The Effects of Trade War on the Labor Market and Trade Diversion*

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Abstract

This study aims to analyze the possible impacts of the U.S. import tariffs against China and other countries on the global economy, specifically the labor market. Running simulations in a computable general equilibrium (CGE) framework based on the Global Trade Analysis Project (GTAP) model, results show that on a global level, lower skilled labor shrinks by 0.02% while higher skilled labor drops by 0.54%. Scenarios include trade policies that have already been implemented, as well as those that are still being considered. In the event that the U.S. raises tariffs for motor vehicles and parts, and other countries retaliate, results show that it would ultimately cause the decline of approximately 11% of the Japanese labor force in the industry. When we focus on the U.S.-China trade dispute, the results reveal trade diversion effects, drawing other countries to increase their production as a substitute. Their shifts in imports consist of a more diversified reliance on other countries and regions that make up for the loss in imports from each other. The results suggest that trade diversion effect would occur, predicting steep decline in bilateral trade between the two countries affected and increasing exports towards their third trading partners. Estimation results also show that exports from Japan to the U.S. and China increase while exports to other countries and regions decrease. This study shows that there have been various shifts in the world economy, indicating that world trade has become more diversified.

1. Introduction

Trade liberalization has become prominent and widespread over the past three decades. In general, economists agree that open economies grow faster than their counterparts do, and that economic development has been greatly supported by

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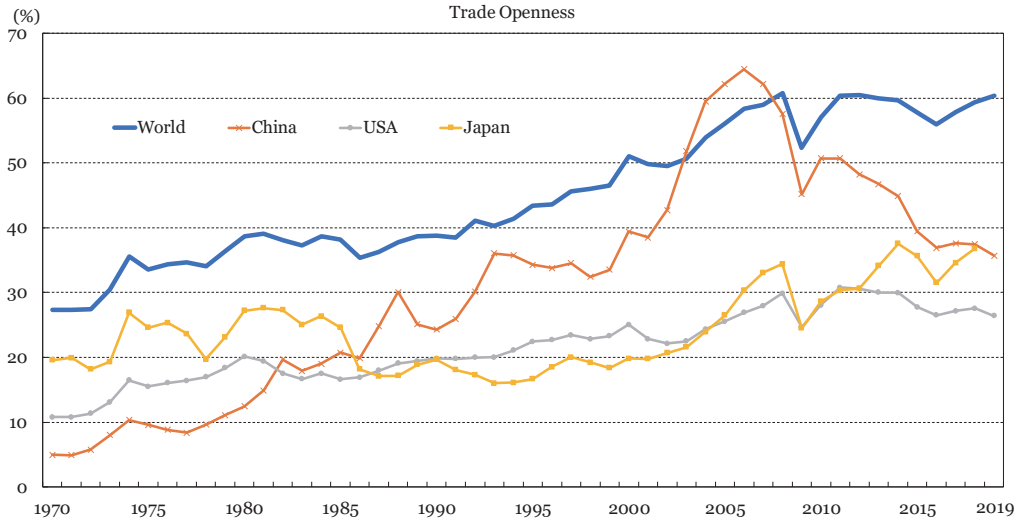
Figure 1. Trade Openness over the Years



Source: World Bank national accounts data and OECD National Accounts data files
Note: Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.

open trade (Grossman and Helpman, 1991; Edwards, 1993). Figure 1 shows trade openness in the world over the years. It also indicates how Japan has been steadily broadening its trade liberalization process. Up until recent years, there has been an upward trend in trade openness in the U.S. and China as well. China has remarkably increased its presence in the global world in the 2000s. In contrast, recently, the U.S. has been pushing for protectionist policies.

Protectionism is trying to use restrictions such as tariffs to boost a country's industry and shielding it from foreign competition. On March 1, 2017, the Office of the U.S. Trade Representative (USTR) released the 2017 Trade Policy Agenda. The report outlines the Trump Administration's four trade priorities: promoting U.S. sovereignty, enforcing U.S. trade laws, leveraging American economic strength to expand U.S. goods and services exports, and protecting U.S. intellectual property rights. Compared with former President Obama's trade policy agenda, the Trump administration prioritizes strengthening the manufacturing base, negotiating bilateral rather than multilateral trade agreement and renegotiating or revising existing trade agreements. For example, in January 2017, the U.S. withdrew from the Trans-Pacific Partnership (TPP) agreement, and taking effect on July 1, 2020, the North American Free Trade Agreement (NAFTA) has been replaced by the United States–Mexico–Canada Agreement (USMCA).

In theory, taxing items coming into the country means people are less likely to buy them as they become more expensive. The intention is that they buy cheaper local products instead, boosting the country's economy. However, given the rapid globalization that has been occurring over the course of about three decades, many companies also use imported intermediate inputs from abroad. This implies that the prices of final goods that these affected firms produce could increase, negatively affecting households.

This paper aims to estimate the possible worldwide impacts of trade policies the U.S. has put into effect as well as those that have been announced to being considered. Computable general equilibrium (CGE) analysis is used to simulate and analyze various scenarios of tariff increases and their possible effects on the world economy by adopting the Global Trade Analysis Project (GTAP) model. This is a unique attempt in that all countries affected are incorporated in the model individually in order to accurately reflect the reality of what has been happening regarding the trade disputes, with its main focus being the impact on the labor market. In addition, this current study's contribution is that it investigates further into possible trade diversion effects. Moreover, this study places more emphasis on effects in Japan, besides U.S. and China. The remainder of this paper is organized as follows. Section 2 presents a broad overview of the relevant literature. Section 3 briefly explains the background and timeline of the trade disputes. Section 4 introduces the methodology. Estimation results are discussed in Section 5. Section 6 concludes.

2. Literature Review

Barattieri and Cacciatore (2020) empirically show that while protectionism has small and short-lived beneficial effects in the protected industries, it has long-lasting negative impact on downstream industries. The increase in the cost of intermediate inputs leads to a decline in employment in affected industries as well. Consistent with this study is Bown et al. (2020), which investigates the effects of antidumping duties that U.S. has been applying on China. Their results indicate that tariffs in upstream industries negatively affect downstream industries, raising input prices and decreasing employment, sales and investment.

Ciuriak and Xiao (2018) use a CGE model to examine the effects of increased tariffs on steel and aluminum imposed by the U.S. on its trading partners. Their simulation results indicate that this move will induce an increase in U.S. production of the goods subject to the tariffs. However, this also means that prices of these

goods would increase in the U.S., which leads to a reduction in real GDP by 0.06% and jobs by approximately 22,700.

Carvalho, Azevedo and Massuquetti (2019) examine the effects of the U.S.–China trade war on emerging economies, using a CGE model. Their results suggest that the trade war would lead to a reduction in U.S. trade deficit and an increase in domestic production of those sectors affected by higher import tariffs, while Chinese producers and consumers would bear the burden of the trade war. However, both countries and the world as a whole would suffer from a decline in welfare. With the increase in protectionism between the two largest global economies, their simulation reveals that some important emerging countries not directly involved in the trade war would benefit by the shift in demand to sectors where they have comparative advantages.

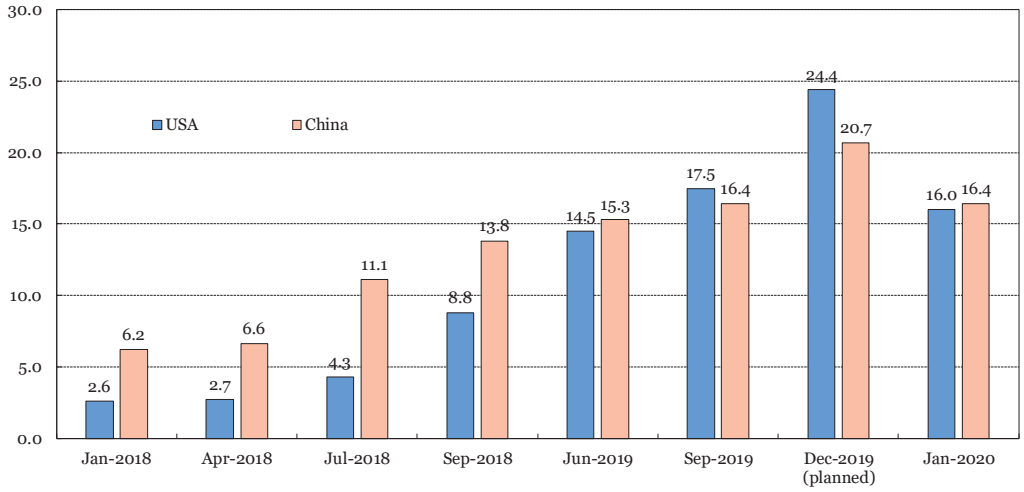
A study by Bollen and Rojas-Romagosa (2018) estimates the effects of increased protectionism with different scenarios based on a CGE model. It summarizes the possible economy wide effects from the perspective of a trade war, resulting in only losers, in the case of a full-blown escalation of the trade conflict, where a much larger number of products are targeted. At higher tariff rates the loss will continue to rise, but less quickly, because most sectors will already be priced out of the market.

The consensus of the existing literature is that, those directly involved in tariff escalation in a trade war suffer the most, while their trading partners may be affected by positive or negative spillovers. Positive spillovers for third party economies are generated due to market opportunities created by redirection of trade and investment. However, there is an increasing likelihood of negative spillovers due to slowdown in global demand. These are likely to be fueled by uncertainties that lead consumers to delay spending and businesses to hold on to their investments. This present study investigates these potential effects on not only U.S. and China, but also third-party economies.

3. Background

Figure 2 shows that the U.S. tariffs on Chinese imports increased from 2.6% in January 2018 to 17.5% in September 2019. At the same time, the tariffs China imposed on imports from the U.S. have increased from 6.2% in January 2018 to 16.4% in September 2019. The planned further increases to 24.4% and 20.7% by the U.S. and China respectively by December 2019 was not implemented. Thus, as of January 2020, average U.S. and China tariffs vis-à-vis are at 16.0% and 16.4%,

Figure 2. Average Tariff Rates



Source: Bekkers and Schroeter (2020)'s calculations based on trade data from the Trade Data Monitor and tariff data collected by the WTO secretariat

respectively.

In March 2018, the U.S. officially signed a tariff decree imposing 25% and 10% tariffs on imported steel and aluminum, respectively, on its trading partners. This triggered retaliation from China, as well as from other countries. Next, with regard to China, in July 2018, 25% tariffs worth 34 billion USD were imposed on Chinese products. In retaliation to the U.S. tariffs, China applied 25% tariffs on products originating from the U.S. worth 34 billion USD. In August 2018, the U.S. implemented a 25% tariff on goods originating from China worth 16 billion USD, and China imposed retaliatory tariffs on U.S. products. In September 2018, the U.S. implemented tariffs on 200 billion USD worth of Chinese products, and China responded by implementing additional tariffs. After numerous talks and threats, in December 2018, U.S. halted imposing tariffs on an additional 267 billion USD worth of Chinese products. Although 300 billion USD worth of Chinese goods were scheduled to begin in September and December 2019, the U.S. agreed not to proceed with tariffs that had been scheduled to take effect in December.

During this time, the U.S. Department of Commerce also announced the addition of Huawei Technologies Co. Ltd. and its affiliates on its 'entity list', which effectively bans U.S. companies from selling to the Chinese telecommunications company without U.S. government approval. More entities have been added to this list since.

Finally, on January 15, 2020, U.S. and China signed the Phase One trade deal.

They agreed on cutting some U.S. tariffs on Chinese goods, in exchange for Chinese pledges to purchase more of American farm, energy and manufactured goods and address some U.S. complaints about intellectual property practices. The estimated total U.S. tariffs applied exclusively to Chinese goods is 550 billion USD and the estimated total Chinese tariffs applied exclusively to U.S. goods is 185 billion USD.

4. Methodology

This study uses GTAP 9 Data Base from Center for Global Trade Analysis, Purdue University. The database covers 140 regions and 57 sectors with reference years 2004, 2007 and 2011. The latest reference year is used in the model calibration.

Countries were mapped into the U.S., China, Japan, EU, Canada, Mexico, ASEAN and NIES, as well as countries that have imposed direct retaliatory tariffs against the U.S. (see Table 1). Factors of production were aggregated into "Higher

Table 1. Regional Aggregation Mapping

Regional Aggregation Mapping

Region	Members
Japan	Japan
United States	United States
China	China
European Union	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden
Canada	Canada
Mexico	Mexico
United Kingdom	Untited Kingdom
ASEAN	Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, the Philippines, Thailand and Vietnam
NIES	South Korea, Taiwan, Hong Kong and Singapore
Brazil	Brazil
Russia	Russia
India	India
Turkey	Turkey
RoW	Other countries not specified above

Table 2. Factor Endowment Aggregation Mapping

Factor Endowment	Aggregation Group
Officials and managers Technicians and associate professionals	Higher Skilled Labor
Clerks Service and market sales workers Agricultural and unskilled workers	Lower Skilled Labor
Land	Land
Capital	Capital
Natural resources	Natural resources

Skilled Labor," "Lower Skilled Labor," "Land," "Capital" and "Natural Resources" (see Table 2). Land and natural resources are set to be immobile across sectors, while capital goods are also assumed to have limited mobility in order to achieve short-run simulation results (Burfisher, 2011). As for sectors, this research follows the default GTAP database sector aggregation (see Table 3).

This study employs tariff policy simulations using the GTAP CGE model. CGE analysis enables us to calculate likely future outcomes of the tariff policies via mathematical simulations. As both the U.S. and China are large economies, their trade policies could send repercussions to other countries. CGE models can capture these linkages through price mechanisms (Hosoe et al., 2010). The simulation is of general equilibrium in nature, meaning that it captures both direct and indirect effects stemming from linkages across different countries and markets.

GTAP model is a CGE model developed by Center for Global Trade Analysis, Purdue University. The full model was introduced in Hertel (1997). It is a multi-region, multi-sector, computable general equilibrium model, with perfect competition and constant returns to scale. Aside from extensive modeling of inter-regional linkages, mainly via international trade, it models demand for domestic and foreign-produced goods. In brief, the model has the following properties (Lans and Rutherford, 2016; van der Mensbrugghe, 2018):

- It models the behavior of firms and three regional households (private household, government household and savings expenditure) in each region.
- Firms minimize their cost of production subject to production technology represented in constant elasticity of substitution (CES) functional form. Firms are assumed to be price takers.
- Regional households maximize their utility subject to income from net payments of factor use (for private household) or revenue of government distor-

Table 3. Sector Aggregation Mapping

GTAP Code	Description	Aggregation Group After Simulation
PDR	Paddy rice	Agriculture, forestry and fisheries
WHT	Wheat	
GRO	Cereal grains nec	
V_F	Vegetables, fruit, nuts	
OSD	Oil seeds	
C_B	Sugar cane, sugar beet	
PFB	Plant-based fibers	
OCR	Crops nec	
CTL	Bovine cattle, sheep and goats, horses	
OAP	Animal products nec	
RMK	Raw milk	
WOL	Wool, silk-worm cocoons	
FRS	Forestry	
FSH	Fishing	
COA	Coal	Energy
OIL	Oil	
GAS	Gas	
ELY	Electricity	
GDT	Gas manufacture, distribution	
P_C	Petroleum, coal products	
CMT	Bovine meat products	Processed food and beverages
OMT	Meat products nec	
VOL	Vegetable oils and fats	
MIL	Dairy products	
PCR	Processed rice	
SGR	Sugar	
OFD	Food products nec	
B_T	Beverages and tobacco products	
TEX	Textiles	Textiles, apparel and leather
WAP	Wearing apparel	
LEA	Leather products	
LUM	Wood products	Wood and paper products
PPP	Paper products, publishing	
CRP	Chemical, rubber, plastic products	Chemicals, plastics and rubbers
OMN	Minerals nec	Minerals
NMM	Mineral products nec	
I_S	Ferrous metals	Steel
NFM	Metals nec	Metals
FMP	Metal products	
MVH	Motor vehicles and parts	Motor vehicles and parts
OTN	Transport equipment nec	Other transport equipment
ELE	Electronic equipment	Electronic equipment
OME	Machinery and equipment nec	Machinery and equipment
OMF	Manufactures nec	Manufactures
CNS	Construction	Construction
TRD	Trade	Trade
OTP	Transport nec	Transportation services
WTP	Water transport	
ATP	Air transport	
WTR	Water	Services
CMN	Communication	
OFI	Financial services nec	
ISR	Insurance	
OBS	Business services nec	
ROS	Recreational and other services	
OSG	Public Administration, Defense, Education, Health	
DWE	Dwellings	

tionary measures (for government household).

- Private household expenditure is modeled using constant difference of elasticities (CDE) functional form to account for its non-homothetic preferences.
- Imports are differentiated by source and governed by Armington import substitution elasticity parameter.

The simulation scenarios presented in this paper are as follows.

Scenario 1: U.S. imposing 25% tariffs on motor vehicles and parts worth 360 billion USD. All other countries retaliate by imposing similar tariff rate increase on imports from the U.S.

Scenario 2: U.S. imposing tariffs on all trading partners of 25% on steel and 10% on aluminum. Other countries retaliate by imposing tariffs (countries, tariff rates and affected products are chosen based on official government statements).

Scenario 3: U.S. imposing 25% tariffs on 250 billion USD worth of goods imported from China. China imposing retaliatory tariffs ranging from 5% to 25% on 110 billion USD worth of imports from the U.S.

Scenario 4: U.S. imposing 25% tariffs on 267 billion USD worth of imports from China. China imposing retaliatory tariffs of 25% on 20 billion USD worth of imports from the U.S.

Note that Scenario 1 has been announced by the U.S. but is still under consideration.

5. Results

First, Figures 3 and 4 show the impact on the global labor market in the possible case of Scenario 1, which covers the protection of motor vehicles and parts industry. The assumption here is that if the U.S. imposes tariffs on motor vehicles and parts against the whole world, all other countries will retaliate by increasing tariff rates on U.S. imports to the same degree. Therefore, the U.S. labor market will be affected by a 1.35% overall increase in Scenario 1 based on this current model. However, just from Scenario 1, USMCA's labor market as a whole decreases by 0.32%. Meanwhile, labor markets in Japan, China, ASEAN, NIES, EU and Russia suffer losses, whereas India, Brazil and UK are positively affected. Results show that on a global level, lower skilled labor shrinks by 0.02% while higher skilled labor drops by 0.54%.

The results reveal that higher skilled labor is affected more than lower skilled

Figure 3. Estimated Impact on Higher Skilled Labor

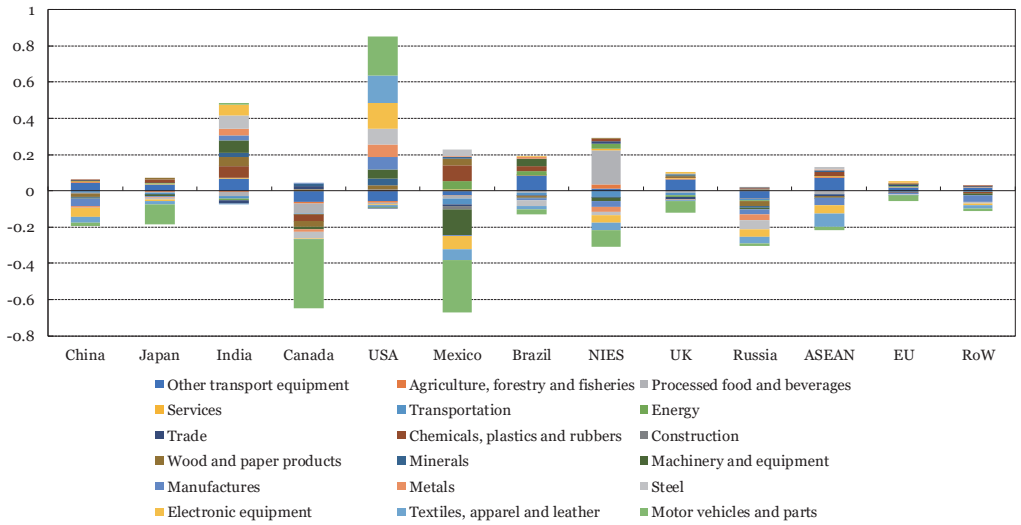
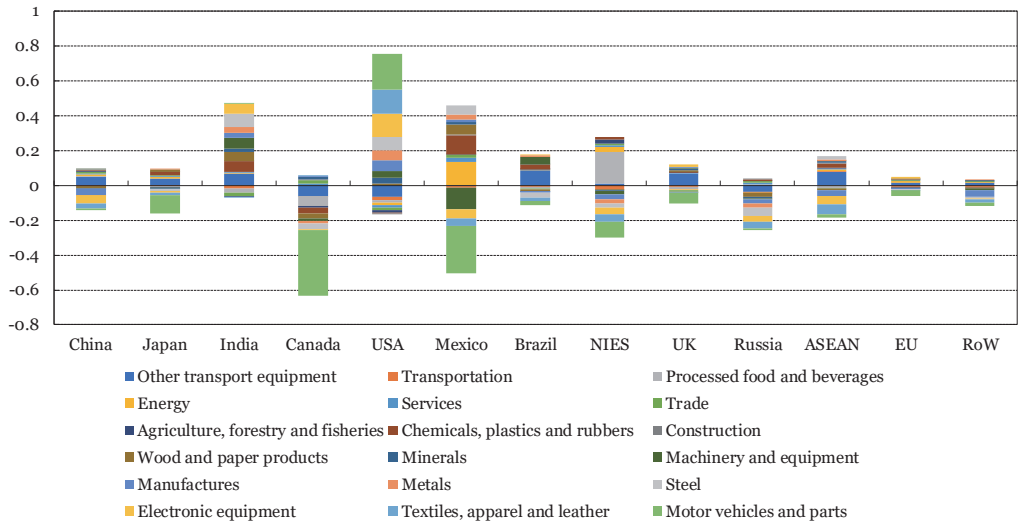


Figure 4. Estimated Impact on Lower Skilled Labor



labor. This is because the sectors being protected by higher tariffs are mainly lower-skill oriented. The U.S. employment in the protected sectors as well as sectors that are closely linked via vertical trade increases. This increase comes with a cost of labor demand in other transport equipment and transportation services, especially for lower skilled workers.

Figure 5. Estimated Impact from Scenario 1 on the Japanese Labor Market (Left: U.S. imposition of tariffs, Right: Retaliatory tariffs)

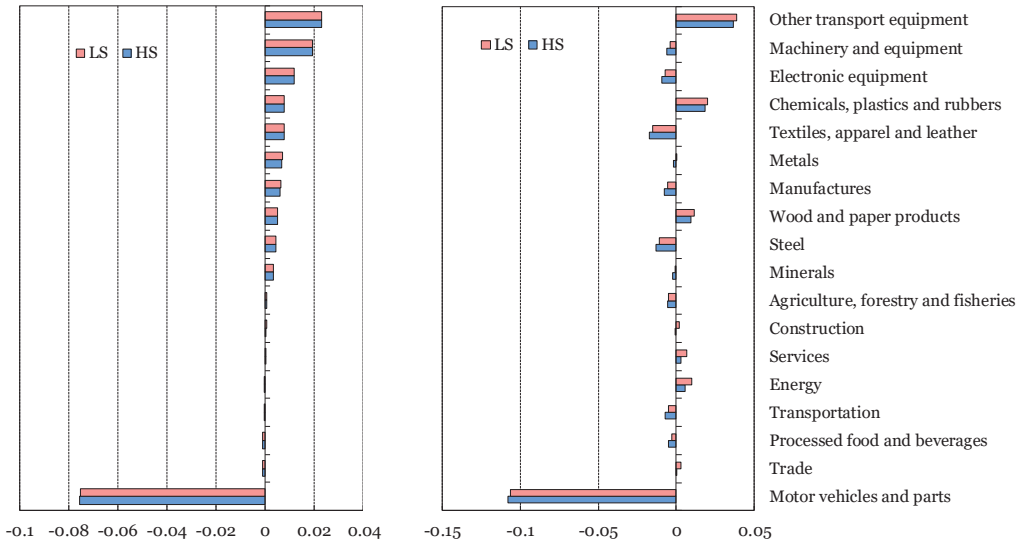
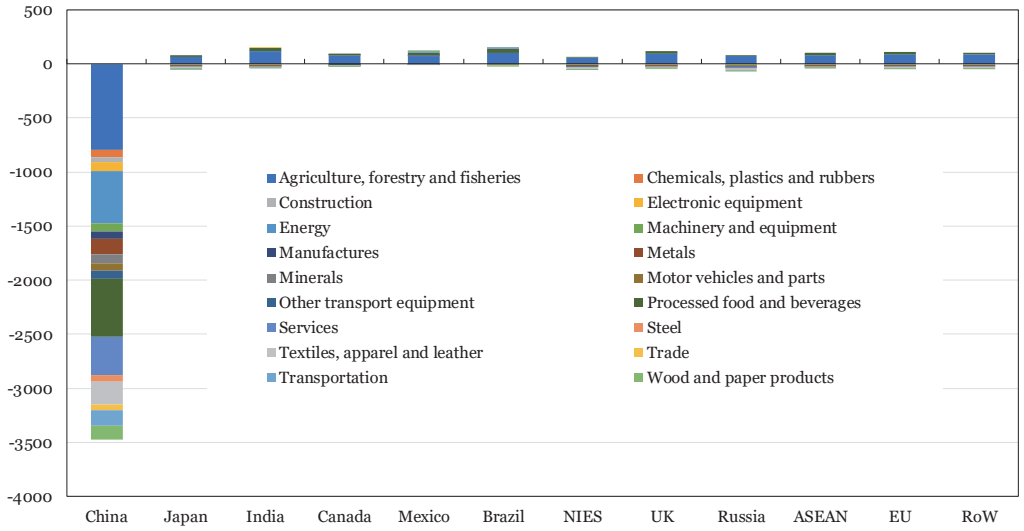


Figure 5 shows the labor market effects in Japan for different industries in the possible case of Scenario 1. The graph on the left depicts the impact from the initial U.S. imposition of tariffs and the graph on the right shows the effects from retaliatory tariffs. The targeted motor vehicles and parts sector suffers the most severe hit, for both higher and lower skilled labor. This is the main and mostly only impact when the initial U.S. tariffs are imposed. However, if Japan and other countries retaliate with higher tariffs against the U.S., other sectors suffer from decrease in labor demand. This reveals the potential harm to domestic industries when raising tariffs.

It is important to note that our estimation results for labor showed a trend that is in line with the effects on production. Overall, motor vehicles and parts production drops by 7.6%, due to the 17% drop in their exports to the U.S. in Scenario 1. This is consistent with the fact that approximately 30% of Japan's exports to the U.S. consists of motor vehicles and parts. This ultimately causes the decline of approximately 11% of the labor force in the industry. Substitution effect takes place, however, that causes other transport equipment production to increase by 2.4%, ultimately increasing labor demand by 4%.

Scenarios 2 and 3, which replicate policies that have already been implemented, along with Scenario 4, decrease GDPs of the world's economic giants China and the U.S. by 0.4% and 0.1%, respectively. This leads the world GDP to drop by 0.1%

Figure 6. Estimated Impact on U.S. Imports by Country/Region



as well (Yane and Nishioka, 2019). Ultimately, results show that the Chinese economy will most likely take a bigger hit than the U.S.

Figure 6 shows that the U.S.-China trade war, mainly modelled in Scenarios 3 and 4, causes a great drop in U.S. imports from China. Meanwhile, U.S. imports of agriculture, forestry and fisheries goods increases from other countries. This trend is further elucidated in Figure 7. This indicates a diversion effect, caused by the U.S. restricting imports from their main importer, China, drawing other countries to increase their production as a substitute.

Chinese imports, on the other hand, have a greatly reduced share from the U.S., while those from all other economies increase, as shown in Figure 8. Figure 9 reveals a similar pattern of diversion effect as we have seen in the U.S. Chinese imports consist of a more diversified reliance on other countries and regions that make up for the loss in imports from the U.S.

Figure 10 shows the impact on Japanese exports by country or region. It depicts the great increase in exports to China and the U.S., more so for China. The detailed breakdown of industries is shown in Figure 11. Agriculture, forestry and fisheries as well as processed food and beverages products mainly make up for the increase in exports towards U.S. and China. Specifically, services exports to China rise. At the same time, exports to other countries and regions decrease. These are namely agriculture, forestry and fisheries products, textiles, apparel and leather products, transportation services, wood and paper products and electronic equipment.

Figure 7. Estimated Impact on U.S. Imports by Industry

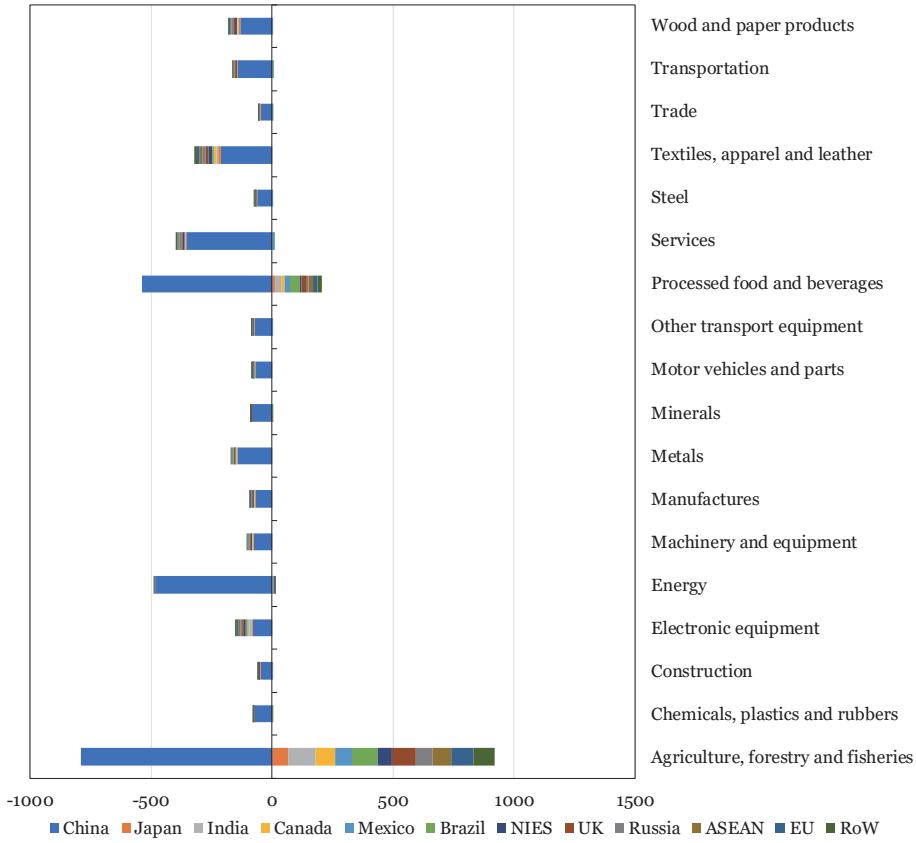


Figure 8. Estimated Impact on China's Imports by Country/Region

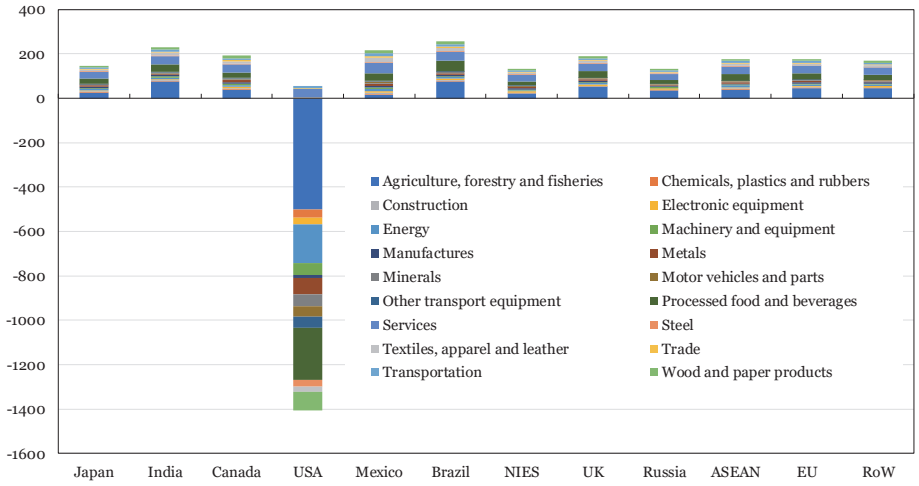


Figure 9. Estimated Impact on China's Imports by Industry

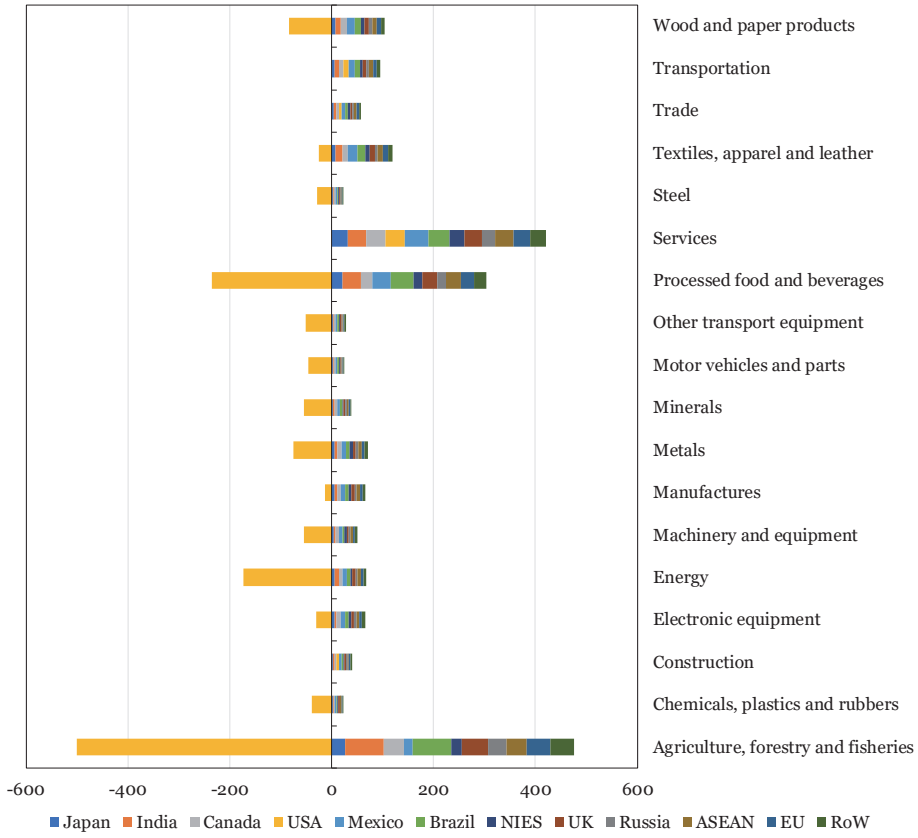


Figure 10. Estimated Impact on Japan's Exports by Country/Region

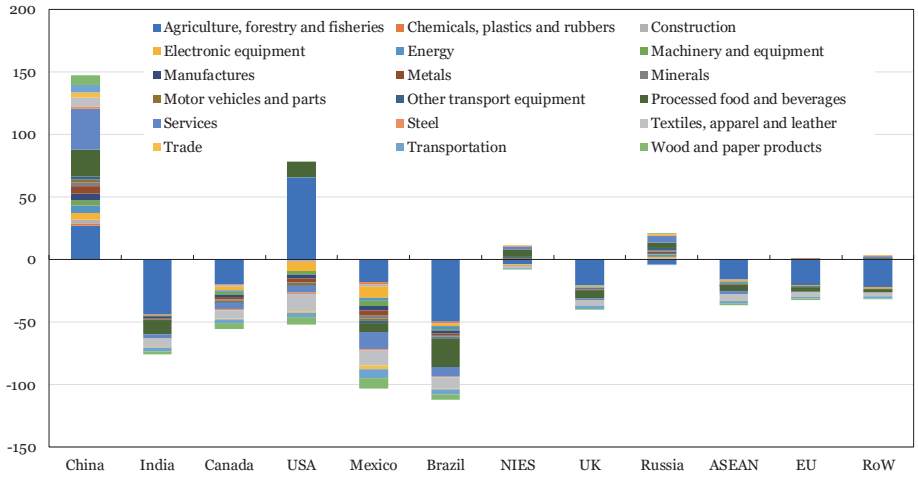
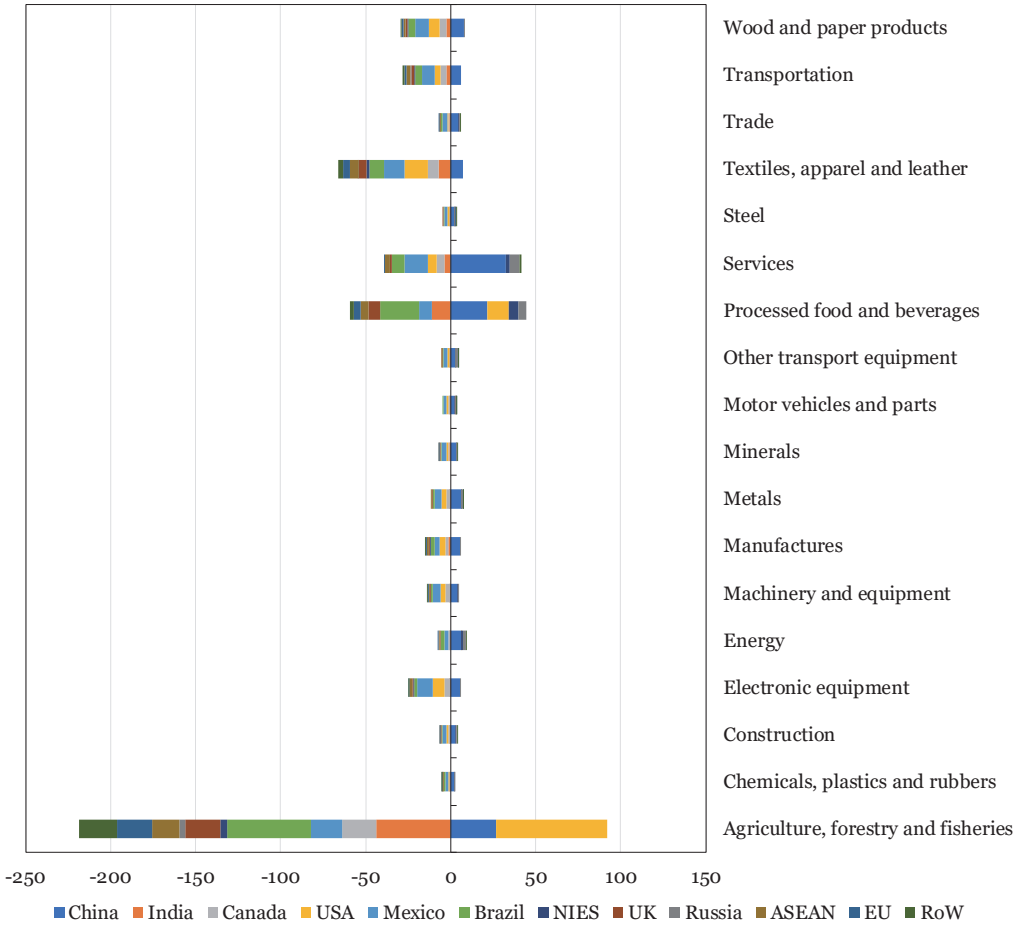


Figure 11. Estimated Impact on Japan's Exports by Industry



6. Concluding Remarks

This study shows estimated effects of the ongoing trade war, focusing especially on tariffs imposed by the U.S. on various economies. The worldwide economic impact on the labor market from the raging trade war is negative, where lower skilled labor shrinks by 0.02% while higher skilled labor drops by 0.54% based on the CGE simulations. In the event that the U.S. raises tariffs for motor vehicles and parts, and other countries retaliate, results show that it would ultimately cause the decline of approximately 11% of the Japanese labor force in the industry.

When we focus on the U.S.-China trade dispute, the results reveal trade diversion effects, drawing other countries to increase their production as a substitute.

Their shifts in imports consist of a more diversified reliance on other countries and regions that make up for the loss in imports from each other. The results suggest that trade diversion effect would occur, predicting steep decline in bilateral trade between the two countries affected and increasing exports towards their third trading partners.

Estimation results also show that exports from Japan to the U.S. and China increase while exports to other countries and regions decrease. This study shows that there have been various shifts in the world economy, indicating that world trade has become more diversified.

In conclusion, production levels among industries change and shift, and will require smooth and frictionless labor movement. Therefore, it is important to set up policies that will protect workers who will face unemployment, lower wages or decrease in the quality of their working environment. Supporting training programs that help people develop new job skills would also be essential.

On January 15, 2020, U.S. and China signed the Phase One trade deal. They agreed on cutting some U.S. tariffs on Chinese goods, in exchange for Chinese pledges to purchase more of American farm, energy and manufactured goods and address some U.S. complaints about intellectual property practices. Therefore, further research is needed to include these potential agreements and policies.

Moreover, fixed labor force and capital have the tendency to underestimate the negative impact the protectionist policies have on an economy. For example, by making labor markets endogenous, we will be able to make more viable estimations of the impact on the labor market in the short run. This should be addressed in future studies.

Finally, it is important to capture the increasing uncertainties the world is facing today. Negative spillovers are likely to be fueled by uncertainties that lead consumers to delay spending and businesses to hold on to their investments. Whether either positive spillovers or negative spillovers outweigh the other would depend on being able to accurately measure these variables.

References

Barattieri, A., and M. Cacciatore (2020) "Self-Harming Trade Policy? Protectionism and Production Networks," *NBER Working Paper* No. 27630.

Bekkers, E., and S. Schroeter (2020) "An Economic Analysis of the US-China Trade Conflict," *World Trade Organization Staff Working Paper* ERSD-2020-04.

Bollen, J., and H. Rojas-Romagosa (2018) "Trade Wars: Economic Impacts of US Tariff Increases and Retaliations: An International Perspective," *CPB Netherlands Bureau for Economic Policy Analysis*. Available online: https://www.cpb.nl/sites/default/files/omnidownload/CPB-

Background-Document-November2018-Trade-Wars-update.pdf
Bown, C., P. Conconi, A. Erbahar, and L. Trimarchi (2020) "Trade Protection along Supply Chains," (mimeo).
Burfisher, M. E. (2011) *Introduction to Computable General Equilibrium Models*, Cambridge: Cambridge University Press.
Carvalho, M., A. Azevedo and A. Massuquetti (2019) "Emerging Countries and the Effects of the Trade War between US and China," *Economies* 7(2), 45.
Ciuriak, D., and J. Xiao (2018) "Quantifying the Impacts of the US Section 232 Steel and Aluminum Tariffs," *C.D. Howe Institute Working Paper*, Available at SSRN: https://ssrn.com/abstract=3190699.
Edwards, S. (1993) "Openness, trade liberalization, and growth in developing countries," *Journal of Economic Literature* 31(3), pp. 1358–1393.
Grossman, G. M., and E. Helpman (1991) *Innovation and Growth in the Global Economy*, MIT Press: Cambridge, MA.
Hertel, T. W. (ed.) (1997) *Global Trade Analysis: Modeling and Applications*, Cambridge: Cambridge University Press.
Hosoe, N., K. Gasawa, and H. Hashimoto (2010) *Textbook of Computable General Equilibrium Modelling: Programming and Simulations*, London: Palgrave Macmillan.
Lanz, B. and T. F. Rutherford (2016) "GTAPinGAMS: Multiregional and Small Open Economy Models," *Journal of Global Economic Analysis* Volume 1 No. 2, pp. 1-77.
van der Mensbrugghe, D. (2018) "The Standard GTAP Model in GAMS, Version 7," *Journal of Global Economic Analysis* 3(1), pp. 1-83.
Yane, H., and S. Nishioka (2019) "A CGE Analysis on Trade War: Grave Divide in Future Paths of the World Economy," *Japan Center for Economic Research: Special Research Report*.