Brexit Uncertainty: Trade Externalities Beyond Europe

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Brexit uncertainty has reduced trade between the United Kingdom (UK) and rest of the European Union (EU). Recent evidence finds lower UK firm export entry into the EU (Crowley et al., 2019) and lower UK-EU bilateral export values and product entry (Graziano, Handley and Limão, 2018; hereafter GHL). The ongoing risk of renegotiation since the June 2015 referendum announcement, generates an option value of waiting for firms making sunk cost investments, e.g. to export. After Brexit the UK will no longer be subject to the EU common trade policy and will therefore have to renegotiate preferential trade agreements (PTAs) and multilateral ones. We test the importance of this source of Brexit uncertainty and find evidence of negative trade externalities beyond Europe.

The trade effects of Brexit threaten to spillover beyond UK trade with the EU and Europe. Forecasts of the costs of Brexit expost focus on trade with the EU (Dhingra et al., 2017; Sampson, 2017). Similar costs apply to non-EU countries that do not renegotiate agreements with the UK, but also to others for the following reason. Any UK renegotiation with non-EU countries will be lengthy and the resulting agreement subject to trade policy uncertainty (TPU) given the UK's propensity to abandon PTAs (e.g. EFTA in 1973).[1] Less credible commitments may reduce the value of future PTAs to governments and firms (Carballo et al., 2018).

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[1] Thus Brexit induced TPU can affect UK trade with the EU and its non-European PTAs (accounting for over 56% of UK trade); with recently negotiated PTAs (Canada, Japan, Mercosur, Singapore, another 5%); and with the top 5 WTO partners (about 25%) that may seek renegotiation.

We provide evidence for one such source of TPU by following GHL: they estimate elasticities of export value and participation with respect to Brexit uncertainty for the UK-EU whereas we focus on UK trade with a set of non-European countries it had PTAs with by 2016. We use monthly and product level variation in exports to identify the cross elasticity of changes in the probability of Brexit (before the June 2016 referendum) and the tail-risk for different products. This model-based tail-risk measures the share of lost profits if trade barriers increased to a particular level. We focus on a scenario that seems plausible: a return to the higher most-favored-nation tariffs (MFN). Using these elasticities we quantify the average change in Brexit probability before vs. after the referendum: it reduced UK-PTAs average trade value by around 18% and net product entry by 37%, but only in industries with high sunk costs of exports.

I. Framework

We employ the framework in GHL, so here we describe only its key elements and implications. Increases in TPU increase the option value of waiting and lower current export entry if it requires sunk costs.

Demand exhibits constant elasticity of substitution σ over varieties $v \in V$ produced by firms with heterogeneous cost, c_v. Demand is decreasing in advalorem trade barriers faced in market i by an exporter in x of any variety in an industry V, with $\tau_{ixV} \geq 1$ in the absence of free trade. Monopolistic competition implies a standard constant mark-up rule over marginal cost. If a firm did not export in period $t-1$ then it must pay a sunk cost to export at t. This export capital survives with probability β.

Future export conditions, such as τ_{ixV}, are uncertain. So the firm's optimal decision satisfies a cutoff rule requiring the net

value of exporting to exceed the value of waiting to enter in a later period. GHL show that only those firms with cost below a threshold value enter. This threshold is c^U_{iVt}=$c^D_{iVt} \times U(\bar{\omega}_{iVt})$ where c^D_{iVt} is the deterministic cutoff (reflecting the PDV of investment) and the uncertainty factor $U \in (0, 1]$ implies a stricter entry cutoff whenever future conditions are expected to change and there is some tail risk: $\bar{\omega}_{iVt} - 1 < 0$. The latter measures the expected proportion of operating profit loss if conditions change.

GHL relate tail risk to Brexit by assuming that this process increased the probability, m_t, of drawing policies from a riskier distribution and show the tail risk can be written as a weighted average of Brexit and EU risk

$$\bar{\omega}_{ixVt} = m_t \omega^{BR}_{ixV} + (1 - m_t)\omega^{EU}_{ixV}. \tag{1}$$

We measure shocks to exporter beliefs about Brexit, m_t, by changes in prediction markets about a leave referendum outcome.

If exporters did not expect reversals under the EU state, then $\omega^{EU}_{ixV} = 1$ and we need only model ω^{BR}_{ixV}. Consider two possible Brexit outcomes $s = \{MFN, FTA\}$ where FTA denotes a renegotiation of zero tariffs that raises some barriers common across all products, τ^{FTA}. Alternatively, under MFN, countries revert to applying their WTO tariffs on the preferential partners, τ^{MFN}_{ixV}. If, conditional on Brexit, the MFN scenario occurs with probability η^{MFN} then $\bar{\omega}_{ixVt} = \eta^{MFN} \left(\tau^{MFN}_{ixV}\right)^{-\sigma} + \left(1 - \eta^{MFN}\right) \left(\tau^{FTA}\right)^{-\sigma}$.

Aggregating the firm cutoff decisions to the industry level we obtain a TPU-augmented gravity equation for exports: $R_{ixVt} \propto U(\bar{\omega}_{iV,l})$. GHL show that the delayed exit effects from sunk costs are captured by lags of the uncertainty factor and provide the identifying conditions required for a structural interpretation of the cross elasticity in the following specification:

$$\begin{aligned} \ln R_{ixVt} = {} & \\ & \textstyle\sum_l W^{MFN}_l \{\ln B_{t-l}[1 - (\tau^{MFN}_{ixV})^{-\sigma}]\} \\ & + \alpha_{ixV,ixt} + e_{ixVt}. \end{aligned} \tag{2}$$

We estimate the W_l coefficients and predict their sum to be negative; it reflects an interaction of η^{MFN} and other structural parameters and its absolute value is what GHL define as the permanent cross-elasticity of uncertainty ($\ln B_{t-l}$) and risk. The bilateral fixed effects vary by both industry, α_{ixV}, (e.g. baseline uncertainty and idiosyncratic trade patterns) and time, α_{ixt} (e.g. unobserved aggregate uncertainty and bilateral shocks). A similar specification can be derived for net product entry.

II. Data

We measure Brexit uncertainty using a prediction market based variable: the average daily price of a contract traded in PredictIt.org paying \$1 if a majority voted for Brexit in a referendum held by December 2016 and zero otherwise. We interpret changes in this contract price as providing new information to exporters leading them to update beliefs about the average probability of the event. The average was about 30% and it varied substantially in this period; it correlated in reasonable ways with political events and polling.

We use a subsample of the data in GHL, which was composed of a total of 45 countries including the EU, OECD and BRICs. By the end of 2016 the UK had PTAs with the EU-27, the focus of GHL; EFTA (Iceland, Norway, Switzerland) and 5 non-european countries that apply zero (or negligible) tariffs on most of the goods imported from the UK and vice versa. The agreements with Turkey (1996), Mexico (2000), Israel (2000) and Chile (2004) have withstood the pressure of large shocks and potential trade wars, such as the great trade collapse and Korea's started in 2011. They represent the group of potentially credible agreements subject to a TPU shock in our UK-PTA sample; all statistics and results refer to them unless otherwise stated.

The bilateral monthly trade at the 6-digit HS level is from Eurostat; it ends in 06/2016 and extends to 08/2015 for export values and to 08/2014 for the entry and exit analysis (to condition on export participation at $t-12$). In 2016 these PTAs accoun-

ted for 4% of UK good exports and 3.5% of its imports. The value regressions use the ixV observations with positive trade for all months. Average product entry is 20% and exit is 28%, both have coefficients of variation above 1.6.[2]

We use the simple average MFN tariffs in 2015 from the TRAINS database to construct HS6-level tail risk factors. These are the rates currently applied to non-PTA countries and thus the threat under the MFN scenario. We use MFN tariffs for other developed countries to construct instruments as described in GHL.

The UK MFN tariff is positive for over 75% of HS6 products. The associated risk factor is computed as $1-(\tau^M)^{-4}$; its average and standard deviation are 0.15 and 0.13 respectively. These statistics also hold on average for its PTA partners.[3]

III. Results

A. Export Values

We estimate (2) and find evidence that increases in the probability of Brexit lowered export values for products where MFN tariffs would be applied. The cross-elasticity of 1.46 in column 1 of Table 1 is obtained using IV.[4] All specifications control for importer-exporter-HS6 (ixV) and bilateral-month fixed effects (ixt).

B. Mechanisms: Entry, Exit and Sunk Costs

We also find evidence for the role of export sunk costs and entry and exit behavior, which are consistent with the theoretical model.

In the presence of export sunk costs, the model predicts that uncertainty lowers exports via firm entry and exit. The cross-elasticity based on export value reflects that behavior, but since it focuses on continuously traded products in this period and does not use firm data, it does not allow us to directly test this channel. Thus we also use a sample of intermittently traded products to estimate export entry and exit using a linear probability model and the right hand side variables in (2).

As the model predicts, entry decreases with MFN risk (Table 1, column 2). Exit increased but the coefficient is not precisely estimated.[5]

We apply the approach in Handley and Limão (2017) to identify high sunk cost industries using a broad set of non-EU exporters to the UK. As the model predicts, the negative impacts on export values and entry remain negative and significant for the high cost sample (with magnitudes similar to Table 1) and are insignificant for the low cost sample.

IV. Quantification and EU Comparison

An advantage of using a continuous measure of uncertainty shocks is that it provides an elasticity, which allows us to quantify the effect of alternative shocks in a way that event studies do not. Moreover, in our framework the cross-elasticity is a function of deep parameters and thus useful for counterfactual analysis. Here we compute the uncertainty elasticity at the average MFN risk, 0.15, and its implication for a specific shock: the average growth in the Brexit probability in the 12-month period after the referendum.

The average uncertainty elasticity in column 1 of Table 2 is 0.22 ($= 1.46 \times 0.15$), implying that a persistent uncertainty increase of two standard deviations, equal to 0.14, in the pre-referendum period lowers average exports by over 5 log points.[6] The referendum uncertainty shock was considerably larger than two standard deviations;

[2]The potential set of product entrants at t are all ixV with zero value at $t-12$; potential exiters at t are those with positive values in $t-12$.

[3]There is some variation in risk for PTA countries, e.g. Chile has less import tariff variation, Korea has higher average risk.

[4]Specifically we instrument the UK-PTA risk for each HS-6 using the median HS6-specific MFN risk across the US, Japan, Canada, and Australia.

[5]The entry elasticity is larger than exit, which is consistent with the model since firms can immediately respond by entering when conditions improve but when they deteriorate firms can choose to wait.

[6]This is likely a conservative estimate since a return to MFN would also increase non-tariff barriers and there are other scenarios, such as the FTA, controlled for by fixed effects.

Table 1—UK and PTAs MFN risk

	Export Value	Entry	Exit
$Pr(Brexit) \times MFNRisk$	-1.46	-0.462	0.134
	(0.861)	(0.173)	(0.222)
N	34,353	149,944	89,648

Notes: Export value (ln) defined at the exporter-importer-HS6-month level, $Entry(t) = 1$ if $Export(t) > 0$ and $Export(t-12) = 0$ for the exporter-importer-HS6 observation not traded the same month in previous year, $Exit(t) = 1$ if $Export(t) = 0$ and $Export(t-12) > 0$ for the exporter-importer-HS6 observation traded the previous year. Pr(Brexit) defined as the monthly average (ln) leave prediction market contract price and MFN risk defined as $1 - (\tau^{MFN})^{-\sigma}$, where $\sigma = 4$ and $\tau^{MFN} = 1 +$ MFN advalorem/100. We instrument the MFN risk by the median HS6-specific MFN risk across four large countries (Australia, Canada, Japan and US). Reported coefficients are the sum of current and two monthly lags. Robust standard errors clustered at the exporter-importer-HS6 level in parenthesis. All estimations include exporter-importer-HS6 and importer-exporter-month fixed effects.

Table 2—Brexit Uncertainty Impacts at Average MFN Risk

	UK-PTAs (non european)			UK-EU (GHL, 2018)		
	Export	Entry	Exit	Export	Entry	Exit
Uncertainty Elasticity	0.22	0.38	0.075	0.22	0.35	0.21
Referendum shock (log points)	-18	-31	6.2	-18	-29	18

Notes: Elasticity computed using the product of the absolute value of Table 1 coefficients and mean risk, 0.15, (column 1) and further dividing by dependent variable mean (entry or exit in columns 2 and 3 respectively). Columns 4-6 show the corresponding estimates using UK-EU sample in GHL (2018). The second row uses a shock of -0.81, 2/3 of the average change in lnB after the referendum.

if conditional on a leave vote the exporters believed that Brexit became a certainty in the year after then the shock in $\ln B$ would be -1.23. But soon after the referendum it became clear that Brexit remained uncertain, in fact about one third of the growth in voter support for leave up until the referendum was reversed in the subsequent year. So, similarly to GHL, we assume 1/3 of Brexit regret and model the referendum shock as the remaining 2/3 of -1.23. With this we isolate the Brexit TPU effect from the referendum: an 18 log point reduction in average UK-PTA exports.

In column 2 we find an entry elasticity of 0.38; which is higher than for values as we may expect since entrants are smaller. The referendum reduces entry growth by 31 log points (a 6 percentage point decline in the entry rate) and net entry by 37 log points. The comparable estimates for the UK-EU in GHL are replicated in columns 4-6. We obtain identical elasticities for value and entry respectively.

V. Conclusion

Our findings indicate that Brexit affects a larger share of UK trade than previously realized and imposes policy uncertainty externalities on other countries. Future work could analyze the impacts via other agreements, not just preferential, but also multilateral.[7]

Even if the UK renegotiated its current agreements keeping all their provisions, they would likely be less credible and thus result in trade disintegration relative to a pre-Brexit world. Two broader implications of this and other research on TPU are that (i) countries and firms may now fear a reversal of commitments in several trade agreements and (ii) even if ongoing disputes are resolved, e.g. between the US and China, their negative impact on the credibility of the trading system will persist; both of these contribute to trade disintegration

[7] A candidate for analysis is EFTA (Norway, Iceland, and Switzerland) but it requires alternative risk measures since these countries advalorem MFN tariffs are zero in most goods.

and are amplified by global input-output linkages.

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