Swiss market access in a global trade war

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We measure the extent to which Swiss market access would be affected in a global trade war. After calculating the change in tariffs at the tariff-line level that Swiss exporters would face in a trade war, we then aggregate them at the industry, destination market, and global level using theoretically well-grounded aggregation methods first introduced by Anderson and Neary (1996). Our results suggest that Swiss market access will be seriously jeopardized in the event of a global trade war, with an increase in tariffs faced by Swiss exporters of 34 percentage points. The largest increases in tariffs would be experienced in large destination markets where Swiss exporters currently benefit from low export barriers (the European Union, the United States and Japan). Chemicals, machinery, professional and scientific equipment, and food experience above average increases in tariff barriers.

JEL codes: trade war, Swiss market access
Key words: F13

1 Introduction

We estimate the impact that a global trade war would have on tariff barriers faced by Swiss exporters in the rest of the world by estimating the change in tariffs if all countries were to set their tariffs non-cooperatively. The idea is that during a global breakdown in international cooperation, all countries exploit their market power in international markets by imposing higher tariffs on goods in which they have more market power (Edgeworth, 1894; Johnson, 1953). The extent to which this affects Swiss exporters depends on the composition of the Swiss export bundle across products and destination markets, and on whether Switzerland's trading partners are already imposing non-cooperative tariffs in the existing regime. Importantly, this could happen even when the partner is a member of the World Trade Organization (WTO) because the multilateral trading system offers enough flexibility for member countries to set tariffs non-cooperatively, either because they face a large number of uncoordinated small exporters (Ludema and Mayda, 2013) or because there is "tariff water" in their tariff schedule (Nicita, Olarreaga and Silva, 2018).[2]

2 "Tariff water" is the difference between the tariff bound which is negotiated in the WTO and the most-favored nation (MFN) applied tariff. WTO member countries cannot apply tariffs above their negotiated tariff bounds, but many member countries do have bound tariffs which are several orders of magnitude larger than their applied tariffs, creating what is referred to as "tariff water" (or "tariff overhang").

Results suggest that the average exporting country in the world experiences a 23 percentage point increase in tariff barriers in the rest of the world. This average increase hides a lot of heterogeneity, with 30 countries facing tariff in- creases of less than 5 percentage points and 30 countries facing tariff increases of more than 40 percentage points. The average increase for Switzerland is above average, at 34 percentage points. This represents more than a tenfold increase in current tariff barriers faced by Switzerland, which are below 3%. There is an even larger increase in barriers faced in the largest destination markets for Swiss exporters: the European Union, the United States and Japan increase their barriers on Swiss exporters by more than 40 percentage points. Destination markets and sectors in which Swiss exporters currently face low tariff barriers experience the largest increases. Among the sectors with above-average increases are large export sectors such as chemicals, professional and scientific equipment, machinery and food.

These results are important for at least three reasons. First, even if a global trade war is an unlikely scenario, it cannot be fully excluded, and to correctly value the existing level of international cooperation one needs to know what the counterfactual would be in its absence. Second, results can help identify coalitions of countries that are interested in preserving the existing level of international trade cooperation. Indeed, results show that there is a lot of heterogeneity in the increase in tariff barriers faced by exporters of different countries. Antigua and Barbuda, with a 0.1 percentage point increase in tariffs faced by exporters in the rest of the world, is likely to be less interested in preserving the existing level of cooperation than Lesotho, where exporters would face a 93 percentage points increase in tariffs barriers. And last but not least, the results help identify Switzerland's export industries that would have an incentive to cooperate to prevent the escalation of current international trade tensions.

In estimating the change in market access for Swiss exporters, we face three main challenges. First, we need to estimate the change in tariffs in the case of a global trade war. Because we define a trade war as a move to the non-cooperative tariff where market power is fully exploited, we first need to have an estimate of what such a change in tariffs would imply. Using a bit of theory, we show that the change from a cooperative to a non-cooperative tariff is simply given by the inverse of the export supply elasticity of the rest of the world. To implement this, we use the recent estimates of export supply elasticities of the rest of the world provided by country and tariff line by Nicita, Olarreaga and Silva (2018). The second challenge is that not all countries may be at their cooperative tariffs initially, either because they are outside the WTO (and therefore they can already set non-cooperative tariffs, as shown by Broda, Limão and Weinstein (2008)), because there is a preferential trade agreement and they have moved beyond the

multilateral cooperative tariff, or because there is tariff water in their schedule and, as shown by Nicita, Olarreaga and Silva (2018), they are already setting tariffs non-cooperatively. We introduce all these elements to estimate the change in tariffs that would occur as countries move from their current tariffs to the non-cooperative tariff. The third challenge is to aggregate all these tariff changes across destination markets or industries in a meaningful manner. Simple or export-weighted averages are atheoretical and suffer from well-known biases. Simple averages give the same weight to tariff lines with very different economic meaning, and export-weighted averages suffer from a downward bias as sectors which face very high export barriers tend to export less and therefore have a lower weight. We use a theoretically well-grounded aggregation procedure in the spirit of Anderson and Neary (1996) and similar to their mercantilistic measure in Anderson and Neary (2003). The aggregate measure we use to capture market access barriers is the MA-OTRI[3] developed by Kee, Nicita and Olarreaga (2009). It is defined as the uniform tariff that, if it were to be applied to all goods in all destinations, would lead to the same level of exports as currently observed. In order to compute this measure, we need estimates of import demand elasticites at the tariff-line level in all countries, which we borrow from Kee, Nicita and Olarreaga (2008).

We are not the first to compute changes in protection associated with a move to non-cooperative tariffs in the case of a trade war. Grossman and Helpman (1995) and Bagwell and Staiger (1999, 2002, 2016) provide theoretical underpinnings for such an assumption, while Ossa (2014, 2015) provides some estimates. The main difference between these studies and the current paper is that we consider that in the presence of tariff water, initial tariffs are already set at their non-cooperative levels as shown in Nicita, Olarreaga and Silva (2018). Given that around three-quarters of WTO members' tariff lines allow for tariff water, this implies that the increase in tariffs in the case of a tariff war are likely to be much smaller than previously estimated. On the other hand, we also consider that many tariffs in the world are set below their MFN levels because of preferential trade agreements (PTAs) and therefore a break in cooperation would imply even larger increases in protection. Even if Espitia, Mattoo, Mimouni, Pichot and Rocha (2018) estimate that only 5% of global exports benefitted from a preference of more than 5 percentage points, the difference can be important for some products in some destination markets.

The rest of the paper is organized as follows. Section 2 discusses the methodology used to predict changes in tariffs in the case of a global trade ward. Section 3 presents the aggregation procedure used to calculate the global index of increases

3 Market Access-Overall Trade Restrictiveness Index.

in tariff changes, or aggregates by destination market or product. Section 4 presents data sources and Section 5 presents the results. Section 6 provides some concluding remarks and caveats.

2 A trade war and changes in tariffs

In order to assess the change in tariffs during a trade war, we first need to determine tariff levels as countries move from a cooperative to a non-cooperative equilibrium. In a non-cooperative setting, we assume that countries set tariffs (T) in order to maximize an objective function (G) that includes both social welfare (W) and lobbying contributions by firms, as in GROSSMAN and HELPMAN (1994):

$$G(T) = W + \beta\pi \tag{1}$$

where β is the weight given to firms' profits in the government's objective function, and π is the firms' profits.

After some rearranging, the first-order condition of the government's problems yields:

$$T^N = \frac{\beta z}{e} + \frac{1}{e^*} \tag{2}$$

where T^N is the optimal non-cooperative tariff, z is the output-to-import ratio, e is the import demand elasticity and e^* is the export supply elasticity of the rest of the world. The first term captures political economy motives for tariffs, and depends on the weight that the government gives to firms' profits (and their political lobbying contributions) in its objective function, the relative size of the sector with respect to imports, and the import demand elasticity for Ramsey pricing reasons. The more elastic the import demand elasticity, the larger the deadweight loss of a given tariff, which makes the decision to increase a tariff more costly in terms of welfare. The second term captures the non-cooperative rationale for exploiting the importer's market power by imposing higher tariffs on sectors in which it has more market power (i.e., those in which the inverse of the export supply elasticity of the rest of the world is smaller). Indeed, with a more inelastic export supply elasticity in the rest of the world, a given tariff will lead to a larger decline in world prices as the decline in demand is mainly absorbed by a price decline when exported quantities adjust little to price changes.

In a cooperative equilibrium such as that offered by the WTO, member countries choose, through negotiation, the tariff that maximizes the joint welfare of the

home country and its trading partners (Grossman and Helpman, 1995; Bagwell and Staiger, 2002):

$$G^{WTO}(T) = G + G^* = (W + \beta\pi) + (W^* + \beta^*\pi^*) \tag{3}$$

where the variables with asterisks denote the variables of the other WTO members.

After some rearranging, the maximization of the joint welfare function in the cooperative equilibrium yields:

$$T^C = \frac{\beta z}{e} \tag{4}$$

where T^C is the cooperative tariff. Only the political economy term of the non-cooperative tariff (T^N) remains when tariffs are set cooperatively. Indeed, the market power term disappears from the cooperative tariff because the decline in world prices associated with a higher tariff in the importing country implies a simple redistribution of income from the exporter to the importer. When tariffs are set cooperatively, there is no more room for redistributing income across trading partners, and the market power term vanishes.[4]

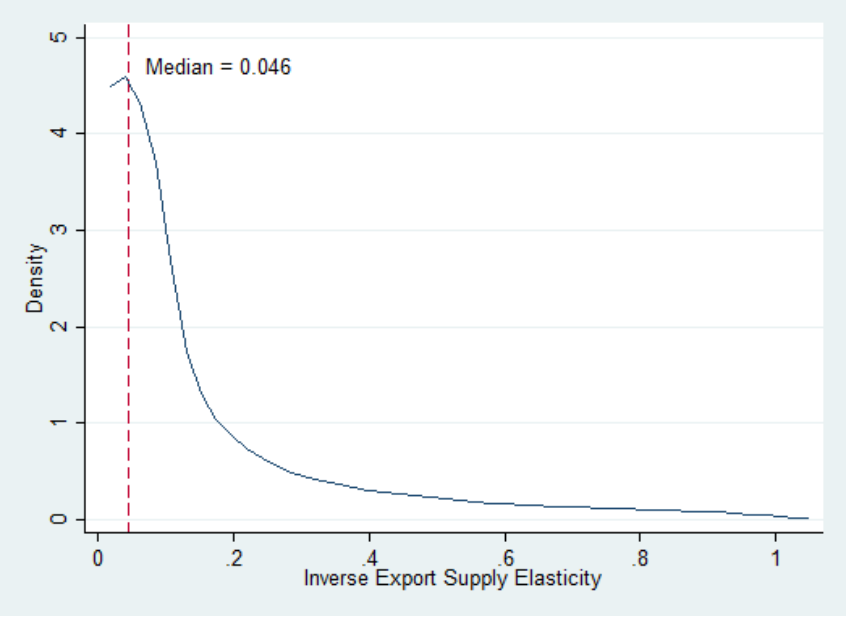
The change in tariffs associated with a move from a cooperative to a non-cooperative equilibrium is then given by the difference between (2) and (4):

$$\Delta T^{war} = T^N - T^C = \left(\frac{\beta z}{e} + \frac{1}{e^*}\right) - \left(\frac{\beta z}{e}\right) = \frac{1}{e^*} \tag{5}$$

Thus, assuming that political economy forces are not affected by the trade war (which is arguably not a trivial assumption), the change in tariffs following a move from a cooperative to a non-cooperative tariff is simply given by the inverse of the export supply elasticity of the rest of the world. Using the estimates of Nicita, Olarreaga and Silva (2018), we can estimate the distribution of tariff changes in a move from cooperative to non-cooperative tariffs (see Figure 1).

Figure 1: Distribution of the inverse of export supply elasticity in the rest of the world

4 Note that in Nicita, Olarreaga and Silva (2018), the cooperative tariff is negatively correlated with the inverse of the export supply elasticity of the ROW. The reason is that we allow for exporters to lobby their government to help reduce tariffs in the importing country in the cooperative equilibrium and they have stronger incentives to lobby their government when the importer has market power. So, the traditional market power term vanishes in the cooperative equilibrium, but a new term appears that is negatively correlated with market power.



Note: The inverse of the export supply elasticity in the rest of the world is our estimate of the change in tariffs when moving from a cooperative to a non-cooperative tariff. Source: Data are from Nicita, Olarreaga and Silva (2018)

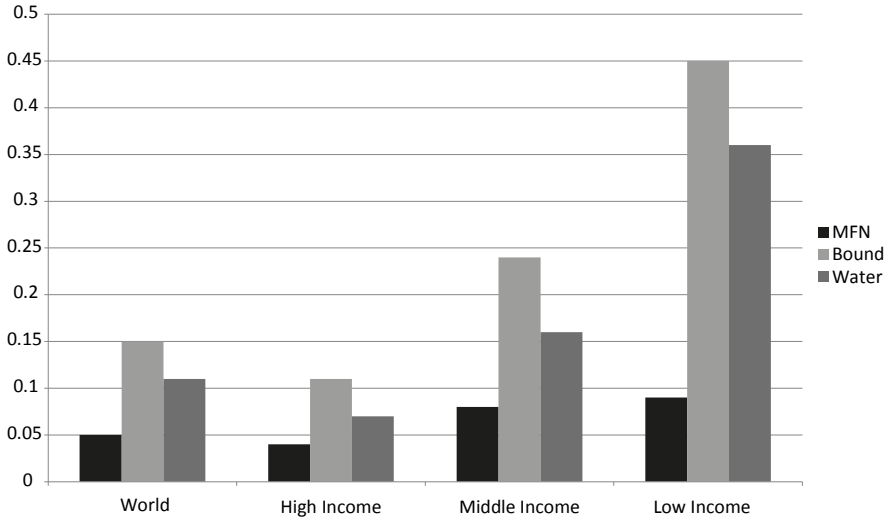
The median increase in tariffs is equal to 4.6 percentage points. Thus, even if all tariffs were to change from cooperative to non-cooperative, the median increase will be relatively modest. This is because most countries have little market power.

Note, however, that even "small countries" can have some market power in some markets. For example, among the 21,000 tariff lines in the top 10% in terms of market power, i.e., those with an increase in tariffs when moving from the cooperative to the non-cooperative tariff of more than 125%), Burundi has seven tariff lines and Uruguay more than 100. Of course, the European Union and the United States have more than 1,400 tariff lines each, and they will see the largest increases in their import tariffs partly because they have more market power than others.

There is, however, a second reason why the increase in tariffs in the European Union and the United States is likely to be larger than in other WTO members. Around three-quarters of tariff lines of WTO members have some tariff water. As shown by Nicita, Olarreaga and Silva (2018), in the presence of tariff water, WTO members will already be setting non-cooperative tariffs, whereas in the absence of tariff water, WTO members set their tariffs cooperatively. The

European Union, the United States and other high-income countries tend to have much less tariff water in their tariff schedules than low-income countries do (see Figure 2). Thus, high-income countries such as the European Union and the United States tend to have a larger share of their tariff lines which are currently set cooperatively. A trade war is thus likely to lead to a higher increase in tariffs in high-income countries with low levels tariff water than in countries with tariff water or that are outside the WTO and therefore are already setting their tariffs non-cooperatively.

Figure 2: Tariff water in WTO members tariff schedules by level of income



Note: Tariff water is defined as the difference between the bound tariff in WTO members' tariff schedules and their MFN applied tariff.

Source: Data are from Nicita, Olarreaga and Silva (2018).

Another reason why changes in tariffs may be larger than those implied by the move from cooperative to non-cooperative tariffs is the presence of a large share of PTAs in which countries have reduced their bilateral tariffs beyond the cooperative level implied by MFN tariffs in the WTO.

In order to consider these different elements, we define the change in tariffs due to a trade war according to the following rule:

$$\Delta T^{war} = \begin{cases} 1/e^*, \text{ if } T^{mfn} = T^{bound} \text{ and No PTA} \\ 0, \text{ if } T^{mfn} < T^{bound} \text{ (or not a WTO member) and No PTA} \\ 1/e^* + (T^{mfn} - T^{pref}) \text{ if } T^{mfn} = T^{bound} \text{ and PTA} \\ T^{mfn} - T^{pref}, \text{ if } T^{mfn} < T^{bound} \text{ and PTA} \end{cases}$$

where T^{mfn} is the MFN tariff, T^{bound} is the bound tariff, and T^{pref} is the preferential tariff on imports from a preferential partner.

This rule is our departure from existing work as in Ossa (2014, 2015), which defines the move towards a trade war as given by the first line. It indicates that this will only be the case if there is no PTA in place between the two countries and if there is no tariff water. Note that if there is no tariff water, this move would necessarily be WTO-incompatible. In the presence of tariff water, there will be no change in tariffs as the importer will already be setting non-cooperative tariffs. In the presence of a PTA (and in the absence of tariff water), the change in tariff will be given by the move from the cooperative to the non-cooperative tariff, plus the difference between the MFN tariff (i.e., the cooperative tariff) and the preferential tariff. This move would also be WTO-incompatible as the new tariff will necessarily be above the bound. Finally, if there is tariff water and a PTA in place, then the change in tariff is simply given by the difference between the MFN tariff (which in this case is the non-cooperative tariff) and the preferential tariff.

To examine the importance of this departure from the existing literature, in a robustness section we modify the rule for tariff changes so that in all cases the increase in tariffs is given by $1/e^*$. The implicit assumption is that importers are always at their cooperative tariff (no PTAs and no tariff water).

3 Aggregating across products and markets

As discussed by Anderson and Neary (1996), measures of protection obtained by aggregating tariffs across products and markets using simple and trade-weighted measures are often difficult to interpret . The authors instead propose using theory-driven measures, such the uniform tariff that, if applied to all imported goods by a country, would keep welfare constant. In a subsequent paper (Anderson and Neary, 2003) they extend this idea to what they call a "mercantilist index of protection", which is the uniform tariff that, if applied to all goods in a given country, would keep the imports of that country constant. Kee, Nicita and Olarreaga (2009) apply this idea to market access and develop what

they labelled *MA-OTRI*, which is the uniform tariff that, if it were to be applied by all importing partners on all goods, would lead to the same level of exports in the exporting country. More formally,

$$\text{MA-OTRI}_c\text{: } \sum_n \sum_p x_{ncp}(\text{MA-OTRI}_c) = \sum_n \sum_p x_{ncp}(T_{ncp}) = x_c^0 \tag{6}$$

where x_{ncp} are exports of good n by country c to partner p and x_c^0 is the current level of exports of country c given the observed levels of bilateral tariff protection, T_{ncp}, in partner p on exports of country c of good n.

Taking the total differential of (6), noting that total exports of c should remain unchanged, and rearranging yields:

$$\text{MA-OTRI}_c = \frac{\sum_n \sum_p x_{ncp} \varepsilon_{np} T_{ncp}}{\sum_n \sum_p x_{ncp} \varepsilon_{np}} \tag{7}$$

where ε_{np} is the trading partner p's import demand elasticity for good n.

Equation (7) suggests that MA-OTRI_c is the weighted average of the tariffs applied by different trading partners on products exported by country c, where the weights used in this average are represented by the product between the trading partner p's import demand elasticity and the exports from country c to this trading partner. By giving more weight to tariff lines with a large import demand elasticity, we avoid the downward bias that occurs when higher tariffs reduce exports of goods with a more elastic import demand. And by giving more weight to products with a large export share, we focus on economically meaningful tariffs.

Note that (7) can be calculated for existing levels of tariffs or for changes in tariff such as those induced by a tariff war and given by equation (6). In the empirical section, we do both and compare how tariff changes correlate with existing levels of tariff protection across products and markets. We calculate these indices at the global level for all countries to compare the increase in export barriers that Swiss exporters would face in the case of a trade war with the export barriers that exporters in other countries would face.

But we also calculate the indices by destination market for Swiss exporters and by broad groups of products across all destination markets of Swiss exporters to identify the destination markets and the sectors in which Swiss exporters are likely to experience the largest increases in tariffs in the event of a trade war. These last two indices of increases in tariff protection are given by:

$$\text{MA-OTRI}_{cp} = \frac{\sum_n x_{ncp} \varepsilon_{np} \Delta T_{ncp}^{war}}{\sum_n x_{ncp} \varepsilon_{np}} \tag{8}$$

$$\text{MA-OTRI}_{ci} = \frac{\sum_{nei} \sum_p x_{ncp} \varepsilon_{np} \Delta T_{ncp}^{war}}{\sum_{nei} \sum_p x_{ncp} \varepsilon_{np}} \tag{9}$$

The index MA-OTRI$_{cp}$, described in expression (8), measures the average tariff increase faced by country c in exporting to country p, while the index MA-OTRI$_{ci}$, described in expression (9), measures the average tariff increase faced by exports of goods in industry i from country c across all trading partners.

4 Data

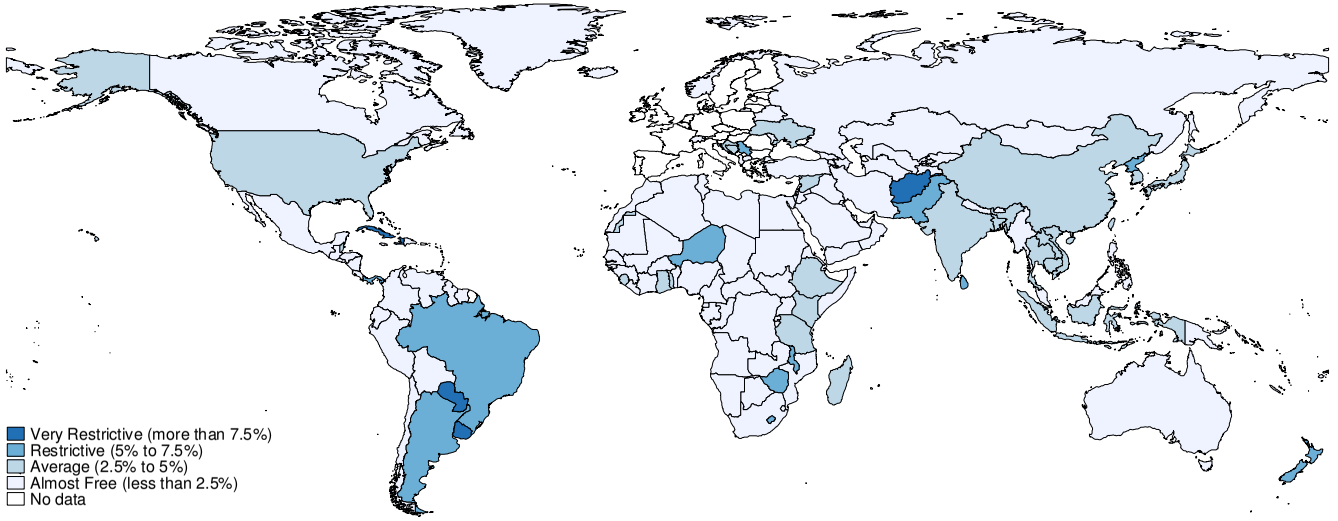
Expressions (7)-(9) indicate that measuring the average level of or the change in tariffs faced by exporters requires data on tariffs (MFN, preferential and bound), elasticities (the rest of the world's export supply and price elasticity of import demand) and trade flows, as well as information on PTAs. We use information on MFN and preferential tariffs from the World Integrated Trade Solution (WITS) at the 6-digit level of the Harmonized System. All data are for the year 2011.[5] Data on tariff bindings also at the 6-digit level of the Harmonized System are provided by the WTO. The information on elasticities come from two sources: information on price elasticity of import demand is obtained from Kee, Nicita and Olarreaga (2008); information on the rest of the world's export supply is from Nicita, Olarreaga and Silva (2018). Finally, information on the presence of PTAs is obtained from Baier et al. (2014).

5 Results

We proceed in three steps. We first compare the increase in tariffs that would be experienced by Swiss exporters in case of a global trade war to the increases that would be experienced from exporters in other countries. We then focus on which are the destination markets in which Swiss exporters would experience the largest increase, and finally examine which are the sectors that would be more exposed.

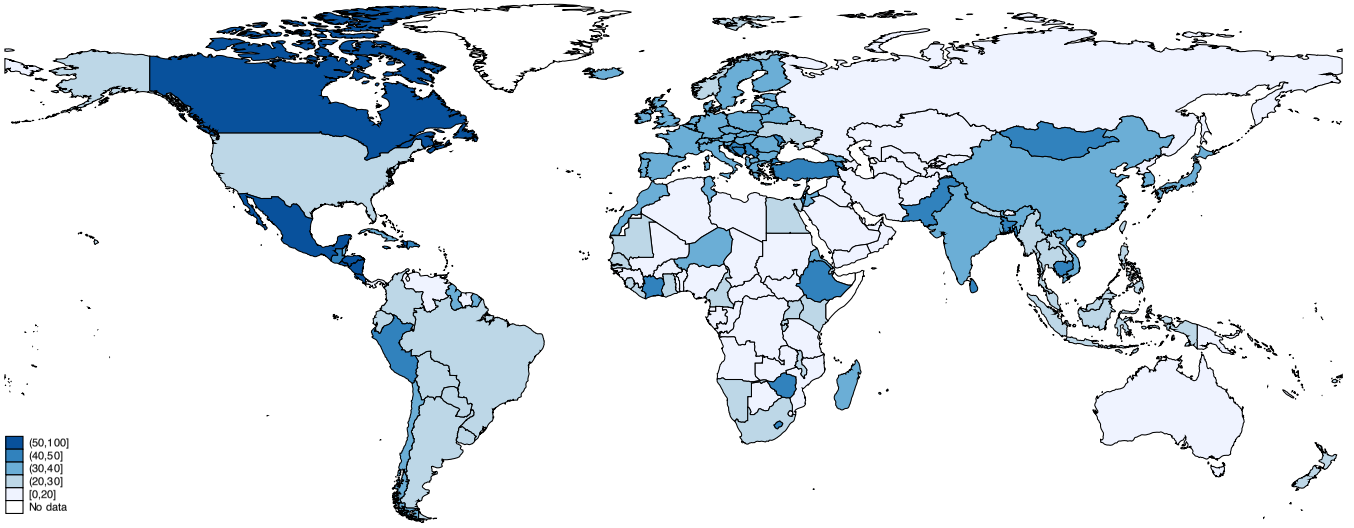
5 We performed a robustness using pre-crisis tariff data for the year 2006 and obtained very similar results (available upon request). The correlation between the change in tariffs faced by all exporters is 0.6.

Figure 3 Tariff faced by exporters of all countries in the rest of the world



Note: The map provides the estimates for each country of MA-OTRI given the observed levels of tariff protection in 2011 in the rest of the world.

Figure 4: Increases in tariff barriers faced by exporters in the rest of the world



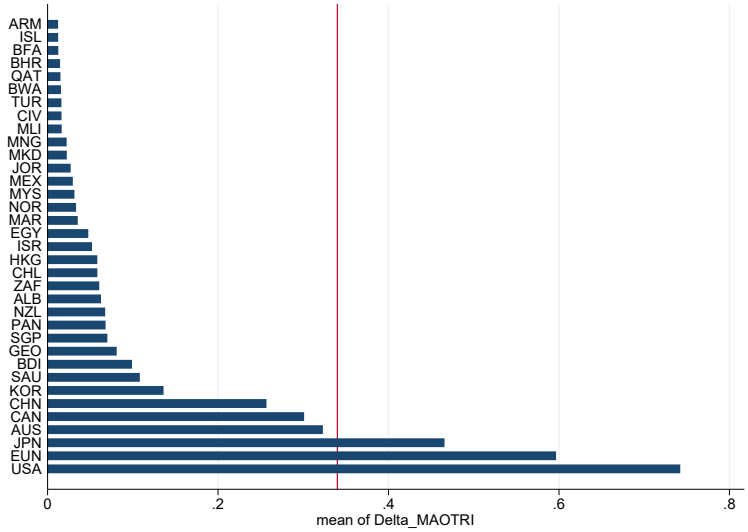
Note: The map provides the estimates for each country of changes in MA-OTRI due to a global trade war.

We start by assessing the extent of current tariff protection faced by each country's exporters in the rest of the world. Figure 3 provides a heat-map of the MA-OTRI of each exporting country. The average MA-OTRI in 2011 is 4%, with only 15 countries facing an MA-OTRI above 10%. A trade war would dramatically change this, as can be seen in Figure 4. The average MA-OTRI will rise by 23 percentage points, and 15 countries will face an increase in their MA-OTRI of more than 50 percentage points. Swiss exporters would experience an above-average increase in their MA-OTRI of 34 percentage points, which is within the top quartile of changes in MA-OTRI that world exporters would experience.

The reason for the relatively large increase in the MA-OTRI faced by Swiss exporters in the case of a trade war is partly explained by the composition of the Swiss export bundle in terms of products and destination. Let us start with the countries in which Swiss exporters would face the largest increases in MA-OTRI. Figure 5 shows these in ascending order. The red vertical line provides the average increase experienced by Swiss exporters of 34 percentage points. The largest (and only above-average) increases for Swiss exporters are experienced in the United States, the European Union and Japan. The only other markets where Swiss exporters experience increases in MA-OTRI of more than 20 percentage points are China, Canada and Australia. In Saudi Arabia and Korea the increases in MA-OTRI are 11% and 14%, respectively. In all other countries, the increases in MA-OTRI during a trade war would be below 10 percentage points. In 108 destination markets, the increase in MA-OTRI that Swiss exporters would face is below 1 percentage point. The main reason for this is that many of these destination markets have little market power on which to act. The above-average increase in MA-OTRI in Switzerland is explained by a few large destination markets with significant market power (the United States, the European Union, Japan, China, Canada and Australia), with little water in their tariff schedule and, in the case of the European Union and China, a PTA in place.

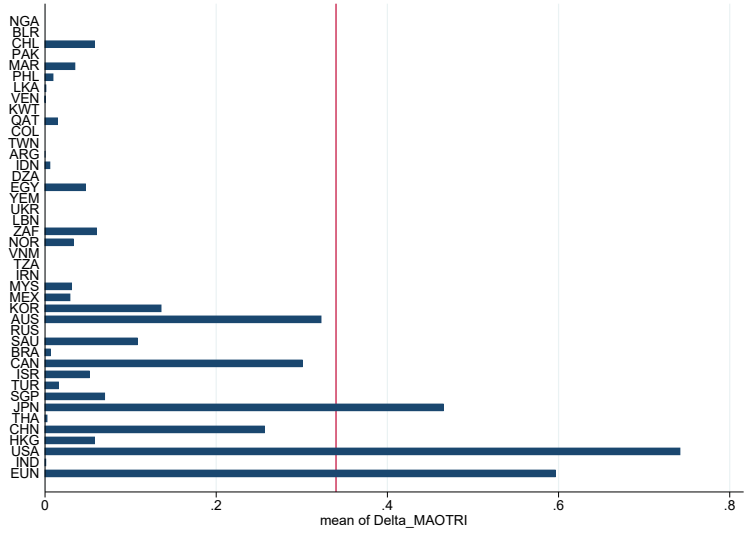
Together, these six markets represent more than 62% of Swiss exports. As shown in Figure 6, which orders the top destination markets in terms of their share of Swiss exports, the largest increases in MA-OTRI will tend to be experienced in the largest destination markets. The exception is India, which is the second destination market for Swiss exporters after the EU, with a market share of 11%, and where Swiss exporters would face no increase in tariffs due to the large presence of tariff water in India's tariff schedule.

Figure 5: Increases in tariff barriers faced by Swiss exporters by destination market



Note: The figure provides the estimates for Switzerland of changes in MA-OTRI due to a global trade war in the destination markets with the largest increases in tariff protection.

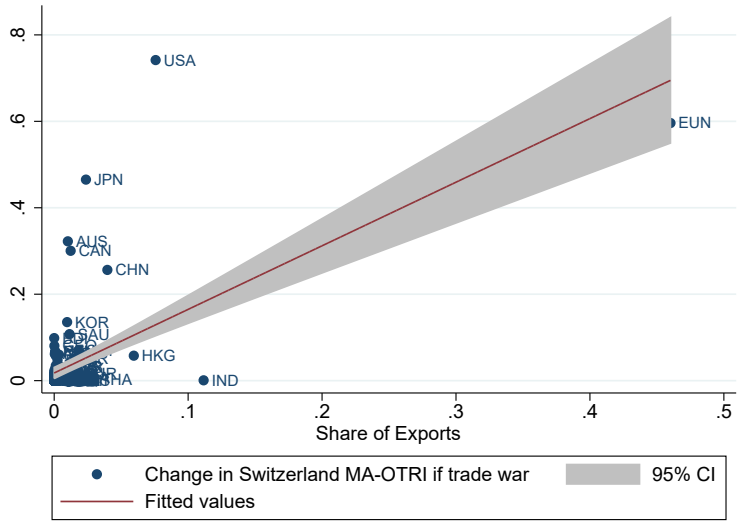
Figure 6: Larger increases in tariff barriers for Swiss exporters in larger markets



Note: The figure provides the estimates for Switzerland of changes in MA-OTRI due to a global trade war in the top destination markets in terms of current Swiss exports.

The positive relationship between export share and the increase in MA-OTRI is confirmed by Figure 7, which correlates the share of each destination market in total Swiss exports with the increase in MA-OTRI that would be experienced in each market. There is a strong positive and statistically significant correlation (and this is with or without the European Union, which is the top destination market by several orders of magnitude).

Figure 7: Increases in tariff barriers and Swiss exports

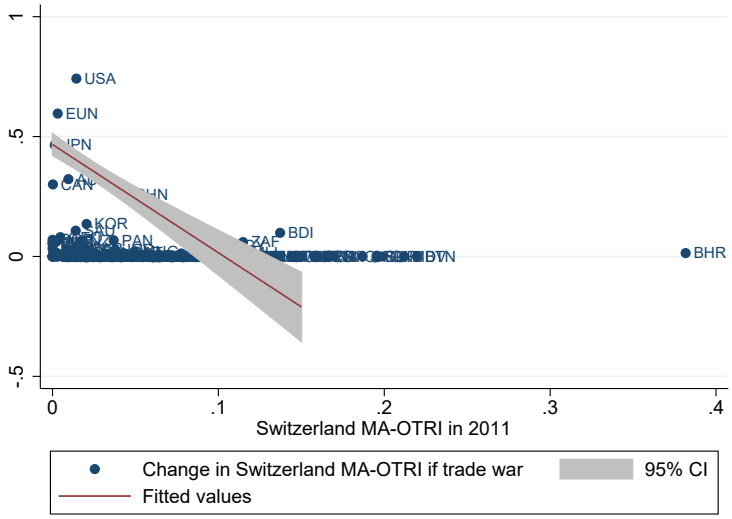


Note: The figure provides the correlation between increases in tariff barriers faced by Swiss exporters and the export share in each destination market

On the other hand, there is a negative relationship between the existing level of MA-OTRI faced by Swiss exporters in 2011 and the increase in MA-OTRI following a trade war, as shown in Figure 8. Thus, the markets where the largest increases in MA-OTRI would occur are not only the largest markets in terms of exports today, but are also the markets where Swiss exporters currently face the lowest tariff barriers.

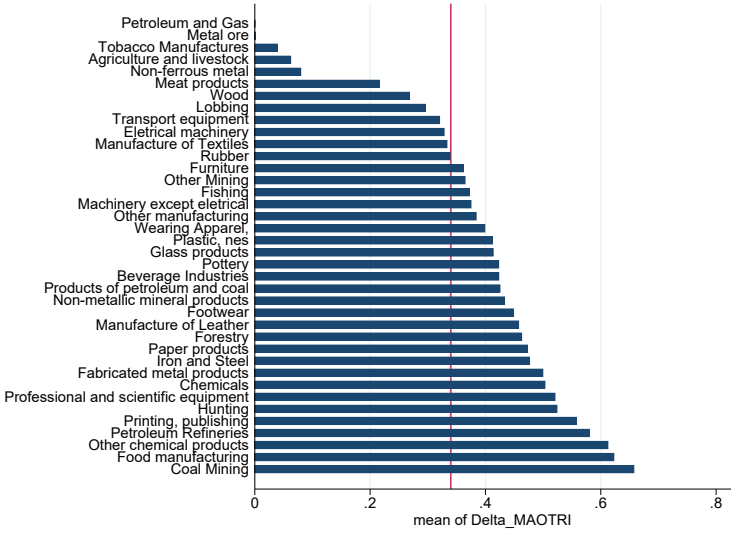
The sectors where Swiss exporters would face above-average increases in tariff barriers in the rest of the world include chemical products, professional and scientific equipment, machinery and food manufacturing, which are all important exporting sectors. But other sectors, such as non-ferrous metals, electrical machinery and tobacco manufactures, which are also relatively important in terms of export shares experience below-average increases, as shown in Figure 9.

Figure 8: Larger increases in tariff barriers in markets with low tariff barriers



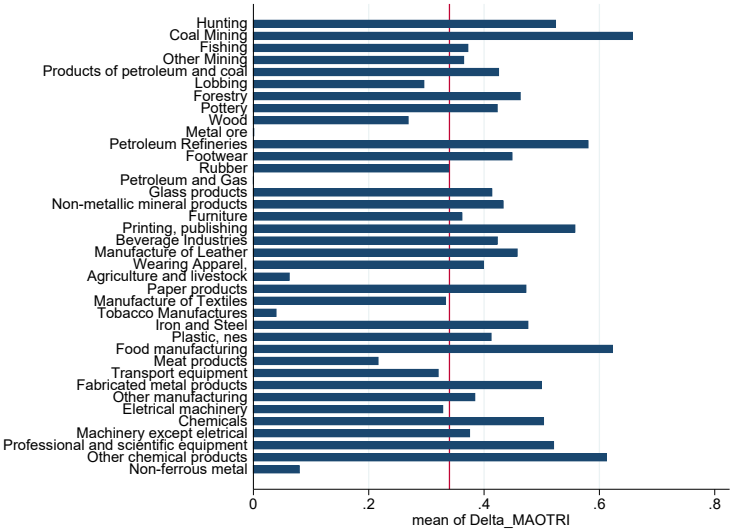
Note: The figure provides the correlation between increases in tariff barriers faced by Swiss exporters and the current level of tariff protection in each destination market.

Figure 9: Tariff increases by ISIC sector faced by Swiss exporters



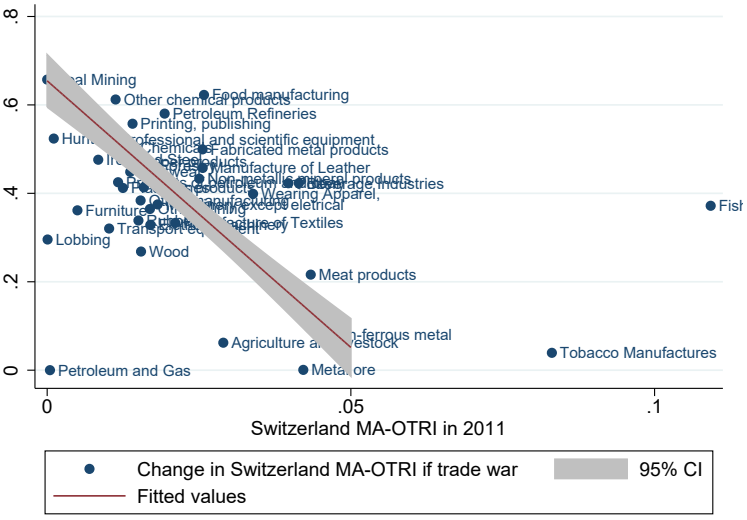
Note: The figure provides the tariff increase by sector experienced by Swiss exporters in the case of a trade war.

Figure 10: No correlation between tariff increases by ISIC sector faced by Swiss exporters and their export share



Note: The figure provides the estimates for Switzerland of changes in MA-OTRI by sector due to a global trade war but where sectors are ordered by size.

Figure 11: Larger increases in tariff barriers in sectors currently facing low tariff barriers



Note: The figure provides the correlation between changes in MA-OTRI due to a trade war and the level of MA-OTRI in 2011.

The lack of correlation between export shares and tariff increases across industries is illustrated in Figure 10. Industries are ranked in increasing order in terms of their export value, with hunting being the sector with the lowest export share among 3-digit ISIC revision 2 industries. As can be seen, there is no clear pattern between the export share of each industry and the tariff increase it experiences, contrary to what we observed for destination markets, where larger increases in tariff barriers are experienced in larger destination markets.

Finally, the sectors where Swiss exporters faced lower tariff barriers in 2011 would be the sectors with the largest increases in tariff barriers in a global trade war. This is illustrated in Figure 11, which shows a strong negative and statistically significant correlation between 2011 levels of MA-OTRI and the changes in MA-OTRI by ISIC export sector.

5.1 Robustness with no PTAs and no tariff water

To assess the quantitative importance of our assumptions that the presence of PTAs and tariff water must be taken into account when calculating tariff increases in the case of a trade war, we provide a summary of the results where these two assumptions are removed and tariff changes are simply given by a move from cooperative to non-cooperative tariffs (i.e., $1/e^*$).

The correlation between the measures of tariff increases across industries with and without the two assumptions on PTAs and tariff waters is 0.78, indicating that the pattern of tariff increases faced by Swiss exporters across different industries is not affected by these assumptions. However, the simple average level of tariff increases across industries increases quite significantly by 10 percentage points. Differences in some industries can be as high as 64 percentage points. This is the case for tobacco, for example, which is explained by the fact that many of the countries to which Switzerland exports tobacco have a lot of tariff water in their schedules. Because we previously assumed that countries with tariff water will already be setting non-cooperative tariffs, we previously had no tariff changes in these countries, and therefore a small increase in tariff protection for Swiss tobacco exporters. In other industries the difference in tariff is negative, as for example in forestry products, where the tariff increase is 5% lower when we do not take into account the presence of PTAs and tariff water. This is explained by the fact that Switzerland exports a large share of forestry products to countries with no tariff water, but with whom it has a PTA. Because we no longer consider the move from the preferential tariff to the MFN tariff in these types of countries, the tariff increase faced by Swiss exporters is smaller.

In sum, while for some industries the difference in assumptions could lead to very different results, the overall picture in terms of tariff increases following a global trade war remains quite similar when we take into account the presence of tariff water and preferential trade agreements.

6 Concluding remarks

We have estimated the effect that a global trade war would have on the tariffs faced by Swiss exporters in the rest of the world. We assume that a global trade war will imply all countries moving to their non-cooperative tariffs. Contrary to the existing literature, we have taken into consideration the presence of preferential trade agreements and tariff water when considering the moves to non-cooperative tariffs. Results suggest that a global trade war will result in a tenfold increase in tariff barriers faced by Swiss exporters. They will face the largest tariff increases in their largest destination markets (European Union, United States and Japan) and in countries and industries in which today they face the lowest levels of tariffs.

Our results should be taken with caution, as there are several caveats. First, a trade war may not necessarily imply a move to the non-cooperative tariff determined by the importer's market power (Evenett, 2018). In repeated games, apparently irrational or self-hurting behavior can pay off, and these are not considered here. Second, to estimate the change in tariffs, we assume that political economy forces for and against tariff protection will remain unchanged in the case of a global trade war. This is unlikely to be the case, and one can think of reasons why forces lobbying for and against protection will change in the case of a trade war. Third, we have only considered tariff changes, but because non-tariff measures can also be used for protectionist reasons, tariff changes may not need to be that large. Finally, the current trade war between the United States and some of its trading partners is far from a global trade war and it has only affected a limited share of world trade. Nevertheless, the exercise in this paper can shed light on what would happen if the current tension were to spread across the entire world trading system.

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