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Trade policy uncertainty as barrier to trade

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Abstract

This paper studies the effects of trade policy uncertainty on the extensive and the intensive margins of trade for a sample of 149 exporters at the HS6 digit level. We measure trade policy uncertainty as the gap between binding tariff commitments under trade agreements (multilateral and regional agreements) and applied tariffs- what is also known as tariffs' water. Our results show that trade policy uncertainty is an important barrier to export. On average the elimination of water increases the probability of exporting by 12 percent. A one percent decrease of water also increases export volumes by one percent. We also find that the negative impact of trade policy uncertainty is higher for countries with low quality of institutions and in the presence of global value chains. Finally, our findings show that on average trade policy uncertainty is equivalent to a level of tariffs between 1.7 and 8.7 percentage points.

Keywords: Binding overhang, tariffs, policy space, non-tariff barriers, World Trade Organization

JEL Codes: F10, F13, F14

1. Introduction

Policy makers have long believed that an important contribution of trade agreements is to increase the predictability of trade policy. The WTO and its multilateral agreements of trade in goods aim at ensuring that trade flows as smoothly, predictably and freely as possible. Specifically WTO members make commitments not to increase tariffs above some bound rates.[1] Still, trade policy regimes are flexible and tariffs may change without the violation of WTO rules. In fact, a substantial portion of global trade occurs under flexible trade policy regimes. In 2011, on average 27 percent of world imports were either unbound or bound with a gap between the bound rate (the so called "tariff water") and the applied rate greater than 5 percentage points. The global average level of tariff water is about 18 percentage points, ranging from about 4 percentage points in high income countries to approximately 24 percentage points in middle and low income countries (Groppo and Piermartini, 2014).

Uncertainty of trade policy, defined as the risk of a tariff reversal has real economic effects. In a model of trade with heterogeneous firms, Handley (2014) shows that uncertainty over future conditions of trade creates an option value of waiting to enter a new market, thus inducing firms to delay the entry in a foreign market. The risk of a trade policy reversal acts as a fixed cost to enter an export market and therefore has a negative impact on the extensive margin of trade. In this set up, tariff commitments under the WTO should increase the number of products that countries trade.

Existing evidence supports the view that trade policy uncertainty has a negative effect on the number of traded products (the extensive margin of trade). Focusing on Australia's commitments under WTO, Handley shows that entry is higher in sectors characterised by lower binding overhangs (the gap between the applied and the ceiling level of the tariff). The interpretation is that the uncertainty-reducing effect of lower binding overhang favours exports to Australia. In particular, Handley estimates that, if Australia unilaterally reduced tariffs to free trade levels, the number of traded products would increase by 4 percent. Alternatively, if Australia both reduced tariffs to zero and bound them through WTO commitments, the combined impact of removing the motives for caution and delay would increase the number of traded products by 11 percent. In another paper, Handley and Limão (2012) show a significant increase in Portuguese exports to the EU upon accession. In particular, they find evidence of increased entry of Portuguese firms even in sectors where applied tariffs did not change. They interpret this as evidence that Portugal's accession to the EU eliminated

[1] Economic theory has recently shown that the reduction of trade policy uncertainty could per se be a motive to enter an agreement. Even if an agreement does not reduce applied tariffs' rates, there are welfare gains from reducing uncertainty (Limao and Maggi, 2013). In support of these views, Groppo and Piermartini (2014) show that WTO commitments -of not increasing tariffs above a certain level- do reduce trade policy uncertainty. Mansfield and Reinhardt (2008) also find that GATT/WTO membership reduces export volatility by up to one-third.

the (pre-accession) risk that tariffs faced by Portuguese exporters may increase to the level of EU external tariffs. Handley and Limão (2013) also point at large positive effects on trade and welfare following China's accession to WTO. They estimate that reducing the threat of a trade war explains 22% of Chinese export growth to the U.S. In addition, reduced policy uncertainty lowered U.S. prices, thus increasing consumers' income by at least 0.8 percent, the welfare equivalent of an 8 percentage point tariff decrease.

The aim of this paper is to deepen our understanding on the quantitative impact of more predictable market access conditions deriving from trade agreements on trade flows and in particular on the extensive margin of trade. To this purpose, we define trade policy uncertainty as the degree of flexibility that both multilateral and preferential trade agreements provide. Specifically, applied tariffs are allowed to vary, and in particular to freely increase up to certain limit or bound rate. We define trade policy uncertainty as the gap between the bound and the applied rate and we test the impact of this tariff overhang (or tariff water) on the extensive and the intensive margins of trade, that is the probability and the value of exports, respectively.

Our paper contributes to the existing literature in several ways. First, it extends the analysis of the quantitative effects of trade policy uncertainty (TPU) to the volume of exports. So far the literature has focused on the analysis of the effects of TPU on the probability of a country to export. However, to the extent that uncertainty of trading conditions imposes an extra fixed cost to trade, it will also affect the intensive margin of trade. Focussing on the insecurity of trading conditions -be it in the form of exporters' risk to lose their shipment because of hijacking, to having to pay a bribe, or to facing particular delays related to poor governmental regulations, Crozet et al. (2008) show that an increase in insecurity decreases both the number of exporters and the volume of their exports.[2]

Second, we analyse how the impact of trade policy uncertainty on trade (both on the intensive and extensive margin) varies across countries and sectors, and we identify factors explaining such variations. For this, we extend the analysis of the impact of TPU on trade to a sample of 149 countries and run the analysis at HS6 digit.

In particular, we expect that TPU is a more important obstacle to trade for countries with poor quality of institutions. The intuition behind this reasoning is that firms perceive countries with better institutions as countries that are more credible in terms of the policies that they adopt or as countries that would vary less their trade policies. Since both regional and multilateral commitments may work

[2] Crozet et al. (2008) describe insecurity as an exogenous probability for firms to be directly hurt by a negative event when trying to enter the export market. Unlucky exporters have to pay an extra fixed cost to sell on the foreign market.

as a credibility devise for countries with weak institutions, in our analysis we take into account not only countries commitments under the WTO but also under PTAs.

We also look at whether the sensitivity of trade to TPU depends on specific industry characteristics. Several authors have argued that uncertainty is an important obstacle to trade when production takes place in global supply chains. Uncertainty is a source of agglomeration when production is fragmented (Harrigan and Venables, 2006).[3] Therefore, one may expect that TPU has a stronger negative effect in the export margins of intermediate goods input into further processing. To this purpose, we test whether the relationship between TPU and export margins is stronger for intermediates goods. We also test whether the sensitivity of trade to TPU depends on the degree of differentiation of a product. Whilst the empirical literature shows that tariffs have a higher negative impact on homogeneous goods (see Kee, Nicita and Olarreaga, 2004), the impact of uncertainty on this kind of goods could go the opposite way. Compared to differentiated goods providers, firms supplying more standardized inputs could more easily offer their products in other markets once a trade policy reversal takes place in a certain destination. Therefore, homogeneous goods should be less affected by TPU.

Third, we address potential problems of endogeneity deriving both from reverse causality and omitted variables bias. Reverse causality arises, for example, if governments are more willing to bound tariff lines where they are less likely to change their MFN tariff. This would bias our results downwards. We address this issue by running our regression for the sub-sample of countries that have acceded the WTO after the Uruguay Round (UR). Our claim is that compared with pre-existing members, these countries were not involved in the UR negotiations and therefore had less of a say on the level at which to bound their tariffs. To control for omitted variables bias, we add different sets of fixed effects in our estimation.

Finally, we assess whether our results are robust across time and controlling for prohibitive tariffs. A tariff is prohibitive when it the facto act as an import ban. Any additional tariff increase above this rate will therefore have no effect on trade. There are cases when countries bound their tariff at a level above the bound rate. In these cases a government can increase a tariff rate above the prohibitive rate, but this additional increase is likely to have no economic effects. Failing to consider this may provide

[3] Harrigan and Venables (2006) show that the demand for timeliness in delivery generates incentives for the clustering of plants around the assembler or retailer. In their model, time costs are qualitatively different from other costs of distance because of uncertainty. To stress this point, they show that in a model where final assembly occurs in two locations, uses a number of components and cannot be completed until all parts have arrived, component production will tend to cluster around just one of the assembly plants. The incentive to agglomerate arises due to an increasing marginal value of timeliness stemming from the fact that all components are needed for final assembly. This is because the late arrival of any one component may disrupt production and thus can have a very high cost as a percentage of the cost of each component. A parallel point can be made for uncertainty in the cost of an input.

biased results. Hence, we run regressions using the prohibitive tariff as the actual bound rate whenever the bound tariffs are above their prohibitive level.

We find that multilateral and preferential trade commitments have a positive impact on both the extensive and the intensive margins of trade. In particular, we find that on average the elimination of water increases in TPU decreases the probability to export by 12 percentage points. The impact of TPU on the intensive margin of trade is also negative and the elasticity of exports to water is around 1 on average. Our results also confirm that the negative impact of trade policy uncertainty is higher for countries with low quality of institutions, in the presence of global value chains and for differentiated products.

2. Data

Trade policy uncertainty can be measured in different ways. To reflect the theoretical prediction that what matters for a firm when deciding if exporting to a certain destination and/or how much to export is the risk of a trade policy reversal rather than volatility in import tariffs, we measure TPU as the gap between bound rates and effectively applied tariffs -what is also known as water or binding overhang.[4] The reasons are twofold. First, independently on whether water changes a lot or not over time, the simple fact that it exists has an impact on export decisions; second, volatility captures the temporary movements of tariffs that for potential exporters are not as important as the long term levels of water.

In the case of two WTO member countries that have not formed a preferential trade agreement between them, bound tariff rates are represented by the ceiling rates at which individual WTO members have committed under the WTO. WTO members have the flexibility to increase applied tariffs up to their bound levels and can take another member to dispute settlement only when it increases its applied tariff above the bound level. The size of water measures the possibility of a country to freely increase its applied MFN tariffs up to the bound rate without incurring into a dispute at the WTO. The simple presence of water makes trade policy less predictable and therefore more uncertain.

In our analysis we take commitments under PTAs into account by setting the bound rate equal to the preferential tariff for those country pairs that have signed a preferential agreement. Specifically, the level of water is equal to zero for those country pairs making part of a PTA with the exception of

[4] One often suggested alternative is to consider the second moment of the distribution of tariffs. However, such measure would capture also the possibility of tariff reductions which are not relevant for the export choice of firms.

those cases where the MFN rate is lower that the preferential tariff.[5] Algebraically, we define water in sector k for a country pair ij as follows:

$$Water_{ijk} = \begin{cases} max(Pref\ rate_{ijk} - MFN_{jk}, 0) & \forall ij \in PTA \\ Bound\ rate_{ijk} - MFN_{jk}, & otherwise \end{cases} \quad (1)$$

Data on MFN applied and WTO bound rates are obtained from Groppo and Piermartini (2014). Their database combines information on MFN applied tariffs from the WTO's Integrated Data Base (IDB) and UNCTAD's Trade Analysis and Information System (TRAINS).[6] The latter database is also used to extract data on effectively applied tariffs for country pairs belonging to a PTA. Data on WTO bound rates are from the WTO Consolidated Tariff Schedules (CTS) database.

Trade data has been retrieved from the UN COMTRADE database. We use bilateral exports at the 6-digits level of the Harmonized System 1996. Since the number of observations in the full sample is huge and creates computational challenges, we have established a set of restrictions to reduce the sample size. First, we focus on a cross section analysis for the year 2011. Second, we exclude agricultural sectors. These sectors are characterised by a relevant portion of non-ad valorem tariffs and other country-specific distortions such as agricultural subsidies, for instance, and therefore the calculation of the equivalent bound rates could be misleading or biased. Third, we exclude importers and exporters that were not WTO members in 2011.[7] Fourth, we omit from the sample countries whose share of world trade is less than 0.1 percent. Finally, we disregard zero trade observations in products for which certain countries, mainly small countries, do not export to any destination, under the assumption that such countries do no produce these products. After applying these restrictions, we have information on trade, tariffs, bound rates and additional control variables for 149 developed and developing countries exporting up to 4381 different HS6 products to 102 destinations. The number of observations in our baseline regression is therefore around 10 million.

Table 1 presents some summary statistics for the main variables of interest.[8] The average value of exports is almost 1.2 million of dollars. The average applied tariff rate is 4.94 percent while the bound rate is 9.12 percent, almost twice the tariff. The average level of water is slightly more that 4 percent. Tariffs and bound rates vary considerably as does the level of water. There are cases where water is negative. For example, for the EU negative water is recorded on certain footwear from China due to

[5] For example, the MFN rate of Australia and Indonesia in "Liquid dielectric transformers<650 KVA" and other electrical machinery and equipment is lower than the preferential rate agreed with Thailand on those products.

[6] In particular the authors use TRAINS as the primary source for tariff data and IDB to fill the missing values.

[7] Considering only WTO members and manufacturing products, we have information about 151 countries exporting to 123 countries in 4399 products. This translates into a sample of more than 81 million observations.

[8] Summary statistics are calculated for the sub-sample of observations that are actually used in our econometric analysis.

an antidumping duty in that year. However, given that we run our regressions using log (water), our results are not affected by these outliers.[9] In few instances applied tariffs can be higher than 100 percent[10]; also bound rates and water can go beyond 350 percent.[11] Finally, almost half of the country pairs considered in our analysis are involved in a preferential trade agreement.[12]

In our sample of countries, around 15 percent of exports is subject to trade policy uncertainty (see Figure 1). Figure 2 shows how the distribution of water changes across countries. Specifically, developing and emerging countries present wider flexibility compared to developed ones.

3. Empirical analysis

a. Econometric specification

We are interested in the effect of trade policy uncertainty on the extensive and intensive margins of trade. Specifically, we estimate the following specification:

$$y_{ijk} = \alpha + \beta_1 \log(Water_{ijk}) + \beta_2 \log(\tau_{ijk} + 1) + \beta_3 Size\ Rel_{jk} + \beta_4 X_{ij} + \delta_{jk_{2d}} + \delta_{ik_{2d}} + \varepsilon_{ijk} \quad (2)$$

For the extensive margin regressions, the dependent variable y_{ijk} captures the probability that country i exports product k to country j, $\Pr(Export\ ijk)$, where $Export_{ijk}$ is a dichotomous variable for positive trade flows in product k between countries i and j. For the intensive margin regressions y_{ijk} is represented by the log of total exports of product k from country i to country j, $\text{Ln}(Export_{ijk})$.

$Water_{ijk}$, our main variable of interest, is calculated as in equation (1) and captures the level of trade policy uncertainty faced by country i when exporting product k to country j[13]; τ_{ijk} measures the applied tariffs that country j imposes on country i in product k; $Size\ Rel_{jk}$ captures the relative importance of importer j in sector k and is calculated as the ratio of product k's share in country j's

[9] As a robustness check we also run the same regressions using water in levels. The results are qualitatively the same.

[10] Indonesia has a tariffs higher than 100 percent for the HS1996 product code 330210, "Mixed odoriferous substances – food & drink industries".

[11] Panama has a tariff and binding on the HS code 871000 "Tanks and other armoured fighting vehicles, motorised, whether or not fitted with weapons, and parts of such vehicles" of 368 and 353 per cent respectively.

[12] Regarding the PTA variable, we rely on a newly built database by the WTO Secretariat (see WTO, World Trade Report 2011).

[13] In some specifications we use bound rates instead of water in order to explore the impact of the binding levels on the intensive and extensive margins of trade.

exports to its share in world trade[14]; X_{ij} includes a set of standard gravity variables, such as the log of distance, contiguity, common language, colonial relationship, and common legal origin in order to control for country-pair specific characteristics; ($\delta_{jk_{2d}}$) and ($\delta_{ik_{2d}}$) are importer-industry and exporter-industry fixed effects, where industries are defined at the HS Section level (2 digits) and control for any unobservable country-industry specific characteristics.[15] In all the regressions, robust standard errors are clustered at the importer-product level.

b. Baseline Results –Extensive and Intensive Margin

Table 2 reports the results of the linear probability model estimated in equation (2).[16] As expected, column 1 shows that higher applied tariffs in country j are negatively related to the probability of exporting from country i to j. The coefficient of log tariff is negative and significantly different from zero. Tariffs are on average 4,94 per cent. This implies that decreasing tariffs by one percentage point-equivalent to a 20 percent reduction of the average tariff, increases the probability of export by 0.11 percentage points ($\beta_2 * 0.20$).

The size of a sector in the importer country is positively related to trade. This result may be interpreted as a sign of the importance of intra-industry trade. The sign of the other control variable is in line with the economic literature. In particular, countries that are far away have a lower probability to trade while countries that share borders, language and a common colonial relationship tend to trade more.

Column 2 shows how trade commitments (multilateral and regional) affect the probability of trade between two countries. The negative and significant coefficient of the (log of the) bound rate suggests that countries are less likely to export to countries with higher bound rates. At the average level, a reduction of bindings of one percentage point (from 9.1 to 8.1 percent) is associated to a 1.5 percent increase in the probability of export. . Similarly, a reduction of applied tariffs by one percentage point is associated to an 8.6 percent increase in the probability of export. These results indicate that not only lower tariff rates, but also more stringent bindings are related to more international trade. The coefficients of all other variables are equal in sign and magnitude to the previous column.

[14] In formula, the variable has been constructed as $\frac{Export_{jk}/\sum_k Export_{jk}}{\sum_j Export_{jk}/\sum_j \sum_k Export_{jk}}$ where $Export_{jk}$ is country j's exports of good k. The variable has then been normalized in order to take values between -1 and 1 and where 0 is the threshold that establishes whether a country specializes in a product or not.

[15] Note that due to the size of the dataset, the inclusion of importer- and exporter-product fixed effects at the HS 6 digits level presents computational challenges.

[16] In order to avoid the incidental parameter problem due to the big set of fixed effects included in the regression we use OLS to estimate the impact of trade policy uncertainty on the extensive margin of trade. In particular, the coefficients of equation (2) have been estimated using the Stata command *reg2hdfe* developed by Guimaraes and Portugal (2010).

Our baseline result is shown in column 3. Trade policy uncertainty, as captured by water, reduces the probability to trade and the magnitude of the coefficient is economically significant. At the average level of water, improvements in commitments through a reduction of water by one point, from 4.2 to 3.2 percent (almost 24 percent decrease), is associated to an increase in the probability of exporting of 2.9 percentage points. Alternatively, eliminating trade water will increase exports by 12 percent. Our outcomes are in line with the theoretical prediction that trade policy uncertainty represents a cost that induces firms to wait and postpone entry to foreign markets. Firms are more likely to export their products not only to countries that have lower tariffs (the coefficient is negative and significant), but also to countries with lower water, where the losses deriving from a potential increase in tariffs are limited.

The OLS results for the intensive margin are presented in Table 3. The log-log nature of our specification allows us to interpret, the coefficients on tariffs, bound rates and water as elasticities. Column 1 shows that a one percent reduction in tariffs is associated to a 2.9 percent increase in the value of exports. When we add bound tariff rates (column 2) the tariff coefficient decreases to 1.8 percent. Moreover, a reduction in bound rates is negatively associated to the value of exports: reducing the bound rate by one percent increases exports by a 1.1 percent. Column 3 shows our baseline results. A reduction of water has a positive effect on the intensive margin of trade. In particular, a one percent decrease in water is associated to a 1.1 percent increase in the value of exports. The coefficient on tariffs remains negative and significant.

In the last three columns of Table 3, water is captured by a set of dummy variables identifying different thresholds of policy space. In particular, a set of dichotomous variables is used to capture positive water, water higher than 5 and water higher than 10 respectively. These regressions will allow us to compute the tariff-equivalent of trade policy uncertainty, for different levels of water.[17] The coefficients show that whilst having positive water is equivalent to having a tariff of 1.7 percent, (see column 4), the tariff equivalent of having water of at least 5 or 10 is equal to 8.7 and 7.5 percent respectively (see columns 5 and 6). The fact that the tariff equivalent of water bigger than 5 and bigger than 10 are very similar is likely due to the fact that there are few observations in our sample with water between 5 and 10 (see figure 1).[18]

4. Endogeneity

[17] We follow the formula of Kee et al. (2009), $TE = \left(e^{\beta_1} - 1\right) / \beta_2$, in order to compute the tariff equivalent (TE) for dichotomous variables capturing water levels bigger than 0, 5 and 10 respectively.

[18] Calculations of tariff equivalents by country are available from the authors upon request.

Our results may suffer from an endogeneity bias due to potential reverse causality. Negotiated bound rates, and therefore water, may be affected by trade: the terms-of-trade (TOT) argument for tariff setting suggests that a large importer of a product may wish to set its bound rate high, in order to have the flexibility to realise TOT gains. To control for this, we re-estimate our equations on the subsample of importers that acceded the WTO after 1995. The rationale behind this choice is that given that new acceding countries were not involved in the UR negotiations at the moment of accession, they have to accept the conditions set by the previous members. Hence, it is unlikely that the MFN and bound rates of new acceding countries depend on their trade structure.

Table 4 shows the results on the impact of trade policy uncertainty on the extensive and intensive margins of trade for the subsample of new acceding countries importing from any WTO member. These results are similar to the ones presented in the previous tables. Higher levels tariffs, tariff bound rates and water reduce the probability of exporting to a new acceding member of the WTO. The coefficients are all negative and significant. As to the magnitudes, the coefficients of water and log tariffs in columns 3 and 6 are now larger compared to their respective coefficients in tables 2 and 3. This might be due to the sample of countries included in the regression.[19]

The coefficients in column 3 indicate that at the average level of water, a reduction of one point in water from 5.4 to 4.4 is associated to an increase in the probability of exporting of 12.7 points. Similarly export probability increases by 18.3 points when tariffs go from the average level of around 6 to 5 percent. For the intensive margin regressions, the coefficient of water also increases in the subsample of new acceding countries (see column 6). The elasticity of exports to water is now -5, almost equal to the elasticity of exports to tariffs. A 1 percent reduction of water is associated with an increase in the value of exports of 5 percent.

Endogeneity may also arise from the presence of omitted variables bias. To address this concern, we run a set of regressions where we use country-pair fixed effects in addition to importer-industry[20] fixed effects. As in the baseline regressions, we capture exporter-product characteristics by adding the exporter's world share of exports in a certain product. We also control for importer-product characteristics by adding the relative size of a sector in the importer country.

The results, reported in Table 5 are in line with the baseline regressions both for the extensive and the intensive margins of trade. In the former case both tariffs and water still have a negative effect on the probability to trade. The coefficient of water is somehow smaller: water elimination is associated with an increase in the probability to trade of 6,5 percent. The increase in the probability to trade due to a

[19] The average level of water in this subsample is 5.4 while average tariff is 6.2 percent.
[20] Where industries are defined at the HS 2 digits level.

decrease of tariff from5 to 4 percent is equal to 11.7 percent (see column 3 of Table 5). A marginal increase of 1 percent in the level of water is associated to a decrease in the value of exports of 0.6 percent. The decrease in exports due to an increase in tariffs is higher and equal to 3.7 percent (see column 6 of table 5).

5. Robustness

In our analysis we include both bound and unbound tariff lines. In particular, for unbound tariffs -tariffs without a maximum ceiling-, we have imputed a rate equal to the peak tariff, defined as three times the average tariff.[21]

A potential problem deriving from our estimations is that tariff water may provide an overestimation of the extent of the flexibility of multilateral and preferential trade agreements since, for certain tariff lines the bound levels may be above the prohibitive tariff levels -tariff levels above which trade would be equal to zero (see Foletti et al. 2011). As a robustness check, we re-estimate equation (2) using the level of *effective water* as explanatory variable for trade policy uncertainty:

$$water_{ijk}^{eff} = \begin{cases} B_{jk} - \tau_{ijk} & \text{if } B_{jk} < \tau_{ijk} \\ \tau_{jk}^{P} - \tau_{ijk} & \text{otherwise} \end{cases} \qquad (3)$$

where $\tau_{jk}^{P} = \tau_{jk} + \frac{1+\tau_{jk}}{\sigma_{jk}}$ and σ_{jk} is the import demand elasticity estimated at the HS 6 digit level by Kee et al (2008). In equation (3), the level of effective water is equal to the difference between the prohibitive tariff and the applied rate, for all those tariff lines where the bound rate or the imputed rate for the unbound lines is above the prohibitive tariff. For those tariff lines where the bound rates are equal or below the prohibitive rates, the effective level of water coincides with the originally calculated levels of water.

The results for the extensive margin of trade, presented in Table 6, are in line with our main predictions. Specifically, higher levels of water reduce the probability that a product is traded. Reducing effective water by one, from the average of 3.9, is associated to an increase of the probability of export of 2.6 points in the full sample (column 2). The general result holds also for the subsample of importers that acceded WTO after 1995: a reduction of effective water from 5.3 to 4.3 is associated to an increase in the probability of trade of 13.3.

The coefficients of effective water are also consistent with the baseline results for the intensive margin regression (see Table 7). A reduction of water has still a positive effect on export volumes. In

[21] The definition of peak tariff is consistent with the accepted practice at WTO.

particular, a one percent decrease in effective water is associated with a 0.9 percent increase in the value of exports. As in the baseline regressions, the coefficients of all variable of interest increase when only new acceding countries are included in the sample.

Finally, to show that our results are robust to different years we re-estimate the impact of water on the extensive and intensive margin for the year 2007. The results reported in Table 8 are qualitatively and quantitatively similar to the results for 2011. At the average level of tariff in 2007, a decrease in tariffs by one percentage point increases the probability of export by 6 points, at the average level of water, a decrease in water by one point increases trade by 1 point.[22] Table 8 also shows that the results for the intensive margin in 2007 are qualitatively the same as the results for 2011, yet the magnitudes of the coefficient of water is smaller in 2007.[23]

6. Trade Policy Uncertainty and Institutions

Countries with better institutions are likely to have more credibility in terms of the policies that they adopt. Therefore, potential exporting firms may perceive the presence of policy flexibility as a lower concern in such countries. We explore this aspect by adding an interaction term between water and the level of institutions in our regressions.

In Table 9, we report the results of our regressions. Using the Worldwide Governance Indicator database to measure the quality of institutions across countries, we show the coefficients of the interaction term for three indicators of institutional quality -rule of law, regulatory quality and control of corruption. The coefficients of the interaction terms are all are positive and statistically significant meaning that the negative effect of water both in the extensive and intensive margins of trade, is attenuated for countries with better institutions. In particular, we estimate that an improvement of one point in the level of institutional quality reduces the negative effect of water on the probability of export between 40 and 60 percent on average. An increase of one point in the level of institutions also reduces the elasticity of export values by an amounts between 32 and 58 percent.

7. Trade Policy Uncertainty and Product Characteristics

We now turn to the analysis of whether the impact of trade policy uncertainty is magnified in the presence of global value chains (GVCs). Yi (2003) shows that tariffs and non-tariff measures matter

[22] In 2007, the average tariff and water in our sample are 6.2 and 6.4 respectively. The average bound rate is 12.6 percent.

[23] The differences in the magnitude of the coefficient is mainly due to the different samples available in 2007 and 2011. If we select the observations in the sample such that we have the same country-pairs in both year, the coefficients become very similar to the coefficients for 2011 reported in tables 1 and 2.

more in GVCs, because in GVC goods cross borders multiple times and each time they do so, they incur the cost of the trade barrier they face. Following the same logic, TPU should have a stronger negative effect in the export margins of intermediate goods inputs into further processing. Papers such as Harrigan and Venables (2006) also show that uncertainty is an important obstacle to trade when production takes place in global supply chains: it is a source of agglomeration when production is fragmented.[24]

To test whether TPU has an amplified impact in the presence of GVCs, we include the interaction between water and a dummy that identifies the sectors involved in global value chains (GVCs). The dummy is equal to one for parts and components defined as the Standard International Trade Classification (SITC Rev.3) equivalent of Broad Economic Categories (BEC) parts and components plus unfinished textiles in SITC section division 65.[25] Results are presented in column 1 and 4 of Table 10. The coefficients of water and log tariff are still negative and significant. At the average tariff, a decrease in the applied tariff of one percentage point increases in the probability of trade by 11.2 points. Water elimination for non-intermediate products is associated with an increase in the probability to export of 7.5 percent. The coefficient of the interaction term is also negative and significant, implying that intermediate goods are more sensitive to trade policy uncertainty. In particular, a 100 percent reduction in water increases the probability of exporting by 13.5 percent.

In addition, we examine whether water has a different effect for products that are more or less differentiated. We have no prior expectations about the difference between homogeneous and differentiated goods. A trade-off between at least two mechanisms is at play. On the one hand, homogeneous goods are more sensitive to changes in prices. This would suggest that homogenous goods are also more sensitive to uncertainty. Conversely, providers of standardized goods can more easily redirect their supply of intermediates towards countries with lower levels of trade policy uncertainty compared to providers of more differentiated and tailor-made goods. As a consequence, differentiated goods are more sensitive to uncertainty.

To investigate the sensitivity of homogeneous versus heterogeneous products are more or less sensitive to trade policy uncertainty we add in our regressions an interaction term between water and a categorical variable capturing the level of differentiation of goods. In particular we use the classification of products created by Rauch (1999), that groups sectors at the 4 digits SITC level into differentiated products (Rauch index=2) reference priced (Rauch index=1), or homogeneous goods

[24] The authors focus on uncertainty in time costs but a similar logic could be applied for uncertainty in trade policy.

[25] Product nomenclatures have then been converted using the conversion tables prepared by the UN Statistics Division.

(Rauch index=0). Columns 2 and 3 of Table 10 show the results of regression (2) augmented with the interaction between water and different formulations of the Rauch classification.

In column 2 the coefficient of water is negative and significant suggesting that water has a negative impact on the probability of exporting homogeneous goods. The negative coefficient of the interaction shows that such negative effect of water is stronger the more differentiated the goods. In column 3 we interact water with a dummy equal to one for differentiated goods only. The coefficient of the interaction term is still negative and significant.

As far as the intensive margin is concerned, table 10 (columns 4-6) show the impact of TPU for intermediates and for products with different levels of differentiation on the intensive margin of trade. Also in this case the coefficient of the interaction between water and parts and components is negative and significant. The elasticity to water of non-intermediate goods is around two thirds of the elasticity of intermediates. This means that increases in the level of water are associated with bigger decreases in exports of intermediate goods. Similarly, differentiated goods are more sensitive to increases in the level of water.

8. Conclusions

This paper contributes to the emerging economic literature that studies the role of trade policy uncertainty on the choice of firms to export. It also investigates the impact of trade policy uncertainty on the intensive margin of trade.

Our main results show that TPU has a negative impact both on the probability to export and on export volumes for a wide set of importers and exporters using disaggregated data. Our findings are robust to endogeneity.

We also analyze the impact of TPU across countries and sectors. Our results show that for countries with better institutions the impact of TPU is dampened: stability and credibility of importers reduces the cost due to the presence of policy space. In addition the presence of policy space is an important obstacle to trade when production takes place in global supply chains and has a higher negative impact for more differentiated good compared to standardized ones.

Finally, in terms of policy implications, this paper provides evidence on the importance of trade commitments. In particular it supports the view that trade policy uncertainty act as a barrier to trade. Hence there is a commercial value of binding tariffs even when the bound rate is above the applied rate.

A. Tables and Figures

Figure 1

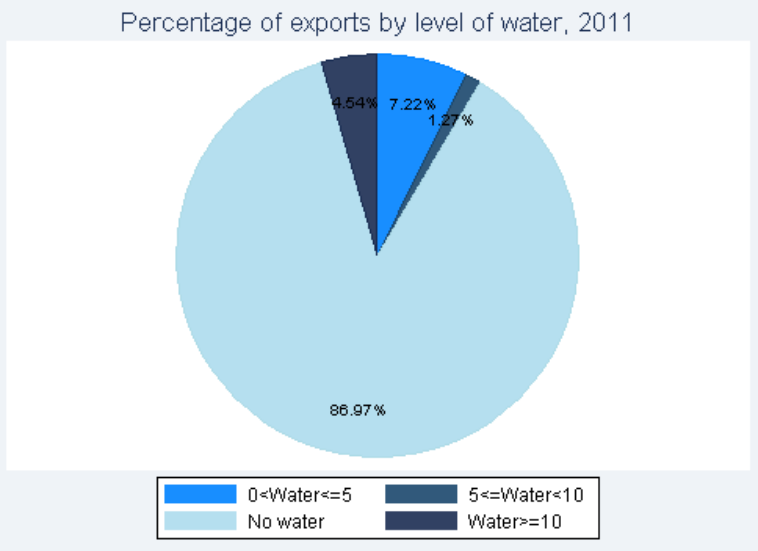

Figure 2: Average water by country, 2011

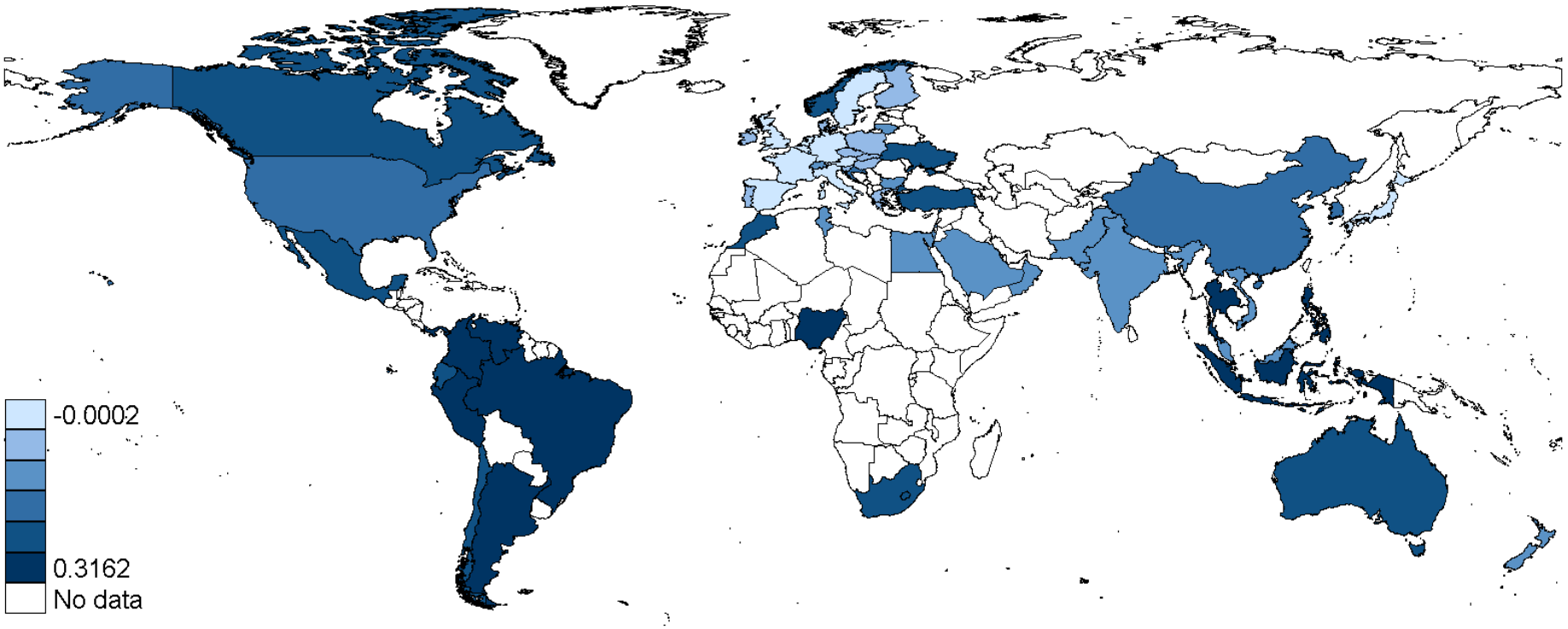

Table 1: Summary statistics for baseline sample

	Mean	St.Dev.	Min	Max
Exports (1000s $)	1148.82	62466.7	0	69194976
Exports (log)	10.53	3.28	0	24.96
Product traded (binary)	0.297	0.457	0	1
Water	0.0418	0.107	-0.3	3.5333
Water (log)	0.0366	0.0886	-0.3566	1.5114
Tariff	0.0494	0.0626	0	1.0167
Tariff (log)	0.04659	0.0564	0	0.7015
Binding	0.0912	0.1338	0	3.6833
Binding (log)	0.081	0.1077	0	1.544
PTA	0.47	0.5	0	1
N	10032922			

Table 2: Trade policy uncertainty and export probabilities - Baseline results extensive margin

	(1)	(2)	(3)
VARIABLES	Probability to export		
Water (log)			-0.121***
			(0.00325)
Tariff (log)	-0.541***	-0.426***	-0.559***
	(0.0121)	(0.0124)	(0.0121)
Bound rate (log)		-0.141***	
		(0.00348)	
Relative size of k in j	0.0664***	0.0663***	0.0663***
	(0.000872)	(0.000872)	(0.000872)
Distance (log)	-0.118***	-0.115***	-0.115***
	(0.000279)	(0.000286)	(0.000285)
Observations	10,048,382	10,032,922	10,032,922
R-squared	0.356	0.356	0.356
Other gravity variables	Yes	Yes	Yes
Importer-Industry FE	Yes	Yes	Yes
Exporter-Industry FE	Yes	Yes	Yes

Robust SE in brackets clustered by importer-product. All regressions include a set of standard gravity country-pair specific controls such as contiguity, common language, colonial relationship and legal origins.

*** p<0.01, ** p<0.05, * p<0.1

Table 3: Trade policy uncertainty and export volumes - Baseline results intensive margin

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Log of exports					
Water (log)			-1.060***			
			(0.0477)			
=1 if water>0				-0.0504***		
				(0.0102)		
=1 if water>5					-0.272***	
					(0.0101)	
=1 if water>10						-0.236***
						(0.0107)
Tariff (log)	-2.860***	-1.772***	-2.825***	-2.826***	-2.730***	-2.795***
	(0.113)	(0.127)	(0.113)	(0.114)	(0.113)	(0.113)
Bound rate (log)		-1.089***				
		(0.0501)				
Relative size of k in j	0.465***	0.464***	0.464***	0.465***	0.464***	0.464***
	(0.00933)	(0.00934)	(0.00934)	(0.00933)	(0.00933)	(0.00933)
Distance (log)	-0.802***	-0.785***	-0.785***	-0.797***	-0.782***	-0.786***
	(0.00315)	(0.00320)	(0.00320)	(0.00326)	(0.00320)	(0.00319)
Observations	2,985,267	2,980,211	2,980,211	2,985,267	2,985,267	2,985,267
R-squared	0.321	0.321	0.321	0.321	0.321	0.321
Other gravity variables	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Exporter-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust SE in brackets clustered by importer-product. All regressions include a set of standard gravity county-pair specific controls such as contiguity, common language, colonial relationship and legal origins.

*** p<0.01, ** p<0.05, * p<0.1

Table 4: Robustness to endogeneity – Sample of new acceding countries

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Probability to export			Log of exports		
Water (log)			-0.686***			-5.090***
			(0.0398)			(0.250)
Tariff (log)	-0.886***	-0.430***	-1.133***	-4.105***	-0.394	-5.503***
	(0.0279)	(0.0344)	(0.0325)	(0.291)	(0.322)	(0.301)
Bound rate (log)		-0.737***			-5.214***	
		(0.0396)			(0.257)	
Relative size of k in j	0.0493***	0.0480***	0.0480***	0.00193	-0.00641	-0.00660
	(0.00256)	(0.00255)	(0.00255)	(0.0323)	(0.0320)	(0.0320)
Distance (log)	-0.114***	-0.105***	-0.105***	-0.799***	-0.743***	-0.745***
	(0.000854)	(0.00101)	(0.00101)	(0.0123)	(0.0127)	(0.0127)
Observations	1,051,481	1,051,481	1,051,481	262,481	262,481	262,481
R-squared	0.344	0.349	0.349	0.310	0.313	0.313
Other gravity variables	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Exporter-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust SE in brackets clustered by importer-product. The estimates are based on the subsample of importers that acceded the WTO after 1995. All regressions include a set of standard gravity country-pair specific controls such as contiguity, common language, colonial relationship and legal origins.
*** p<0.01, ** p<0.05, * p<0.1

Table 5: Robustness to omitted variable bias – Country-pair FE

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Probability to export			Log of exports		
Water (log)			-0.0651***			-0.588***
			(0.00819)			(0.1036)
Tariff (log)	-0.563***	-0.486***	-0.577***	-3.642***	-3.186***	-3.721***
	(0.0126)	(0.0144)	(0.0126)	(0.1323)	(0.1582)	(0.1336)
Bound rate (log)		-0.0991***			-0.547***	
		(0.00880)			(0.109)	
Relative size of k in j	0.0676***	0.0676***	0.0676***	0.483***	0.483***	0.483***
	(0.000867)	(0.000867)	(0.000867)	(0.0092)	(0.0092)	(0.0093)
World share of exports of k from i	0.980***	0.980***	0.980***	10.351***	10.348***	10.348***
	(0.00320)	(0.00320)	(0.00320)	(0.029)	(0.029)	(0.029)
Observations	10,048,382	10,032,922	10,032,922	2,985,267	2,980,211	2,980,211
R-squared	0.356	0.356	0.356	0.331	0.330	0.330
Importer-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Country pair FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust SE in brackets clustered by importer-product.
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Probability a product is traded – Robustness to prohibitive tariff and effective water

VARIABLES	(1)	(2)	(3)	(4)
	Full sample		New acceding countries	
Effective water (log)		-0.0999***		-0.700***
		(0.00349)		(0.0236)
Tariff (log)	-0.371***	-0.586***	-0.481***	-1.199***
	(0.0123)	(0.0122)	(0.0276)	(0.0305)
Effective bound rate (log)	-0.0233***		-0.0971***	
	(0.000346)		(0.00125)	
Relative size of k in j	0.0664***	0.0665***	0.0479***	0.0477***
	(0.000873)	(0.000875)	(0.00251)	(0.00257)
Distance (log)	-0.128***	-0.117***	-0.146***	-0.106***
	(0.000308)	(0.000287)	(0.000960)	(0.000929)
Observations	9,894,489	9,894,489	1,028,518	1,028,518
R-squared	0.358	0.357	0.360	0.350
Other gravity variables	Yes	Yes	Yes	Yes
Importer-Industry FE	Yes	Yes	Yes	Yes
Exporter-Industry FE	Yes	Yes	Yes	Yes

Robust SE in brackets clustered by product-importer. The bound and water take into consideration the prohibitive tariffs when the line is unbound. The estimates in columns 3 and 4 are based on the subsample of importers that acceded the WTO after 1995. All regressions include a set of standard gravity country-pair specific controls such as contiguity, common language, colonial relationship and legal origins.
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Intensive margin – Robustness to prohibitive tariff and effective water

	(1)	(2)	(3)	(4)
VARIABLES	Full sample		New acceding countries	
Effective water (log)		-0.886***		-4.956***
		(0.0491)		(0.249)
Tariff (log)	-3.532***	-2.829***	-3.662***	-5.479***
	(0.120)	(0.114)	(0.305)	(0.308)
Effective bound rate (log)	0.0775***		-0.122***	
	(0.00434)		(0.0164)	
Relative size of k in j	0.467***	0.466***	0.00721	-0.000502
	(0.00936)	(0.00936)	(0.0325)	(0.0323)
Distance (log)	-0.780***	-0.794***	-0.829***	-0.754***
	(0.00346)	(0.00323)	(0.0129)	(0.0128)
Observations	2,950,880	2,950,880	258,918	258,918
R-squared	0.321	0.321	0.310	0.313
Other gravity variables	Yes	Yes	Yes	Yes
Importer-Industry FE	Yes	Yes	Yes	Yes
Exporter-Industry FE	Yes	Yes	Yes	Yes

Robust SE in brackets clustered by product-importer. The bound and water take into consideration the prohibitive tariffs when the line is unbound. The estimates in columns 3 and 4 are based on the subsample of importers that acceded the WTO after 1995. All regressions include a set of standard gravity controls such as contiguity, common language, colonial relationship and legal origins.
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Probability a product is traded and intensive margin – Results in 2007

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Probability to export			Log of export		
Water (log)			-0.0643***			-0.681***
			(0.00244)			(0.0363)
Tariff (log)	-0.369***	-0.296***	-0.372***	-3.198***	-2.469***	-3.162***
	(0.00867)	(0.00907)	(0.00867)	(0.0937)	(0.103)	(0.0937)
Bound rate (log)		-0.0797***			-0.721***	
		(0.00271)			(0.0391)	
Relative size of k in j	0.0610***	0.0610***	0.0610***	0.401***	0.401***	0.401***
	(0.000792)	(0.000793)	(0.000793)	(0.00842)	(0.00843)	(0.00843)
Distance (log)	-0.125***	-0.124***	-0.124***	-0.754***	-0.743***	-0.744***
	(0.000250)	(0.000255)	(0.000255)	(0.00281)	(0.00286)	(0.00286)
Observations	12,104,556	12,078,392	12,078,392	3,469,514	3,462,684	3,462,684
R-squared	0.353	0.353	0.353	0.313	0.313	0.313
Other gravity variables	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Exporter-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust SE in brackets clustered by importer-product. The estimates are based on the subsample of importers that acceded the WTO after 1995. All regressions include a set of standard gravity country-pair specific controls such as contiguity, common language, colonial relationship and legal origins.
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Interaction with institutions: extensive and intensive margins

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES		Probability to export			Log of export	
Water (log)	-0.093***	-0.116***	-0.094***	-0.879***	-1.084***	-0.932***
	(0.0048)	(0.0034)	(0.0045)	(0.0548)	(0.0477)	(0.0524)
Tariff (log)	-0.560***	-0.561***	-0.560***	-2.838***	-2.833***	-2.836***
	(0.0121)	(0.0121)	(0.0121)	(0.113)	(0.113)	(0.113)
Water*Rule of law	0.051***			0.516***		
	(0.0054)			(0.0675)		
Water*Regulatory quality		0.047***			0.350***	
		(0.0051)			(0.0677)	
Water*Control of corruption			0.057***			0.445***
			(0.0058)			(0.0676)
Relative size of k in j	0.0663***	0.0663***	0.0663***	0.464***	0.464***	0.464***
	(0.0009)	(0.0009)	(0.0009)	(0.00934)	(0.00934)	(0.00934)
Distance (log)	-0.115***	-0.115***	-0.115***	-0.785***	-0.784***	-0.785***
	(0.0003)	(0.0003)	(0.0003)	(0.00320)	(0.00320)	(0.00320)
Observations	10,032,922	10,032,922	10,032,922	2,980,211	2,980,211	2,980,211
R-squared	0.356	0.356	0.356	0.321	0.321	0.321
Other gravity variables	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Exporter-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust SE in brackets clustered by importer-product. All regressions include a set of standard gravity country-pair specific controls such as contiguity, common language, colonial relationship and legal origins.
** p<0.01, ** p<0.05, *<0.1

Table 10: Interactions with industry variables: extensive and intensive margins

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Probability to export			Log of export		
Water (log)	-0.113***	-0.0294***	-0.0753***	-1.020***	-0.859***	-0.907***
	(0.00353)	(0.00810)	(0.00491)	(0.0476)	(0.177)	(0.0922)
Water*GVC	-0.0313***			-0.567***		
	(0.00943)			(0.106)		
Water*Rauch classification		-0.0535***			-0.153	
		(0.00472)			(0.0955)	
Water*differentiated			-0.0606***			-0.279***
			(0.00598)			(0.101)
Tariff (log)	-0.489***	-0.573***	-0.561***	-2.804***	-2.765***	-2.793***
	(0.0112)	(0.0117)	(0.0117)	(0.107)	(0.110)	(0.110)
=1 if parts & components	0.0968***			0.0200		
	(0.00173)			(0.0163)		
Rauch classification		0.0545***			-0.205***	
		(0.000963)			(0.0124)	
=1 if differentiated			0.0637***			-0.221***
			(0.00130)			(0.0150)
Distance (log)	-0.116***	-0.117***	-0.117***	-0.785***	-0.783***	-0.783***
	(0.000277)	(0.000284)	(0.000284)	(0.00314)	(0.00323)	(0.00323)
Size of domestic market	0.0644***	0.0638***	0.0638***	0.465***	0.458***	0.457***
	(0.000839)	(0.000855)	(0.000856)	(0.00917)	(0.00933)	(0.00934)
Observations	10,724,481	10,163,763	10,163,763	3,093,033	2,917,553	2,917,553
R-squared	0.359	0.359	0.359	0.325	0.326	0.326
Other gravity variables	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Exporter-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust SE in brackets clustered by importer-product. All regressions include a set of standard gravity country-pair specific controls such as contiguity, common language, colonial relationship and legal origins.
*** p<0.01, ** p<0.05, * p<0.1

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