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ABSTRACT

This paper provides an economic analysis of the trade conflict between the US and China, providing an overview of the tariff increases, a discussion of the background of the trade conflict, and an analysis of the economic effects of the trade conflict, based both on empirics (ex post analysis) and on simulations (ex ante analysis). Bilateral tariffs have increased on average to 17% between the US and China, and the Phase One Agreement signed in January 2020 between the two countries only leads to minor reductions in the tariffs to 16%. The trade conflict has led to a sizeable reduction in trade between the US and China in 2019 and is accompanied by considerable trade diversion to imports from other regions, leading to a reorganization of value chains in (East) Asia. The simulation analysis shows that the direct effects of the tariff increases on the global economy are limited (0.1% reduction in global GDP). The impact of the Phase One Agreement on the global economy is even smaller, although the US is projected to turn real income losses into real income gains because of the Chinese commitments to buy additional US goods. The biggest impact of the trade conflict is provoked by rising uncertainty about trade policy and the paper provides a framework to analyze the uncertainty effects.

Keywords: Trade conflict, Economic simulations, Trade effects of tariffs

JEL-codes: F12, F13, F14, F17

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1 INTRODUCTION

Since 2018 the United States and China have imposed various restrictive measures on trade flows between the two countries, of which increases in tariffs have been most prominent. Tariff increases by the United States on Chinese imports led to a quick response of China, also raising its tariffs on American imports. Although the trade conflict seemed to escalate in the Fall of 2019 with new tariff increases, at the end of 2019 the two countries agreed on a truce, cancelling some of the announced tariff increases and rolling back some of the earlier increases in tariffs. The truce led to the so-called Phase One Agreement signed in January 2020.

This paper analyzes the economics of the trade conflict, discussing the economic background of the trade conflict, providing an overview of the different measures taken and exploring the economic effects, going into the impact already generated (ex post analysis) and the impact expected in the future (ex ante analysis), paying special attention to the possible effects through uncertainty about trade policy. The economic effects are examined both reviewing the literature and doing own analysis. For the ex post analysis, we explore how trade flows between China and the US have changed over the last two years and we analyze patterns of trade diversion.

For the ex ante analysis, the WTO Global Trade Model (GTM), a recursive dynamic computable general equilibrium (CGE) model, is employed. There is extensive discussion about the potential effects of the trade tensions on the global economy through rising trade policy uncertainty and we incorporate the framework proposed by Handley and Limao (2017) into the Melitz firm heterogeneity version of the GTM in simplified form. In particular, rising trade policy uncertainty is modelled through an increase in the discount rate triggering an increase in fixed export costs for given sunk export costs. In the ex ante analysis, we develop four scenarios to be able to evaluate the impact of the Phase One Agreement and to assess the impact of rising trade policy uncertainty.

Since the start of the trade conflict between the US and China the two countries have raised tariffs substantially on each other's exports, from 2.6% to 17.5% on Chinese imports into the US and from 6.2% to 16.4% on US imports into China. The Phase 1 Agreement between the US and China reduced the tariffs on Chinese imports into the United States to 16%. To limit the scope of the paper, it focuses on the trade tensions between the US and China.[1]

The tariffs on Chinese imports have been motivated with at least four arguments: (i) address bilateral trade imbalances; (ii) make tariffs more reciprocal; (iii) bring back manufacturing jobs; (iv) address Chinese policies with negative spillovers such as poor IP protection, subsidies of state-owned enterprises, and forced technology transfer. The economic underpinning of the first three arguments will be discussed in detail in the paper.

Although trade flows from China to the US still increased in 2018 because of frontloading by about 7%, exports from China to the US fell substantially in the first three quarters 2019 for tariffed goods, by 13%. US exports to China fell by about 1% in 2018, accelerating to a reduction of more than 25% in the first three quarters of 2019. While Chinese exports to the US still increased in 2018 by 7% because of frontloading, they dropped in the first quarter of 2019 by about 13%.

The ex post analysis also shows that there was significant trade diversion towards imports from other trading partners. Four East Asian countries (Japan, South Korea, Taiwan, and Viet Nam) exported less to China and more to the US, in particular in the electrical equipment sector. This indicates that value chains in East Asia are reorganized in response to the trade conflict. The main insight from the empirical literature so far on the trade conflict is that there has been complete pass-through of higher import tariffs on Chinese goods to tariff inclusive import prices.

The ex ante analysis shows that the direct impact of the tariff increases in the trade conflict are expected to be limited, in the range of a 0.1% reduction in global GDP. Furthermore, the impact of

[1] In the quantitative exercise we also take into account the tariffs imposed by the US on steel and aluminum since 2018. Additional US tariff measures are under discussion in 2019. The US government is considering raising tariffs on imports of cars and car parts (about 300 billion dollars) to 25% with the same legal justification as the steel and aluminum tariffs, national security under Section 232 of the Trade Expansion Act. Such tariffs would in turn provoke retaliation. On October 18, 2019 the US also raised tariffs on imports of a value of 7.5 billion on various products from the European Union as retaliation measures for the WTO-inconsistent subsidies in the EU for Airbus. This will likely trigger retaliation by the EU on US imports (on 12 billion import value) because of WTO-inconsistent subsidies to Boeing.

the Phase One Agreement on global GDP is an order of magnitude smaller and hardly changes the direct impact on the global economy. Remarkably, the analysis shows that the real income effects for the US change from negative into positive with the Phase One Agreement, because of the Chinese commitment to buy additional US goods. The positive impact of the trade conflict on other countries because of beneficial trade diversion is projected to turn negative as a result of the Chinese commitments to source more imports from the US.

The analysis discussed so far only takes into account the direct effects and does not consider possible effects through uncertainty. Our next step is to include an analysis of the effects of uncertainty. Determining the uncertainty impact is a complex undertaking and so our results should be interpreted with caution. Nevertheless, our analysis indicates that the impact through uncertainty is much larger than the direct effect. Measures of trade uncertainty have increased manifold since 2018. Taking into account uncertainty effects, the loss in global GDP would be much more considerable and increase to between 0.34% and 0.50%.

The projected effects reported in other ex ante studies are close to the simulated effects with the WTO Global Trade Model, except for the distribution of losses across regions. In the simulations including uncertainty we project larger negative effects for the US because uncertainty about future policy according to the Trade Uncertainty Indicator is mostly related to trade between the US and its trading partners.

The paper is organized as follows. Section 2 gives an overview of the tariff measures taken so far. Section 3 goes into the impact on trade so far (ex post analysis). Section 4 discusses the different arguments given to underpin the tariff measures against China thus providing background of the trade conflict. Section 5 goes into the impact of the trade conflict through trade policy uncertainty. Section 6 then presents the results of simulations with the WTO Global Trade Model and Section 7 concludes by relating the simulation results with the earlier simulation results on the effects of a global trade war in Bekkers and Teh (2019).

2 OVERVIEW OF MEASURES

The United States started to increase tariffs on Chinese imports in March 2018 and the response of the Chinese government followed shortly afterwards. Table 1 shows the value of trade affected by each of the rounds of tariff increases, while Figure 1 shows the evolution of the average tariff rates on US imports from China and Chinese imports from the US. The tariff increasing measure affecting most additional trade was taken on September 24, 2018. The US levied additional tariffs of 10% on roughly $200 billion Chinese imports, which increased further to 25% on May 10, 2019.

The average tariffs imposed by the US on imports from China have increased substantially since the start of the trade conflict, from a 2.6% MFN tariff rate to a tariff rate of 17.5% on the 1st of September 2019. Initially the US announced a further extension of the scope of the tariff increases, which would have raised average tariffs to 24.4% on December 15. However, because of the truce in the trade conflict this increase was never implemented and instead, as part of the Phase 1 Agreement between the US and China, average tariffs fell to 16%. The tariff increases implemented on the 1st of September 2019 on about 120 billion of consumer goods will be halved, from a 15% increase to 7.5% increase.

Figure 1 shows that the tariffs China imposed on imports from the US have increased from 6.2% in January 2018 to 16.4% in September 2019. The planned further increases to 20.7% by December 2019 was not implemented. At the same time China reduced MFN tariffs on other trading partners, corresponding to an average reduction in tariffs of about 5%.

The average tariff rates reported in Figure 1 differ slightly from the numbers reported in Bown (2019), because of differences in weighting schemes. Whereas Bown (2019) weights the tariff averages by US exports to the world and China's exports to the world in 2017, we weight by bilateral imports. Thus, the averages are only weighted by trade that is affected by tariff increases. As a comparison we use a similar reference group weighting method as Bown (2019) (Figure A1 in the Annex) based on US total imports from the world and China's total imports from the world. Figure A1 confirms the sensitivity of the averages to the weighting scheme. The United States started the trade conflict targeting primarily intermediate goods but has moved to the imposition of tariffs on almost all goods, including consumption goods. Since the US imports disproportionately fewer intermediate goods from China than the rest of the world and disproportionately more final goods, bilaterally weighted average tariff rates tend to be lower for the first tariff measures in 2018 and higher for the tariff measures at the end of 2019 compared to tariff rates weighted by reference groups.

Table 1 – Trade Coverage of Tariff Increases

US imports from China

Measure	Mar. 23, 2018	Jul. 6, 2018	Aug. 23, 2018	Sep. 24, 2018	May 10, 2019	Sep. 1, 2019	Dec. 15, 2019
Trade in US$ billion	3.60	33.44	14.31	198.87	-	130.15	161.88
Cumulative trade in US$ billion	3.60	35.81	49.52	237.07	237.07	336.36	487.35

Chinese imports from the US

Measure	Apr. 2, 2018	Jul. 6, 2018	Aug. 23, 2018	Sep. 24, 2018	Jun. 1, 2019	Sep. 1, 2019	Dec. 15, 2019
Trade in US$ billion	2.97	42.52	14.11	53.39	52.85	28.67	44.80
Cumulative trade in US$ billion	2.97	45.37	57.45	107.91	107.74	110.96	113.59

Note: Values of trade coverage are based on trade data in 2017. The numbers in the row "Cumulative trade" are not equal to the sum of the numbers in the row "Trade", because in some cases additional tariffs cover the same HS-lines. Cumulative trade of China for June 1, 2019 is smaller than for September 2018, because China has eliminated some MFN tariffs in between.

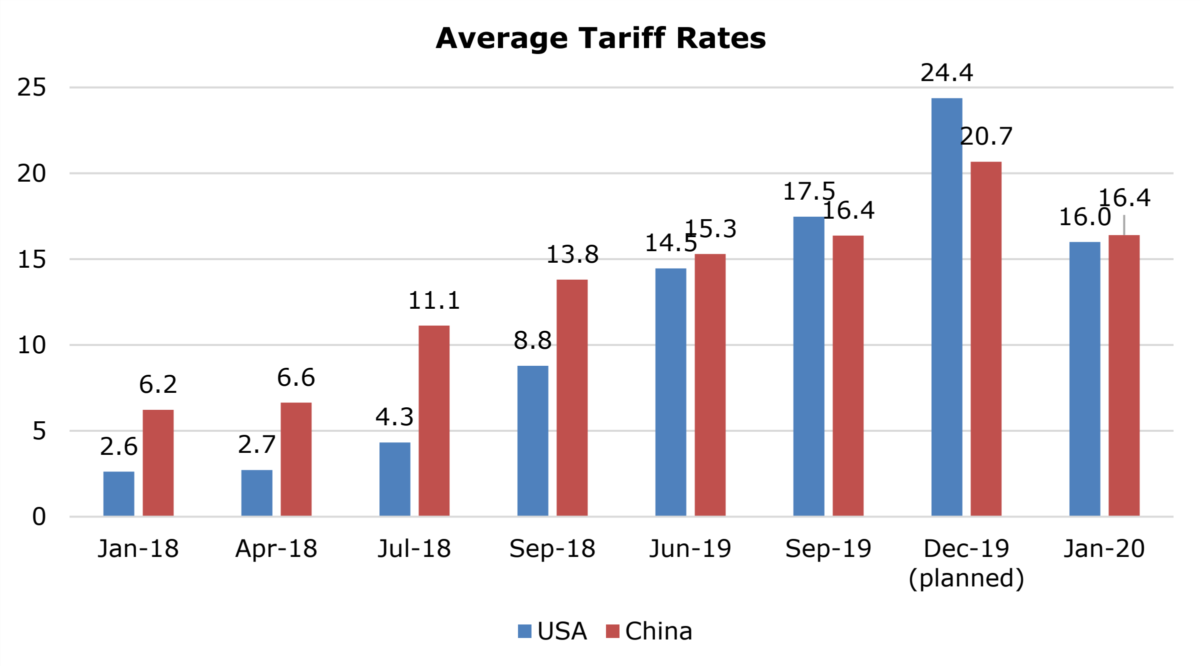
The descriptive analysis of the tariff increases in this and the following section is based on two datasets. First, the Trade Data Monitor (TDM) provides quarterly trade data on US imports and Chinese imports with all partners at 8-digit tariff-line level from the first quarter of 2017 to the third quarter of 2019. Second, the WTO-Secretariat constructed a database that includes MFN tariffs, applied tariffs and additional tariffs due to all measures taken between January 2018 and December 2019. Products affected by additional tariffs are identified by information given on governmental websites and notifications to the WTO. [2]

As part of the Phase 1 Agreement China committed to raise its imports from the United States by 200 billion over 2020 and 2021. This promised Chinese increase in imports from the US is sizeable. Relative to the pre-trade conflict level of 2017, imports should increase according to the Phase 1 Agreement by 200 billion over two years (32 in agriculture, 52 in energy, 78 in manufacturing, and 38 in services). This increase of 100 billion on average per year constitutes an almost 50% increase compared to the pre-trade conflict imports of about 210 billion in 2017. (153 billion of merchandise imports and 57 billion of services exports from the US to China, both based on WTO data).

China has not committed to a reduction of its additional tariffs on US imports and can choose its own way to realize the 200 billion increase in imports from the US. Although the agreement states "that purchases will be made at market prices based on commercial considerations", an increase in imports by 50% will require intervention by the Chinese government likely leading to sizeable trade diversion away from exports from other countries.

[2] The data sources mentioned in Section 2 have been complemented by data from Chad Bown (https://www.piie.com/blogs/trade-and-investment-policy-watch/trump-has-gotten-china-lower-its-tariffs-just-toward) on China's MFN tariff cuts on 1st of May 2018, 1st of July 2018, 1st of November 2018 and 1st of January 2019. Calculations of the tariff rates in Figure 1 take the MFN tariff cuts into account.

Figure 1 – Evolution of Average Tariff Rates



Note: average tariff rates on US imports from China and Chinese imports from the US are weighted by total imports from China and total imports from the US in 2017 respectively
Source: Author's calculations based on trade data from the Trade Data Monitor and tariff data collected by the WTO secretariat.

3 TRADE EFFECTS 2018-2019 (EX POST ANALYSIS)

3.1 Changes in Imports

This section analyzes the impact of the tariff measures taken by the US and China so far on trade between the two countries. Table 2 gives an overview of the import values and corresponding percentage changes for three categories of products between 2017 and 2019, products subject to tariffs, products not subject to tariffs, and all products. In 2018 imports from China still increased relative to 2017, for tariffed as well as non-tariffed products, which seems to indicate that anticipation effects of higher tariffs played a role. However, in 2019 trade between the US and China has fallen substantially. US imports of products that were affected by tariff measures decreased by up to 13.5% while Chinese imports of tariffed products declined even stronger, namely by 25%.

In order to analyze the role of the tariff increases in the decrease of imports and to determine the importance of anticipation effects, we look at the development of total imports between the US and China over time for different categories of products in greater detail. In Figure 2 changes in imports are calculated as the percentage change compared to the same quarter in the previous year. The changes are calculated for five categories of products: products that are not at all affected by tariffs during the trade conflict and products that are affected in one of the four periods displayed in the graphs.

Table 2 – Trade between the US and China between 2017 and 2019

		US imports from China			Chinese imports from the US		
		2017	2018	2019	2017	2018	2019
Non-tariffed products	import value	10.78	12.47	13.09	42.20	47.43	41.42
	perc change	--	15.69	4.99	--	12.41	-12.68
Tariffed products	import value	507.81	542.92	469.68	107.46	106.62	79.39
	perc change	--	6.91	-13.49	--	-0.78	-25.54
All products	import value	518.59	555.39	485.89	149.66	154.06	123.72
	perc change	--	7.10	-12.51	--	2.94	-19.69

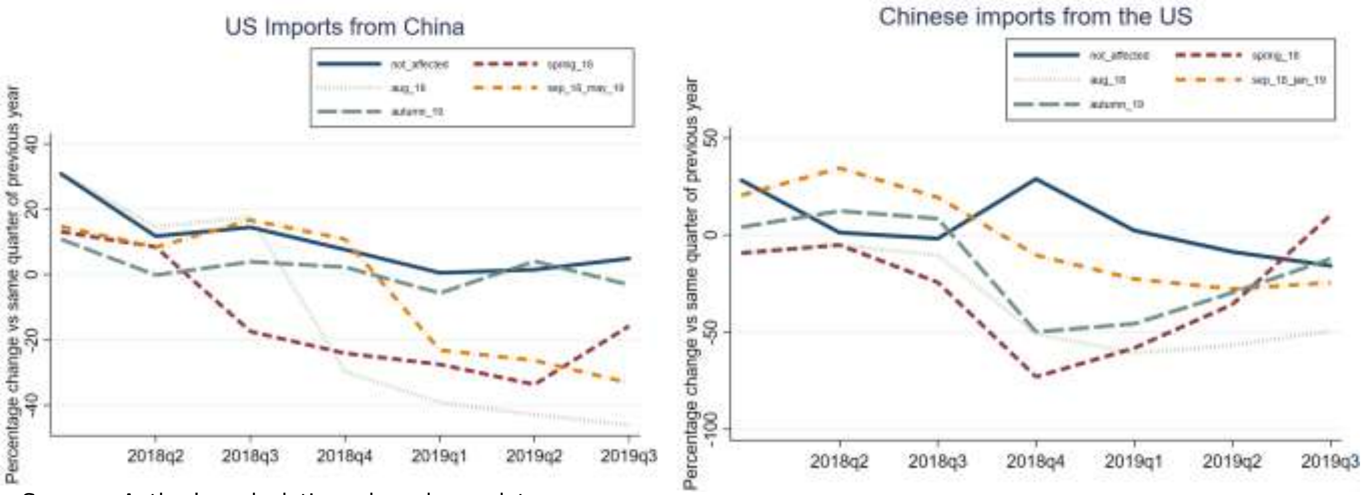
Note: Import values are in US$ billion; trade values for 2019 are rescaled by the total value in 2017 over the sum of the first three quarters of 2017 since trade data for the fourth quarter of 2019 were not available yet.
Source: Author's calculations based on data sources mentioned in section 2

The graph on the left of Figure 2 shows that imports of Chinese goods into the US that were affected by the first tariff measures in spring 2018 (red dashed line), declined strongly from the second quarter of 2018 onwards. Products affected by the tariff increases in August 2018 (grey dotted) show the same pattern with an almost immediate negative effect on imports. Considering products that faced a tariff increase in September 2018 and further increases in May 2019 (yellow dashed) show a rather delayed effect due to frontloading which means that Chinese exporters sold more in anticipation of even higher tariffs in 2019. Non-tariffed products had overall stable import patterns. Taken as a whole, the strongest effects of the additional tariffs occurred in 2019 with decreases of imports of up to 40%.

The graph on the right of Figure 2 displays the impact on Chinese imports. Effects are more difficult to disentangle compared to US imports, since products are overlapping considerably between the time periods. However, it can be noted that products affected by tariff increases in spring 2018 (red dashed) had the strongest negative decline in imports at the end of 2018 while imports of products that were not affected by tariff increases seem to have increased to compensate for declined imports of affected goods. Alternatively, the increase in imports of non-tariffed goods could be due to anticipation effects of export restrictive measures by the United States.

Overall, the analysis in Figure 2 indicates that tariff increases between the US and China have already had strong effects on bilateral trade between the two countries with the responses displaying intuitive patterns, including anticipation effects.

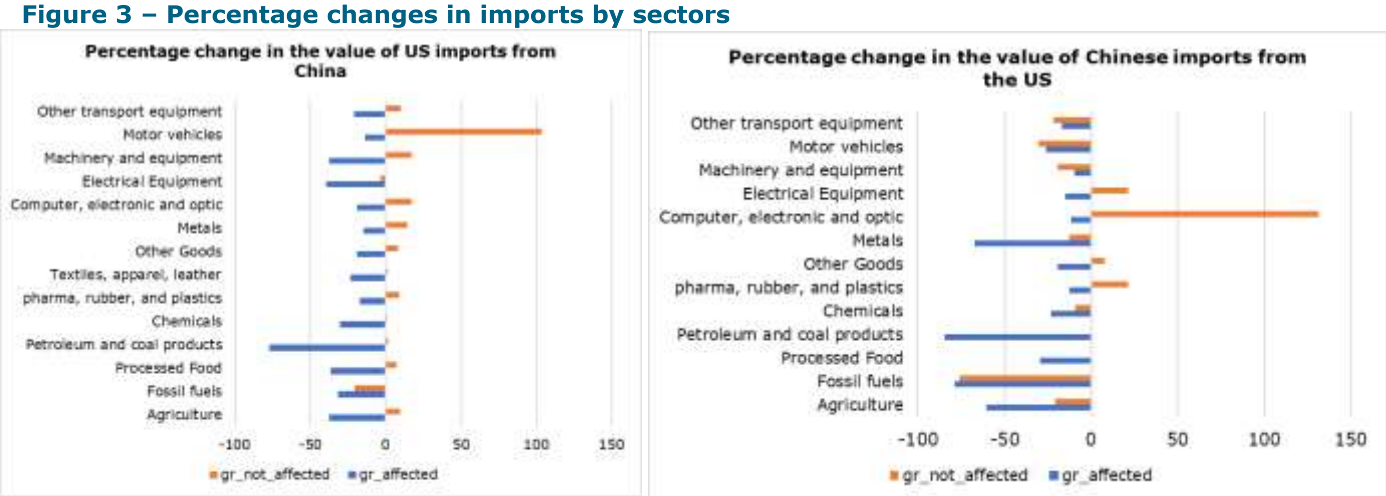
Figure 2 – Percentage changes in the value of imports



Source: Author's calculations based on data sources mentioned in section 2

Looking at economic sectors and making the broad distinction between products that were hit by a tariff measure in 2018 and non-tariffed products confirms the impact on imports described above. The left panel of Figure 3 clearly indicates that US imports of tariffed products decreased while imports of almost all non-tariffed products increased. The sector with the strongest decline is petroleum and coal products where imports decreased by up to 75%. In other sectors such as machinery, electrical equipment and agricultural products imports decreased by up to 40%.
The picture for Chinese imports (right panel Figure 3) is again more blurred because of the general slowdown of the Chinese economy. There has been an overall decrease of imports from 2018 to 2019. However, the effect on imports of tariffed products is clear: imports in all sectors have faced a negative growth rate with imports of petroleum, metals and agricultural products declining the most. Remarkable is the increase in imports of Computer, Electronic, and Optic Equipment, which can be related to the fact that Chinese companies wanted to make sure to be able to import crucial inputs in the production process before the US would take export restricting measures.

Figure 3 – Percentage changes in imports by sectors



Notes: Percentage changes are calculated as the difference in imports between the first half of 2018 and the first half of 2019; products are first aggregated by GTAP sectors, then further aggregated by 14 broad GTAP sector categories
Source: Author's calculations based on data sources mentioned in section 2

3.2 Trade Diversion

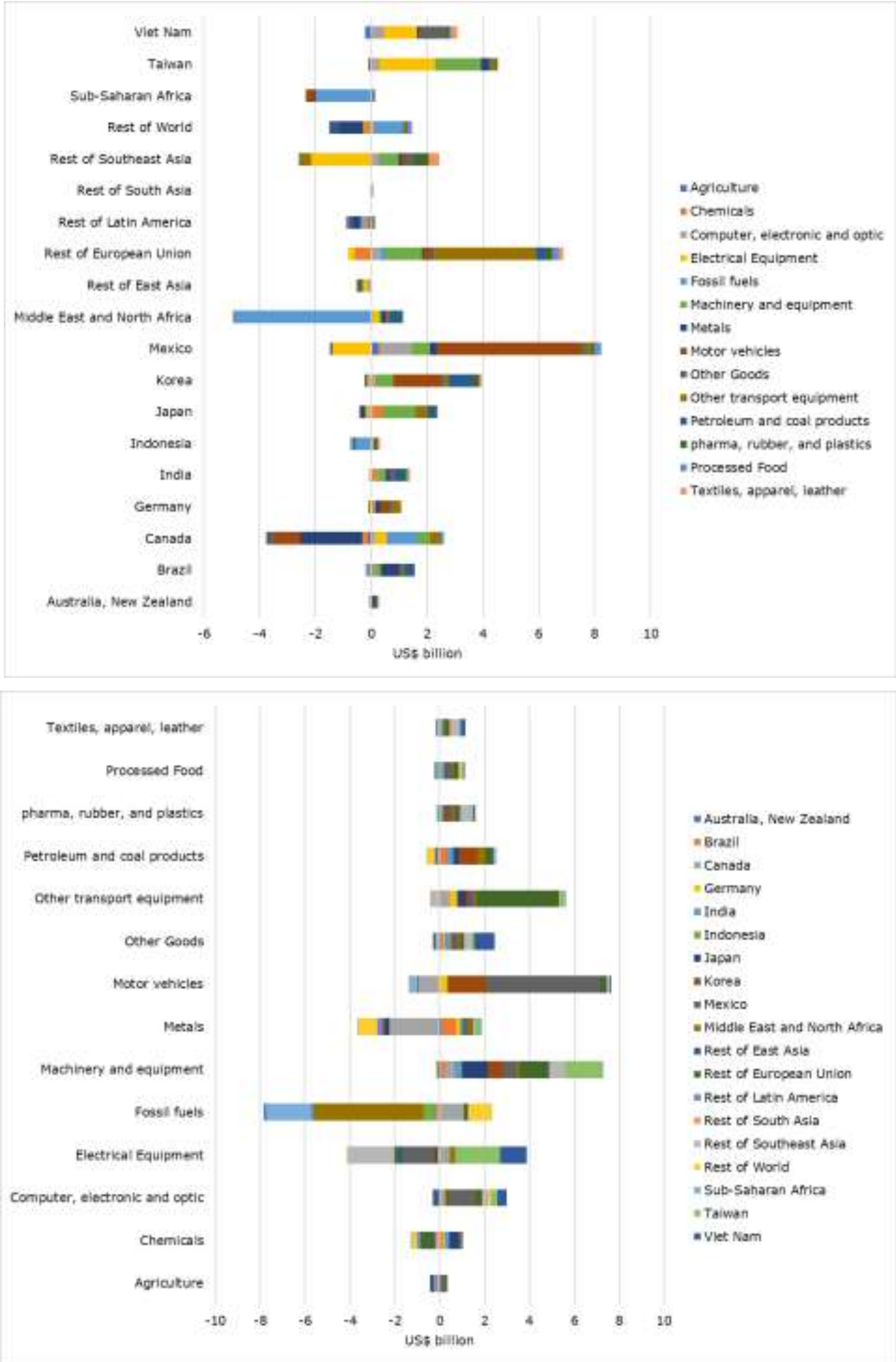
The reduction in trade between the United States and China has led to trade diversion: more trade with third countries. The analysis in this subsection aims at identifying which countries have benefitted the most from the trade tensions in terms of increased exports to the United States and China and which sectors were primarily concerned by trade diversion effects.[3] To analyze trade diversion as a result of rising tariffs, we only explore changes in imports from other countries of goods that have been affected by a tariff measure in 2018. In particular, we report the change in imports from third countries comparing the first two quarters of 2019 with the first two quarters of 2018.

Concerning the United States, diversion effects amount to around 21 billion dollars which is in line with the findings in Nicita (2019). This means that the total decrease in imports from China of 35 billion dollars, comparing the first two quarters of 2019 to the first two quarters of 2018, was compensated by an increase of imports from other countries than China of 21 billion dollars. The upper panel of Figure 4 shows that countries that increased their exports to the United States the most and thus are major beneficiaries of the trade tensions are Mexico, the European Union, Taiwan and Viet Nam. Mexico exported an additional 6.8 billion dollars to the US, mainly in the sectors motor vehicles and computers and electronic devices. The European Union, except Germany, follows with additional 6 billion stemming primarily from increased exports of transport equipment and machinery. Taiwan increased its exports to the US by 4.5 billion and Viet Nam by 2.8 billion, both with the largest part in the sectors electrical equipment and machinery.

The lower panel of Figure 4 shows how heterogenous the trade diversion effects are across sectors. As identified in the previous paragraph, the sectors in which imports from third countries increased the most are the following: motor vehicles, machinery, transport equipment and electrical equipment. The sectors machinery and electrical equipment are most hit by the trade tensions with a decrease in US imports from China of 9.3 billion and 10 billion respectively. Increased imports from third countries of about 7 billion in the sector Machinery do not fully compensate for the trade loss with the trade diversion effects split among various countries such as Taiwan, Korea, Japan and the European Union. This is also the case for the sector Electrical equipment where Taiwan and Viet Nam benefit from increased exports to the United States which is however accompanied by decreased exports from other Southeast Asian countries and Mexico. In the sector Motor vehicles, the increase of US$ 6.3 billion is mostly to the advantage of Mexico which contributes with increased exports of US$ 5 billion. This more than compensates for the decrease of US$ 1 billion imports from China. Finally, in the sector Transport equipment, the European Union is the major beneficiary and trade diverted to third countries makes up for the trade loss with China.

[3] We follow the same approach as in Nicita (2019).

Figure 4 – Trade diversion effect of US imports

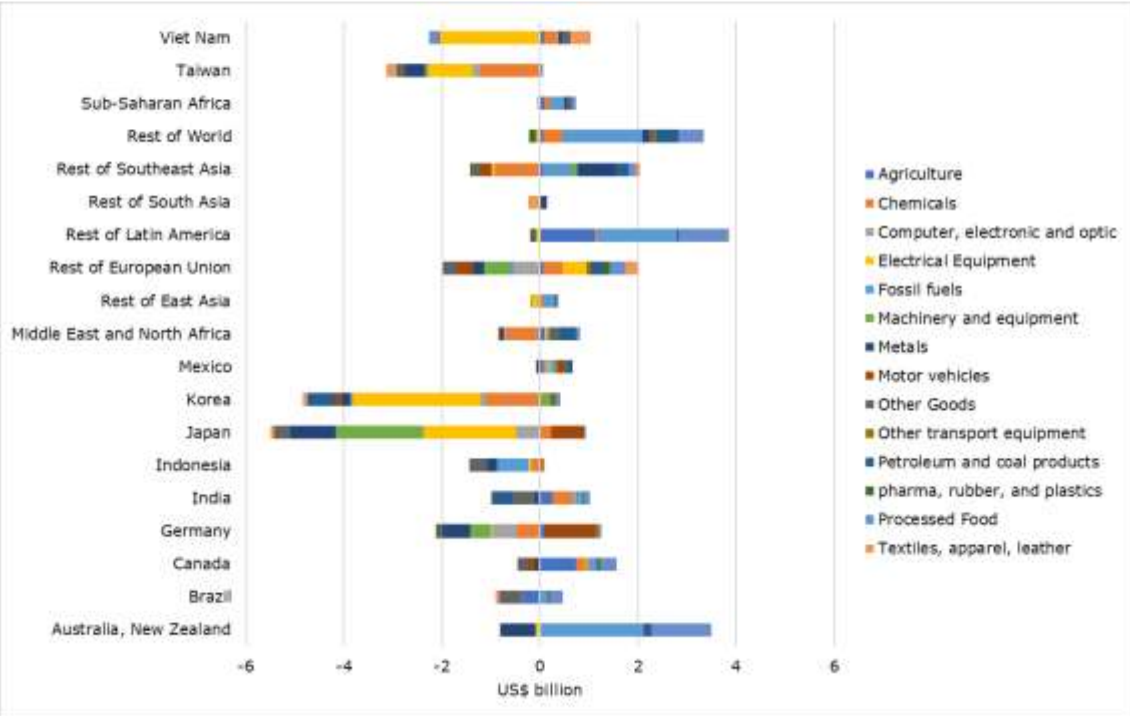


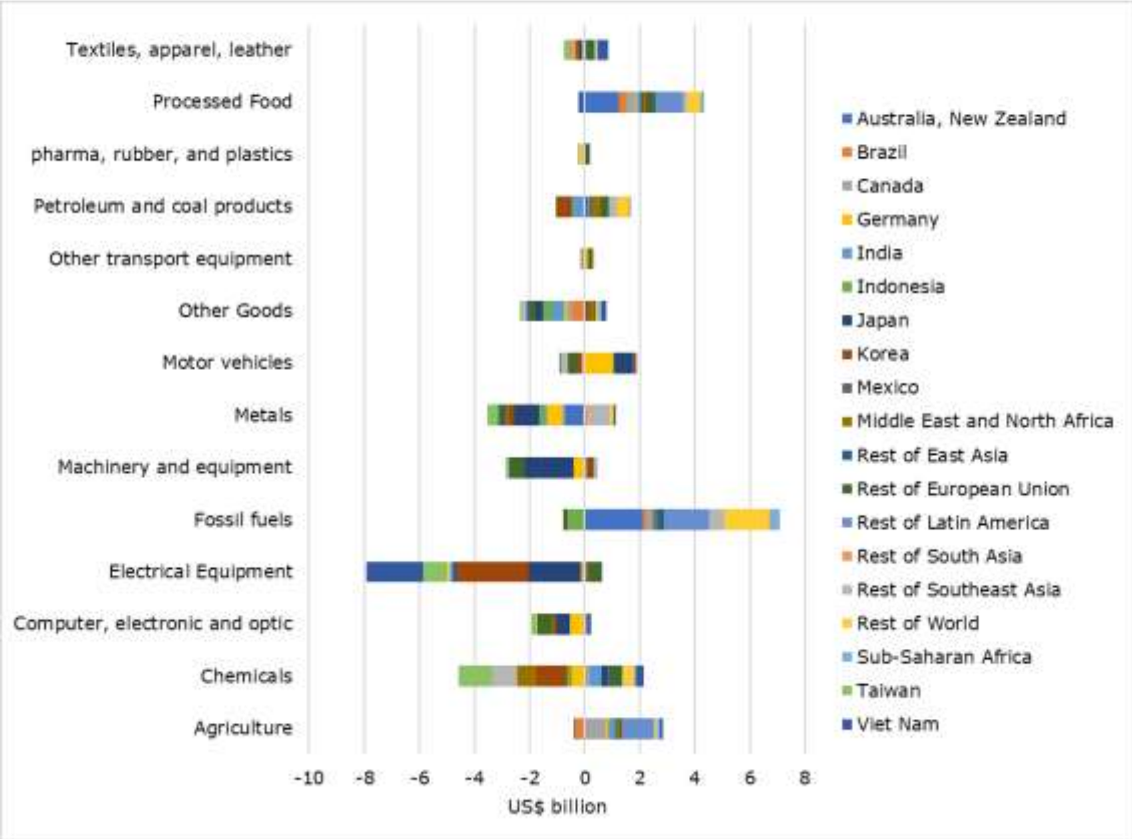
Notes: Changes in imports are calculated as the difference between the first half of 2018 and the first half of 2019 in US$ billion; products are first aggregated by GTAP sectors, then further aggregated by 14 broad GTAP sector categories; countries are grouped into 21 GTAP regions
Source: Author's calculations based on data sources mentioned in section 2

Figure 5 depicts the trade diversion patterns for China. The upper panel contains the changes by country and the lower panel the changes by sector. The patterns in China are remarkably different from the patterns in the US. The reduction in imports from the US in the first two quarters of 2019 are not countered by more imports from third countries but reinforced by a fall in imports from third countries. There are two main reasons for this pattern. First, the growth of the Chinese economy has slowed down in 2019 leading to less demand for imports. Second and more subtle, the exports from China to the US are much larger than the imports from the US into China. This implies for Chinese imports from third countries that the diversion of trade towards other sources is less important than the reduced demand of intermediates used for further processing to export to the US.

Studying the sectoral and regional patterns of changes in Chinese imports leads to three other, partially related, insights. First, four East-Asian economies, Viet Nam, Taiwan, Korea, and Japan, are exporting substantially less to China and exporting more directly to the United States (see Figure 4, upper panel). This suggests that value chains are reorganized in East Asia. Second, in the sectors agriculture, processed food, and fossil fuels more classical trade diversion is visible with more imports from regions like (rest of) Latin America, Australia and New Zealand, and Rest of the World. Third, there is a big drop in imports of electrical equipment into China mostly from Asian countries such as Japan, Korea, and Japan. This is again evidence of a reorganization of value chains with less imports of intermediates in this sector into China.

Figure 5 – Trade diversion effect of Chinese imports





Notes: Changes in imports are calculated as the difference between the first half of 2018 and the first half of 2019 in US$ billion; products are first aggregated by GTAP sectors, then further aggregated by 14 broad GTAP sector categories; countries are grouped into 21 GTAP regions
Source: Author's calculations based on data sources mentioned in section 2

3.3 Insights from the literature with ex post analyses

We now turn to the (short-term) price and welfare effects of the tariff increases on the United States analyzed in various studies based on observed changes in the data. Various publications on this come to a similar conclusion (Amiti et al., 2019a, 2019b; Fajgelbaum et al., 2019; and Cavallo et al., 2019) on the price effects in the US. Both in 2018 and 2019 there has been a complete pass-through of US tariffs to importer prices. This means that additional tariffs faced by US importers have led to proportional increases in importer prices. Hence, until 2019 Chinese exporters did not reduce their prices to (partially) compensate importers for the higher tariffs. This result appears in all four publications. Amiti et al. (2019b) confirm earlier work on this, showing complete pass-through with unit value data until 2019. Given the fact that US import demand from China did not fall in 2018 in expectation of higher tariffs in 2019, it could be that Chinese export prices will fall later.

Cavallo et al. (2019) generate two other relevant insights on price changes. First, they show that for some products higher import prices are in turn passed on to consumers in the form of higher retail prices (for example for washing machines). However, for most products preliminary data indicate that retailers absorbed the higher import prices in the form of lower profit margins. Second, Cavallo et al. (2019) find that the export prices from the US did decline in response to the retaliatory tariffs. Products affected by the tariff measures displayed declining prices since mid-2018, whereas non-affected prices displayed a flat pattern.

Flaaen and Pierce (2019) examine the impact of the higher US tariffs on manufacturing employment, disentangling three channels: rising employment because of more protection; falling employment because of higher prices of intermediate inputs making production in the US more expensive; falling employment because of retaliatory tariffs. They find that, at least in the short run, the last two negative channels are dominant, leading on net to a fall in manufacturing employment. As they observe, it might take time for the economy to adjust to the new situation and thus for the first positive channel to fully take effect. Handley et al. (2020) also focus on the value chain channel finding that exporting firms using intermediate inputs affected by higher import tariffs reduce their exports. They find more exposed products display 2 percentage point lower export growth than products not exposed.

4 BACKGROUND OF TRADE TENSIONS

At least four different reasons have been put forward in the policy discussion in the United States to motivate the tariff increases on steel and aluminium imports under Section 232 of the Trade Expansion Act and on imports from China under Section 301 of the 1974 Trade Act:

1. Manufacturing jobs should be brought back to the United States.
   As discussed for example in Goswami (2019), it is argued that tariffs on manufacturing imports could contribute to this.
2. Tariffs should be "reciprocal" at the bilateral level.
   As discussed in Griswold (2019), bilateral reciprocity of tariffs, as defined by the United States in this context, requires that tariff rates at the tariff line level imposed by the US should be at the same level as tariffs faced by the US.
3. The Bilateral trade deficit with China should be eliminated.
   As discussed for example by Pettis (2019), the gap between tariffs imposed and tariffs faced is considered an important driver of bilateral trade deficits of the US vis-à-vis various trading partners, in particular China. Raising import tariffs on imports in general and on Chinese imports in particular would help reduce the trade deficit in general and the bilateral trade deficit with China in particular.
4. China should change various policies with adverse effects.
   The following policy issues have been used to motivate the tariffs on imports from China, as discussed for example in Ciuriak (2019): the poor protection of intellectual property rights in China, forced technology transfer from foreign companies investing in China, and the heavy involvement of the Chinese government in its economy through (implicit) subsidization of state-owned companies (SOEs).

Most economists are skeptical about the first three arguments for the tariff increases. The first argument, raising tariffs to bring manufacturing jobs back to the United States could be motivated based on the work by Autor et al. (2013) who have shown empirically that rising imports from China have contributed significantly to falling manufacturing employment in the US.[4] Goswami (2019) takes the work by Autor et al. (2013) as starting point to explore to what extent higher tariffs could contribute to an increase in manufacturing employment in the US. She shows that although tariffs could have contributed to the maintenance of manufacturing jobs in the 1991-2007 period, this is not the case for the period 2010-2016. In the latter period import tariffs on Chinese goods would not have contributed to the maintenance of manufacturing jobs. The reason is that for the latter period the China-shock did not have a negative impact on US manufacturing jobs.

Furthermore, most of the reduction in the manufacturing share of employment can be explained by structural change.[5] Kehoe et al. (2018) for example find that only 15% of the reduction in the manufacturing share of employment between 1992 and 2012 can be explained with the presence of trade deficits in this period, whereas most of the decline is explained by differential productivity growth. Bekkers (2019) shows in simulations with the WTO Global Trade Model that over a 20-year period increasing tariffs by almost 60 percentage points (the global trade war scenario explored in Bekkers and Teh (2019), based upon Nicita et al., 2018) would not compensate for the decline in manufacturing in the US because of structural change. So, higher tariffs on manufacturing will raise manufacturing employment, but the decline in manufacturing employment driven by structural change more than cancels out the tariff driven increase in manufacturing employment.

Second, Griswold (2019) explains that imposing "reciprocal tariffs", i.e. equalizing the tariffs imposed by the US and those faced by the US at the tariff line level, would be at odds with the principle of MFN and would raise the administrative burden of tariff policy considerably. Bekkers and Keck (2020) examine the welfare effects of non-reciprocal tariffs. In particular, they calculate the

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[4] The work by Autor, Dorn and Hanson (2013) has been criticized for example by Feenstra et al. (2019) who claim that the loss in manufacturing jobs because of increased imports is outpaced by the gain in jobs because of rising exports.

[5] The main driver of structural change is lower productivity growth in services than in manufacturing combined with a limited scope for substitution between manufacturing and services. Lower productivity growth of services raises the price of services and with limited scope for substitution its value share in the economy will increase. The other main reason for structural change is changing preferences towards services.

welfare, trade, and terms of trade losses imposed on trading partners of countries' actual tariff rates. The analysis shows that richer countries and countries with higher initial tariffs impose larger welfare losses on their trading partners. This analysis provides support for the idea that from a welfare perspective tariffs should be lowered more by countries with higher initial tariffs (higher tariffs generate larger losses for trading partners), but also that richer countries should set lower tariffs. Despite of these findings, tariff rates varying by country of origin would be at odds with MFN and thus involve substantial administrative costs and incentives for trade deflection and the necessity of costly rules of origin.

Third, most economists contend that trade policy is not an appropriate tool to reduce trade imbalances, since these are driven by macroeconomic factors. To provide some background behind this claim, recall the macroeconomic identity that the trade balance has to be equal to the capital balance which in turn is equal to savings minus investment. So, in a country like Germany running a trade surplus, capital outflows exceed capital inflows and savings exceed investment, whereas the United States is running a trade deficit and capital inflows exceed capital outflows, and investment has to exceed savings.

Most economists argue that savings and investment are not significantly affected by policies impacting imports and exports such as tariff rates. In the standard intertemporal model of international finance (Obstfeld and Rogoff, 1995) the capital balance is determined by the difference between the world and autarky interest rates which in turn are driven by differences in productivity growth. Countries with above average income growth in earlier periods should run current account deficits, as in these countries consumption is expected to be larger than production in earlier periods. Empirics are not in line with these predictions of the standard intertemporal model. Capital is flowing from emerging countries such as China to developed countries and in particular to the United States, corresponding with a trade surplus of China and a trade deficit of the United States. Capital moves from high-growth countries to low-growth countries. The international finance literature focuses mostly on financial market imperfections in emerging countries to explain that capital flows from emerging to developed countries on net. However, tariffs and trade policy in general do not play a role in explaining the direction of international capital flows and thus also the trade balance. The empirical literature on the long-run determinants of current account imbalances corroborates this finding. Lane and Milesi-Ferretti (2012) show that current account imbalances are driven by variables like the GDP growth rate, the old-age dependency ratio, ageing speed, and foreign asset positions.

The implication for bilateral trade balances is clear. Higher US tariffs on Chinese imports will lead to less imports from China and therefore a lower bilateral trade deficit, absent countermeasures from China.[6] However, trade diversion will lead to more imports from other countries and since the aggregate trade balance is driven by macroeconomic factors, the aggregate trade deficit will not significantly change.[7]

Assessing the fourth argument for the tariff increases is beyond the scope of this paper and is not further discussed here.

5 THE ROLE OF TRADE POLICY UNCERTAINTY

5.1 Introduction

Trade growth has slowed considerably in 2019. WTO trade statistics show that trade growth has been flat in 2019 with a year-on-year growth in trade volumes of about 0.3% in the first three quarters of 2019.[8] At the same time global trade uncertainty has significantly increased since the start of the trade tensions between the US and China in 2018. Figure 6 displays the Trade Uncertainty Index from Ahir et al. (2019) put together in co-operation with the IMF for 143 countries. This measure is based on a count of how often the words "uncertainty" and "trade" (or words related to trade such as "protectionism", "tariff", or "WTO") appear together in reports of the Economist Intelligence Unit. The figure displays the index for the most relevant countries. It is clear that the

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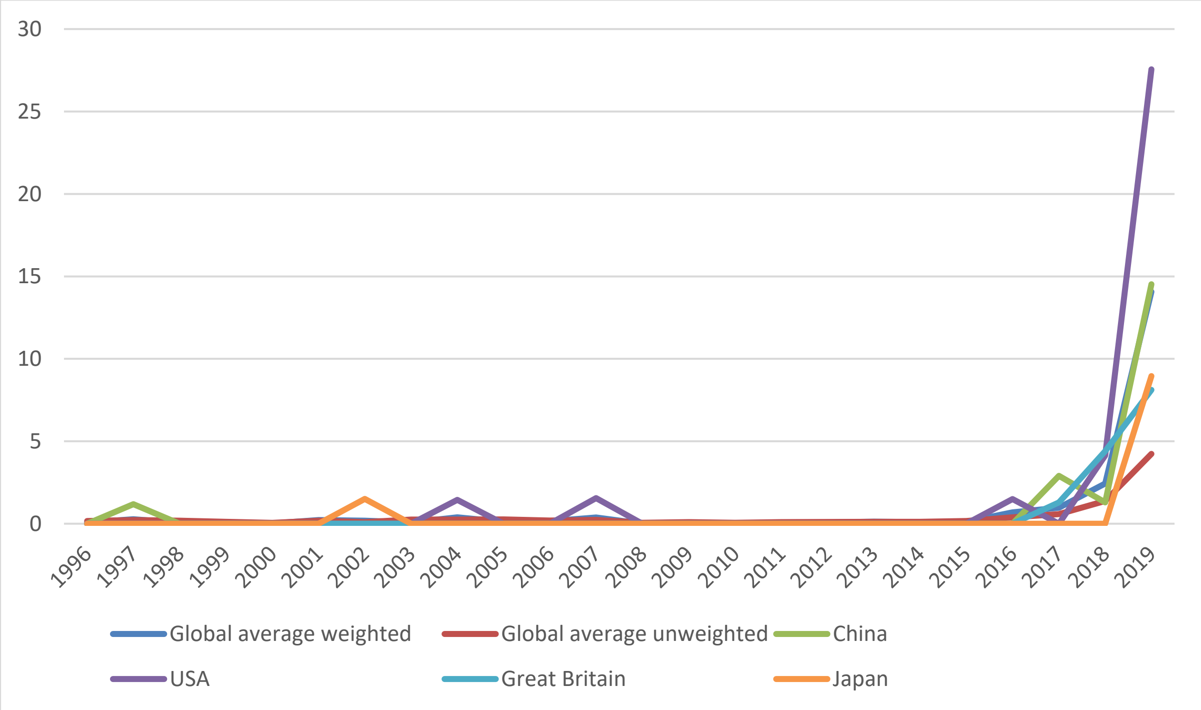
[6] Because of countermeasures by China and changes in macroeconomic conditions (strong demand in the US and a slowing down of economic growth in China), the bilateral trade deficit of the US vis-à-vis China has so far not fallen significantly.

[7] See also Obstfeld (2018) on this point.

[8] The CPB World Trade Monitor (Egbert, 2016) reports a negative trade growth for the whole 2019 of 0.3%. Differences with the WTO statistics can be explained by, among other reasons, differences in country coverage and choice of deflators.

increase in trade uncertainty as of 2018 is unprecedented since 1996, the first year for which the index is calculated. The increase in trade uncertainty is largest for the US, followed by China. The GDP weighted global average follows the same pattern as the index for China. The unweighted global average also increases since 2017, but by much less. This indicates that trade uncertainty is concentrated in the economically largest countries of the world.

Figure 6 Trade Uncertainty index from 1996 to 2019, selected countries and global average



Source: Ahir et al. (2019).

The discussion shows that trade growth decelerated significantly in 2019 relative to previous years, whereas uncertainty about trade increased to levels not seen before. The main question is then to what extent the slowdown in trade growth is caused by the trade tensions between the United States and China. In the next subsection we will discuss insights from the literature and in Subsection 5.3 conduct an empirical analysis on the relation between the trade conflict and trade uncertainty.

5.2 Insights from the literature on trade policy uncertainty

Two strands of literature can shed light on the relation between the trade conflict and trade policy uncertainty. First, there is work showing a direct effect of trade policy uncertainty on trade through its impact on the decision to start exporting. More uncertainty about trade policy implies that companies will wait to pay the sunk costs necessary to start trading across borders. Handley and Limao (2017) have estimated the boost to exports from China to the United States after accession of China to the US because of the reduction in uncertainty about possible US tariffs for Chinese exporters. They argue that one-third of the increase in exports from China to the US since the entry of China to the WTO can be related to reduced uncertainty about trade policy. Their methodology has not been applied to the current trade tensions because of lack of information on the probability of different trade policy scenarios.

Second, uncertainty about trade policy affects investment decisions of companies. Krugman (2019) explains this very clearly with an example of two companies producing in an exporting and an import-competing sector. If it were 100% certain that the tariffs stay in place, the producer in the import-competing sector could raise investments and if it were sure there would be an agreement about the reduction of tariffs to pre-trade conflict levels, the producer in the exporting sector could raise investments. If it is uncertain what will happen, companies in both sectors will wait with investing.

Researchers at the American central bank, the FED, have attempted to quantify the impact of uncertainty about trade policy on investment and their main finding is that so far trade policy uncertainty (TPU) has reduced investment in the US by 1% to 2% (Caldara et al., 2019). They measure TPU in three different ways based on: (i) earnings calls of publicly listed companies in which TPU is mentioned; (ii) historical newspaper reports of TPU; (iii) historical volatility in tariffs. Using variation across sectors in the earnings calls of firms and investment they have come up with a reduction of about 1% of investment driven by TPU. A VAR analysis based on historical volatility comes to 1% to 2%.[9] This effect is corroborated by the Survey of Business Uncertainty (SBU) conducted by Altig et al.(2019), who have asked firms directly how much the tariff hikes and trade policy tensions have affected capital expenditures. Based on their survey-method, they estimate a reduction of investment in the private sector of 1.2%.

Davis (2019) explains why the trade policy uncertainty had a much larger impact on the stock market than on investment itself, observing for example that the S&P 500 fell by 2.5% on March 22, 2018, the day the US announced higher tariffs on 50 billion dollars of Chinese imports. Many companies listed on the stock market have substantial commercial interests outside of the US which were also heavily affected by the new tariffs and the uncertainty surrounding it. Furthermore, the survey methodology might not be able to capture indirect effects of TPU on domestic investment. This indicates that the 1.2% reduction in investment estimated by Altig et al.(2019) and the 1%-2% reduction estimated by Caldara et al.(2019) can be treated as a lower bound on the investment effects of TPU.

5.3 Analyzing the determinants of the Trade Uncertainty Index

In this section we study the determinants of the Trade Uncertainty Index more formally, focusing on the role of the trade conflict between the US and China. We regress the Trade Uncertainty Index on a country's share of foreign value added in trade between the US and China interacted with a dummy for the US-China trade conflict. The US-China dummy is equal to one from 2018 for all regions. The foreign value-added variable is interacted with the US-China dummy, because dependence on US-China trade is expected to have an impact form the start of the trade conflict between the US and China.

To capture the general impact of Brexit and the US-China trade conflict, we also include a general dummy variable for the occurrence of Brexit and the US-China trade conflict. The Brexit dummy is equal to one from 2016 only for the EU countries. Furthermore, the share exported to the US from all countries and the share exported to Great-Britain from EU-countries (interacted respectively with the Brexit and US-China dummies) are included to explore the impact of trade relations with the US and with Great Britain (in the EU) on the Trade Uncertainty Index. Since we cannot measure foreign value added of China and the US in trade between the US and China, we exclude these two countries from the analysis. The same holds for Great Britain.

Table 3 displays the results of the regression analysis. The first column shows, as expected, that trade uncertainty has increased in the EU countries since 2016 and that trade uncertainty has increased for all regions since 2018, because both the dummy for Brexit and the dummy for the US-China trade conflict are significantly different from zero. Columns two and three show, as expected, that a larger share of foreign value added in trade between the EU and Great Britain lead to a bigger increase in trade uncertainty from 2016. However, when controlling for the export share to the US/China and Great Britain in columns four and five, the effect of the share of foreign value added in trade between the EU and Great Britain becomes insignificant.

[9] The empirical analysis has been fed into a two country DSGE model by the researchers.

Table 3 Regression table on the determinants of the Trade Uncertainty Index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dummy Brexit	0.405**	-0.0205	-0.237	-0.131	-0.0840	-0.120	-0.0464
	(3.26)	(-0.15)	(-1.62)	(-1.00)	(-0.56)	(-0.91)	(-0.31)
Dummy USA/CHN conflict	2.552***	2.792***	2.758***	1.826***	1.857***	1.930***	2.025***
	(15.25)	(16.26)	(15.56)	(9.17)	(9.27)	(8.78)	(9.13)
FVA in GDP * dummy Brexit		148.1***		15.70		13.21	
		(7.53)		(0.57)		(0.48)	
FVA in GDP * dummy USA/CHN conflict		-65.37***		-86.88***		-82.49***	
		(-4.92)		(-6.38)		(-5.82)	
FVA in total exp * dummy Brexit			102.2***		-6.068		-13.22
			(7.96)		(-0.27)		(-0.58)
FVA in total exp * dummy USA/CHN conflict			-26.46**		-53.12***		-49.83***
			(-3.14)		(-5.97)		(-5.48)
Share of exp to GBR * dummy Brexit				35.29***	37.87***	35.01***	38.40***
				(8.20)	(7.04)	(8.12)	(7.13)
Share of exp to USA * dummy USA/CHN conflict				7.381***	7.838***	7.185***	7.493***
				(8.57)	(8.69)	(8.17)	(8.12)
Share of exp to CHN * dummy USA/CHN conflict						-1.489	-2.353
						(-1.11)	(-1.76)
Constant	0.179***	0.179***	0.179***	0.179***	0.179***	0.179***	0.179***
	(4.79)	(4.86)	(4.86)	(4.99)	(4.98)	(4.99)	(4.99)
Observations	2592	2592	2592	2592	2592	2592	2592
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of countries	108	108	108	108	108	108	108

Notes: FVA stands for foreign value added to goods traded between either GBR and the EU or CHN and the USA (depending on the dummy it is interacted with), FVA is divided either by GDP or total exports;
t statistics in parentheses: * p<0.05 ** p<0.01 *** p<0.001

Contrary to what is expected the sign for foreign value added in trade between China and the US interacted with the US-China dummy is negative and significant, both in columns two and three and in columns four and five (controlling for the share exported to the US/China and Great Britain). Hence, we do not find support for the hypothesis that countries more dependent on trade between the US and China, as measured by their value-added share in trade between these two countries, display bigger increases in trade uncertainty.

Columns four and five show that direct dependence on trade with Great Britain or the US does have a significant impact on trade uncertainty. A higher export share to the US and a higher export share to Great Britain both have a highly significant positive impact on trade uncertainty. The export share to China instead does not have a significant impact on trade uncertainty (columns six and seven).

Altogether the empirical analysis suggests that trade uncertainty is driven by direct trade relations with the US and Great Britain and by a general trend to increased trade uncertainty.

As a robustness check, we include the share of foreign value added in trade between the US and China in two separate variables, namely foreign value added to exports from the US to China and foreign value added to exports from China to the US. The signs and significance of those variables confirm the previous results. Foreign value added in exports from China to the US and from the US to China have a negative impact on Trade Uncertainty, whereas a larger export share to the US does raise Trade Uncertainty. The regression results can be found in Table A.1 in the Annex.

5.4 Concluding remarks

The analysis in this section shows that there has been both a general increase in trade uncertainty for all countries regardless of how much they trade with the US and a specific increase for countries trading more with the US. For the construction of the trade policy uncertainty scenarios in the next section, this suggests that a scenario in which market participants expect both an increase in trade costs between all trading partners and an additional increase in trade costs for trade with the US seems most realistic (TPU high scenario). If we want to be prudent, a scenario can be developed in which there is no increase in trade costs between all trading partners and only vis-à-vis the United States (TPU low scenario).

6 PROJECTED MEDIUM-RUN IMPACT OF TRADE TENSIONS: SIMULATIONS WITH THE WTO GLOBAL TRADE MODEL (EX ANTE ANALYSIS)

6.1 Introduction: methodology

We employ the WTO Global Trade Model to project the medium-run effects of the tariff increases by the United States and China, also taking into account the possible effects through trade policy uncertainty (TPU).[10] This exercise entails the construction of a baseline, a business as usual scenario, and a set of policy experiments. The baseline projects how the global economy would develop without tariff increases based on demographic and macroeconomic projections following the same approach as in earlier studies on the effects of a global trade conflict (Bekkers and Teh, 2019).

The WTO Global Trade Model (GTM) is a recursive dynamic CGE model, based on the static version of the GTAP model (Corong et al, 2017). The model contains multiple sectors and factors of production, four types of demand (private demand, government demand, investment demand, and intermediate demand by firms), intermediate linkages, non-homothetic preferences for private households, various types of taxes, and a global transport sector. In each region there is a representative agent spending her income (the sum of factor income and tax revenues) on private consumption, government consumption, and savings based on utility maximization. Firms choose the optimal combination of factor inputs and intermediate inputs based on profit maximization. National savings are collected by a global trust and allocated to investment in different regions such that changes in rates of return are equalized.

The GTM extends the GTAP model in a number of ways. First, it contains multiple periods, accounting for endogenous capital accumulation based on recursive dynamics. This means that the capital stock in a certain period is equal to the capital stock in the previous period plus investment minus deprecation. The trade structure in the model is flexible, based on Bekkers and Francois (2018), allowing the modeller to switch between a (perfect competition) Armington structure and (monopolistic competition) Ethier-Krugman or Melitz structures. The simulations in the current paper employ the Melitz firm heterogeneity version of model, thus enabling us to model trade policy uncertainty.

Baseline data from the latest version of the GTAP Data Base (GTAP10 in 2014), aggregated to 12 regions, 9 sectors, and 5 factors of production, are projected to 2023 based on IMF data on per capita GDP growth, population growth, and labour force growth. Additionally, the model incorporates changes in preferences and differential productivity growth to account for structural change, following the approach in Bekkers and Teh (2019).

[10] The Global Trade Model is a standard quantitative trade model and a non-technical description can be found in the appendix to this note drawing on earlier publications such as the World Trade Report 2018.

6.2 Four policy experiments

Four policy experiments will be conducted:

1. Trade conflict
   Tariff increases between the US and China since 2018 absent the Phase One Agreement of January 15, 2020: Section 232 and 301 tariff increases and response by China.[11] Only the actual tariff increases implemented will be taken into account.
2. Trade conflict with escalation
   Tariff increases between the US and China since 2018 absent the Phase One Agreement but including the announced escalation. In September 2019 the US announced that additional tariffs would be increased from 25% to 30% on tariff packages implemented before September 2019. Furthermore, additional tariffs were announced for December 15 on 160 billion of imports, mostly consumer goods.
3. Trade conflict with Phase One Agreement
   Tariff increases between the US and China since 2018 including the commitments in the Phase One Agreement between the US and China:
   - Additional tariffs on 130 billion introduced on the 1st of September 2019 are reduced to 7.5% instead of 15%.
   - China raises imports for various goods and services by 200 billion in total over two years relative to the initial level in 2017, corresponding with an average increase of 100 billion annually.
4. Trade conflict with effect of trade policy uncertainty (TPU low and TPU high)
   Tariff increases between the US and China since 2018 as under (1) plus the impact through uncertainty about trade policy.

6.3 Phase One Agreement

Besides the components of the Phase One Agreement mentioned under the third policy experiment in the previous subsection, the agreement also contains provisions on other topics such as the strengthening of intellectual property right protection in China, restrictions on currency manipulation, and access for financial services (China and USA Governments, 2020). However, most observers argue that the commitments in this field do not constitute a significant change relative to existing policies of China (Wolf, 2020). Only changes in the field of agricultural policy and financial services could lead to significant changes in non-tariff measures (NTMs). However, it is difficult to determine the quantitative importance of these commitments without further details. Moreover, as argued below the commitment by China to buy additional amounts of agricultural goods and (financial) services will have similar effects on the US economy as a reduction in NTMs. Only the impact on the Chinese economy would differ.

Besides the reduction of the tariff increases on the September 1 package from 15% to 7.5%, the US also cancelled the announced additional tariffs on 160 billion of imports, initially planned for December 15. Furthermore, an increase in additional tariff rates on earlier packages from 25% to 30% was not implemented. To show the impact of the cancellation of these announced tariff increases, we include a separate second scenario, Trade Conflict with Escalation. The scenario shows what would have happened if these further tariff increases would have been implemented.

The increase in imports from the US that the Chinese government has committed to in the Phase One Agreement is sizeable. Relative to the pre-trade conflict level of 2017, imports should increase by 200 billion over two years (32 in agriculture, 52 in energy, 78 in manufacturing, and 38 in services). This increase of 100 billion on average per year constitutes an almost 50% increase compared to the pre-trade conflict imports of about 210 billion in 2017. (153 billion of merchandise imports and 57 billion of services exports from the US to China, based on WTO data).[12]

China has not committed to a reduction of its additional tariffs on US imports and can choose its own way to realize the 200 billion increase in imports from the US. Although the agreement states "that purchases will be made at market prices based on commercial considerations", an increase in imports by 50% will require some type of intervention by the Chinese government likely leading to

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[11] Many thanks to Edvinas Drevinskas, Adelina Mendoza and Dayong Yu for help with preparation of the data on tariff increases.

[12] See data.wto.org.

sizeable trade diversion away from exports from other countries. There are three ways in which the additional purchases could be modelled.

1. There could be a reduction in Chinese tariffs on American imports to stimulate imports from the US. To target the announced additional purchases, it could be necessary that the tariffs would become negative and would thus turn into a subsidy on imports of American goods. This policy would drive a wedge between the price of American exports and Chinese exports and lead to lower prices of Chinese imports from the US and higher prices of American exports to the US.
2. There could be some type of obligation for Chinese importers to buy more American goods. This will drive up demand for American goods and thus lead to higher prices of American goods. Since the Chinese government would not provide subsidies to Chinese buyers in this case, this will also lead to higher prices for Chinese importers. Since the Chinese government would request its companies to buy more American goods in this case, this may lead to an increase in average prices of Chinese imports. The reason is that Chinese companies will have to buy more American goods than what is economically optimal, thus raising average prices. Modelling this option would require a disequilibrium approach in which the marginal rates of substitution between imports from the US and imports from other regions would not be equal anymore to the price ratio of imports from the two sources.
3. There could also be an increase in Chinese imports from the United States with a neutral impact on Chinese import prices. Employing the Twist-parameter approach of Dixon and Rimmer (2002), there is a cost neutral increase in demand for imports from the US because of shifting preferences. Cost neutral means that the average price of imports would not change.

Since it is unclear which of the first two options (or which mix of the two) is chosen and the first two options have an opposite impact on the import price in China and all three options have a similar impact on the price of American exports, we modelled the additional purchases with the third option. When presenting the results, we will discuss the repercussions for Chinese import prices of alternative modelling choices. We will then also discuss that the announced reduction of NTMs in agriculture could lead to lower prices of Chinese imports, because they would reduce trade costs.

6.4 Modelling the increase in trade policy uncertainty

To model the impact of rising TPU we incorporate a simplified version of the Melitz-style firm heterogeneity model used by Handley and Limao (2017) and employed by these scholars to study the impact of reduced TPU for China in exporting to the US after China became member of the WTO. In their framework falling uncertainty about trade policy makes it more profitable for firms to invest in the fixed costs to enter a foreign market. We follow the theoretical framework of Handley and Limao (2017) with one modification. We model rising uncertainty about trade policy through an increase in fixed export costs because of a rise in the discount rate.[13] The motivation is that higher uncertainty leads to a higher cost of capital and thus to a higher discount rate.

Instead of using a dynamic theoretical framework with the option value of waiting to enter an export market rising with heightened uncertainty, we model rising uncertainty about trade policy theoretically through an increase in fixed export costs because of a rise in the discount rate. The modelling framework is also employed in Bekkers and Teh (2020) and presented in detail in Appendix B. The approach leads to similar outcomes as the option value approach in Handley and Limao (2017), as further discussed in Appendix B.[14] Decisive for the outcomes of counterfactual experiments is how the experiments are quantitatively implemented. To project the effects of rising trade policy uncertainty in the current trade tensions, three inputs are required: the probability that tariffs increase further, the level of tariffs if they would increase further, and the economic costs of uncertainty about further rising tariffs. We will discuss each of these inputs now in turn.

In our simulations the third ingredient, the economic cost of uncertainty, is based on calculating the trade cost equivalent of the negative effect of water in the tariffs as estimated by Osnago et al. (2018). The first two inputs are more difficult to obtain and thus make projections about the impact

[13] In the Melitz firm heterogeneity model sunk export costs can be converted into fixed export costs by multiplying by the discount rate.

[14] In this respect it is relevant to observe that the counterfactual exercises in Handley and Limao (2017) are also comparative static in nature (comparing a baseline and counterfactual static equilibrium outcome) although based on a dynamic theoretical framework.

of TPU complicated: it is unknown what probability exporters and investors assign to potential further tariff increases and which higher tariff scenario they envisage.

To gauge the probability of further tariff increases we employ the Trade Uncertainty Index discussed in Section 5. We map the global change in trade uncertainty before and after 2018 into the change in the probability that tariffs will increase based on the average share of trade on which tariffs are increased before 2018 using water in the tariffs and after 2018 using both the water in the tariffs and raising tariffs without respecting bound WTO tariffs.

Countries have raised tariffs on average in 2.2% of the tariff lines (Jakubik and Piermartini, 2019), whereas after 2018 tariffs were still raised in 2.2% of the tariff lines and on top for 3.7% of global trade. This constitutes an increase of 168%. The global Trade Uncertainty Index has increased by a factor of 76.4, implying that the ratio of the increase in the Trade Uncertainty Index to the increase in the probability of a tariff increase is equal to 44.6. This ratio is then used to map country-level increases in the trade uncertainty indicator into increases in the probability of tariff increases.

Since we do not know which tariff increase market participants expect, we work with two scenarios for expected further tariff increases:

a. Low and concentrated TPU
   Under this scenario uncertainty would be limited to tariffs between the US and its trading partners. In particular, tariffs between the US and China would be expected to increase to 40%, tariffs on cars would increase to 25% between the US and all its trading partners, and tariffs on other goods would increase to 10% between the US and its trading partners.
b. High and spread TPU
   Under this scenario uncertainty would be extended to tariffs between all countries, although it would still be higher for trade between the US and its trading partners. In particular, tariffs would rise to 60% for trade between the US and China, to 25% for trade between the US and other trading partners and to 10% for all other international trade.

The main advantage of the Phase One Agreement could be a reduction in uncertainty about trade policy. However, it is not clear so far by how much trade policy uncertainty will fall as a result of the Phase One Agreement between the US and China. Important in this respect is also that our empirical work in Section 5 on the determinants of the Trade Uncertainty Index shows that this index does not rise with the share of foreign value added in trade between the US and China, but merely with the share of exports to the United States. The truce between the US and China does not necessarily ease the trade tensions between the US and other trading partners, such as the European Union. Therefore, we do not assume a fall in TPU as a result of the Phase One Agreement.

Table 4 Trade weighted averages of fixed cost equivalent and ad valorem equivalent trade cost increases because of increased trade policy uncertainty

Region	Average per exporter				Average per importer			
	AVE TPU low	AVE TPU high	FCE TPU low	FCE TPU high	AVE TPU low	AVE TPU high	FCE TPU low	FCE TPU high
ASEAN	0.1	0.3	0.7	2.1	0.1	0.2	0.4	1.3
China	2.1	3.9	19.4	48.7	1.3	2.7	10.1	23.9
EU28	1.2	3.0	9.3	33.7	0.5	1.8	4.0	21.3
India	0.7	1.7	3.6	10.2	0.1	0.4	0.3	2.3
Japan	3.0	3.9	26.4	43.7	0.8	2.6	5.3	19.3
Latin America	0.9	1.6	4.5	8.3	0.6	1.2	2.9	6.4
Middle East	0.2	0.5	1.4	4.0	0.2	0.5	1.1	3.0
Other Asia	0.2	0.3	0.9	2.0	0.1	0.3	0.5	1.8
Sub Sah. Africa	0.2	0.7	1.3	3.5	0.1	0.3	0.5	1.5
USA	6.1	13.8	42.6	138.0	7.7	14.5	61.3	159.9
Other developed	1.2	2.2	7.5	14.5	1.2	2.1	6.8	12.9
Rest of World	0.2	0.7	1.0	3.9	0.1	0.4	0.5	2.6
Global average	**1.5**	**3.1**	**11.1**	**32.1**	**1.5**	**3.1**	**11.1**	**32.1**

Source: Own calculations based upon Trade Uncertainty Indicators, Osnago et al. (2018) and Jakubik and Piermartini (2019)

Table 4 displays the average increase in fixed exports costs and the equivalent increase in iceberg trade costs in the two TPU scenarios. The table makes clear that the average global trade cost increase is relatively limited ranging between 1.5% and 3.1%. However, the effect is concentrated in the US with average increases in trade costs between 6.1% and 13.1%.

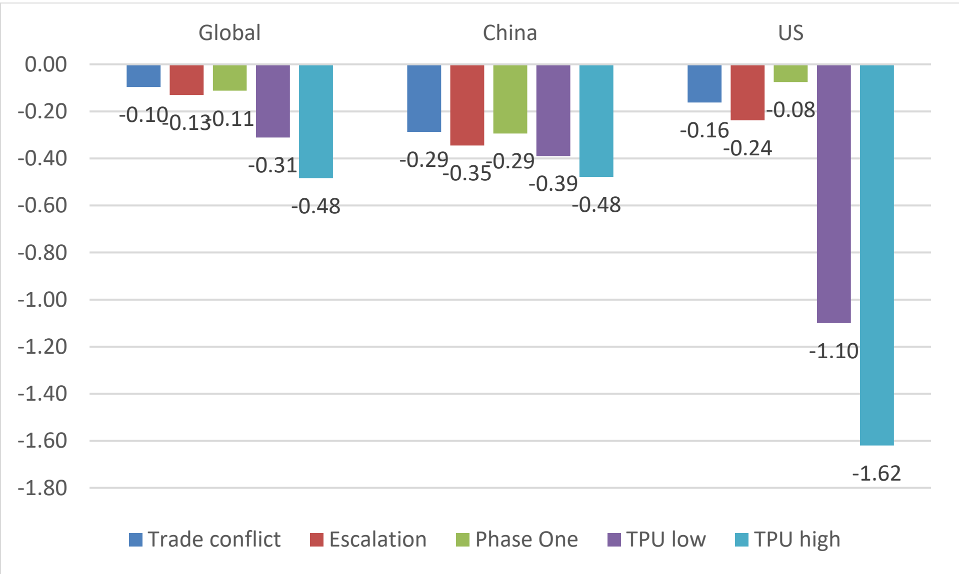
The increase in fixed costs has been converted into ad valorem equivalents to be able to compare the shock with other trade costs shocks. Reporting the fixed cost equivalent is useful, because it enables calculation of the implied increase in interest rate spreads. Assuming for example that the initial spread on investing in the fixed costs to export from the United States was 200 basis points, the increase of 42.6% respectively 138% in fixed export costs in the US in the TPU low respectively TPU high scenario corresponds with an increase of 85 respectively 276 basis points.

6.5 Results of simulation exercise

6.5.1 Macroeconomic Impact

Figure 7 displays the projected medium-run percentage changes in real GDP under the four scenarios, Trade Conflict, Escalation, Phase One Agreement and TPU (High and Low), in the US, China and globally (by 2023). The difference between the projected global GDP loss in the Trade Conflict Scenario (blue bar), the counterfactual Escalation Scenario (red bar) and the Phase One Scenario (green bar) is very small. The GDP losses under the Phase One Agreement are considerably smaller for the US under the Phase One Scenario than under the Escalation Scenario, suggesting that the US is better off with the agreement than with further escalation. The projected impact through trade policy uncertainty instead is large, especially for the United States. The reason is that most uncertainty about trade policy is concentrated in the US and its trading partners. Because the Trade Uncertainty Index in China has increased much less, the impact on the Chinese economy is also smaller in the trade policy uncertainty scenarios. As mentioned before, it is so far unclear by how much trade uncertainty has fallen because of the Phase One Agreement between the US and China.

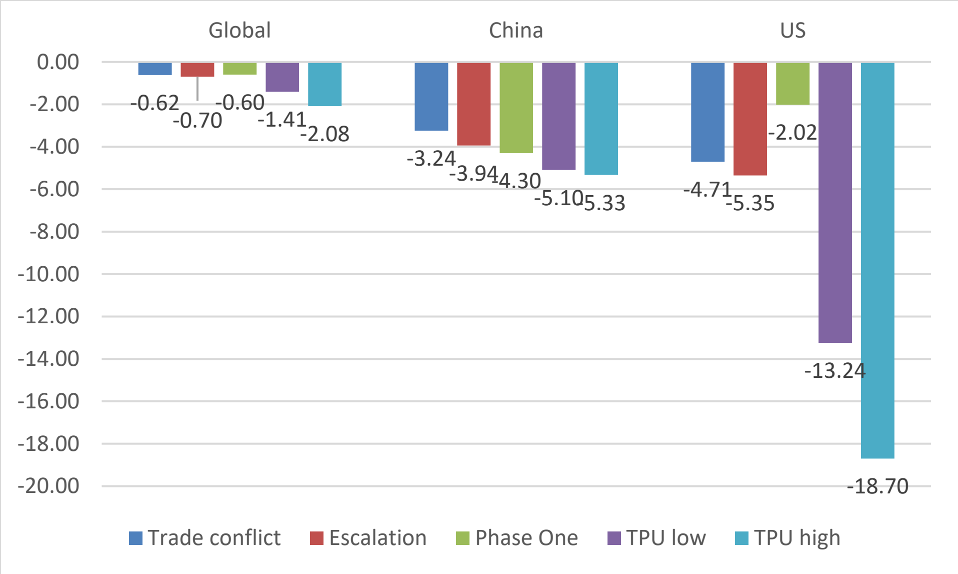
Figure 7 - Per cent change real GDP by 2023 under different scenarios



Source: Simulations with WTO Global Trade Model.

Figure 8 shows the projected per cent change in real exports under the four scenarios. Like for GDP, the negative impact of trade policy uncertainty on real exports is much larger, in particular for the US.

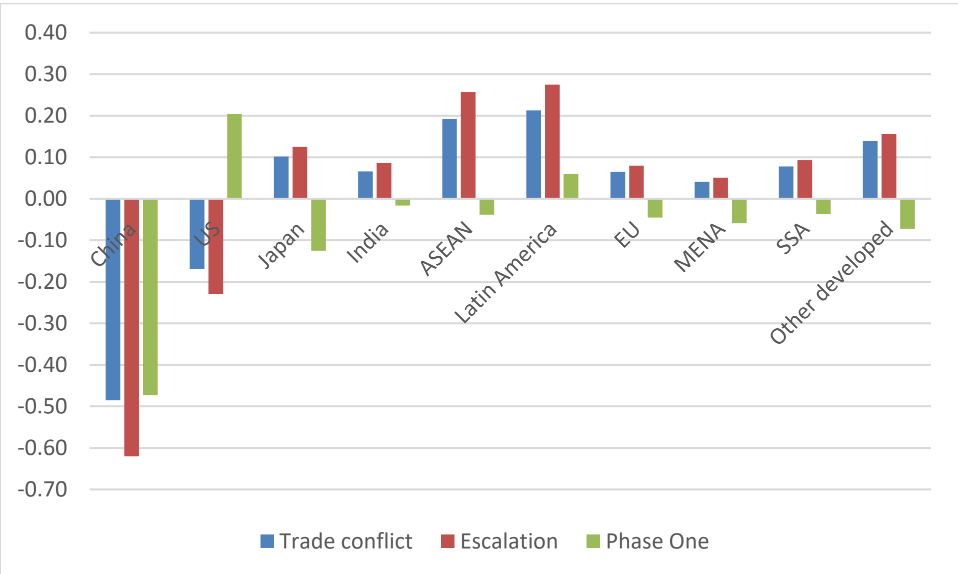
Figure 8 - Per cent change real exports by 2023 under different scenarios



Source: Simulations with WTO Global Trade Model.

To further shed light on the economic impact of the Phase One Agreement, we look at the effect on real income (defined as nominal income divided by the average price level) of the three scenarios (excluding trade policy uncertainty). Figure 9 shows a remarkable difference in real income effect for the US and third countries. Whereas under both the Trade Conflict and Escalation Scenario the US would lose and third countries would gain in terms of real income, under the Phase One Scenario the impact would be reversed with the US actually gaining and most third countries losing. The reason is that there is a sizeable increase in the demand for US exports away from third country exports in the Phase One Scenario leading to terms of trade improvements for the US and terms of trade losses for third countries. In our simulations the impact on China in the Escalation and Phase One Scenarios are similar. However, as discussed in the previous Section, depending on the way China implements the commitments to raise its imports from the US, there will either be an increase in import prices or a higher fiscal burden to finance the additional imports, which will most likely aggravate the welfare losses in the Phase One Scenario.

Figure 9 – Change in real income in different regions



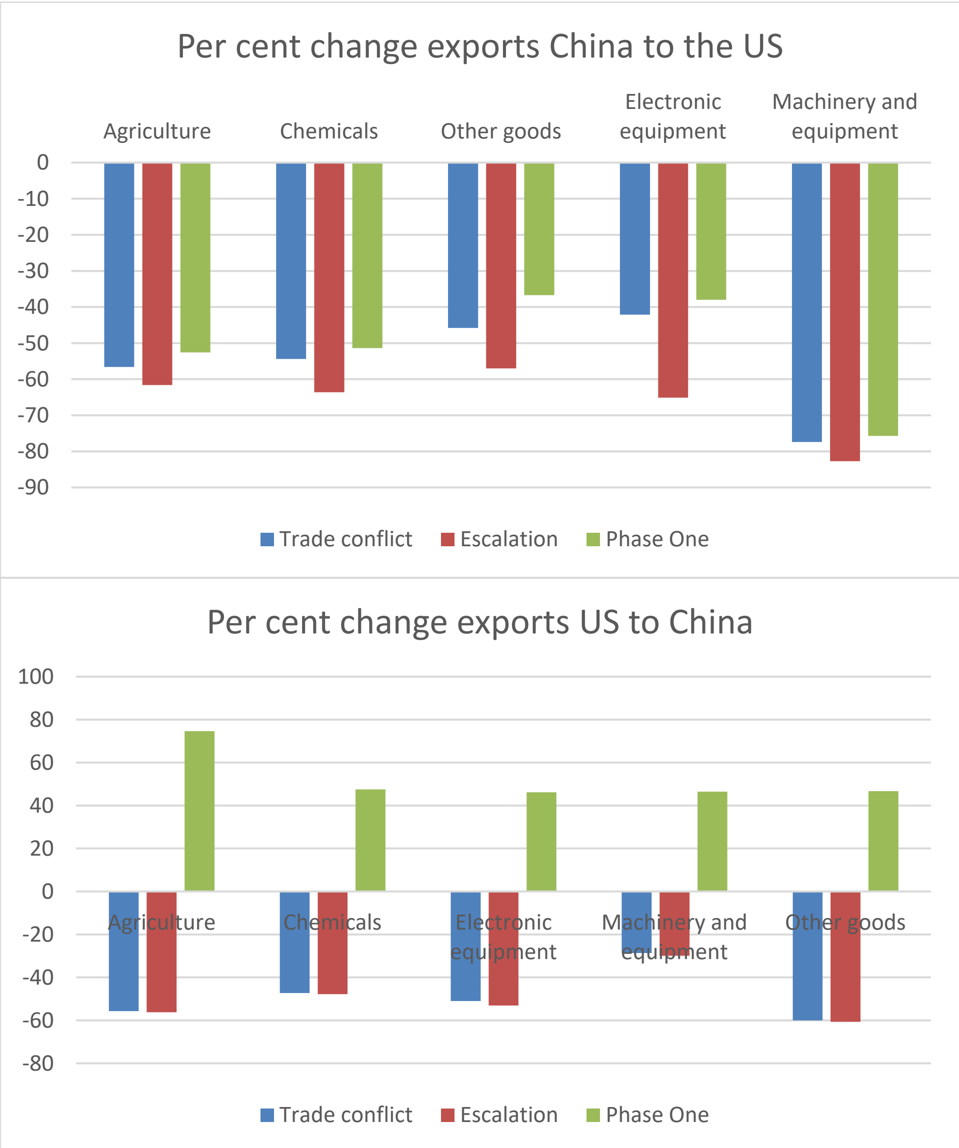
Source: Simulations with WTO Global Trade Model.

Not displayed in the figure is that in the two trade policy uncertainty scenarios (TPU High and TPU Low) some regions are projected to lose considerably (the EU, Japan and Other developed regions), whereas other regions would expand their GDP. The reason for this distinction between developed and developing economies is that the Trade Uncertainty Index rises much more in developed economies.

6.5.2 Impact on trade patterns

To shed further light on changes in trade patterns, we examine changes in bilateral trade patterns. Figure 10 shows the change in bilateral exports between the US and China. Bilateral exports from China to the US are projected to fall drastically in the different sectors, for example by more than 60% in electronic equipment and more than 80% in machinery equipment. This is also the case under the Phase One Scenario. So, the reduction in the tariff increase agreed on in the Phase One Agreement is insufficient to limit the fall in exports from China to the US.

Figure 10 - Per cent change in bilateral exports between China and the US

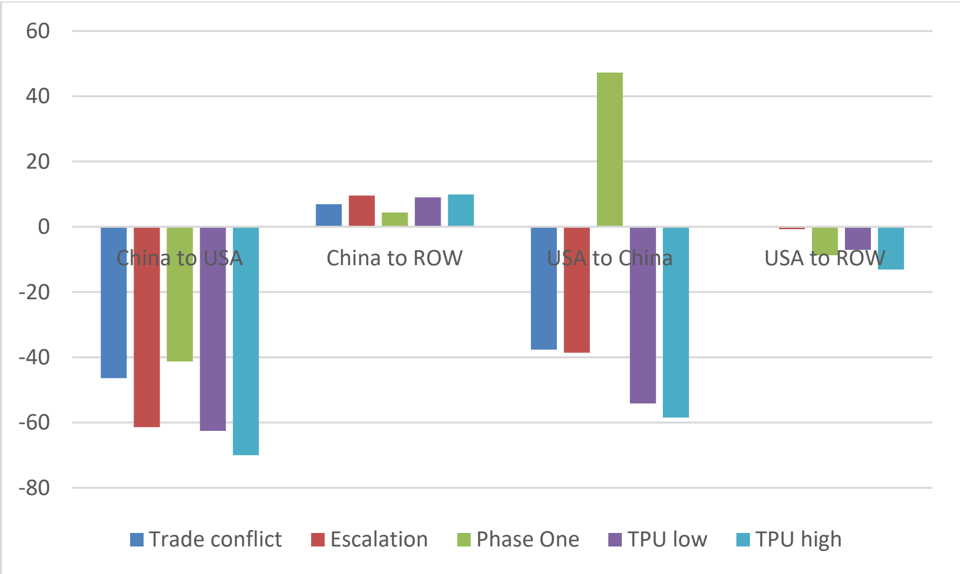


Source: Simulations with WTO Global Trade Model.

The impact on exports from the US to China is projected to change a lot with the Phase One Agreement. By design the change in exports of the different goods would change from negative to positive, because of the Chinese commitment to buy additional American goods. As discussed before, this change will require significant efforts by the Chinese government to raise imports from the US, either in the form of tariff reductions and (implicit) subsidies on American imports or through targets to purchase additional American imports.

In Figure 11 we split up the changes in exports of China and the US into changes in exports to the US and China and changes in exports to the Rest of the World (ROW). The figure shows that China raises its exports to third countries, although on net exports are still falling considerably as we have seen in Figure 7 above. The US does not raise its exports to third regions (Rest of the World, ROW) in the different scenarios. Four factors play a role in the different scenarios. First, the increasing steel and aluminum tariffs the US imposes on various trading partners have led to a response by these trading partners in the form of higher import tariffs, making it more costly for the US to export to third regions as well. Second, the increased protection on imports from China makes it more attractive for US firms to sell domestically and thus makes it less attractive to export. Third, in the Phase One Scenario, exports to China actually rise because of the Chinese commitments to buy more American imports. This leads to less exports to third countries. Fourth, in the trade policy uncertainty scenarios, rising fixed investment costs of exporting between the US and all its trading partners are reducing trade.

Figure 11 Per cent change exports from US and China to each other and to other regions (Rest of the World ROW)



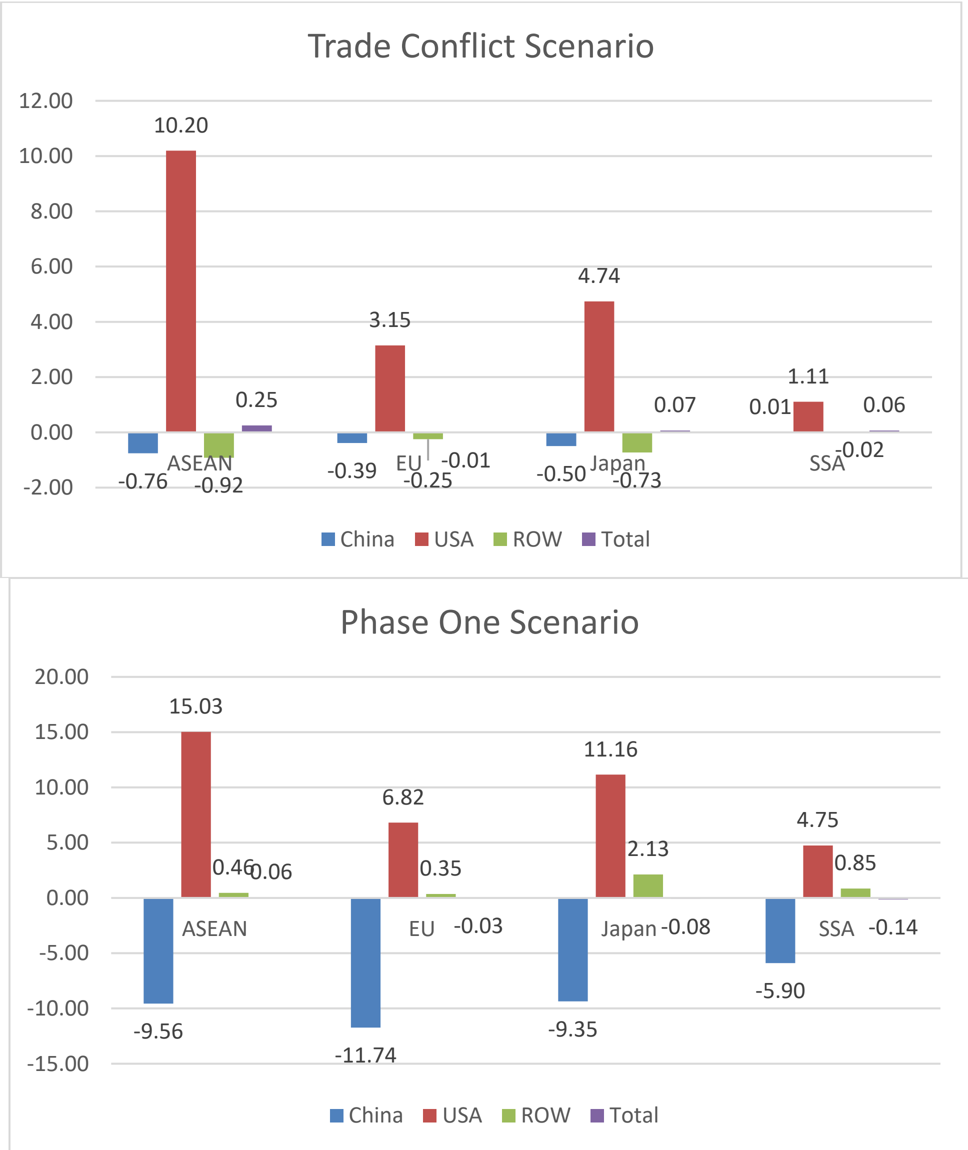
Source: Simulations with WTO Global Trade Model.

Figure 12 shows the patterns of trade diversion in both the Trade Conflict and Phase One Scenario for various regions or more specifically the per cent change in real exports from ASEAN, the EU, Japan and Sub Saharan Africa (SSA) to China, the US, and all regions (Total). In the Trade Conflict Scenario exports from other regions to China are projected to fall, whereas exports to the US would increase. Although the impact on total exports is small, this figure illustrates the reorganization of value chains, in particular for the countries of ASEAN. They export less to China and instead export more goods directly to the US. The reason for this pattern is that China is exporting much more to the US than the other way around. Hence, the classical trade diversion effect will dominate for exports to the US, whereas exporting to China will become more complicated, because China will demand fewer intermediate inputs used for exporting. Furthermore, competing in China's markets will become harder, because China's sales will be reoriented more to the domestic market. In the US the last two forces are less important, because its exports to China are smaller and it has a more closed economy.

In the Phase One Scenario exports from third countries to China fall much more substantially, because the classical trade diversion effect disappears. China is actually importing more instead of less from the US in this scenario and thus diverts imports away from third countries. Although this will be bad for exporters to China, the impact on total exports from the four regions is very small (comparing Total in the upper panel and lower panel of Figure 12). Nevertheless, we have seen in

Figure 9 that in terms of real income third regions do incur small losses under the Phase One Scenario, mostly because of unfavorable changes in terms in trade.

Figure 12 Per cent change in real exports by 2023 from various regions to China, the USA, other regions (Rest of World ROW) and all regions (Total) under Trade Conflict and Phase One Scenario



Source: Simulations with WTO Global Trade Model.

6.6 Comparison with other quantitative studies

Various academic scholars and research institutions have projected the expected impact of the US-China trade conflict on macroeconomic outcomes such as trade and GDP. This literature can be split into analyses with macroeconomic business cycle models and analyses based on quantitative trade models.

The most important analysis with a macroeconomic model is conducted by the IMF employing GIMF, a macroeconomic business cycle model. The latest projections on the impact of the trade conflict with this model are reported in the WEO of October 2019 (IMF, 2019, Box 1.2):[15]

- The IMF projects a GDP reduction of 0.8% in 2020. This is a short-run effect, whereas the WTO Global Trade Model focuses on the long-run.

[15] https://www.imf.org/~/media/Files/Publications/WEO/2019/October/English/Ch1.ashx?la=en

- The IMF projects a long-run reduction of about 0.2% of GDP from the tariffs and 0.3% taking into account uncertainty and confidence effects. These results are similar to the results of the simulations with our Global Trade Model:
    - We project a direct negative impact from the tariffs on global GDP of 0.13%, which is somewhat smaller than the 0.2% projected by the IMF. The reason is that our long-run trade elasticities are bigger, and our treatment of investment is different. In particular, we work with long-run trade elasticities based on empirical estimates of the long-run relation between trade values and trade costs. Larger elasticities generate bigger trade effects, but smaller GDP effects. With a larger elasticity the response to changes in trade costs is more pronounced. However, the welfare costs are smaller, because it is easier for consumers and firms to substitute away from the more expensive goods subject to additional tariffs.
    - We project a similar effect taking into account uncertainty effects: -0.34% global GDP in the TPU Low Scenario compared with -0.3% by the IMF. Our way to model uncertainty is different, however. The IMF looks at the impact of heightened uncertainty on investment in genera l through a rising interest rate spread and a higher risk premium, whereas we focus on reduced investments because of higher costs of entering foreign markets.

There are many studies employing quantitative trade models. Although the details of the models differ, they all employ a common structure with multiple sectors and intermediate linkages like the WTO Global Trade Model. There are three main differences between the studies: (i) the size of the tariff shocks; (ii) the time horizon; (iii) the variant of the model employed and the inclusion of additional channels.

Since the trade conflict between the US and China develops rapidly, the different studies conducted in the last two years necessarily work with different scenarios for the tariff increases. Some studies present comparative static effects (without taking changes in the capital stock into account) and others employ, with different horizons, recursive dynamic models in which the capital stock adjusts over time. Some studies only report the "direct" effects of the tariff increases employing a standard (Armington or Eaton-Kortum) trade structure, whereas other studies work with firm heterogeneity models and include the effects through changes in investment, uncertainty, or productivity.

Table 5 compares 7 CGE-studies displaying the real GDP effects for China, the US and globally (if reported) and furthermore the size of the shock, the variant of model and included shocks, the type of model, and the time horizon. To consider the impact of additional channels, for some studies multiple results are reported. For comparison, also the projected effects of the simulations with the WTO Global Trade Model are reported.

The table shows that the projected effects differ substantially across the different studies, mainly because of differences in the size of tariff shocks and time horizons. The studies reporting global effects come to a reduction in global GDP in the medium run (by 2023) of 0.13% (WTO study) and in the long run (by 2030) of 0.2%. Including increases in trade costs (treated as tariffs) for services (Freund et al.) or productivity effects (Itakura) the global GDP loss would rise to 0.3%. Accounting for uncertainty effects through trade costs, losses would rise to between 0.34% and 0.5% (WTO study). Including a negative impact on investment the global losses would rise to 1.7%, although this result should be interpreted with care.

All studies report effects for the US and China. The effects of studies taking only the direct effects of tariffs into account report effects between -0.14% (Felbermayr and Steininger with comparative static model) and -0.34% (Balistreri et al. with monopolistic competition model). Effects become bigger when taking into account trade cost increases for services (-0.4% in Freund et al.), productivity effects (-1.4% in Itakura), tariffs on cars (-1.3% in Walsmley and Minor), investment effects (-1.6% in Freund et al.) and uncertainty effects (between -1.15% and -1.66% in the WTO study).

Table 5 Comparison studies with quantitative trade models on the effects of the US-China trade conflict

Study	Per cent change real GDP rel. to baseline China	US	World	Size shock	Variant	Model	Type	Horizon
Balistreri et al.(2018)	-0.34	-0.20		Section 232 (aluminum and steel) and Section 301 measures plus retaliation until January. 2019	Standard Armington	GTAP in GAMS	CGE	Comp. Stat.
	-0.63	-0.34			Krugman mon. comp.			
Bellora and Fontagné (2019)	-0.39	-0.28		Section 232 (aluminum and steel) and Section 301 measures plus retaliation until January 2019. Tariff shocks aggregated with ref. weighting	Standard	MIRAGE-E	CGE	Rec. Dyn. 2030
Caceres et al.(2019)	-0.4	-0.3		25% all goods trade US-China	Melitz firm heterogeneity model	Caliendo, Romalis, Feenstra and Taylor (2017)	NQT	Comp. Stat.
Felbermayr & Steininger (2019)	-0.25	-0.14		25% all goods trade US-China	Standard Eaton and Kortum	Caliendo and Parro 2015)	NQT	Comp. Stat.
Freund et al.(2018)	-2.5	-0.4	-0.3	25% all trade (including services) US-China	Standard Armington	LINKAGE	CGE	Rec. Dyn. 2030
	-3.5	-1.6	-1.7	Investment/GDP ratio falls by 0.5pp	With investment effects			
Itakura (2019)	-1.4	-0.3	-0.2	Section 232 and Section 301 until June 2019 (including increase to 25% on 200 billion)	Standard Armington	GDYN	CGE	Rec. Dyn. 2035
	-1.7	-1.4	-0.3		With productivity effects			
Walmsley and Minor (2018)	-2.7	-1.3		25% all goods trade US-China. Aluminum and steel and cars (25%), Mexico and Canada exempted	Standard Armington	GDYN	CGE	Rec. Dyn. 2030
WTO (2019)	-0.34	-0.24	-0.13	All tariffs announced and implemented until Oct. 2019 under Section 232 and Section 301	Melitz firm heterogeneity	Global Trade Model	CGE	Rec. Dyn. 2023
	-0.43	-1.15	-0.34		With uncertainty effects			
	-0.51	-1.66	-0.50					

Notes: CGE=computable general equilibrium model. NQT=new quantitative trade model. Comp.Stat=comparative static (comparing two equilibria). Rec. Dyn=recursive dynamic (solving model multiple periods).
Source: Various studies as listed in the table.

The projected impact on China in the studies accounting only for the direct tariff effects are bigger and also vary more: between -0.25% in Felbermayr and Steininger and -1.4% in Itakura. The large effect in Itakura can be explained with the way investment is modelled in GDYN (also used by Minor and Walsmley). Their investment allocation rule must lead to large capital outflows from China generating substantial losses, given the relatively small global effect of -0.2% in Itakura. The projected negative GDP effect becomes large when adding shocks to services trade costs in the study by Freund et al. (2.5%), which is difficult to explain since investment reallocation does not play a role in this model because of the assumption of fixed trade balances. Adding the negative (domestic) investment shock the losses would even go to 3.5% in the same study. In the WTO study the projected effect for China is between -0.43% and -0.51%.

We draw the following conclusions on the expected GDP effects based on the comparison of studies:

- The direct effect of the tariff increases on global GDP is projected to be around -0.2%. Taking into account additional productivity and uncertainty effects the impact is expected to go up to -0.3% to -0.5%. As such the projected effects with the quantitative trade models are close to the long-run effects reported by the IMF (-0.2% direct effect and -0.3% with uncertainty and productivity effects).
- The direct effect of the tariff increases on US GDP is relatively uniform across the different studies range between -0.2% and -0.4%. Considering additional productivity and uncertainty effects the impact will rise to -1.2% to -1.5%.

- The effect for China varies much more. In the studies only considering the direct effects the projected GDP loss ranges between 0.3% and 1.4%. Considering the additional impact of rising trade costs for services or productivity effects, the projected losses rise to between 1.7% and 2.5%.

7 CONCLUDING REMARKS

The US and China have raised tariffs manifold on each other's exports. US tariffs on imports from China have increased from 3.1% in 2017 to 21% and might increase further to 26.6%. Chinese tariffs on US exports have increased from 8% to 21.8% and might increase further to 25.9%.

US exports to China have decreased by about 7% in 2018, accelerating to a reduction by 19% in the first quarter of 2019. While Chinese exports to the US still increased in 2018 by 7% because of frontloading (anticipating tariff increases later on), they dropped in the first quarter of 2019 by about 13%.

At least four reasons have been given in the American policy discussion for raising tariffs on imports from China: (i) address bilateral trade imbalances; (ii) make tariffs more reciprocal; (iii) bring back manufacturing jobs; (iv) address Chinese policies with negative spillovers such as poor IP protection, subsidies of state-owned enterprises, and forced technology transfer. The first three arguments are discussed and provide a poor economic justification for the tariff measures according to most economists. Evaluating the validity of the fourth argument is beyond the scope of this note.

Since the start of the trade conflict between the US and China trade uncertainty has increased by a lot and many observers have argued that the impact of the conflict through heightened uncertainty might be big. Trade uncertainty has an impact through at least two different channels: (i) through the decision to start exporting; (ii) through the general impact on investment. Empirical research in the US suggests that investment has fallen so far by 1%-2% because of increased trade uncertainty.

We conduct simulations on the impact of the trade conflict with the WTO Global Trade Model, examining the direct impact of the tariffs and the effect through heightened uncertainty, concentrating on the first channel mentioned. According to the simulations global GDP would fall by 0.13% by 2023 because of the China-US tariffs. Taking into account uncertainty effects, the loss in global GDP would be much more considerable and increase to between 0.34% and 0.50%. Global trade is projected to fall by 0.7% without uncertainty effects and by between 1.5% and 2.1% taking into account uncertainty effects. The impact of the truce between the US and China agreed on mid-October is expected to be very small, as it does not undo most of the tariff measures and is not expected to reduce uncertainty about trade policy.

A review of other studies with quantitative trade models on the repercussions of the trade conflict between the US and China shows that the direct effect of the tariff increases on global GDP is projected to be around -0.2%. Taking into account additional productivity and uncertainty effects the impact is expected to go up to -0.3% to -0.5%. As such the projected effects with the quantitative trade models are close to the long-run effects reported by the IMF

The simulations with the WTO Global Trade Model generate effects close to the effects in other studies. The projected impact of the tariff measures on global GDP is close to the impact in other studies: 0.2% GDP loss because of the direct effect of the tariffs and between 0.3% and 0.5% GDP loss taking into account uncertainty effects. The main difference with the other studies lies in the distribution of the losses across regions in the simulations accounting for uncertainty. Since the simulations with the WTO Global Trade Model assume that uncertainty about future policy is mostly related to trade between the US and its trading partners, most of the negative GDP and trade effects are also concentrated in the US. This assumption seems reasonable, as there are no concrete signals that other countries are considering imposing additional trade restrictions on each other at a large scale.

The projected impact of the tariff measures of 0.1% on GDP and 0.6% on global trade is small in comparison to the projected GDP and trade losses of respectively 2% and 17% of a global trade war in an earlier publication (Bekkers and Teh, 2019). The main reason is that the trade war would be global and would not be contained to trade between the US and China. Hence, it is important for other participants in the global economy to communicate the message that they will stick to their multilateral trade commitments.

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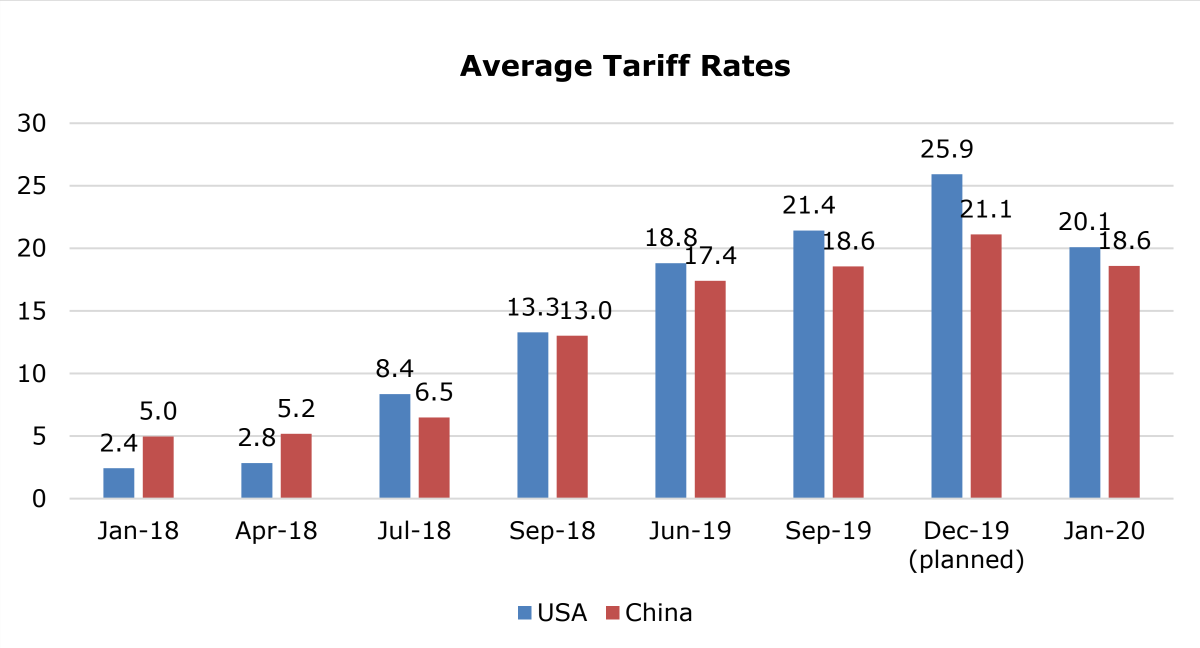
ANNEX A ADDITIONAL TABLES AND FIGURES

Figure A.1 – Average Tariff Rates (weighted by total imports)



Note: average tariff rates on US imports from China and Chinese imports from the US are weighted respectively by total US imports and total Chinese imports in 2017.
Source: Author's calculations based on trade data from the Trade Data Monitor and tariff data collected by the WTO secretariat.

Table A.1 Regression table on the determinants of the Trade Uncertainty Index. Separate FVA variables

	(1)	(2)	(3)	(4)
Dummy Brexit	-0.0159	-0.219	-0.128	-0.0699
	(-0.12)	(-1.49)	(-0.97)	(-0.47)
Dummy USA/CHN conflict	2.875***	2.851***	1.878***	1.922***
	(16.49)	(15.34)	(9.16)	(9.09)
FVA in GDP * dummy Brexit	146.5***		15.47	
	(7.45)		(0.57)	
FVA CHN to USA in GDP * dummy USA/CHN conflict	-51.79***		-80.83***	
	(-3.64)		(-5.49)	
FVA USA to CHN in GDP * dummy USA/CHN conflict	-191.8***		-136.8**	
	(-3.87)		(-2.82)	

FVA in total exp * dummy Brexit		99.33***		-8.856
		(7.66)		(-0.39)
FVA CHN to USA in total exp * dummy USA/CHN conflict		-23.11**		-50.79***
		(-2.67)		(-5.51)
FVA USA to CHN in total exp * dummy USA/CHN conflict		-89.56*		-88.65*
		(-2.29)		(-2.33)
Share of exp to GBR * dummy Brexit			35.08***	38.11***
			(8.15)	(7.08)
Share of exp to USA * dummy USA/CHN conflict			7.230***	7.731***
			(8.28)	(8.50)
Constant	0.179***	0.179***	0.179***	0.179***
	(4.87)	(4.86)	(4.99)	(4.98)
Observations	2592	2592	2592	2592
FE	yes	yes	yes	yes
Number of countries	108	108	108	108

Notes: FVA stands for foreign value added to goods traded between either GBR and the EU or CHN and the USA (depending on the dummy it is interacted with), FVA is divided either by GDP or total exports;
t statistics in parentheses: * $p<0.05$ ** $p<0.01$ *** $p<0.001$

ANNEX B MODELLING CHANGES IN TRADE POLICY UNCERTAINTY[16]

Changes in trade policy uncertainty (TPU) are modelled as in the firm heterogeneity model of Handley and Limao (2017). We adapt the framework such that it can applied directly to the firm heterogeneity module of the WTO Global Trade Model, described in Bekkers and Francois (2018) and Aguiar et al. (2019). In Handley and Limao's framework firms compare expected profits from exporting with sunk entry costs to decide whether to start exporting. Expected future profits fall when there is an increase in uncertainty about future tariffs, thus reducing entry. Handley and Limao model a Markov process with three states, a high and low tariff state and an intermediate tariff state. An increase in the variance of future tariffs (in a mean-preserving way) provokes a fall in firm entry.

The main change to this modelling framework is that rising uncertainty is modelled with an increase in the discount rate instead of through a fall in expected future profits. Hence, the effective per period fixed exporting costs f^x rise for given sunk export costs, f^e, since $f^x = \delta f^e$. An increase in fixed export costs will have a similar impact as the fall in future expected profits in Handley and Limao (2017): less entry of firms into the export market and thus less exports.[17]

In Handley and Limao (2017) the change in tariff uncertainty is calculated using the relation between variation in changes in imports across sectors and variation in the reduction in tariff uncertainty with China's WTO accession. In our simulations, we calculate the increase in fixed export costs based on three inputs: the probability of an increase in tariffs; the tariff rates in case of a tariff increase; the economic costs of higher trade policy uncertainty.

The first two inputs are described in Section 6.4 of the main text. The determine the economic costs of changes in expected future trade policy, the gravity estimates on the negative trade effects of tariff water in Osnago et al. (2018) are employed. Tariff water can be used as a proxy for tariff uncertainty, since it allows countries to raise tariffs within the rules of the multilateral trading system above the applied levels up to the bound levels. Obviously, the question is to what extent higher uncertainty about tariffs exceeding WTO bounds is comparable to uncertainty about tariffs staying within the bounds. We think that the use of the estimates on the trade depressing effect of water in the tariffs provides a prudent lower bound for the impact of the uncertainty surrounding trade policy since 2018.

Combing the gravity estimates with the expected tariff increase and the increased probability of tariff increases makes it possible to calculate the expected increase in fixed export costs (modelled theoretically with a rise in the discount rate). To calculate the fixed cost equivalent (and the ad valorem equivalent) we write the theoretical gravity equation for the value of trade from country i to country j in sector k as:

$$V_{ijk} = s_{ik}\tau_{ijk}{}^{-\theta_k} f_{ijk}^{x}{}^{-\frac{\theta_k - \sigma_k + 1}{\sigma_k - 1}} d_{jk} \qquad \text{(B.1)}$$

s_{ik} and d_{jk} are exporter and importer specific terms, τ_{ijk} iceberg trade costs, f_{ijk}^{x} fixed trade costs and θ_k and σ_k are respectively the Shape parameter of the Pareto distribution and the substitution elasticity between varieties. Denoting a_{unc} as the estimated coefficient on water in the tariffs from Osnago et al. (2018), Δt_{ijk} as the expected change in tariffs, and $\Delta prob_{ij}$ the change in probability of a tariff increase, the ad valorem and fixed cost equivalent can be defined as follows:

$$AVE_{ijk} = exp\left\{-\frac{a_{unc}\Delta prob_{ij}\Delta t_{ijk}}{\theta_k}\right\} - 1 \qquad \text{(B.2)}$$

[16] This Appendix is based on Bekkers and Teh (2020). Compared to Bekkers and Teh (2020) the current study also takes into account changes in the probability that tariffs will increase.

[17] The increased uncertainty is only related to exporting. Therefore, the higher discount rate only raises the per period fixed export costs, costs, f_x, and has no impact on the sunk entry costs of domestic entry.

$$FCE_{ijk} = exp\left\{-\frac{a_{unc}\Delta prob_{ij}\Delta t_{ijk}}{\frac{\theta_k-\sigma_k+1}{\sigma_k-1}}\right\} - 1 \quad \text{(B.3)}$$

As described in Section 6.4, two scenarios are proposed for the expected increase in tariffs, Low and concentrated TPU, and High and spread TPU.

A possible concern about the theoretical framework is that the impact of rising trade policy uncertainty is modelled through an increase in the discount rate to convert sunk export costs into fixed export costs instead of through a dynamic framework with changes in future expected profits. However, as pointed out in the text also the counterfactual exercises in Handley and Limao (2017) consist of a comparative static comparison of two (static) equilibria. Furthermore, one could fear that the implementation of rising trade policy uncertainty through an increase in fixed export costs overestimates the welfare losses associated with rising trade policy uncertainty. Higher fixed export costs generate like higher iceberg trade costs welfare losses both because of a loss of resources (rectangles in a partial equilibrium demand-supply framework) and because of a distortion in the allocation of resources (triangles). Therefore, we compare the change in trade flows and real income in our framework with the changes reported in Handley and Limao (2017).

In one of the main counterfactual experiments in Handley and Limao (2017), imports from China fall if trade policy uncertainty would go up again in 2005. In particular, the value of imports would fall by 32 log points (about 28%) and the corresponding welfare decrease is 0.4 log points (about 0.4%).[18] In our experiment with TPU only going up vis-a-vis China (operationalized through an increase in fixed export costs), trade falls by about 22% and welfare falls by about 0.22%. Our experiment is different, so therefore the change in the value of trade is different. However, the relation between trade change and welfare change is comparable.

We can also look at the change in the import share. In Handley and Limao the mentioned experiment triggers a fall in the import share of 1.2 percentage points (pp) from 4.5pp to 3.3pp. They do not model services and intermediate linkages, assuming that only manufactures are consumed. In our experiment the import share from China falls from 1.8pp to 1.4pp, a fall of 0.4pp. So, our fall in the import share is 1/3 of their fall (0.4pp in our case and 1.2 in Handley and Limao), whereas the welfare loss is about half (0.22% in ours and 0.4% in Handley and Limao). Hence, for a given fall in the import share our model generates a somewhat bigger welfare effect. However, our model accounts for intermediate linkages, which makes welfare effects bigger.

Hence, this comparison implies that the approach with changes in the discount rate and fixed export costs generates effects comparable to those in Handley and Limao (2017). Theoretically, this can be explained as follows. In Handley and Limao's framework, future profitability falls, leading to less export entry. This drives up the aggregate price index. In our model fixed export costs fall, which also leads to less export entry driving up the aggregate price index. In the terminology of a simple partial equilibrium model of the costs of protection, their uncertainty effects are also about resource losses (rectangles) like our fixed export costs and not only about triangles (as with tariffs), because their increase in uncertainty is also triggering a fall in entry in export markets.

[18] Pages 2770-2772 of Handley and Limao (2017).