>

[13] Ideally, we would prefer to analyze the effects of changes in China's iceberg trade cost parameter $d_{CHN}^{s}$ since many of China's industrial policies may be implemented through non-tariff barriers. However, the iceberg trade cost is not observable from the data, so the power of tariff $(1 + \tau_{CHN}^{s})$ is the best option available. From equation (8), changing either $(1 + \tau_{ni}^{s})$ or $d_{ni}^{s}$ should have the same effect on the net trade cost. A caveat is that $\tau_{ni}^{s}$ is distributed back into household incomes, whereas $d_{ni}^{s}$ simply leaks from the model. Hence, the simulation is likely to overestimate the net welfare effects.

[14] This experiment assumes that other countries do not retaliate against China's tariff hike. Table A-7 and Table A-8 report cases in which the rest of the world also imposes the same kind of tariffs on China. In this case, China suffers welfare losses while developing Southeast Asian economies enjoy trade diversion from China, which seems to outweigh China's trade destruction.

In the baseline simulation in Section 4, we predicted that China will increase its skilled labor share from 3.98% in 2015 to 5.13% in 2025 and hold everything else constant. In this section, we provide three variations to this simulation. First, we examine what would happen if China's increased skilled labor share was approximately half as large, to 4.46% in 2025 instead, while still holding everything else constant. Next, we assume that countries in the rest of the world also increase their skilled labor endowments, holding total population constant. Finally, we relax the assumption of constant total population and allow the skilled and unskilled workforces to grow independently.[15] All forecasts follow the same quadratic time trend model used in Section 4.

Table 11 presents the results of the simulation variants above. Table A-3 and Table A-4 in the appendix and Table OA-1 through Table OA-4 in the online appendix provide detailed results.[16] When China's skilled labor share grows only to 4.46%, the spillover onto other countries is of course more moderate than the baseline results in Table 6. When the increase in China's competitiveness in skilled sectors is smaller, other middle-income countries can retain some of their competitiveness. Nonetheless, when the rest of the world also accumulates its skilled workforce, two counteracting effects on skill premia come into play. On the one hand, the rest of the world can maintain its export competitiveness in skill-intensive products, keeping the skill premium high. On the other hand, they also have a larger domestic supply of skilled workers, reducing the skill premium. While the overall effects on skill premia tend to be negative due to the supply increase, real household income still increases in most countries.

Value-added share

In the baseline simulation in Section 4, we discussed the case in which China increases its value-added shares by 25% in eight sectors prioritized under the Made in China 2025 policy. In this section, we test the sensitivity of those results to the magnitude and scope of China's policy change. We begin by varying the size of the increase to 10% and 50%, respectively, for the same eight sectors. Then we examine the effect of a change in scope, from the eight targeted sectors to all tradable sectors.

Table 12 presents the main results from these experiments, while Table OA-5 through Table OA-10 in the online appendix show detailed results. The results from varying the sizes of the shocks are straightforward, as the magnitudes of the outcome vary in the same fashion. Nonetheless, this exercise still allows us to get a better grasp of the impacts of China's policy when the actual policy

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[15] More concretely, we forecast $L_{it} = \beta_0 + \beta_1 t + \beta_2 t^2 + \epsilon_{it}$ and $H_{it} = \beta_0 + \beta_1 t + \beta_2 t^2 + \epsilon_{it}$, where $L_{it}$ and $H_{it}$, respectively, are numbers of unskilled and skilled workers in country $i$ at time $t$.

[16] Access the online appendix at https://tinyurl.com/mpa8c6dk.

size is difficult to pin down. The change in the scope of the policy from the eight MIC-2025 targeted sectors to all tradable sectors yields quite different results. When China becomes more inwardly-oriented across the board rather than only in high-tech sectors, skill premia of middle-income countries no longer fall. Nonetheless, real incomes in the rest of the world still fall due to the trade destruction effect of increased inward orientation in the world's largest trading economy.

Tariffs

In the baseline simulation in Section 4, we analyzed the case in which China increases tariffs in the eight sectors targeted by the Made in China 2025 policy, holding other countries' tariffs constant. In this section, we begin by allowing other countries to retaliate against China by raising the same kind of tariffs. Then, we examine the effect of China's tariffs on the baseline scenario but with a smaller magnitude of 10%. Finally, we let China raise its tariffs by 25% in all tradable sectors.

Table 13 presents the main results, while Table A-7 and Table A-8 in the appendix and Table OA-11 through Table OA-14 in the online appendix provide the detailed results. The retaliatory tariff scenario gives a mixed picture of trade destruction due to the global increase in trade barriers and trade diversion from China to other countries. Overall, the effects on the skill premia are mixed, while the effects on household incomes tend to be mostly positive among middle-income Southeast Asian economies. The experiment with only 10% tariffs from China gives a straightforward variation from the baseline results with smaller magnitudes of changes, exhibiting the case when China decides to take a less aggressive move. Finally, the case where China imposes tariffs on all tradable sectors greatly reduces household incomes globally and suppresses skill premia in middle-income economies. They can no longer export manufactured products to China and are forced to divert their exports to other destinations.

Combined shocks

Lastly, we combine multiple shocks from the baseline scenarios in Section 4 together to estimate the effects on the rest of the world when China decides to apply multiple changes simultaneously. Table A-5 and Table A-6 show the outcomes when China increases its skilled labor endowment and increases its value-added shares simultaneously. Table A-9 and Table A-10 present the outcomes when China applies all three changes in the baseline scenario altogether. Overall, middle-income Asian economies tend to lose their export competitiveness in skilled sectors, experience decreases in skill premia, and have lower real household incomes.

## 6. Conclusion

China's skill endowments, trade structure, and industrial policies have changed significantly in the past two decades. We analyze the effects of some of these changes on the export competitiveness and labor markets of other economies using a general equilibrium trade model, with a particular focus on middle-income economies most closely tied to the China-centered economic system. Counterfactual simulations with this model show that the rise of China can deplete middle-income competitiveness in skill-intensive manufacturing sectors and reduce the relative wages of skilled workers. These effects are strongest in the Southeast Asian economies, which are most closely linked to China. These simulation findings appear to have a good correspondence with evidence from micro-data. Using labor force and household survey data from Thailand, Kitayaporn (2023) estimates that a one percent decline in the skill premium contributes to a 1.9 percentage point drop in the educational enrollment rate of 15-23-year-old children and young adults. In the scenario where China increases its skilled labor endowment and domestic value-added share, Thailand's skill premium is expected to fall by 0.54% (Table A-5), which translates into a drop of 1.03 percentage points in the educational enrollment rate.[17] Because middle-income developing economies need to accumulate more human capital to avoid a "middle-income trap," they need to appropriately respond to this external threat to ensure their prospect of long-run economic growth.

Because of China's prominence in the world trading system, its economic policies have the potential to alter the terms of trade for many other developing economies. China's aggressive pursuit of a larger tertiary-educated workforce, and its industrial policies targeting increased reliance on domestic producers of high-skill products, have potentially large and negative implications for middle-income economies' efforts to upskill their own industries and labor forces. For countries affected in this way, China's policies demand greater effort to ensure that their own educational systems are capable of sustaining increases in skilled labor endowments. To the extent that China shocks increase national income, affected countries should aim to leverage this windfall to raise the affordability of education among their credit-constrained populations. Lastly, building a diversified trade portfolio and maintaining strong international relationships with multiple trade partners can also increase the chances of survival when a major economic player like China decides to become more insular.

[17] Kitayaporn (2023) estimated that Thailand's skill premium decreased by about 1.20% per year from 1995 to 2019. Hence, the predicted 0.54% change in skill premium due to China's structural changes contributes to a non-trivial part of the fall in skill premium observed in Thailand's data.

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## Tables

Table 1: Trends in China's revealed comparative advantage

| Sector Name | 2000 | 2007 | 2012 | 2017 |
|---|---|---|---|---|
| Agriculture, hunting, forestry, and fishing | 2.24 | 2.05 | 1.59 | 1.33 |
| Mining and quarrying | 0.97 | 0.66 | 0.51 | 0.71 |
| Food, beverages, and tobacco | 1.12 | 1.08 | 1.16 | 0.97 |
| Textiles and textile products | 3.53 | 3.28 | 3.11 | 2.74 |
| Leather, leather products, and footwear | 3.43 | 3.28 | 2.79 | 2.64 |
| Wood and products of wood and cork | 1.41 | 1.92 | 2.17 | 2.07 |
| Pulp, paper, paper products, printing, and publishing | 0.75 | 0.62 | 0.71 | 0.66 |
| Coke, refined petroleum, and nuclear fuel | 1.21 | 1.09 | 0.98 | 1.02 |
| Chemicals and chemical products | 1.03 | 1.04 | 0.99 | 0.92 |
| Rubber and plastics | 1.57 | 1.41 | 1.37 | 1.30 |
| Other nonmetallic minerals | 1.85 | 1.52 | 2.00 | 1.97 |
| Basic metals and fabricated metals | 1.07 | 1.42 | 1.32 | 1.29 |
| Machinery, nec | 0.76 | 1.15 | 1.09 | 1.13 |
| Electrical and optical equipment | 1.13 | 1.70 | 1.86 | 1.72 |
| Transport equipment | 0.32 | 0.49 | 0.64 | 0.62 |
| Manufacturing, nec; recycling | 2.37 | 2.13 | 1.66 | 1.51 |

Source: Asian Development Bank's Global Value Chain Key Indicators Database

Table 2: Selected summary statistics by country

| Country | Value-added share ($\eta_n$) | Gross output (m. USD) ($Y_n$) | Import value (m. USD) ($M_n$) | Import tariff (%) ($\tau_n$) | Unskilled labor ($L_n$) | Skilled labor ($K_n$) |
|---|---|---|---|---|---|---|
| ARG | 0.4734 | 1,029,082 | 49,581 | 10.17 | 18,158,568 | 548,106 |
| AUS | 0.4354 | 2,531,732 | 174,341 | 1.54 | 9,247,587 | 2,958,837 |
| BRA | 0.4485 | 3,073,990 | 145,039 | 10.46 | 90,924,627 | 8,392,279 |
| BRN | 0.4226 | 24,968 | 4,672 | 0.82 | 190,499 | 15,401 |
| KHM | 0.5342 | 31,594 | 18,185 | 10.37 | 7,999,098 | 245,695 |
| CAN | 0.4653 | 2,738,557 | 340,724 | 1.93 | 13,871,454 | 5,211,575 |
| CHN | 0.3533 | 31,155,157 | 1,005,314 | 4.22 | 749,270,748 | 31,057,046 |
| EFTA | 0.4416 | 2,017,100 | 298,709 | 2.11 | 5,926,831 | 1,586,597 |
| EU | 0.4296 | 25,141,450 | 4,108,241 | 2.30 | 176,946,077 | 31,909,823 |
| HKG | 0.3500 | 624,033 | 612,139 | 0.00 | 2,647,125 | 1,129,088 |
| IND | 0.4514 | 3,954,560 | 268,802 | 10.33 | 437,708,193 | 32,490,747 |
| IDN | 0.5165 | 1,603,334 | 137,350 | 4.24 | 110,154,717 | 9,047,444 |
| JPN | 0.4831 | 7,879,902 | 470,307 | 1.81 | 43,993,137 | 15,440,985 |
| KOR | 0.4041 | 3,296,363 | 343,895 | 8.08 | 18,363,624 | 6,979,495 |
| LAO | 0.3660 | 29,939 | 6,563 | 5.62 | 3,191,191 | 232,834 |
| MYS | 0.3857 | 717,150 | 174,976 | 6.04 | 12,615,034 | 1,513,126 |
| MEX | 0.5049 | 1,951,352 | 297,760 | 5.26 | 44,501,305 | 7,178,297 |
| MMR | 0.4092 | 138,661 | 21,906 | 2.34 | 23,351,917 | 1,174,831 |
| NZL | 0.4471 | 337,327 | 30,076 | 1.19 | 2,066,921 | 308,031 |
| PHL | 0.4552 | 558,353 | 92,752 | 3.53 | 38,808,314 | 2,724,556 |
| RUS | 0.4646 | 2,394,668 | 169,089 | 3.32 | 51,277,586 | 19,528,249 |
| SAU | 0.5519 | 966,301 | 141,373 | 4.81 | 10,670,000 | 2,269,607 |
| SGP | 0.3871 | 789,547 | 241,866 | 0.17 | 2,011,320 | 1,308,238 |
| ZAF | 0.3969 | 625,459 | 83,375 | 5.14 | 20,230,468 | 999,953 |
| THA | 0.3969 | 921,938 | 157,556 | 4.90 | 31,755,420 | 5,311,721 |
| TUR | 0.4607 | 1,618,559 | 166,795 | 3.84 | 26,448,515 | 2,596,637 |
| GBR | 0.4614 | 4,978,232 | 554,001 | 2.26 | 24,894,285 | 7,706,926 |
| USA | 0.5000 | 31,513,723 | 1,951,131 | 1.38 | 107,780,887 | 44,065,953 |
| VNM | 0.3349 | 585,639 | 179,429 | 4.61 | 51,488,676 | 2,195,691 |
| ROW | 0.5048 | 12,954,728 | 27,864,552 | 3.55 | 578,555,551 | 54,534,568 |

Note: The value-added share is averaged across all sectors. The import tariff is averaged across all sectors and trade partners. The gross output is the total value of all sectors. The import value is the total values of all sectors and trade partners.

Sources: OECD, World Bank, Barro and Lee (2021), author's calculation

Table 3: Selected summary statistics by sector

| Sector | Value-added share ($\eta^s$) | Gross output (m. USD) ($Y^s$) | Import value (m. USD) ($M^s$) | Import tariff (%) ($\tau^s$) | Unskilled labor share ($\beta^s$) (non-OECD) | Unskilled labor share ($\beta^s$) (OECD) | Productivity dispersion ($\theta^s$) |
|---|---|---|---|---|---|---|---|
| Agriculture | 0.5348 | 5,385,929 | 1,226,523 | 8.27 | 0.9658 | 0.7110 | 9.11 |
| Fishing | 0.5697 | 454,887 | 69,840 | 4.05 | 0.8439 | 0.7110 | 9.11 |
| Mining | 0.5590 | 4,170,872 | 2,672,194 | 1.16 | 0.4424 | 0.6329 | 13.53 |
| Food | 0.2669 | 6,537,298 | 2,508,878 | 11.04 | 0.7871 | 0.6417 | 2.62 |
| Textiles | 0.3412 | 2,594,191 | 2,481,712 | 7.07 | 0.8799 | 0.6075 | 8.10 |
| Wood | 0.3346 | 692,997 | 310,985 | 4.24 | 0.7548 | 0.7101 | 11.50 |
| Paper | 0.3204 | 1,442,730 | 737,597 | 2.77 | 0.7130 | 0.6069 | 16.52 |
| Petroleum | 0.2139 | 2,830,008 | 1,665,734 | 1.96 | 0.1079 | 0.6723 | 64.85 |
| Chemical | 0.3190 | 5,021,653 | 4,686,845 | 2.45 | 0.5367 | 0.4697 | 3.13 |
| Rubber & plastics | 0.3212 | 1,655,476 | 1,143,719 | 5.53 | 0.7095 | 0.6416 | 1.67 |
| Non-metallic min. | 0.3377 | 1,834,414 | 514,956 | 4.24 | 0.5877 | 0.6617 | 2.41 |
| Basic metals | 0.2376 | 3,561,878 | 2,792,563 | 2.22 | 0.7289 | 0.7141 | 3.28 |
| Fabric. metals | 0.3345 | 2,179,031 | 1,035,255 | 4.42 | 0.7871 | 0.6218 | 6.99 |
| Electronics | 0.3325 | 3,319,882 | 6,109,822 | 2.07 | 0.6731 | 0.3957 | 8.54 |
| Electrical eqpmt | 0.3008 | 1,936,815 | 1,914,649 | 3.40 | 0.5609 | 0.5308 | 12.91 |
| Machinery | 0.3345 | 3,183,905 | 3,713,629 | 2.94 | 0.6043 | 0.5144 | 1.45 |
| Motor vehicles | 0.2806 | 4,058,361 | 3,830,857 | 6.97 | 0.6884 | 0.6824 | 1.84 |
| Other vehicles | 0.3221 | 1,160,705 | 1,306,873 | 3.63 | 0.7338 | 0.5314 | 0.39 |
| Other manuf. | 0.3575 | 1,604,486 | 1,307,505 | 5.21 | 0.7820 | 0.5251 | 3.98 |
| Utility | 0.4210 | 4,546,300 | 80,365 | 0.59 | 0.4004 | 0.7388 | 8.22 |
| Construction | 0.3837 | 10,448,081 | | | 0.7706 | 0.7075 | |
| Wholesale&retail | 0.5938 | 13,183,039 | | | 0.7481 | 0.6747 | |
| Land transport | 0.4784 | 3,478,946 | | | 0.8412 | 0.8164 | |
| Water transport | 0.3481 | 621,182 | | | 0.6837 | 0.7566 | |
| Air transport | 0.3147 | 819,390 | | | 0.5090 | 0.7476 | |
| Aux transport | 0.4637 | 1,560,124 | | | 0.5401 | 0.7473 | |
| Postal | 0.5098 | 474,118 | | | 0.7466 | 0.7734 | |
| Hotel&restaurant | 0.4501 | 3,490,004 | | | 0.7744 | 0.7468 | |
| Publishing | 0.4342 | 1,567,083 | | | 0.6122 | 0.6141 | |
| Telecom | 0.4837 | 2,210,048 | | | 0.3165 | 0.7671 | |
| IT services | 0.5455 | 2,430,779 | | | 0.1301 | 0.6389 | |
| Finance | 0.6209 | 7,514,731 | | | 0.2897 | 0.6155 | |
| Real estate | 0.7476 | 9,162,309 | | | 0.4439 | 0.6057 | |
| Research | 0.5440 | 6,220,577 | | | 0.5127 | 0.6565 | |
| Admin | 0.5657 | 4,141,583 | | | 0.4058 | 0.6743 | |
| Public | 0.6288 | 7,139,803 | | | 0.4142 | 0.6921 | |
| Education | 0.7487 | 4,266,692 | | | 0.0997 | 0.7340 | |
| Health | 0.5908 | 6,123,300 | | | 0.2287 | 0.7600 | |
| Recreation | 0.5248 | 1,171,447 | | | 0.3514 | 0.8521 | |
| Other services | 0.6321 | 1,988,345 | | | 0.8680 | 0.6787 | |

Note: The value-added share is averaged across all countries. The import tariff is averaged across all importers and trade partners. The gross output is the total value of all countries. The import value is the total values of all importers and trade partners.

Sources: OECD, World Bank, Caliendo and Parro (2015), author's calculation

Table 4: Selected baseline summary statistics of China

| Sector | Value-added share ($\eta_{CHN}^{s}$) | Gross output (m. USD) ($Y_{CHN}^{s}$) | Import value (m. USD) ($M_{CHN}^{s}$) | Import tariff (%) ($\tau_{CHN}^{s}$) |
|---|---|---|---|---|
| Agriculture | 0.4695 | 1,691,663 | 62,806 | 7.95 |
| Fishing | 0.4805 | 188,175 | 1,316 | 5.95 |
| Mining | 0.3003 | 947,227 | 131,475 | 0.27 |
| Food | 0.2257 | 1,753,283 | 46,254 | 8.81 |
| Textiles | 0.1975 | 1,373,248 | 23,059 | 6.15 |
| Wood | 0.2064 | 244,112 | 8,352 | 1.14 |
| Paper | 0.2145 | 412,640 | 20,661 | 2.32 |
| Petroleum | 0.2172 | 575,268 | 20,384 | 3.35 |
| Chemical | 0.1877 | 1,779,178 | 132,950 | 3.30 |
| Rubber & Plastics | 0.1643 | 533,252 | 16,887 | 5.12 |
| Non-metallic minerals | 0.2072 | 962,275 | 6,897 | 6.27 |
| Basic metals | 0.1425 | 1,645,265 | 95,050 | 1.27 |
| Fabricated metals | 0.1954 | 640,931 | 11,916 | 5.62 |
| Electronics | 0.1917 | 1,353,838 | 204,770 | 3.06 |
| Electrical equipment | 0.1896 | 963,390 | 45,155 | 2.58 |
| Machinery | 0.2129 | 1,291,745 | 86,837 | 3.19 |
| Motor vehicles | 0.1885 | 1,173,641 | 65,063 | 9.27 |
| Other vehicles | 0.2040 | 206,120 | 18,684 | 2.75 |
| Other manufacturing | 0.2142 | 261,887 | 6,540 | 6.01 |
| Utility | 0.2684 | 1,124,329 | 259 | 0.00 |
| Construction | 0.2366 | 2,984,189 | | |
| Wholesale & retail | 0.6355 | 1,575,048 | | |
| Land transport | 0.3877 | 778,150 | | |
| Water transport | 0.3334 | 73,851 | | |
| Air transport | 0.2847 | 99,414 | | |
| Aux transport | 0.3716 | 158,523 | | |
| Postal | 0.4426 | 84,911 | | |
| Hotel & restaurant | 0.4069 | 447,065 | | |
| Publishing | 0.3083 | 74,834 | | |
| Telecom | 0.2104 | 284,529 | | |
| IT services | 0.4663 | 377,472 | | |
| Finance | 0.8376 | 993,519 | | |
| Real estate | 0.7192 | 875,019 | | |
| Research | 0.3343 | 614,075 | | |
| Admin | 0.3875 | 689,939 | | |
| Public | 0.6384 | 658,665 | | |
| Education | 0.7940 | 453,674 | | |
| Health | 0.5336 | 409,029 | | |
| Recreation | 0.5262 | 130,084 | | |
| Other services | 0.5995 | 271,701 | | |

Note: The import tariff is averaged across all trade partners. The import value is the total values of all trade partners.
Sources: OECD, World Bank, author's calculation

Table 5: Counterfactual changes in exports as China accumulates human capital

| Sector | CHN | JPN | KOR | EU | USA | IDN | MYS | THA | VNM |
|---|---|---|---|---|---|---|---|---|---|
| Agriculture | -23.36% | 8.47% | 6.12% | 3.22% | 4.34% | 3.31% | 9.08% | 13.71% | 2.95% |
| Fishing | -7.47% | 7.66% | 8.12% | 2.32% | 3.77% | 5.35% | 5.13% | 3.11% | 2.31% |
| Mining | 66.85% | -8.40% | -17.84% | -2.12% | 0.11% | -0.88% | 0.77% | -2.40% | -2.22% |
| Food | -2.60% | 1.71% | 1.35% | 0.95% | 1.10% | 1.13% | 1.02% | 0.46% | 1.74% |
| Textiles | -5.39% | 10.36% | 7.48% | 7.78% | 9.62% | 7.71% | 6.33% | 6.63% | 4.58% |
| Wood | -4.02% | 5.42% | 1.38% | 3.02% | 4.98% | 4.57% | 3.81% | 5.44% | 4.15% |
| Paper | 6.47% | -2.67% | -3.68% | -1.37% | -1.00% | -2.34% | -0.80% | -2.14% | -4.19% |
| Petroleum | 2948.63% | 4.97% | 3.36% | 0.97% | 4.93% | 2.64% | 6.51% | 1.39% | 7.65% |
| Chemical | 7.11% | -0.09% | 0.08% | -0.06% | 0.17% | -0.27% | 0.25% | -0.05% | -0.06% |
| Rubber & Plastics | 3.37% | 0.72% | 0.79% | 0.44% | 0.30% | -0.27% | 0.51% | 0.13% | 0.30% |
| Non-metallic minerals | 6.70% | -0.17% | -0.28% | -0.22% | -0.06% | -1.02% | 1.62% | -1.02% | -0.96% |
| Basic metals | 6.64% | -1.33% | -1.31% | -0.14% | -0.02% | -1.39% | -0.32% | -0.84% | -0.37% |
| Fabricated metals | 7.34% | -1.65% | -2.05% | -0.85% | -0.62% | -2.14% | -0.81% | -1.20% | -0.07% |
| Electronics | 7.02% | -4.75% | -3.89% | -3.45% | -4.08% | -5.33% | -2.53% | -4.53% | -2.41% |
| Electrical equipment | 20.05% | -10.86% | -11.03% | -6.96% | -7.72% | -8.58% | -6.49% | -7.55% | -7.30% |
| Machinery | 4.29% | 0.53% | 0.62% | 0.54% | 0.40% | -0.48% | 0.07% | -0.28% | 0.89% |
| Motor vehicles | 3.69% | 0.40% | 0.54% | 1.00% | 0.96% | -0.36% | 0.61% | -0.06% | 0.76% |
| Other vehicles | 2.39% | 0.06% | 0.01% | 1.01% | 0.15% | -0.03% | 0.75% | 0.04% | -0.05% |
| Other manufacturing | 1.51% | 0.72% | 0.10% | 0.59% | 0.72% | 0.06% | 0.56% | 0.26% | -0.18% |
| Utility | 9.41% | N/A | -1.49% | -0.21% | 0.42% | N/A | 0.97% | -5.74% | -3.48% |

Table 6: Counterfactual changes in incomes as China accumulates human capital

| Country | Price index ($\hat{P}_n$) | Real unskilled wages ($\hat{w}_n/\hat{P}_n$) | Real skilled wages ($\hat{r}_n/\hat{P}_n$) | Skill premium ($\hat{r}_n/\hat{w}_n$) | Real HH income ($\hat{I}_n/\hat{P}_n$) |
|---|---|---|---|---|---|
| ARG | 0.36% | 0.21% | -0.04% | -0.25% | 0.13% |
| AUS | -0.37% | -0.07% | -0.08% | -0.01% | -0.08% |
| BRA | -0.06% | 0.14% | -0.15% | -0.29% | 0.01% |
| BRN | -0.04% | 0.13% | 0.14% | 0.01% | 0.23% |
| KHM | 0.17% | 0.43% | -0.53% | -0.96% | 0.13% |
| CAN | -0.04% | 0.01% | -0.01% | -0.02% | 0.01% |
| CHN | -2.19% | 10.54% | -14.34% | -22.51% | 10.51% |
| EFTA | -0.05% | 0.00% | -0.02% | -0.02% | -0.04% |
| EU | -0.03% | 0.02% | -0.02% | -0.03% | 0.00% |
| HKG | -0.44% | 0.35% | 0.32% | -0.03% | 0.41% |
| IND | 0.00% | 0.11% | -0.10% | -0.21% | 0.03% |
| IDN | 0.01% | 0.16% | -0.17% | -0.33% | 0.05% |
| JPN | 0.08% | 0.03% | -0.07% | -0.10% | -0.02% |
| KOR | 0.14% | 0.13% | -0.12% | -0.25% | 0.11% |
| LAO | -0.38% | 0.46% | -1.10% | -1.55% | 0.00% |
| MYS | -0.06% | 0.10% | -0.13% | -0.23% | -0.02% |
| MEX | -0.04% | -0.01% | -0.02% | -0.02% | -0.01% |
| MMR | 0.03% | 0.45% | -0.79% | -1.24% | 0.09% |
| NZL | -0.02% | 0.02% | 0.00% | -0.02% | 0.01% |
| PHL | -0.28% | 0.08% | -0.27% | -0.35% | -0.03% |
| RUS | -0.02% | -0.04% | -0.06% | -0.02% | -0.05% |
| SAU | -0.09% | 0.04% | -0.03% | -0.07% | -0.01% |
| SGP | -0.05% | -0.06% | 0.17% | 0.23% | 0.03% |
| ZAF | -0.22% | 0.09% | -0.19% | -0.27% | -0.06% |
| THA | 0.09% | 0.13% | -0.17% | -0.30% | 0.01% |
| TUR | -0.04% | -0.02% | -0.03% | -0.02% | -0.02% |
| GBR | -0.01% | 0.01% | -0.01% | -0.01% | 0.00% |
| USA | -0.09% | 0.02% | 0.00% | -0.02% | 0.02% |
| VNM | 0.03% | 0.48% | -0.28% | -0.76% | 0.23% |
| ROW | -0.02% | 0.08% | -0.14% | -0.22% | 0.00% |

Table 7: Counterfactual changes in incomes as China increases domestic value-added shares

| Country | Price index ($\hat{P}_n$) | Real unskilled wages ($\hat{w}_n/\hat{P}_n$ ) | Real skilled wages ($\hat{r}_n/\hat{P}_n$) | Skill premium ($\hat{r}_n/\hat{w}_n$) | Real HH income ($\hat{I}_n/\hat{P}_n$) |
|---|---|---|---|---|---|
| ARG | -0.04% | 0.04% | -0.01% | -0.06% | 0.01% |
| AUS | -0.26% | -0.04% | -0.02% | 0.02% | -0.04% |
| BRA | -0.13% | 0.04% | -0.06% | -0.10% | -0.01% |
| BRN | -0.27% | 0.00% | -0.01% | -0.01% | -0.25% |
| KHM | -0.03% | 0.19% | -0.20% | -0.39% | 0.09% |
| CAN | -0.25% | -0.04% | -0.03% | 0.01% | -0.05% |
| CHN | 0.41% | 0.75% | 0.20% | -0.55% | 0.14% |
| EFTA | -0.32% | -0.07% | 0.03% | 0.10% | -0.25% |
| EU | -0.25% | -0.04% | -0.03% | 0.02% | -0.06% |
| HKG | -0.19% | 0.17% | 0.19% | 0.01% | 0.19% |
| IND | -0.16% | 0.06% | -0.09% | -0.14% | 0.00% |
| IDN | -0.12% | 0.09% | -0.10% | -0.19% | 0.02% |
| JPN | -0.35% | -0.08% | -0.05% | 0.04% | -0.11% |
| KOR | -0.35% | -0.11% | -0.14% | -0.02% | -0.28% |
| LAO | -0.11% | 0.18% | -0.06% | -0.24% | 0.10% |
| MYS | -0.24% | -0.06% | -0.11% | -0.05% | -0.11% |
| MEX | -0.22% | -0.04% | -0.04% | 0.01% | -0.05% |
| MMR | -0.17% | 0.15% | -0.17% | -0.33% | 0.06% |
| NZL | -0.26% | -0.04% | -0.03% | 0.01% | -0.05% |
| PHL | -0.24% | -0.01% | -0.08% | -0.08% | -0.02% |
| RUS | -0.22% | -0.03% | -0.08% | -0.04% | -0.07% |
| SAU | -0.17% | 0.02% | -0.03% | -0.05% | -0.04% |
| SGP | -0.45% | -0.13% | -0.12% | 0.01% | -2.70% |
| ZAF | -0.12% | 0.05% | -0.06% | -0.11% | -0.01% |
| THA | -0.21% | 0.03% | -0.22% | -0.25% | -0.10% |
| TUR | -0.24% | -0.07% | -0.06% | 0.01% | -0.06% |
| GBR | -0.29% | -0.05% | -0.03% | 0.02% | -0.01% |
| USA | -0.20% | -0.01% | -0.01% | 0.00% | 0.02% |
| VNM | -0.09% | 0.14% | -0.10% | -0.24% | 0.06% |
| ROW | -0.16% | 0.03% | -0.06% | -0.09% | 0.01% |

Table 8: Counterfactual changes in exports as China increases domestic value-added shares

| Sector | CHN | JPN | KOR | EU | USA | IDN | MYS | THA | VNM |
|---|---|---|---|---|---|---|---|---|---|
| Agriculture | -9.78% | 4.55% | 4.61% | 1.90% | 1.45% | 0.45% | 3.30% | 3.50% | -0.05% |
| Fishing | -4.95% | 5.20% | 5.26% | 1.36% | 1.53% | 1.13% | 2.47% | 1.99% | 0.43% |
| Mining | -9.85% | 2.12% | 2.95% | 0.65% | -0.76% | -1.66% | 0.30% | 0.75% | -1.29% |
| Food | -3.28% | 1.11% | 0.46% | 0.25% | 0.04% | -0.18% | 0.22% | 0.15% | -0.33% |
| Textiles | -5.09% | 6.48% | 5.35% | 4.92% | 5.34% | 3.91% | 3.93% | 4.33% | 1.98% |
| Wood | -7.71% | 9.08% | 5.22% | 3.81% | 4.66% | 3.73% | 4.30% | 4.80% | 3.17% |
| Paper | -10.76% | 9.34% | 7.95% | 5.43% | 5.54% | 4.72% | 5.66% | 5.05% | 3.30% |
| Petroleum | -37.52% | -1.05% | -0.29% | -0.19% | -3.90% | -8.33% | -3.17% | -1.51% | -9.61% |
| Chemical | -6.67% | 2.06% | 2.28% | 0.92% | 0.63% | 0.78% | 1.47% | 1.26% | 0.43% |
| Rubber & Plastics | -2.47% | -0.14% | -0.25% | -0.11% | -0.08% | -0.22% | -0.27% | -0.24% | -0.56% |
| Non-metallic minerals | -2.25% | 0.19% | 0.33% | 0.10% | -0.10% | -0.20% | -0.74% | 0.31% | -0.39% |
| Basic metals | 3.33% | -2.31% | -1.79% | -1.91% | -1.85% | -2.76% | -1.90% | -0.72% | -0.47% |
| Fabricated metals | 15.44% | -5.15% | -3.99% | -3.80% | -3.74% | -5.17% | -4.31% | -3.35% | -3.01% |
| Electronics | 1.31% | -4.10% | -4.44% | -2.38% | -3.35% | -3.93% | -3.28% | -3.20% | -2.40% |
| Electrical equipment | -7.63% | 5.85% | 7.15% | 3.39% | 3.19% | 0.98% | 5.97% | 3.39% | 3.54% |
| Machinery | -1.06% | -0.10% | -0.04% | -0.19% | -0.23% | -0.34% | 0.06% | 0.04% | -0.53% |
| Motor vehicles | 0.25% | -0.08% | -0.07% | -0.52% | -0.45% | -0.53% | -0.27% | -0.03% | -0.58% |
| Other vehicles | -0.15% | 0.08% | 0.09% | -0.31% | -0.12% | -0.44% | -0.24% | -0.26% | -0.33% |
| Other manufacturing | -2.81% | 1.48% | 0.99% | 0.83% | 0.65% | 0.08% | 0.80% | 1.00% | 0.04% |
| Utility | -1.41% | N/A | 1.52% | 0.33% | -0.55% | N/A | -0.04% | 1.45% | 0.41% |

Table 9: Counterfactual changes in incomes as China increases tariffs

| Country | Price index ($\hat{P}_n$) | Real unskilled wages ($\hat{w}_n/\hat{P}_n$ ) | Real skilled wages ($\hat{r}_n/\hat{P}_n$) | Skill premia ($\hat{r}_n/\hat{w}_n$) | Real HH income ($\hat{I}_n/\hat{P}_n$) |
|---|---|---|---|---|---|
| ARG | 0.12% | 0.02% | -0.05% | -0.06% | -0.04% |
| AUS | 0.07% | -0.10% | -0.03% | 0.07% | -0.08% |
| BRA | 0.04% | 0.03% | -0.09% | -0.12% | -0.03% |
| BRN | 0.07% | -0.16% | -0.12% | 0.04% | -0.21% |
| KHM | 0.08% | 0.15% | -0.49% | -0.64% | -0.03% |
| CAN | -0.25% | -0.14% | -0.12% | 0.01% | -0.16% |
| CHN | 1.93% | -0.66% | -0.19% | 0.47% | 0.26% |
| EFTA | -0.68% | -0.25% | -0.03% | 0.22% | -0.69% |
| EU | -0.36% | -0.17% | -0.18% | -0.02% | -0.22% |
| HKG | 0.92% | -1.12% | -1.02% | 0.10% | -0.96% |
| IND | -0.12% | 0.06% | -0.17% | -0.24% | -0.02% |
| IDN | 0.17% | 0.07% | 0.00% | -0.08% | 0.05% |
| JPN | -0.77% | -0.23% | -0.42% | -0.19% | -0.38% |
| KOR | -0.71% | -0.30% | -1.15% | -0.86% | -1.05% |
| LAO | 0.35% | -0.12% | 0.44% | 0.56% | 0.03% |
| MYS | -0.27% | -0.58% | -0.15% | 0.44% | -0.56% |
| MEX | -0.24% | -0.14% | -0.09% | 0.05% | -0.14% |
| MMR | 0.28% | -0.01% | -0.47% | -0.45% | -0.14% |
| NZL | -0.35% | -0.19% | -0.19% | 0.00% | -0.20% |
| PHL | -0.26% | -0.15% | -0.23% | -0.07% | -0.15% |
| RUS | -0.09% | -0.03% | -0.19% | -0.16% | -0.11% |
| SAU | -0.32% | -0.18% | -0.14% | 0.04% | -0.28% |
| SGP | -1.09% | -1.26% | -0.49% | 0.78% | -9.77% |
| ZAF | 0.05% | -0.05% | -0.05% | 0.00% | -0.08% |
| THA | -0.23% | -0.05% | -0.58% | -0.52% | -0.33% |
| TUR | -0.28% | -0.21% | -0.17% | 0.04% | -0.18% |
| GBR | -0.72% | -0.25% | -0.18% | 0.08% | -0.15% |
| USA | -0.28% | -0.15% | -0.16% | -0.01% | -0.10% |
| VNM | 0.12% | -0.12% | -0.60% | -0.48% | -0.27% |
| ROW | -0.27% | -0.01% | -0.14% | -0.13% | -0.03% |

Table 10: Counterfactual changes in exports as China increases tariffs

| Sector | CHN | JPN | KOR | EU | USA | IDN | MYS | THA | VNM |
|---|---|---|---|---|---|---|---|---|---|
| Agriculture | -14.03% | 10.31% | 11.27% | 3.36% | 2.83% | -2.12% | 8.29% | 6.52% | 0.35% |
| Fishing | -8.46% | 11.22% | 10.66% | 2.41% | 3.64% | -0.79% | 6.01% | 2.93% | 1.10% |
| Mining | -22.85% | 20.21% | 30.34% | 3.44% | 2.38% | -0.51% | 8.04% | 7.24% | 5.20% |
| Food | -6.28% | 3.06% | 2.10% | 0.42% | 0.24% | -0.90% | 0.98% | 0.38% | 0.05% |
| Textiles | -8.77% | 14.12% | 10.37% | 7.90% | 8.45% | 3.40% | 7.28% | 7.06% | 3.04% |
| Wood | -13.98% | 20.03% | 12.10% | 6.68% | 8.31% | 3.67% | 8.85% | 10.34% | 6.90% |
| Paper | -20.05% | 24.95% | 20.67% | 10.90% | 11.04% | 4.60% | 11.56% | 10.54% | 7.40% |
| Petroleum | -69.96% | 7.08% | 6.00% | 1.34% | -2.51% | -31.08% | -6.09% | -3.72% | -13.84% |
| Chemical | -8.51% | -10.61% | -14.60% | -3.54% | -4.10% | -7.63% | -7.50% | -8.90% | -7.35% |
| Rubber & Plastics | -5.63% | 2.49% | 2.78% | 0.84% | 0.41% | -1.21% | 0.70% | 0.74% | -0.23% |
| Non-metallic minerals | -6.66% | 3.73% | 4.14% | 0.80% | 0.72% | -1.32% | 3.87% | 1.32% | -0.52% |
| Basic metals | -8.90% | -7.07% | -5.99% | -7.83% | -6.63% | -8.23% | -6.46% | -1.56% | -2.37% |
| Fabricated metals | -15.55% | -6.83% | -3.62% | -3.17% | -0.04% | -2.22% | 0.17% | -1.21% | -3.85% |
| Electronics | -15.47% | -14.94% | -24.69% | -0.74% | -0.73% | 0.89% | -10.92% | -4.04% | -5.53% |
| Electrical equipment | -22.52% | -10.30% | -39.14% | -6.99% | 2.98% | -6.48% | -6.50% | -4.30% | -12.43% |
| Machinery | -5.56% | -3.02% | -3.53% | -2.75% | -2.08% | -1.38% | -1.13% | -0.55% | -4.98% |
| Motor vehicles | -6.94% | -1.78% | -2.75% | -4.57% | -3.87% | -1.53% | -2.33% | -0.34% | -4.78% |
| Other vehicles | -3.32% | 0.36% | 0.16% | -0.59% | -0.28% | -1.19% | -0.68% | -0.37% | -0.65% |
| Other manufacturing | -8.02% | 5.60% | 4.50% | 2.15% | 2.18% | -0.86% | 1.40% | 1.71% | 0.21% |
| Utility | -4.61% | N/A | 4.11% | -0.76% | 0.22% | N/A | -0.54% | 7.40% | 4.12% |

Table 11: Robustness checks – Increases in skilled labor endowment

| Country | CHN's 4.46% skilled labor | | Global skilled labor growth (w/o population growth) | | Global skilled labor growth (with population growth) | |
|---|---|---|---|---|---|---|
| | Skill premium ($\hat{r}_n/\hat{w}_n$) | Real HH income ($\hat{I}_n/\hat{P}_n$) | Skill premium ($\hat{r}_n/\hat{w}_n$) | Real HH income ($\hat{I}_n/\hat{P}_n$) | Skill premium ($\hat{r}_n/\hat{w}_n$) | Real HH income ($\hat{I}_n/\hat{P}_n$) |
| CHN | -10.81% | 4.64% | -22.95% | 11.61% | -9.77% | 25.52% |
| JPN | -0.04% | -0.01% | -32.82% | 1.39% | -42.76% | -6.29% |
| KOR | -0.11% | 0.03% | -51.05% | -1.03% | -42.73% | 17.18% |
| EU | -0.01% | 0.00% | -28.79% | 5.34% | -28.18% | 9.17% |
| USA | -0.01% | 0.02% | -12.05% | -0.64% | -10.95% | 9.40% |
| IDN | -0.15% | 0.02% | -17.67% | 5.33% | 1.44% | 19.79% |
| MYS | -0.11% | -0.02% | -16.18% | 5.41% | 6.54% | 21.72% |
| THA | -0.14% | 0.00% | -24.98% | 10.47% | -10.30% | 26.65% |
| VNM | -0.34% | 0.10% | -26.58% | 11.84% | -7.19% | 30.83% |

Table 12: Robustness checks – Increases in China's value-added shares

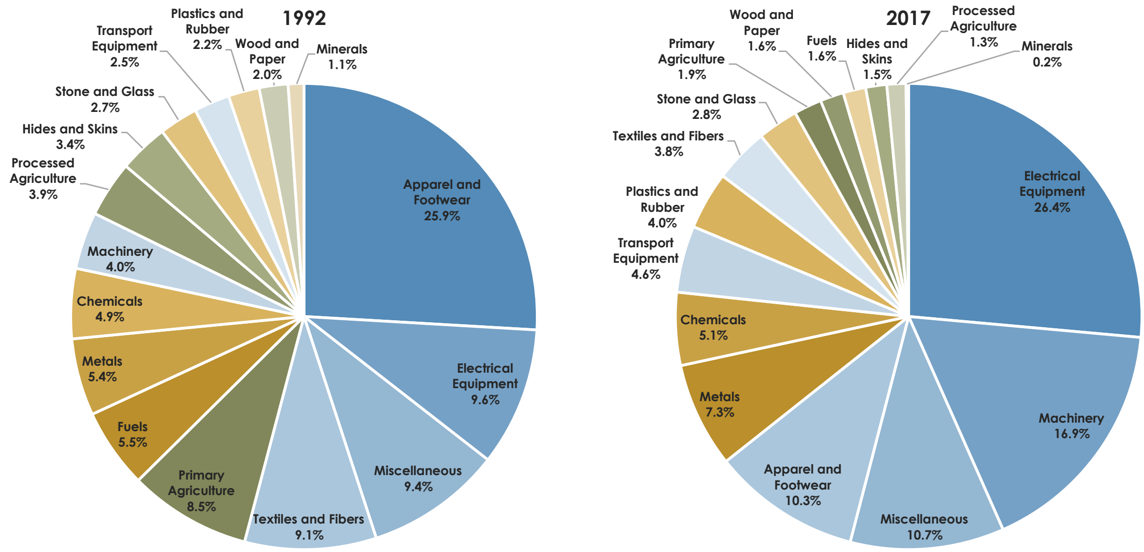
| Country | CHN's value-added share increases by 10% in 8 sectors | | CHN's value-added share increases by 50% in 8 sectors | | CHN's value-added share increases by 25% in all sectors | |
|---|---|---|---|---|---|---|
| | Skill premium ($\hat{r}_n/\hat{w}_n$) | Real HH income ($\hat{I}_n/\hat{P}_n$) | Skill premium ($\hat{r}_n/\hat{w}_n$) | Real HH income ($\hat{I}_n/\hat{P}_n$) | Skill premium ($\hat{r}_n/\hat{w}_n$) | Real HH income ($\hat{I}_n/\hat{P}_n$) |
| CHN | -0.21% | 0.06% | -1.19% | 0.32% | -5.94% | 2.84% |
| JPN | 0.02% | -0.05% | 0.07% | -0.20% | 0.10% | -0.01% |
| KOR | -0.01% | -0.12% | -0.02% | -0.50% | 0.18% | -0.31% |
| EU | 0.01% | -0.03% | 0.03% | -0.10% | 0.04% | -0.03% |
| USA | 0.00% | 0.01% | 0.00% | 0.04% | 0.00% | 0.07% |
| IDN | -0.08% | 0.01% | -0.35% | 0.04% | 0.42% | -0.03% |
| MYS | -0.02% | -0.05% | -0.11% | -0.18% | 0.48% | -0.03% |
| THA | -0.11% | -0.04% | -0.46% | -0.18% | 0.51% | -0.04% |
| VNM | -0.11% | 0.02% | -0.43% | 0.12% | 0.97% | -0.14% |

Table 13: Robustness checks – Increases in China's tariffs

| Country | CHN increases tariffs by 25% in 8 sectors and gets retaliated | | CHN increases tariffs by 10% in 8 sectors w/o retaliation | | CHN increases tariffs by 25% in all sectors w/o retaliation | |
|---|---|---|---|---|---|---|
| | Skill premium ($\hat{r}_n/\hat{w}_n$) | Real HH income ($\hat{I}_n/\hat{P}_n$) | Skill premium ($\hat{r}_n/\hat{w}_n$) | Real HH income ($\hat{I}_n/\hat{P}_n$) | Skill premium ($\hat{r}_n/\hat{w}_n$) | Real HH income ($\hat{I}_n/\hat{P}_n$) |
| CHN | -1.42% | -1.46% | 0.27% | 0.25% | 1.45% | 0.49% |
| JPN | 0.12% | 0.31% | -0.10% | -0.21% | 0.12% | -0.68% |
| KOR | 0.05% | 0.76% | -0.50% | -0.59% | -0.20% | -1.85% |
| EU | 0.12% | 0.18% | -0.01% | -0.12% | 0.13% | -0.48% |
| USA | 0.12% | -0.14% | 0.00% | -0.05% | 0.03% | -0.19% |
| IDN | 0.50% | -0.05% | -0.04% | 0.02% | -0.87% | -0.12% |
| MYS | -0.30% | 0.91% | 0.27% | -0.34% | -0.78% | -1.16% |
| THA | -0.36% | 0.72% | -0.27% | -0.19% | -1.39% | -0.67% |
| VNM | 1.45% | 0.65% | -0.28% | -0.16% | -1.14% | -1.00% |

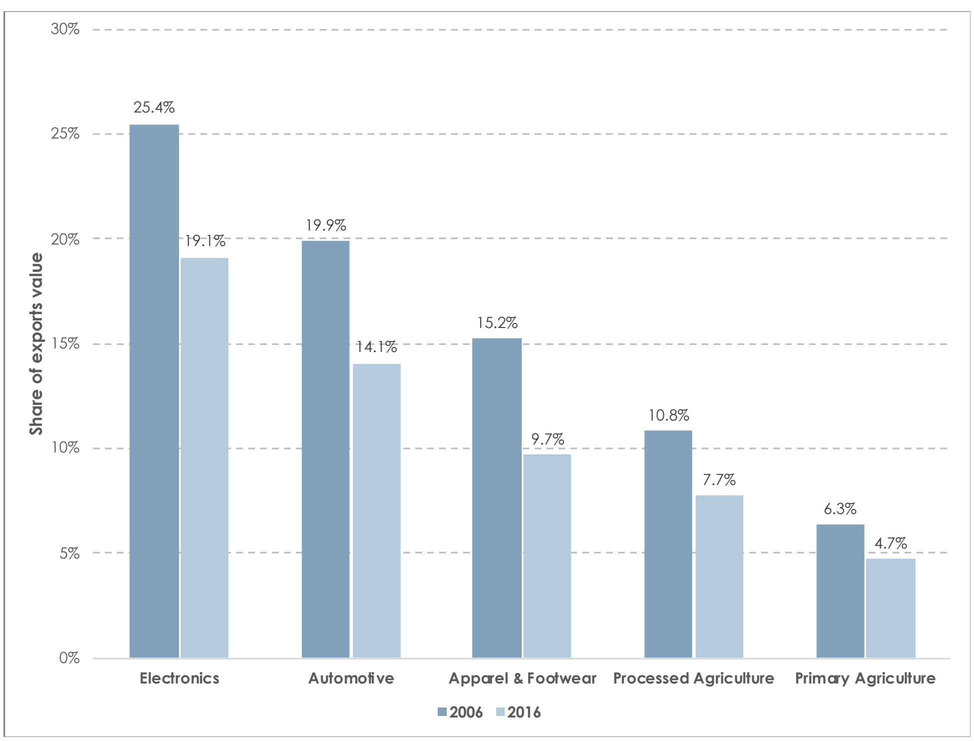
# Figures

Figure 1: China’s merchandise export composition in 1992 and 2017




Note: The total export value was 84.94 billion USD in 1992 and 2.26 trillion USD in 2017.
Source: International Trade Centre’s Trade Map database and World Bank’s WITS database

Figure 2: Share of foreign value added in China’s exports in 2006 and 2016




Source: Asian Development Bank’s Key Indicators Database, author’s calculation

Figure 3: Export changes in China as China accumulates more human capital stock

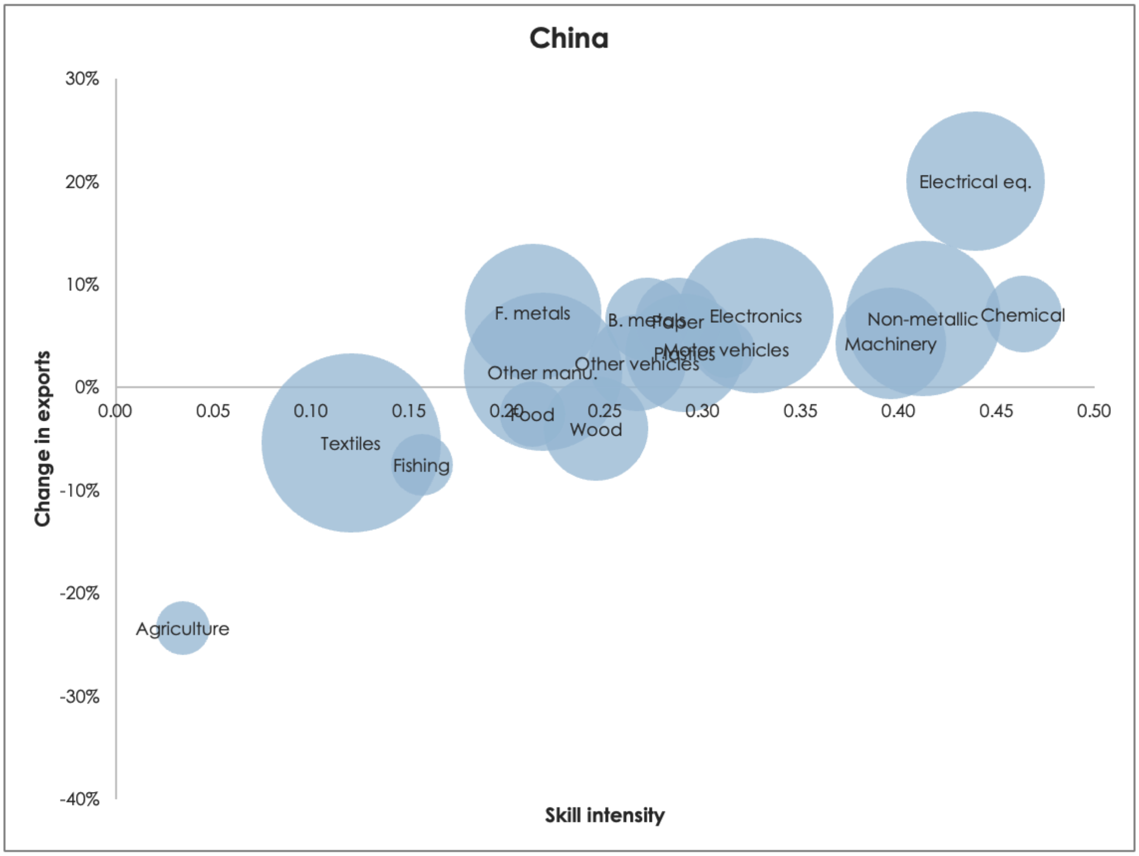
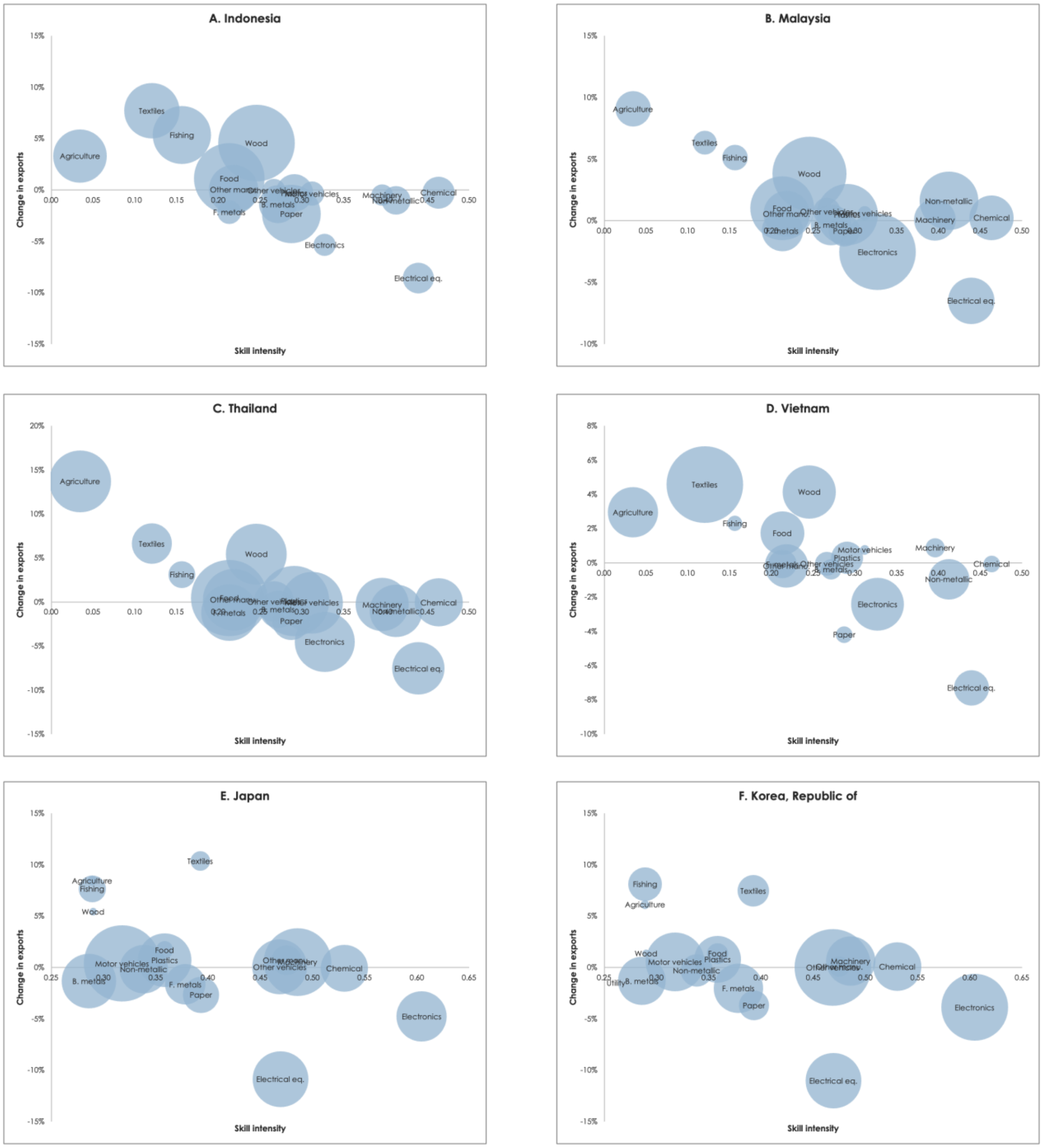


Figure 4: Export changes in selected countries as China accumulates more human capital stock




Notes: Bubble sizes measure the country's revealed comparative advantage in each sector.
Skill intensity is measured by $1 - \beta^s$.
The mining and petroleum sectors are omitted from the figures.

Source: Simulation experiments as described in the text.

Figure 5: Changes in country skill premia as China's skills endowment rises

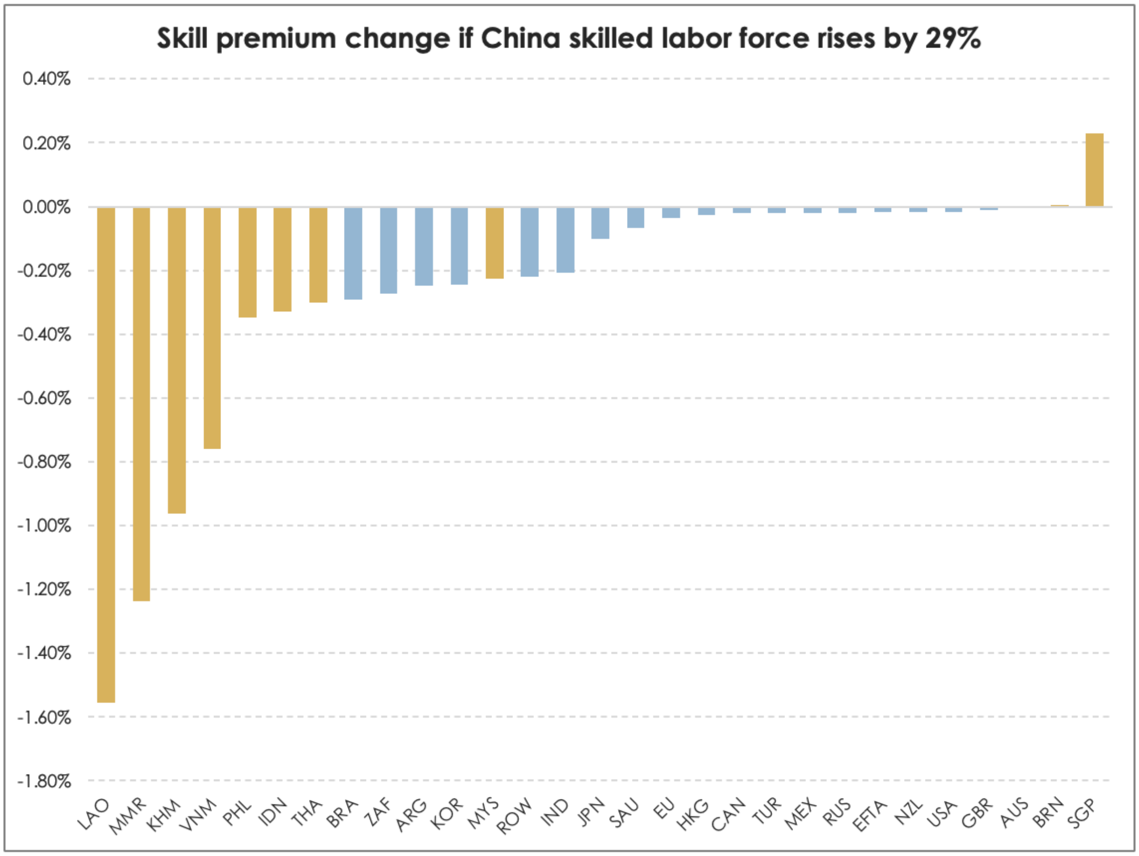
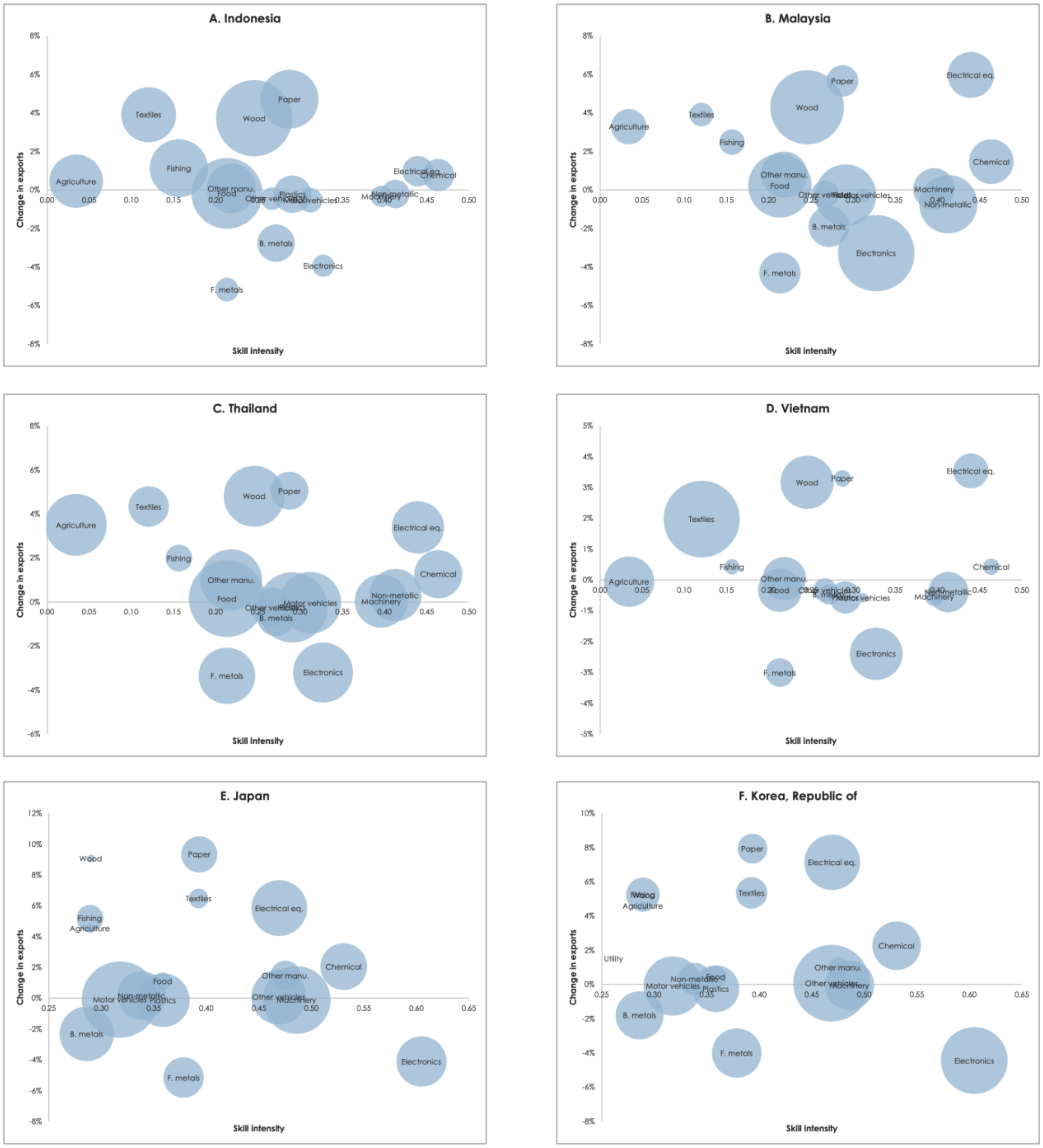


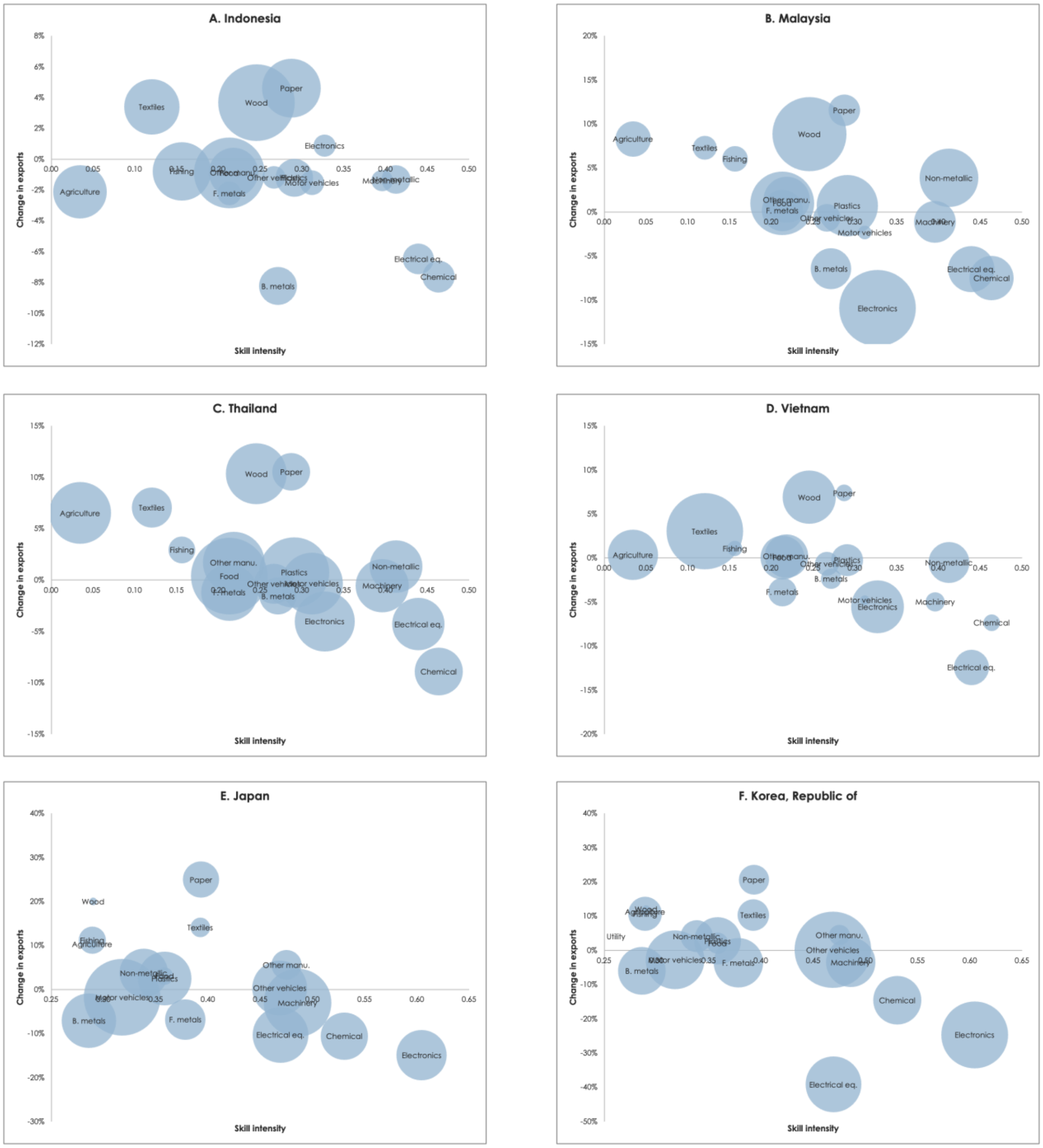
Figure 6: Export changes as China increases domestic value-added shares




Notes: Bubble sizes reflect the country's comparative advantage in each sector.
Skill intensity is measured by $1 - \beta^s$.
The mining and petroleum sectors are omitted from the figures.

Source: Simulation experiments as described in the text.

Figure 7: Export changes as China increases tariffs




Notes: Bubble sizes reflect the country's comparative advantage in each sector.
Skill intensity is measured by $1 - \beta^s$.
The mining and petroleum sectors are omitted from the figures.
Source: Simulation experiments as described in the text.

# Appendix (for publication online)

**Table A-1: List of countries**

| Country code | Country name |
|---|---|
| ARG | Argentina |
| AUS | Australia |
| BRA | Brazil |
| BRN | Brunei Darussalam |
| KHM | Cambodia |
| CAN | Canada |
| CHN | China |
| EFTA | EFTA (Norway, Iceland, and Switzerland) |
| EU | European Union (post-Brexit 27 members) |
| HKG | Hong Kong, SAR China |
| IND | India |
| IDN | Indonesia |
| JPN | Japan |
| KOR | Korea, Republic of |
| LAO | Lao PDR |
| MYS | Malaysia |
| MEX | Mexico |
| MMR | Myanmar |
| NZL | New Zealand |
| PHL | Philippines |
| RUS | Russian Federation |
| SAU | Saudi Arabia |
| SGP | Singapore |
| ZAF | South Africa |
| THA | Thailand |
| TUR | Turkey |
| GBR | United Kingdom |
| USA | United States of America |
| VNM | Viet Nam |
| ROW | Rest of the World |

### Table A-2: List of sectors

| Sector name | Description | ISIC Rev.4 Divisions | Traded/ Nontraded |
|---|---|---|---|
| Agriculture | Agriculture, hunting, forestry | 01-02 | T |
| Fishing | Fishing and aquaculture | 03 | T |
| Mining | Mining and quarrying | 05-09 | T |
| Food | Food products, beverages and tobacco | 10-12 | T |
| Textiles | Textiles, textile products, leather and footwear | 13-15 | T |
| Wood | Wood and products of wood and cork | 16 | T |
| Paper | Paper products and printing | 17-18 | T |
| Petroleum | Coke and refined petroleum products | 19 | T |
| Chemical | Chemical and chemical products | 20-21 | T |
| Rubber & Plastics | Rubber and plastics products | 22 | T |
| Non-metallic minerals | Other non-metallic mineral products | 23 | T |
| Basic metals | Basic metals | 24 | T |
| Fabricated metals | Fabricated metal products | 25 | T |
| Electronics | Computer, electronic and optical equipment | 26 | T |
| Electrical equipment | Electrical equipment | 27 | T |
| Machinery | Machinery and equipment, nec | 28 | T |
| Motor vehicles | Motor vehicles, trailers and semi-trailers | 29 | T |
| Other vehicles | Other transport equipment | 30 | T |
| Other manufacturing | Manufacturing nec; repair and installation of machinery and equipment | 31-33 | T |
| Utility | Electricity, gas, steam and air conditioning supply | 35-39 | T |
| Construction | Construction | 41-43 | N |
| Wholesale & retail | Wholesale and retail trade; repair of motor vehicles | 45-47 | N |
| Land transport | Land transport and transport via pipelines | 49 | N |
| Water transport | Water transport | 50 | N |
| Air transport | Air transport | 51 | N |
| Aux transport | Warehousing and support activities for transportation | 52 | N |
| Postal | Postal and courier activities | 53 | N |
| Hotel & restaurant | Accommodation and food service activities | 55-56 | N |
| Publishing | Publishing, audiovisual and broadcasting activities | 58-60 | N |
| Telecom | Telecommunications | 61 | N |
| IT services | IT and other information services | 62-63 | N |
| Finance | Financial and insurance activities | 64-66 | N |
| Real estate | Real estate activities | 68 | N |
| Research | Professional, scientific and technical activities | 69-75 | N |
| Admin | Administrative and support services | 77-82 | N |
| Public | Public administration and defence; compulsory social security | 84 | N |
| Education | Education | 85 | N |
| Health | Human health and social work activities | 86 | N |
| Recreation | Arts, entertainment and recreation | 90-93 | N |
| Other services | Other service activities | 94-99 | N |

## Table A-3: Counterfactual changes in incomes as the world accumulates more human capital stock

| Country | Price index ($\hat{P}_n$) | Real unskilled wages ($\hat{w}_n/\hat{P}_n$) | Real skilled wages ($\hat{r}_n/\hat{P}_n$) | Skill premium ($\hat{r}_n/\hat{w}_n$) | Real HH income ($\hat{I}_n/\hat{P}_n$) |
|---|---|---|---|---|---|
| ARG | 17.90% | -11.29% | 23.49% | 39.21% | -11.60% |
| AUS | 4.05% | 1.43% | -5.06% | -6.40% | -0.16% |
| BRA | 5.15% | 7.13% | -7.47% | -13.63% | 5.66% |
| BRN | 4.12% | 4.26% | -6.33% | -10.16% | 9.57% |
| KHM | 7.45% | 4.65% | -10.23% | -14.22% | 2.11% |
| CAN | 5.21% | 9.86% | -19.01% | -26.28% | 0.37% |
| CHN | 4.97% | 11.11% | -14.39% | -22.95% | 11.61% |
| EFTA | 6.34% | 11.13% | -19.81% | -27.84% | 7.95% |
| EU | 5.69% | 11.11% | -20.88% | -28.79% | 5.34% |
| HKG | 2.42% | 12.99% | -25.12% | -33.73% | -2.23% |
| IND | 6.63% | 11.39% | -15.39% | -24.05% | 10.04% |
| IDN | 6.08% | 7.00% | -11.90% | -17.67% | 5.33% |
| JPN | 6.62% | 13.69% | -23.62% | -32.82% | 1.39% |
| KOR | 7.28% | 26.36% | -38.14% | -51.05% | -1.03% |
| LAO | 5.84% | 7.34% | -13.57% | -19.48% | 5.46% |
| MYS | 5.84% | 6.92% | -10.38% | -16.18% | 5.41% |
| MEX | 5.37% | 10.27% | -19.75% | -27.22% | 5.21% |
| MMR | 10.81% | 13.49% | -26.68% | -35.39% | 11.82% |
| NZL | 5.32% | 6.98% | -14.38% | -19.97% | 3.92% |
| PHL | 12.05% | -14.77% | 36.73% | 60.43% | -14.38% |
| RUS | 8.02% | 25.46% | -23.75% | -39.22% | 8.06% |
| SAU | 4.44% | 1.75% | -2.78% | -4.45% | 1.27% |
| SGP | 6.57% | 30.23% | -21.24% | -39.52% | 45.13% |
| ZAF | 7.57% | -6.14% | 7.93% | 15.00% | -6.75% |
| THA | 7.26% | 13.22% | -15.06% | -24.98% | 10.47% |
| TUR | 5.51% | 1.97% | -7.09% | -8.88% | 0.91% |
| GBR | 5.14% | 6.91% | -14.14% | -19.69% | 0.51% |
| USA | 4.92% | 3.94% | -8.58% | -12.05% | -0.64% |
| VNM | 6.15% | 12.07% | -17.72% | -26.58% | 11.84% |
| ROW | 5.74% | 8.56% | -13.22% | -20.06% | 5.53% |

## Table A-4: Counterfactual changes in exports as the world accumulates more human capital stock

| Sector | CHN | JPN | KOR | EU | USA | IDN | MYS | THA | VNM |
|---|---|---|---|---|---|---|---|---|---|
| Agriculture | 11.87% | 51.94% | 25.14% | 67.02% | 60.05% | 6.81% | 17.23% | -23.15% | 3.02% |
| Fishing | 0.60% | 31.55% | 19.58% | 47.41% | 48.30% | -0.95% | 28.68% | -9.84% | 9.61% |
| Mining | -7.51% | -27.28% | -24.80% | -2.03% | -10.46% | 1.87% | -0.61% | -7.43% | 13.89% |
| Food | -0.08% | 7.71% | 4.94% | 7.55% | 6.39% | 8.51% | 10.31% | -2.93% | -1.04% |
| Textiles | 3.43% | 41.89% | 33.26% | 42.06% | 50.02% | 3.22% | 10.27% | -6.81% | 1.18% |
| Wood | 2.37% | 3.04% | 2.28% | 20.24% | 27.52% | 5.72% | 10.97% | -17.58% | -6.95% |
| Paper | 0.42% | 32.96% | 29.63% | 44.65% | 32.84% | 3.93% | 8.87% | -25.27% | 4.04% |
| Petroleum | 446.73% | -31.86% | -32.20% | -10.79% | -1.19% | 478.60% | 240.21% | 45.89% | 556.41% |
| Chemical | 4.66% | 10.87% | 16.30% | 10.64% | 6.92% | 5.71% | 6.15% | 2.80% | 6.88% |
| Rubber & Plastics | 4.40% | 5.74% | 5.71% | 7.05% | 6.26% | 0.72% | 3.13% | 0.51% | 3.58% |
| Non-metallic minerals | 6.88% | 3.30% | 0.34% | 5.21% | 6.07% | 7.65% | 8.53% | 5.77% | 6.87% |
| Basic metals | 10.07% | -0.22% | -0.52% | 5.95% | 8.44% | 7.59% | 6.43% | 1.67% | 5.72% |
| Fabricated metals | 4.14% | 7.38% | 9.62% | 17.30% | 10.63% | 1.43% | 0.75% | -10.76% | -0.74% |
| Electronics | 0.74% | 42.75% | 76.49% | 42.84% | 39.34% | -2.76% | -2.02% | -18.99% | 1.29% |
| Electrical equipment | 6.01% | 21.08% | 40.61% | 32.43% | 26.39% | 7.91% | -3.03% | -14.91% | 3.14% |
| Machinery | 5.76% | 7.77% | 9.92% | 8.29% | 5.88% | 4.61% | 4.26% | 3.16% | 3.81% |
| Motor vehicles | 6.02% | 3.39% | 3.12% | 5.49% | 6.14% | 2.67% | 5.15% | 0.08% | 5.45% |
| Other vehicles | 5.72% | 3.46% | 3.73% | 6.08% | 6.00% | 2.50% | 5.50% | 2.03% | 5.20% |
| Other manufacturing | -1.90% | 15.47% | 20.37% | 20.54% | 11.88% | 0.49% | 2.69% | -9.96% | -6.95% |
| Utility | -11.58% | N/A | -24.57% | -16.69% | 8.83% | N/A | 11.61% | -6.05% | 27.32% |

### Table A-5 :Counterfactual changes in incomes as China accumulates more human capital stock and increases domestic value-added shares

| Country | Price index ($\hat{P}_n$) | Real unskilled wages ($\hat{w}_n/\hat{P}_n$) | Real skilled wages ($\hat{r}_n/\hat{P}_n$) | Skill premium ($\hat{r}_n/\hat{w}_n$) | Real HH income ($\hat{I}_n/\hat{P}_n$) |
|---|---|---|---|---|---|
| ARG | 0.32% | 0.26% | -0.05% | -0.31% | 0.15% |
| AUS | -0.64% | -0.11% | -0.10% | 0.01% | -0.12% |
| BRA | -0.20% | 0.19% | -0.21% | -0.40% | 0.00% |
| BRN | -0.31% | 0.12% | 0.12% | 0.00% | -0.05% |
| KHM | 0.12% | 0.62% | -0.71% | -1.33% | 0.22% |
| CAN | -0.30% | -0.02% | -0.03% | -0.01% | -0.04% |
| CHN | -1.78% | 11.36% | -14.21% | -22.96% | 10.62% |
| EFTA | -0.38% | -0.07% | 0.01% | 0.08% | -0.30% |
| EU | -0.30% | -0.03% | -0.04% | -0.02% | -0.06% |
| HKG | -0.62% | 0.51% | 0.50% | -0.01% | 0.59% |
| IND | -0.17% | 0.17% | -0.18% | -0.34% | 0.03% |
| IDN | -0.11% | 0.25% | -0.27% | -0.51% | 0.07% |
| JPN | -0.29% | -0.05% | -0.11% | -0.06% | -0.13% |
| KOR | -0.23% | 0.01% | -0.26% | -0.26% | -0.18% |
| LAO | -0.49% | 0.64% | -1.14% | -1.77% | 0.10% |
| MYS | -0.31% | 0.04% | -0.24% | -0.28% | -0.13% |
| MEX | -0.27% | -0.05% | -0.06% | -0.01% | -0.06% |
| MMR | -0.14% | 0.61% | -0.99% | -1.59% | 0.15% |
| NZL | -0.30% | -0.02% | -0.03% | -0.01% | -0.03% |
| PHL | -0.52% | 0.07% | -0.35% | -0.42% | -0.04% |
| RUS | -0.26% | -0.07% | -0.13% | -0.06% | -0.13% |
| SAU | -0.27% | 0.06% | -0.06% | -0.12% | -0.06% |
| SGP | -0.51% | -0.20% | 0.03% | 0.23% | -2.73% |
| ZAF | -0.35% | 0.14% | -0.24% | -0.38% | -0.08% |
| THA | -0.14% | 0.17% | -0.38% | -0.54% | -0.09% |
| TUR | -0.29% | -0.08% | -0.09% | -0.01% | -0.08% |
| GBR | -0.30% | -0.04% | -0.04% | 0.00% | -0.01% |
| USA | -0.30% | 0.01% | -0.01% | -0.02% | 0.04% |
| VNM | -0.07% | 0.62% | -0.38% | -1.00% | 0.28% |
| ROW | -0.19% | 0.11% | -0.20% | -0.30% | 0.02% |

### Table A-6: Counterfactual changes in exports as China accumulates more human capital stock and increases domestic value-added shares

| Sector | CHN | JPN | KOR | EU | USA | IDN | MYS | THA | VNM |
|---|---|---|---|---|---|---|---|---|---|
| Agriculture | -30.94% | 13.51% | 10.89% | 5.09% | 5.72% | 3.63% | 12.76% | 18.12% | 2.89% |
| Fishing | -12.21% | 13.60% | 13.63% | 3.73% | 5.14% | 6.66% | 7.86% | 5.24% | 2.79% |
| Mining | 50.21% | -6.40% | -15.21% | -1.46% | -0.78% | -2.53% | 1.02% | -1.63% | -3.50% |
| Food | -5.81% | 2.86% | 1.86% | 1.20% | 1.11% | 0.94% | 1.26% | 0.66% | 1.40% |
| Textiles | -10.28% | 17.39% | 13.16% | 12.91% | 15.13% | 11.71% | 10.35% | 11.22% | 6.51% |
| Wood | -11.51% | 14.89% | 6.62% | 6.77% | 9.55% | 8.29% | 8.18% | 10.71% | 7.39% |
| Paper | -4.63% | 6.48% | 4.09% | 4.05% | 4.46% | 2.36% | 4.90% | 2.90% | -0.89% |
| Petroleum | 1785.22% | 3.75% | 2.98% | 0.74% | 0.36% | -5.99% | 3.09% | -0.21% | -2.77% |
| Chemical | 0.52% | 1.82% | 2.18% | 0.80% | 0.72% | 0.42% | 1.60% | 1.11% | 0.29% |
| Rubber & Plastics | 0.89% | 0.52% | 0.48% | 0.30% | 0.19% | -0.51% | 0.21% | -0.13% | -0.30% |
| Non-metallic minerals | 4.29% | 0.02% | 0.05% | -0.12% | -0.19% | -1.20% | 0.84% | -0.68% | -1.33% |
| Basic metals | 9.65% | -3.50% | -2.97% | -1.98% | -1.84% | -4.01% | -2.15% | -1.48% | -0.83% |
| Fabricated metals | 21.87% | -6.27% | -5.57% | -4.35% | -4.16% | -6.88% | -4.75% | -4.25% | -2.95% |
| Electronics | 8.05% | -8.50% | -8.02% | -5.61% | -7.19% | -8.84% | -5.63% | -7.42% | -4.69% |
| Electrical equipment | 11.79% | -5.69% | -4.99% | -3.79% | -4.68% | -7.52% | -1.03% | -4.40% | -4.15% |
| Machinery | 3.18% | 0.42% | 0.56% | 0.32% | 0.13% | -0.81% | 0.11% | -0.24% | 0.32% |
| Motor vehicles | 3.78% | 0.34% | 0.48% | 0.48% | 0.49% | -0.86% | 0.34% | -0.08% | 0.16% |
| Other vehicles | 2.17% | 0.15% | 0.11% | 0.70% | 0.03% | -0.46% | 0.52% | -0.19% | -0.36% |
| Other manufacturing | -1.38% | 2.23% | 1.13% | 1.43% | 1.35% | 0.16% | 1.36% | 1.27% | -0.13% |
| Utility | 7.87% | N/A | 0.11% | 0.14% | -0.19% | N/A | 0.91% | -4.19% | -2.97% |

### Table A-7: Counterfactual changes in incomes as China increases tariffs by 25% in eight MIC-2025 sectors and gets retaliated

| Country | Price index ($\hat{P}_n$) | Real unskilled wages ($\hat{w}_n/\hat{P}_n$) | Real skilled wages ($\hat{r}_n/\hat{P}_n$) | Skill premium ($\hat{r}_n/\hat{w}_n$) | Real HH income ($\hat{I}_n/\hat{P}_n$) |
|---|---|---|---|---|---|
| ARG | 1.09% | -0.46% | 0.13% | 0.59% | -0.09% |
| AUS | 0.44% | -0.44% | -0.35% | 0.09% | -0.16% |
| BRA | 0.90% | -0.25% | 0.05% | 0.30% | 0.01% |
| BRN | 1.92% | -0.92% | -1.09% | -0.17% | 1.01% |
| KHM | 1.37% | -1.22% | 1.56% | 2.81% | -0.24% |
| CAN | 1.32% | -0.13% | -0.10% | 0.03% | 0.12% |
| CHN | -4.02% | -0.64% | -2.05% | -1.42% | -1.46% |
| EFTA | 1.22% | -0.19% | 0.10% | 0.29% | 0.70% |
| EU | 1.47% | -0.17% | -0.05% | 0.12% | 0.18% |
| HKG | 6.54% | -1.91% | -1.81% | 0.11% | -1.51% |
| IND | 1.47% | -0.28% | 0.10% | 0.38% | 0.00% |
| IDN | 1.16% | -0.41% | 0.10% | 0.50% | -0.05% |
| JPN | 1.46% | -0.12% | 0.01% | 0.12% | 0.31% |
| KOR | 1.69% | -0.45% | -0.40% | 0.05% | 0.76% |
| LAO | 0.67% | -0.97% | -1.93% | -0.97% | -0.69% |
| MYS | 1.81% | -0.16% | -0.46% | -0.30% | 0.91% |
| MEX | 1.31% | -0.13% | -0.03% | 0.11% | 0.17% |
| MMR | 1.30% | -0.96% | -1.17% | -0.21% | -0.11% |
| NZL | 1.36% | -0.16% | -0.12% | 0.04% | 0.13% |
| PHL | 3.58% | 0.14% | 0.86% | 0.73% | 0.65% |
| RUS | 1.14% | 0.09% | -0.11% | -0.21% | 0.23% |
| SAU | 1.29% | -0.27% | -0.11% | 0.16% | 0.25% |
| SGP | 2.10% | -0.23% | -0.69% | -0.46% | 12.99% |
| ZAF | 0.51% | -0.60% | -0.36% | 0.24% | -0.18% |
| THA | 1.68% | 0.10% | -0.25% | -0.36% | 0.72% |
| TUR | 1.39% | -0.06% | -0.04% | 0.02% | 0.13% |
| GBR | 0.86% | -0.24% | -0.09% | 0.15% | -0.10% |
| USA | 1.83% | -0.17% | -0.04% | 0.12% | -0.14% |
| VNM | 1.88% | -1.59% | -0.17% | 1.45% | 0.65% |
| ROW | 1.19% | -0.15% | 0.17% | 0.33% | -0.04% |

Table A-8: Counterfactual changes in exports as China increases tariffs by 25% in eight MIC-2025 sectors and gets retaliated

| Sector | CHN | JPN | KOR | EU | USA | IDN | MYS | THA | VNM |
|---|---|---|---|---|---|---|---|---|---|
| Agriculture | 59.09% | -10.70% | -10.88% | -5.57% | -8.47% | -3.34% | -14.10% | -20.08% | -6.21% |
| Fishing | 30.47% | -14.08% | -18.04% | -5.10% | -10.16% | -8.34% | -9.67% | -11.98% | -6.50% |
| Mining | 104.55% | -17.73% | -30.50% | -5.65% | -9.66% | -3.90% | -9.11% | -9.82% | -14.32% |
| Food | 20.98% | -2.74% | -2.28% | -1.92% | -2.29% | -0.60% | -1.81% | -2.37% | -2.69% |
| Textiles | 29.76% | -22.64% | -20.07% | -18.66% | -24.65% | -17.98% | -17.32% | -20.36% | -13.70% |
| Wood | 49.00% | -31.48% | -19.80% | -17.70% | -26.34% | -21.61% | -22.95% | -26.08% | -24.60% |
| Paper | 70.98% | -31.25% | -26.97% | -24.79% | -33.02% | -28.51% | -33.06% | -30.13% | -32.99% |
| Petroleum | 2570.77% | -1.36% | -0.45% | -1.12% | -18.93% | 9.22% | -18.40% | -8.27% | -19.53% |
| Chemical | -36.68% | -13.19% | -20.19% | -3.28% | -4.81% | -3.18% | -8.58% | -11.42% | -7.80% |
| Rubber & Plastics | 14.63% | -3.69% | -4.92% | -2.32% | -2.37% | 0.07% | -3.23% | -3.63% | -3.24% |
| Non-metallic minerals | -25.99% | -0.41% | -0.74% | 0.90% | 0.46% | 7.50% | -10.56% | 3.39% | 4.32% |
| Basic metals | -33.70% | -2.55% | -3.12% | -7.81% | -6.30% | 2.62% | -4.85% | 2.12% | -1.65% |
| Fabricated metals | -62.76% | 1.56% | 1.52% | 5.00% | 7.36% | 21.81% | 10.37% | 4.42% | -3.59% |
| Electronics | -55.79% | 18.12% | -4.91% | 31.74% | 40.34% | 63.80% | 15.10% | 35.50% | 13.16% |
| Electrical equipment | -81.25% | 20.46% | -34.16% | 11.75% | 33.81% | 44.25% | 8.79% | 19.56% | 6.48% |
| Machinery | 11.88% | -8.53% | -10.21% | -6.20% | -5.45% | -1.54% | -5.19% | -3.91% | -8.26% |
| Motor vehicles | -20.87% | -3.58% | -5.96% | -6.43% | -6.11% | 4.58% | -1.71% | 0.14% | -7.76% |
| Other vehicles | 0.79% | 0.08% | -0.52% | -2.17% | -0.60% | 2.32% | -1.78% | 0.78% | 0.76% |
| Other manufacturing | 23.57% | -7.03% | -4.57% | -5.91% | -7.36% | -3.61% | -6.60% | -8.31% | -7.61% |
| Utility | 20.18% | N/A | 1.95% | -2.51% | -4.45% | N/A | -0.35% | -14.48% | -11.03% |

## Table A-9: Counterfactual changes in incomes as China accumulates more human capital stock, increases domestic value-added shares, and raises tariffs

| Country | Price index ($\hat{P}_n$) | Real unskilled wages ($\hat{w}_n/\hat{P}_n$) | Real skilled wages ($\hat{r}_n/\hat{P}_n$) | Skill premium ($\hat{r}_n/\hat{w}_n$) | Real HH income ($\hat{I}_n/\hat{P}_n$) |
|---|---|---|---|---|---|
| ARG | 0.44% | 0.30% | -0.10% | -0.39% | 0.12% |
| AUS | -0.66% | -0.22% | -0.14% | 0.07% | -0.22% |
| BRA | -0.20% | 0.23% | -0.31% | -0.54% | -0.03% |
| BRN | -0.29% | -0.04% | -0.01% | 0.03% | -0.30% |
| KHM | 0.19% | 0.78% | -1.17% | -1.94% | 0.21% |
| CAN | -0.58% | -0.16% | -0.16% | 0.00% | -0.20% |
| CHN | 0.07% | 10.70% | -14.36% | -22.64% | 10.87% |
| EFTA | -1.08% | -0.31% | -0.04% | 0.27% | -0.99% |
| EU | -0.70% | -0.19% | -0.23% | -0.04% | -0.28% |
| HKG | 0.23% | -0.55% | -0.47% | 0.08% | -0.32% |
| IND | -0.32% | 0.23% | -0.35% | -0.58% | 0.02% |
| IDN | 0.02% | 0.32% | -0.28% | -0.59% | 0.11% |
| JPN | -1.08% | -0.27% | -0.52% | -0.26% | -0.50% |
| KOR | -0.96% | -0.29% | -1.37% | -1.08% | -1.22% |
| LAO | -0.20% | 0.54% | -0.78% | -1.31% | 0.12% |
| MYS | -0.61% | -0.50% | -0.40% | 0.10% | -0.67% |
| MEX | -0.55% | -0.19% | -0.15% | 0.04% | -0.20% |
| MMR | 0.11% | 0.64% | -1.56% | -2.18% | 0.01% |
| NZL | -0.68% | -0.20% | -0.22% | -0.02% | -0.23% |
| PHL | -0.78% | -0.06% | -0.56% | -0.50% | -0.18% |
| RUS | -0.41% | -0.10% | -0.33% | -0.23% | -0.24% |
| SAU | -0.63% | -0.13% | -0.19% | -0.07% | -0.35% |
| SGP | -1.61% | -1.43% | -0.45% | 0.99% | -12.53% |
| ZAF | -0.35% | 0.10% | -0.32% | -0.42% | -0.16% |
| THA | -0.40% | 0.13% | -0.93% | -1.06% | -0.41% |
| TUR | -0.61% | -0.29% | -0.25% | 0.03% | -0.25% |
| GBR | -1.04% | -0.29% | -0.21% | 0.07% | -0.15% |
| USA | -0.61% | -0.14% | -0.17% | -0.03% | -0.05% |
| VNM | 0.02% | 0.53% | -0.98% | -1.50% | 0.04% |
| ROW | -0.48% | 0.11% | -0.33% | -0.44% | -0.01% |

## Table A-10: Counterfactual changes in exports as China accumulates more human capital stock, increases domestic value-added shares, and raises tariffs

| Sector | CHN | JPN | KOR | EU | USA | IDN | MYS | THA | VNM |
|---|---|---|---|---|---|---|---|---|---|
| Agriculture | -40.94% | 25.72% | 23.18% | 8.71% | 8.82% | 1.46% | 22.43% | 27.35% | 3.23% |
| Fishing | -20.03% | 26.93% | 24.98% | 6.36% | 8.77% | 6.20% | 14.45% | 8.44% | 3.79% |
| Mining | 15.85% | 10.97% | 9.02% | 1.66% | 1.27% | -3.27% | 8.44% | 5.09% | 0.67% |
| Food | -11.76% | 6.08% | 4.14% | 1.70% | 1.39% | 0.15% | 2.29% | 1.15% | 1.51% |
| Textiles | -18.38% | 34.00% | 24.88% | 21.80% | 24.58% | 15.37% | 18.06% | 19.19% | 9.47% |
| Wood | -24.39% | 37.47% | 19.05% | 13.55% | 18.05% | 12.15% | 17.36% | 23.12% | 14.65% |
| Paper | -24.11% | 32.98% | 25.19% | 15.18% | 15.50% | 7.18% | 16.47% | 13.61% | 5.68% |
| Petroleum | 449.78% | 10.74% | 8.76% | 2.13% | -2.19% | -34.66% | -3.51% | -3.84% | -16.72% |
| Chemical | -7.99% | -9.40% | -13.22% | -2.91% | -3.58% | -7.40% | -6.34% | -8.17% | -7.36% |
| Rubber & Plastics | -4.76% | 3.03% | 3.26% | 1.17% | 0.60% | -1.64% | 0.89% | 0.65% | -0.57% |
| Non-metallic minerals | -2.57% | 3.79% | 4.20% | 0.75% | 0.56% | -2.38% | 4.71% | 0.65% | -1.81% |
| Basic metals | 0.25% | -9.92% | -8.44% | -9.19% | -7.96% | -11.51% | -8.16% | -2.84% | -3.13% |
| Fabricated metals | 3.99% | -11.19% | -7.85% | -6.48% | -3.63% | -8.38% | -4.14% | -4.82% | -6.36% |
| Electronics | -6.80% | -21.68% | -30.40% | -5.98% | -7.60% | -7.93% | -15.68% | -11.04% | -9.87% |
| Electrical equipment | -11.78% | -14.62% | -41.03% | -9.62% | -1.21% | -12.76% | -7.13% | -7.97% | -15.63% |
| Machinery | -2.38% | -2.86% | -3.27% | -2.58% | -2.06% | -2.21% | -1.17% | -0.87% | -4.88% |
| Motor vehicles | -3.14% | -1.61% | -2.48% | -4.27% | -3.56% | -2.34% | -2.15% | -0.44% | -4.78% |
| Other vehicles | -1.14% | 0.49% | 0.23% | 0.08% | -0.27% | -1.63% | -0.23% | -0.59% | -1.05% |
| Other manufacturing | -9.25% | 7.93% | 5.72% | 3.64% | 3.52% | -0.65% | 2.69% | 2.96% | -0.04% |
| Utility | 3.10% | N/A | 4.09% | -0.36% | -0.05% | N/A | 0.29% | 2.41% | 0.58% |