THE DECLINE IN CHINA'S TRADE SHARE OF GDP: A STRUCTURAL ACCOUNTING *

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August 10, 2024

Abstract

China's trade share of GDP has been declining since 2007. To understand this, I develop a multi-sector, multi-region Ricardian trade model to quantify the forces driving changes in China's trade share of GDP from 2002 to 2015. The model features three main types of time-varying shocks: labor productivity shocks, trade cost shocks, and labor mobility cost shocks. These shocks affect China's trade through comparative advantage and specialization. I calibrate the model and conduct structural accounting decompositions. The results indicate that changes in labor productivity and trade costs for both China and foreign regions together account for about 87% of the change in China's trade share of GDP. From 2002 to 2007, the decline in China's international trade costs and foreign labor productivity growth were the primary forces driving the trade share increase. Although China's productivity growth contributed to a decline, it was more than offset by the factors driving the trade share up. From 2007 to 2015, China's productivity growth became the dominant force driving the trade share decline.

Keywords: China's trade share of GDP; Comparative advantage; Specialization; Migration; Internal trade; labor productivity.
JEL code: F11, F43, O53.

*I am deeply indebted to my advisor Dr. Kei-Mu Yi. I sincerely thank Bent Sorensen, German Cubas, Lorenzo Caliendo, Michael E.Waugh, Ping Wang, Jun Nie, George Alessandria, Dietrich Vollrath, Vegard Mokleiv Nygaard, Fan Wang, David Papell, Chinhui Juhn, Aimee Chin, Yoto V. Yotov, Sampson Thomas, Chang Liu, Feng Chen, Swati Singh and all participants in UH Macro Student Workshop, 2023 Midwest Macroeconomics Conference, 2024 Midwest International Trade Conference, 2024 Chinese Economic Association (CEA) Conference for very helpful discussions or helps. All errors are my own.

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1. Introduction

The economic growth of China is one of the most important changes in the world economy over the last several decades. A key feature of this growth is China's increased participation in the global economy, particularly through international trade. Alongside China's increasing share of world GDP and world trade, a puzzling trend has emerged: China's trade share of GDP has been steadily declining since the mid-2000s.

This puzzling downward trend reflects, of course, that China's GDP growth exceeds its trade growth. However, this is not an explanation. As we know from trade theory, several factors, including trade costs, productivity, and endowments, play crucial roles in shaping both trade and GDP dynamics. Countries with low intranational trade costs or high international import trade costs typically depend more on domestic production and less on international trade, leading to a reduced trade-to-GDP ratio.[1] Additionally, low production costs, arising from high productivity or an abundance of endowments such as labor, allow countries to produce a wider range of goods domestically, resulting in a lower trade-to-GDP ratio.

In this paper, I develop and calibrate a model that captures the aforementioned mechanisms. The model is a multi-sector, multi-region Ricardian trade model, drawing from Eaton and Kortum (2002), Caliendo and Parro (2015), and Tombe and Zhu (2019). The model features input-output linkages, international trade, inter-regional trade within China, and labor flow across regions within China. The main "shocks" (or "wedges") include regional-sectoral labor productivity shocks, inter-regional-sectoral trade cost shocks, and inter-regional labor mobility cost shocks. These shocks capture the forces behind China's growing importance in the global economy and its increasing domestic economic integration during the period under study.

I calibrate the model, which successfully recovers the evolution of China's trade share of GDP. Then, I conduct structural accounting decompositions to evaluate the contributions of trade integration, productivity growth, and labor flow to the changes in China's trade share of GDP. The analysis reveals that variations in labor productivity and trade costs, for both China and foreign regions, account for approximately 87% of the changes in China's trade share of GDP. From 2002 to 2007, the primary drivers of the increase in China's trade share were the reduction in China's international trade costs and productivity growth in foreign regions. Although productivity growth in China is significant, it contributes to a decline in the trade share of GDP, a decline that is more than offset by the factors driving the trade

1. Similarly, in countries with high international export trade costs, a greater variety of produced goods will be exported. This will decrease the share of exported goods in total production, thereby reducing the export share of GDP.

share upwards. From 2007 to 2015, productivity growth in China emerges as the dominant force behind the decrease in its trade share of GDP.

In the model, China's trade-to-GDP ratio is fundamentally influenced by its relative productivity compared to foreign countries, trade costs between its regions, international trade costs, and labor supply. The labor supply in each of China's regions is endogenous and primarily depends on migration flows, which, in turn, are influenced by regional productivity and labor mobility costs between China's regions. These factors impact China's trade share of GDP through comparative advantage and specialization.

First, as China's productivity improves, comparative advantage forces enable it to produce a broader range of goods for domestic consumption while importing fewer varieties from abroad. Consequently, the proportion of total spending on domestic goods rises, resulting in a decrease in the import share of GDP.[2]Additionally, productivity growth in one sector can influence others through Input-Output (IO) Linkages. For instance, if heavy industry heavily relies on intermediate inputs from the services sector, improved productivity in services will significantly reduce the production cost of heavy industry. It will also significantly impact the trade share, particularly if heavy industry plays a crucial role in trade.

Second, as China's intranational trade costs rise or its international import trade costs decrease, the country is incentivized to import a broader range of goods from external sources. All else equal, this leads to an increase in expenditure on foreign goods, resulting in a higher import share of GDP. Conversely, if international export trade costs for China's regions decline, the country will export a greater variety of domestically produced goods. This increase in the variety of exported goods will elevate the share of exports in total production, thus raising the export share of GDP.

Third, as labor mobility costs across China's regions decrease, labor moves from low-productivity to high-productivity regions. In high-productivity regions, the net inflow of labor increases the labor supply, which further reduces production costs. Consequently, these regions produce a greater variety of goods domestically, reducing the reliance on imports and thus decreasing the trade share. Conversely, low-productivity regions experience labor outflow, leading to increased production costs. These regions will specialize in fewer varieties and rely more on imports, thereby increasing the trade share. Therefore, the net impact of decreased labor mobility costs depends on which mechanism is dominant.

I evaluate the effects of each of these shocks through a model-based structural accounting decomposition. The model is implemented across 11 regions (8 regions in mainland China and 3 foreign regions) and 4 sectors (Agriculture, Light Industry, Heavy Industry, and Services).

2. Simultaneously, the export share of GDP decreases, despite the greater variety of exported goods, because productivity improvements reduce export prices. Furthermore, export trade must be balanced by import trade.

Due to data availability, the implementation covers the years 2002, 2007, and 2015. To calibrate the time-varying shocks, I extend the methodology developed by Eaton and Kortum (2002).[3] I begin by estimating regional-level importer fixed effects for each sector and year using the model-implied gravity equation. These estimated fixed effects provide insights into productivity and production costs. However, they are identified relative to a base region, which leads to a normalization that makes productivity shocks non-comparable over time. To address this issue, rather than assuming that the fixed effects for the base region are zero, I estimate them through its annual sectoral prices and the analytical relations implied by the model. Using these time-comparable fixed effects, I then calibrate the time-varying shocks using analytical equations derived from the model.

The calibration analysis indicates that China experienced positive labor productivity growth over both analyzed periods. Specifically, from 2007 to 2015, the weighted average productivity growth rate was 51.9% (or 5.4% per year), exceeding the growth rate observed during the preceding period from 2002 to 2007, which was 32.2% (or 5.7% per year). During these two intervals, China's average export trade cost decreased by 22.6% in the earlier period and 23.4% in the later period. Conversely, China's average import trade cost remained nearly constant in the initial period but increased by approximately 15.1% in the subsequent period. Additionally, the average intranational trade cost saw a significant reduction of 12% in the earlier period, though this decrease decelerated in the latter period to only 1.2%. Similarly, the average labor mobility cost decreased across both periods, with the rate of decline slowing from 13.3% in the earlier period to 11.8% in the later period. The behavior of these calibrated time-varying shocks aligns with intuitive expectations and replicates the real-world data well.

To quantify the changes in China's trade share of GDP attributable to a particular force, I employ structural accounting decompositions by comparing scenarios with and without this specific shock. Specifically, I first solve the model in the absence of change in a particular force. I then compare this result with the baseline result, where all shocks are realized.

From 2002 to 2007, two principal factors contributed to the increase in China's trade share of GDP: declining international trade costs and the productivity growth of foreign regions, which drove up the trade share of GDP by 6.8 percentage points (p.p.) and 4.7 p.p., respectively. The productivity growth of China's regions is equally important, but it exerts its effects in an inverse direction, resulting in an 8.4 p.p. decrease in China's trade share of GDP.

From 2007 to 2015, China's productivity growth emerged as the primary and dominant factor contributing to the reduction in its trade share of GDP, resulting in a 12.5 percentage

3. See also Waugh (2010), Levchenko and Zhang (2016), Tombe and Zhu (2019), and Santacreu, Sposi, and Zhang (2023).

point (p.p.) decline. Additionally, China's increasing export trade costs had a more significant negative impact on its trade share than the reduction in import trade costs; the overall effect of these two costs implies a reduction of China's trade share of 3.6 pp. At the sector level, during both periods, although the services component of trade accounts for a relatively small portion of the total trade share of GDP change, through input-output linkages, the productivity growth in China's services sector is as important as the productivity growth in China's heavy industry sector in driving changes in the trade share of GDP. Overall, from 2002 to 2015, changes in labor productivity and trade costs for both China and foreign regions together account for approximately 87% of the fluctuations in China's trade share of GDP.

I also quantify the forces that drive changes in other macroeconomic variables, including China's intranational trade share of GDP and real income per worker. The results reveal that, during the first period, the primary driver of the increase in China's intranational trade share of GDP was the reduction in intranational trade costs, which contributed an increase of 14.3 percentage points (p.p.). However, in the subsequent period, changes in intranational trade costs led to a decrease in the intranational trade share by 4 p.p. Regarding real income per worker, productivity increases are the dominant forces driving its increase in both periods, and its effects are more prominent than other forces. As for the effect of other forces on real income per worker, in the first period, the decline in intranational trade costs resulted in a 4% increase in real income per worker, exceeding the impact of the reduction in international trade costs, which was 2.7%. In the later period, aside from productivity growth, the decrease in labor mobility costs emerged as the second most significant factor, contributing to a 4.5% increase in real income per worker.

The paper is most closely related to Tombe and Zhu (2019), which examines how policy reforms in China from 2000 to 2005 reduced internal trade costs and migration costs and quantifies their effects. The study finds that reductions in internal trade and migration costs together contribute to 36% of China's overall labor productivity growth from 2000 to 2005, and this effect exceeds the effects of reductions in external trade costs. My paper focuses on explaining the mechanisms of forces driving China's declining trade share of GDP and quantifying the impact of each force. I further extend the period to include 2007–2015 and encompass more sectors and regions.

The paper is related to the literature linking trade with the geographical distribution of economic activity. This literature includes studies such as Caliendo and Parro (2015), Allen and Arkolakis (2014), Redding (2016), Caliendo, Parro, Rossi-Hansberg, and Sarte (2018), Caliendo, Dvorkin, and Parro (2019), Rodríguez-Clare, Ulate, and Vasquez (2020), Gai, Guo, Li, Shi, Zhu, et al. (2021). Besides interregional trade and international trade, I further incorporate labor flow under frictions across China's regions in a manner similar to Allen

and Arkolakis (2014) Ahlfeldt, Redding, Sturm, and Wolf (2015), Redding (2016), Tombe and Zhu (2019). This strand of literature primarily focuses on the welfare implications of several exogenous forces, including but not limited to changes in tariffs, labor mobility costs, and productivity. My paper focuses on explaining the mechanism responsible for changing an economy's trade share of GDP as implied by the Ricardian trade model I have developed.

The paper is also related to two strands of literature on trade and the Chinese economy. The first strand is the research on quantifying the consequences of trade on China, either at the aggregate or distributional level. This research often incorporates internal migration and internal trade across China's regions into the model, emphasizing the effects of internal migration or internal trade to varying degrees depending on the paper's focus. This strand is represented by papers such as those by Tombe and Zhu (2019), Fan (2019), Hao, Sun, Tombe, and Zhu (2020) and Ma and Tang (2020).

The second strand is the research on explaining and quantifying the source of China's trade imbalance or export dynamics. Specifically, Alessandria, Choi, and Lu (2017) examines China's growth and integration, in terms of both trade and finance, within a two-country DSGE model. Their primary focus lies in analyzing the impact of alterations in trade barriers on China's trade balance and the accumulation of foreign assets. Liu and Ma (2018) and Brandt and Lim (2020) quantify the drivers of the level of Chinese export change using a Melitz-type trade model. Recently, Alessandria, Khan, Khederlarian, Ruhl, and Steinberg (2021) studied the growth of Chinese exports to the United States over 50 years from a dynamic perspective and emphasized the importance of trade policy expectations in explaining the effects of policy changes on the dynamics of trade flows. My paper focuses on quantifying the change in China's trade share of GDP instead of the level of trade deficit or exports, which has yet to be explored in previous papers.

The rest of the paper is organized as follows. Section 2 provides motivating facts. Section 3 lays out the model and explains the mechanisms. Section 4 describes the data, calibrates the main parameters and shocks, and then briefly discusses the calibrated shocks. Section 5 conducts counterfactual structural decompositions and analyzes the results. Section 6 concludes.

2. Motivating Facts

In this section, I present some key facts concerning Chinese trade and GDP dynamics. First, I describe changes in China's trade share of GDP and compare them with those of other economies. Second, I analyze the disaggregated behavior of China's trade share of GDP changes at the sector level, importer level across China's regions, and exporter level across foreign countries. Specifically, at the sector level, I decompose changes in China's