Online Appendix
Brexit Uncertainty and its (Dis)Service Effects

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July 7, 2022

A Data and Supplementary Results

A.1 Data construction

This Appendix provides additional detail on services trade data, the STRI and the construction of our data set. First, as defined in the WTO General Agreement on Trade in Services (GATS), there are four modes of services trade, which are defined based on the location of the supplier and consumer:

- **Mode 1:** cross-border supply (typically via the internet). The service is traded from supplier to consumer without either party physically moving across borders. For example, an architect in one country emails a digital version of their plans to a foreign client. Mode 1 trade also includes the transportation of goods from one country to another (excluding the value of the goods).
- **Mode 2:** consumption abroad. A consumer from one country travels to another country to consume services, such as a tourist staying at hotels and purchasing food while on vacation in a foreign country.
- **Mode 3:** commercial presence. A services provider sets up a local affiliate to sell services in a foreign country.
- **Mode 4:** temporary presence of natural persons. A services provider temporarily sends a representative to another market to perform a service. For example, an engineering firm could temporarily send engineers to another country to advise local staff on a construction project.

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Typically, cross-border data collected through balance of payments statistics, including the ONS data we use in this paper, covers trade in modes 1, 2, and 4. Since this data is survey-based, it is often difficult to break cross-border services data into the three modes it comprises. Recently, Mann and Cheung (2019) report on efforts to estimate cross-border trade by mode of supply using survey data in the US and UK. Among the industries covered in our data, the UK Office of National Statistics estimates show that mode 1 trade makes up the majority of cross-border trade for every services industry except construction.[1]

While the quarterly cross-border UK services trade data covers 32 extended balance of payments service categories, the OECD STRI industry coverage is more limited. Table A7 shows the correspondence between OECD STRI industries and EBOPS codes used in this paper. The STRI industries are based on International Standard Industrial Classification (ISIC) categories, while the trade data is based on Extended Balance of Payments services (EBOPS) codes. We concorded these by matching the descriptions in each of the classifications. For example, the commercial banking STRI corresponds to ISIC codes 6419-Other (non-central bank) monetary intermediation, 6492-Other credit granting, and 6491-Financial leasing. When matching to EBOPS we looked for trade flows that similarly, did not cover non-loan based financial services, such as hedge funds. Thus, commercial banking was matched to EBOPS 7.1, rather than EBOPS 7. In some cases, such as legal and accounting services, the STRI is more disaggregated than the trade data. In these cases, we average the STRI value across all sub-industries in the category. The match is further restricted by unavailability of the STRI for the following industries: travel services, charges for the use of intellectual property, research and development services, or personal, cultural, and recreational services.

Broad groupings of these sectors follow standard categories used in services trade reports at the USITC (See for example USITC (2020)). Financial services (banking, insurance) are linked by their reliance on risk differentials to make money and need for prudential regulations. Professional services (architectural and engineering, legal and accounting, construction) all require licensing or other credentials for individuals performing the service. Electronic services (telecom, computer, audiovisual) rely intensively on the internet and other broadcasting systems. Transportation includes sea, other, and postal and courier services.

One of the challenges of using the OECD STRI is that it includes measures that explicitly discriminate against foreign firms (such as foreign equity restrictions) along with measures that affect all firms in the market (such as total cost to register a company). While the MFN STRI does provide a breakout of the STRI by discriminatory and non-discriminatory measures, that data is not available for the EEA STRI. In order to account for this, we used industry-specific documentation for the MFN STRI to calculate the share of barriers by category that are considered discriminatory by the OECD. These barrier shares are reported in appendix table A2. Overall, discriminatory measures are concentrated in the first two categories: restrictions to foreign entry and restrictions to movement of people. On average, 91 percent of the measures catalogued in restrictions to foreign entry are discriminatory, while 97 percent of the barriers to movement of people are discriminatory. Based on these

[1]See USITC (2020) for a more detailed discussion of services trade data and various efforts to measure services trade by mode of supply

Table A1: Correspondence between extended balance of payments (EBOPS) industry codes and STRI industries

EBOPS Description	EBOPS Code	Corresponding STRI Industries
Sea transportation	3.1	Maritime transport
Air transportation	3.2	Air transport
Other modes of transportation	3.3	Road transport; rail transport; logistics services
Postal and courier services	3.4	Courier
Construction	5	Construction
Insurance and Pension	6	Insurance and pension services
Explicitly charged and other financial services	7.1	Commercial banking
Telecommunications services	9.1	Telecommunications; broadcasting
Computer services	9.2	Computer services
Legal, accounting, management consulting and public relations	10.2.1	Legal services; accounting services
Architectural, engineering, scientific and other technical services	10.3.1	Architectural services; engineering services
Audiovisual and related services	11.1	Motion pictures; sound recording

classifications, in our main specification, we focus on restrictions to foreign entry.

Finally, the heterogeneity of services trade barriers in the EEA STRI across EU members reflects differences in national law. In particular, the EEA STRI captures both EU-wide and country-specific policies. First, EU Regulations and the Treaty on the Functioning of the European Union are binding at the EU level and do not allow for flexibility across members. These types of policies distinguish the EEA STRI from the MFN restrictions, but are constant across EU members. Second, EU Directives represent EU goals, or prohibit/allow particular policies, but are legislated at the national level and thus can differ in their specific implementation. Finally, where no EU wide policy exists, national laws have different levels of preference for EU member trade. Thus, both EU directives and national laws contributing to heterogeneity in trade policy risk across members (Benz and Gonzales, 2019).[2]

[2]For example, in computer services, EU Regulation 2016/679 (General Data Protection Regulation) indicates that non-EU members must be shown to have adequate protections in place in order to transport data across borders. In addition to this EU-wide legislation, Germany has national legislation restricting the transfer of financial data across borders within the EU, while France does not, which contributes to their different levels of the EEA STRI in this sector.

Table A2: Discriminatory measures by STRI category (percent)

	Restrict. foreign entry	Restrict movt. of people	Other disc. measures	Barriers to competition	Regulatory transparency
Air transport	100	100	92	20	0
Architecture, engineering	80	84	83	45	0
Commercial banking	77	100	57	10	0
Computer	100	100	75	40	0
Construction	100	93	80	40	0
Insurance	86	100	67	11	0
Legal, account., consulting	79	95	83	50	0
Other transport	93	100	84	13	0
Postal and courier	82	100	75	10	0
Sea transport	100	100	95	22	0
Telecommunications	100	100	67	8	0
Average	91	97	78	24	0

Note: Data unavailable for audiovisual services. Counts of discriminatory measures by STRI category were compiled from industry-specific STRI construction methodology papers, available at `www.oecd.org/trade/topics/services-trade/`.

A.2 Supplementary Tables

Table A3: Risk by Industry-UK and EU Services Trade

industry	Fraction of Trade (2016Q1)	Risk		
		Mean	SD	CV
Air transportation	0.173	0.191	0.011	0.056
Architectural, engineering, scientific and other	0.029	0.016	0.023	1.494
Audiovisual and related	0.008	0.030	0.013	0.422
Computer	0.080	0.033	0.013	0.381
Construction	0.021	0.034	0.013	0.374
Commercial banking	0.283	0.069	0.019	0.273
Insurance and Pension	0.055	0.066	0.025	0.377
Legal, accounting, management consulting, PR	0.174	0.067	0.048	0.720
Other modes of transportation	0.023	0.039	0.014	0.360
Postal and courier	0.016	0.039	0.018	0.472
Sea transportation	0.061	0.088	0.028	0.313
Telecommunications	0.077	0.060	0.023	0.381

Notes: Trade shares reflect the aggregate of all non-confidential values in 2016Q1 between UK and all EU in sample. The risk measure applies to the same sample, which differs from the participation sample due to any confidential values.

Table A4: Services Risk and UK-EU Robustness Timing (Moving Average): 2016Q1-2018Q4

	1	2	3
Dependent variable	Value (ln)	Participation (0/1)	Value
Estimation	OLS	OLS	PPML
Pr(Brexit MA)×Risk	-1.753***	-0.436***	-1.272***
	(0.35)	(0.11)	(0.33)
N	2,616	5,748	4,980
R^2	0.94	0.80	0.94

Notes: Pr(Brexit MA) uses the ln of a centered 3 month moving average of probabilities described in Table 1. All other variables defined in Table 1. All specifications include exporter-importer-industry, exporter-importer-quarter fixed effects. Robust standard errors clustered at the importer-industry-quarter level in parenthesis.PPML drops singletons so sample is smaller than participation. PPML sample includes imputed confidential data as described in Table 3 (results similar if we drop imputed values). R^2 reported for OLS estimates are adjusted by the number of parameters while R^2 for PPML estimates are based on McFadden's R^2

Table A5: Services Risk and UK-EU Robustness to Other Barriers: 2016Q1-2018Q4

	1	2	3	4	5	6
Dependent variable	Value (ln)		Participation (0/1)		Value	
Estimation	OLS		OLS		PPML	
Pr(Brexit)×Risk	-1.766***	-1.999***	-0.444***	-0.408***	-1.240***	-2.510***
	(0.36)	(0.42)	(0.11)	(0.13)	(0.33)	(0.42)
Pr(Brexit)×Risk Aggregate		0.315		-0.043		1.044***
		(0.28)		(0.09)		(0.18)
N	2,616	2,616	5,748	5,748	4,980	4,980
R^2	0.94	0.94	0.80	0.80	0.94	0.94

Notes: All variables defined in Table 1. All specifications include exporter-importer-industry, exporter-importer-quarter fixed effects. Robust standard errors clustered at the importer-industry-quarter level in parenthesis.PPML drops singletons so sample is smaller than participation. PPML sample includes imputed confidential data as described in Table 3 (results qualitatively similar if we drop imputed values).

Table A6: Services Risk and UK-EU Robustness to Passporting Risk: 2016Q1-2018Q4

	1	2	3
Dependent variable	Value (ln)	Participation (0/1)	Value
Estimation	OLS	OLS	PPML
Pr(Brexit) x Risk	-1.757***	-0.343***	-1.199***
	(0.36)	(0.11)	(0.33)
Pr(Brexit) x Passporting	-0.002	-0.036***	-0.0152
	(0.03)	(0.01)	(0.02)
N	2,616	5,748	4,980
R^2	0.94	0.80	0.94

Notes: All variables defined in Table 1. Passporting variable equals one where there is a risk that passporting rights would be lost following Brexit. All specifications include exporter-importer-industry, exporter-importer-quarter fixed effects. Robust standard errors clustered at the importer-industry-quarter level in parenthesis.PPML drops singletons so sample is smaller than participation. PPML sample includes imputed confidential data as described in Table 3 (results qualitatively similar if we drop imputed values).

Table A7: UK and EU Risk - Robustness to Unobserved Correlation and Industry Trends: 2016Q1-2018Q4

	1	2	3	4	5	6
Dependent variable	Value (ln)		Participation (0/1)		Value	
Estimation	OLS		OLS		PPML	
Pr(Brexit)×Risk	-1.766***	-0.870**	-0.444***	-0.175	-1.240***	-0.705**
	(0.40)	(0.35)	(0.16)	(0.12)	(0.36)	(0.30)
Industry*Quarter Cluster	x		x		x	
Industry*Time Trend FE		x		x		x
N	2,616	2,616	5,748	5,748	4,980	4,980
R^2	0.94	0.94	0.80	0.81	0.94	0.94

Notes: All variables defined in Table 1. All specifications include exporter-importer-industry, exporter-importer-quarter fixed effects. Robust standard errors clustered at the importer-industry-quarter level in parenthesis. PPML drops singletons so sample is smaller than participation. PPML sample includes imputed confidential data as described in Table 3 (results qualitatively similar if we drop imputed values).

Table A8: UK and EU Risk - Robustness to Unobserved Sector-time Effects: 2016Q1-2018Q4

	1	2	3	4	5	6
Dependent variable	Value (ln)		Participation (0/1)		Value	
Estimation	OLS		OLS		PPML	
Pr(Brexit)×Risk	-1.766***	-1.926***	-0.444**	-0.637***	-1.240***	-1.376***
	(0.44)	(0.42)	(0.18)	(0.14)	(0.30)	(0.31)
Sector*Quarter Cluster	x		x		x	
Sector*Quarter FE		x		x		x
N	2,616	2,616	5,748	5,748	4,980	4,980
R^2	0.94	0.94	0.80	0.81	0.94	0.94

Notes: All variables defined in Table 1. All specifications include exporter-importer-industry, exporter-importer-quarter fixed effects. Robust standard errors clustered at the importer-industry-quarter level in parenthesis. PPML drops singletons so sample is smaller than participation. PPML sample includes imputed confidential data as described in Table 3 (results qualitatively similar if we drop imputed values). The 11 industries are grouped into four standard sectors: Electronic, Financial, Professional and Transport.

Table A9: Services Risk Country Placebo Test: 2016Q1-2018Q4

	1	2	3
Dependent variable	Value (ln)	Participation (0/1)	Value
Estimation	OLS	OLS	PPML
Pr(Brexit)×Risk	-0.382	0.079	-0.103
	(0.37)	(0.10)	(0.14)
N	2,052	5,748	1,986
R^2	0.95	0.84	0.24

Notes: All variables defined in Table 1. All specifications include exporter-importer-industry, exporter-importer-quarter fixed effects. Robust standard errors clustered at the importer-industry-quarter level in parenthesis. PPML drops singletons so sample is smaller than participation. PPML sample includes imputed confidential data as described in Table 3 (results qualitatively similar if we drop imputed values). Placebo sample replaces EU countries with others that did not have a PTA with the EU in 2016: Argentina, Australia, Belarus, Brazil, Canada, China, Hong Kong, India, Indonesia, Iran, Japan, Malaysia, New Zealand, Pakistan, Philippines, Russia, Saudi Arabia, Taiwan, Thailand, United States, Uruguay and Venezuela. Each is assigned the MFN risk measure of the EU country match, as described in the text.

Table A10: Baseline Robustness to Changes in Industry Sample: 2016Q1-2018Q4

	1	2	3	4	5	6
Dependent variable	Value (ln)	Value (ln)	Value (ln)	Value (ln)	Value (ln)	Value (ln)
Estimation	OLS	OLS	OLS	OLS	OLS	OLS
Pr (Brexit) x Risk	-1.612***	-1.865***	-1.681***	-2.249***	-1.836***	-1.773***
	(0.38)	(0.37)	(0.40)	(0.43)	(0.36)	(0.39)
Change in Baseline Sample	-Arch, eng	-Audiovis	-Commercial Banking	-Computer	-Construction	-Insurance
N	2,424	2,544	2,268	2,256	2,472	2,436
R^2	0.94	0.94	0.92	0.94	0.95	0.94

	7	8	9	10	11	12
Dependent variable	Value (ln)	Value (ln)	Value (ln)	Value (ln)	Value (ln)	Value (ln)
Estimation	OLS	OLS	OLS	OLS	OLS	OLS
Pr (Brexit) x Risk	-2.761***	-1.536***	-1.694***	-1.246***	-1.588***	-0.566***
	(0.41)	(0.34)	(0.38)	(0.38)	(0.37)	(0.19)
Change in Baseline Sample	-Leg, acct, consult	-Other transport	-Postal, courier	-Sea	-Telecom	+Air
N	2,268	2,544	2,280	2,280	2,244	2,952
R^2	0.93	0.95	0.92	0.93	0.93	0.94

Notes: All variables defined in Table 1. All specifications include exporter-importer-industry, exporter-importer-quarter fixed effects. Robust standard errors clustered at the importer-industry-quarter level in parenthesis. Results for participation and ppml estimations available upon request.

Table A11: Services Risk by Broad Sector: 2016Q1-2018Q4

	Electronic Services			Financial Services		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Value (ln)	Part. (0/1)	Value	Value (ln)	Part. (0/1)	Value
Estimation	OLS	OLS	PPML	OLS	OLS	PPML
Pr(Brexit)×Risk	-2.774***	0.570**	-4.181***	-0.827	-0.432	-1.444*
	(1.04)	(0.29)	(0.75)	(0.88)	(0.36)	(0.74)
N	624	1,584	1,380	360	1,056	760
R^2	0.94	0.81	0.91	0.93	0.88	0.97
Std. Dev.(Risk)	0.040	0.037	0.038	0.062	0.055	0.057

	Transport Services			Professional Services		
	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable	Value (ln)	Part. (0/1)	Value	Value (ln)	Part. (0/1)	Value
Estimation	OLS	OLS	PPML	OLS	OLS	PPML
Pr(Brexit)×Risk	-5.588***	-1.837***	-3.914***	0.434	-0.504***	-1.498**
	(1.27)	(0.32)	(0.93)	(0.35)	(0.16)	(0.62)
N	624	1,524	1,128	540	1,584	1,477
R^2	0.90	0.81	0.88	0.90	0.72	0.94
Std. Dev.(Risk)	0.051	0.049	0.052	0.047	0.045	0.046

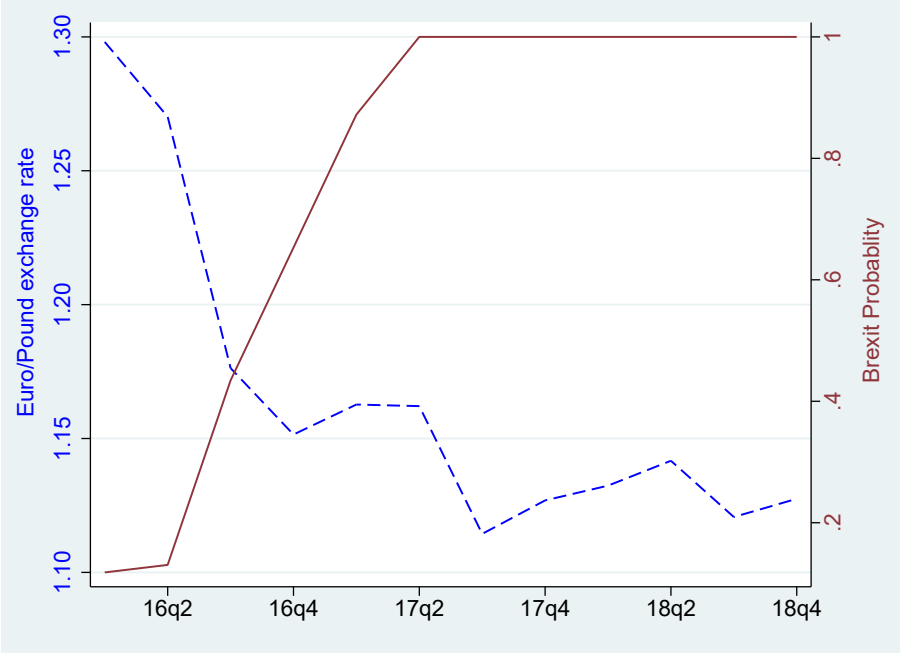
Notes: All variables defined in Table 1. Electronic services include telecommunications, computer services, and audiovisual services. Financial services include commercial banking and insurance. Professional services include architecture and engineering, construction, and legal and accounting services. Transportation services include sea transport, other transport, and postal and courier services. All specifications include exporter-importer-industry, exporter-importer-quarter fixed effects. Robust standard errors clustered at the importer-industry-quarter level in parenthesis. More singleton observations are identified at the broad sector level which results in their sum being smaller than if the sample included all sectors as in table 2. PPML sample includes imputed confidential data as described in Table 3 (results qualitatively similar if we drop imputed values).

Table A12: Services Risk and UK-EU Heterogeneity: 2016Q1-2018Q4

	1	2	3
Dependent variable	Value (ln)	Participation (0/1)	Value
Estimation	OLS	OLS	PPML
Pr(Brexit)×Risk	-0.899**	-0.435***	-0.927***
	(0.37)	(0.13)	(0.33)
Pr(Brexit)×Risk×EU Exporter	-2.685***	-0.026	-1.790*
	(0.66)	(0.24)	(0.94)
N	2,616	5,748	4,980
R^2	0.94	0.80	0.94

Notes: All other variables defined in Table 1. All specifications include exporter-importer-industry, exporter-importer-quarter fixed effects. Robust standard errors clustered at the importer-industry-quarter level in parenthesis. PPML drops singletons so sample is smaller than participation. PPML sample includes imputed confidential data as described in Table 3 (results qualitatively similar if we drop imputed values).

Figure A1: Sterling Depreciation 2016Q1-2018Q4



Notes: Dashed blue line shows the Euro/Pound exchange rate. The solid red line is probability of Brexit, measured as the average of contract prices in the quarter from prediction markets. For our sample period, these two series have a correlation of 0.93.

Table A13: Robustness to Exchange Rate Changes with Heterogeneous Industry Pass-through

	1	2	3	4	5	6
Dependent variable	Value (ln)		Participation (0/1)		Value	
Estimation	OLS		OLS		PPML	
Pr(Brexit)×Risk	-1.769***	-0.880**	-0.433***	-0.208	-1.541***	-0.917***
	(0.30)	(0.38)	(0.12)	(0.13)	(0.32)	(0.33)
Pr(Brexit)×Risk×EU Exporter		-2.856***		-0.737**		-3.722***
		(1.01)		(0.31)		(1.01)
(ln exch-rate) × Industry FEs	X	X	X	X	X	X
N	2,616	2,616	5,748	5,748	4,980	4,980
R^2	0.95	0.95	0.80	0.80	0.94	0.94

Notes: The bilateral exchange rate is defined as the price of exporter's currency in importer's currency. All other variables defined as in Table 1. All specifications include exporter-importer-industry, exporter-importer-quarter fixed effects. Robust standard errors clustered at the importer-industry-quarter level in parenthesis.PPML drops singletons so sample is smaller than participation. PPML sample includes imputed confidential data as described in Table 3.

Table A14: UK and EU Risk - IV Robustness to Industry-Time Effects in Extended Sample: 2016Q1-2018Q4

	1	2	3	4
Dependent variable	Value (ln)		Participation (0/1)	
Estimation	IV		IV	
Pr(Brexit)×Risk	-4.375***	-6.987***	-1.228***	-2.115***
	(1.14)	(1.66)	(0.37)	(0.49)
Industry*Quarter FE		x		x
N	4,692	4,692	11,616	11,616
First Stage F-Stat	22.1	32.1	37.9	37.9

Notes: All variables defined in Table 1. All specifications include exporter-importer-industry, exporter-importer-quarter fixed effects. Robust standard errors clustered at the importer-industry-quarter level in parenthesis. The first stage F-stat is the Kleibergen-Paap Rk Wald Fstatistic and high values reject the weak instrument correlation null. Countries do not have trade agreements with the EU in 2016 include: Argentina, Australia, Belarus, Brazil, Canada, China, Hong Kong, India, Indonesia, Iran, Japan, Malaysia, New Zealand, Pakistan, Philippines, Russia, Saudi Arabia, Taiwan, Thailand, United States, Uruguay and Venezuela.

A.3 Discriminatory Effects of STRI in a Standard Gravity

In this section, we use a standard gravity framework to determine how services trade vary with STRI in a sample that excludes EU-UK flows. We have two goals. First, to show that category 1 of the STRI is relevant and generates discriminatory effects even conditional on other STRI (as we show in the baseline for the EU-UK). Second, to provide an estimate that allows us to gauge how reasonable our uncertainty impacts are. Specifically, whether changes in the STRI that would occur under a no-deal Brexit can generate large enough changes in trade. Our model predicts that the uncertainty elasticity is lower than that of a deterministic change in the STRI; so if the STRI in this sample, which is MFN, is less uncertain than the preferential STRI between the UK and EU, the estimates in this appendix can provide an upper bound on possible uncertainty effects.

We utilize the newly released International Trade and Production Database for Estimation (ITPD-E) (Borchert et al., 2020), which provides bilateral international trade and domestic trade data for service industries from 2000 to 2016.[3] A concordance is performed between the ITPD-E, which follows the ISIC rev. 4 classification, and the data from the UK's Office of National Statistics—classified under a Balance of Payments system. This ensures that we use the same service categories here and in the uncertainty-augmented gravity in the text. We start the analysis in 2014: the first year the STRI is available.

In order to use only MFN STRIs we must go beyond cross-border trade data and explore internal trade. The reason is that MFN STRIs are importer-specific and preclude controlling for unobserved importer heterogeneity, which is essential in standard gravity estimation. By adding information on intra-national trade we can identify the differential impact of MFN STRIs on international trade even after conditioning on importer and exporter fixed effects. Benz (2017) applies this approach to show that increases in the STRI are associated with lower trade between OECD countries. We rely on a similar gravity equation for our analysis:

$$R_{ixVt} = \exp(\beta_1 STRI_{iVt} \times Brdr_{ix} + \beta_2 Brdr_{ix} + \beta_3 FTA_{ixt} + \phi_{ix} + \lambda_{iVt} + \eta_{xVt}) \times \mu_{ixVt} \quad \text{(A.1)}$$

where R_{ixVt} is the value of country x exports to country i in industry V and year t, FTA_{ixt} is a preferential trade agreement dummy, η_{xVt} and λ_{iVt} are the exporter-sector-year and importer-sector-year fixed effects to capture multilateral resistance terms and ϕ_{ix} is a linear function of common bilateral determinants of trade.[4] Lastly μ_{ixVt} is the multiplicative error term.

The coefficient of interest is β_1 and it is identified using the interaction of the STRI score of country i in V at t with a dummy equal to one if the flow is international. Table A15 reports the estimates for (A.1) using annual services data between 2014-16. To match the empirical exercise in section III, we estimate the model using OLS. In order to avoid any of our estimates being impacted by Brexit uncertainy, we exclude all intra-EEA flows.

Column (1) uses only cross-border flows and thus can only identify bilateral determinants, not the STRI. We use it to verify that distance, contiguity, common official language, colonial relationships and trade agreements all have the expected sign and significance for services in this sample.

[3]The data is publicly available at `https://usitc.gov/data/gravity/index.htm`

[4]These are distance, contiguity, common official language and colonial relationships; these and the FTA dummy are from the USITC's Dynamic Gravity Dataset (Gurevich and Herman, 2018).

In column (2), we add intra-national flows and estimate the STRI-1 effects. First, we find that international trade is about 500 lp lower than intra-national trade, even after controlling for distance. Second, this international penalty is magnified by policy restrictions. An increase in the STRI-1 from zero to one (moving from an open to a closed economy) lowers international trade by an additional 600 lp.

What does the estimate in column (2) imply for more reasonable increases in the STRI? An increase from 0.012 (the average STRI-1 in our EU-UK sample) to 0.081 (their average MFN STRI-1 value) implies a 42 log point reduction in services trade. Thus even modest changes in the STRI, such as those under a no-deal Brexit, lead to large trade reductions, which indicates that our uncertainty estimates are plausible.

Column (3) examines the robustness to controlling for additional STRI components as we did in the text. Specifically, we add the interaction of the STRI that includes all five categories and find it does not have a significant effect. The STRI-1 coefficient now represents the differential impact and it is negative and significant. Moreover, the overall magnitude of the STRI-1 effect (from adding the coefficients) is similar to the one in column (2). Both findings support our focus on the STRI-1 measure.

Table A15: Gravity estimates with STRI (2014-16)

	(1)	(2)	(3)
Distance	-0.997***	-0.935***	-0.934***
	(0.05)	(0.07)	(0.07)
Contiguity	0.137	0.138	0.139
	(0.15)	(0.15)	(0.15)
Language	0.327***	0.344***	0.342***
	(0.07)	(0.08)	(0.08)
Colony	0.536***	0.544***	0.548***
	(0.15)	(0.15)	(0.15)
FTA	0.681***	0.533***	0.534***
	(0.11)	(0.12)	(0.12)
Border		-5.017***	-5.296***
		(0.50)	(0.66)
Border × STRI1		-6.078*	-9.633*
		(3.35)	(5.79)
Border × STRI			2.408
			(3.55)
N	16443	17054	17054
R^2	0.78	0.81	0.81
Imp-Sec-Year FE	Yes	Yes	Yes
Exp-Sec-Year FE	Yes	Yes	Yes
Intra-trade flows	No	Yes	Yes

Standard errors clustered at importer and exporter level in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

B Sunk Cost Policy

B.1 Value Functions

In the following derivations, we omit subscripts iV without loss of generality. The expected value of starting to export at time t, conditional on observing the policy and thus K_s, the current business conditions a (expected to remain fixed), the firm's own unit costs c, and the regime r_k, is:

$$\Pi_e\left(a, c, r_k, \beta\right) = \pi(a, c) + \beta \underbrace{\left(1-\gamma_k\right)\Pi_e\left(a, c, r_k, \beta\right)}_{\text{No Shock}} + \beta \underbrace{\gamma_k \Pi'_e}_{\text{Shock}}. \tag{B.1}$$

This includes current operating profits upon entering and the discounted future value. Without a shock the firm's value next period remains unchanged at Π_e. If a shock arrives we have the third term:

$$\Pi'_e = \Pi_e\left(a, c, r_k, \beta\right) - \mathbb{E}\left(k'\right). \tag{B.2}$$

A marginal firm that entered in state s was indifferent between waiting and paying K_s. Therefore, assuming $k^{\max} \leq K_s$ it will also optimally pay any new policy-related sunk cost and obtain the value of exporting net of the average policy cost. Replacing in Π_e we have

$$\Pi_e\left(a, c, r_k, \beta\right) = \frac{\pi(a, c) - \beta\gamma_k \mathbb{E}\left(k'\right)}{1-\beta}. \tag{B.3}$$

The expected value of waiting is

$$\begin{aligned} \Pi_w\left(a, c, r_k, \beta\right) \;=\; & 0 + \beta \underbrace{\left(1 - \gamma_k + \gamma_k\left(1 - \kappa(k_s)\right)\right)\Pi_w}_{\text{Wait}} \\ & + \beta \underbrace{\gamma\kappa\left(k_s\right)\left(\mathbb{E}\Pi_e(a, c, r_k, \beta, k' \leq k_s) - \left(K + \mathbb{E}\left(k' \leq k_s\right)\right)\right)}_{\text{Enter}}. \end{aligned} \tag{B.4}$$

A non-exporter receives zero profits today. The continuation value remains at Π_w if either the policy is unchanged, with probability $1-\gamma_k$, or changes to higher costs, probability $\gamma_k\left(1-\kappa(k_s)\right)$. If the policy changes so that the cost falls below some endogenous trigger level for a firm, $k' < \bar{k}$, then we obtain the third term, reflecting the expected value of exporting net of the expected sunk cost. Rewriting and using $\mathbb{E}\Pi_e(a, c, r_k, \beta, k' \leq k_s) = \Pi_e$ we obtain

$$\Pi_w\left(a, c, r_k, \beta\right) = \frac{\beta\gamma_k\kappa\left(k_s\right)}{1 - \beta\left(1 - \gamma_k\kappa(k_s)\right)}\left[\Pi_e - \left(K + \mathbb{E}\left(k' \leq k_s\right)\right)\right] \tag{B.5}$$

B.2 Cutoff

Using equations (B.3) and (B.5) in the entry indifference equation (8) and simplifying we obtain

$$\frac{\pi(a, c_s^U)}{1-\beta}\frac{1}{K_s} = 1 - \frac{\beta\gamma_k}{1-\beta}\frac{k_s}{K_s}\left[\left(1 - \kappa\left(k_s\right)\right)\left(1 - \frac{\mathbb{E}\left(k' > k_s\right)}{k_s}\right) - 1\right]. \tag{B.6}$$

Without policy volatility, $\gamma_k = 0$, we obtain the standard deterministic entry condition: $\frac{\pi(a,c_s^D)}{1-\beta} = K_s$, which we can use to obtain the cutoff relative to the deterministic.

$$\begin{aligned}\frac{\pi(a,c_s^U)}{\pi(a,c_s^D)} &= 1-\beta_k\tilde{k}_s\left[\left(1-\kappa\left(k_s\right)\right)\left(1-\frac{\mathbb{E}\left(k'>k_s\right)}{k_s}\right)-1\right]\\ \left(\frac{c_s^U}{c_s^D}\right)^{1-\sigma} &= U_s^{1-\sigma}\end{aligned}$$

where $\beta_k \equiv \gamma_k \frac{\beta}{1-\beta}, \tilde{k}_s \equiv \frac{k_s}{K_s}$ and the second line uses the definition of profits, $U_{s,k}$ and $\omega_{is,k}$ in the text.

B.3 Empirical Specification

We use (10) and write it as $\omega_k = m_t \times \omega_k^{BR}$ where $\omega_k^{BR} \equiv \eta_k\left(1-\frac{k_k^{MFN}}{k_k^{EU}}\right)$ for comparability with the GHL derivation. We take a second order approximation of $\ln U$ in the text wrt $\mathbf{u} = \left(\omega_k^{BR}, \ln m_t, \tilde{k}\right)$ around no tail policy risk, $\mathbf{u}_0 = (0, \ln m_0, \tilde{k}_0)$. The general form of the approximation is

$$\ln U\left(\mathbf{u}\right) = \ln U\left(\mathbf{u}_0\right) + \left(\mathbf{u}-\mathbf{u}_0\right)\cdot\bigtriangledown \ln U\left(\mathbf{u}_0\right) + \frac{1}{2}\left(\mathbf{u}-\mathbf{u}_0\right)^T\left(\mathbf{H}\ln U\left(\mathbf{u}_0\right)\right)\left(\mathbf{u}-\mathbf{u}_0\right) + e,$$

where $\bigtriangledown$ is the gradient function and $\mathbf{H}\ln U\left(\mathbf{u}_0\right)$ is the hessian matrix and e the approximation error. Around no tail policy risk we have the following terms.

- Zeros for the first and second derivatives wrt $\ln m$ and its cross-partial with $\tilde{k}$.
- $\ln U\left(\mathbf{u}_0\right) = -\ln\left(1+\beta_k\tilde{k}_0\right)/\left(\sigma-1\right)$
- Tail risk derivatives and cross effects evaluated at $\mathbf{u}_0$

$$\begin{aligned}\left(\sigma-1\right)\frac{\partial \ln U}{\partial \omega_k^{BR}}|_{\mathbf{u}_0} &= -\frac{\partial \ln\left(1-\beta_k\tilde{k}\left(m_t\omega_k^{BR}-1\right)\right)}{\partial \omega_k^{BR}}|_{\mathbf{u}_0} = \tilde{\beta}_k m_0\\ \left(\sigma-1\right)\frac{\partial^2 \ln U}{\partial\left(\omega_k^{BR}\right)^2}|_{\mathbf{u}_0} &= -\frac{\partial^2 \ln\left(1-\beta_k\tilde{k}\left(m_t\omega_k^{BR}-1\right)\right)}{\partial\left(\omega_k^{BR}\right)^2}|_{\mathbf{u}_0} = \left(\tilde{\beta}_k m_0\right)^2\\ \left(\sigma-1\right)\frac{\partial^2 \ln U}{\partial \ln m \partial \omega_k^{BR}}|_{\mathbf{u}_0} &= -m\frac{\partial \ln\left(1-\beta_k\tilde{k}\left(m_t\omega_k^{BR}-1\right)\right)}{\partial m\partial \omega_k^{BR}}|_{\mathbf{u}_0} = \tilde{\beta}_k m_0\end{aligned}$$

- Policy capital derivatives evaluated at $\mathbf{u}_0$

$$\begin{aligned}\left(\sigma-1\right)\frac{\partial \ln U}{\partial \tilde{k}}|_{\mathbf{u}_0} &= -\frac{\partial \ln\left(1-\beta_k\tilde{k}\left(m_t\omega_k^{BR}-1\right)\right)}{\partial \tilde{k}}|_{\mathbf{u}_0} = -\tilde{\beta}_k/\tilde{k}_0\\ \left(\sigma-1\right)\frac{\partial^2 \ln U}{\partial \tilde{k}^2}|_{\mathbf{u}_0} &= -\frac{\partial \ln\left(1-\beta_k\tilde{k}\left(m_t\omega_k^{BR}-1\right)\right)}{\partial \tilde{k}}|_{\mathbf{u}_0} = \left(\tilde{\beta}_k/\tilde{k}_0\right)^2\end{aligned}$$

where $\tilde{\beta}_k \equiv \frac{\beta_k \tilde{k}_0}{1+\beta_k \tilde{k}_0}$.2.2

So the change in uncertainty factor relative to an average under the EU regime is

$$\ln \frac{U(\mathbf{u})}{U(\mathbf{u}_0)} = \left[\frac{\tilde{\beta}_k m_0}{\sigma-1}\omega_k^{BR}\left(1+\frac{\tilde{\beta}_k m_0}{2}\omega_k^{BR}+\ln\frac{m}{m_0}\right)\right]+\left[\tilde{\beta}_k\frac{\tilde{k}-\tilde{k}_0}{\tilde{k}_0}\left(-1+\frac{\tilde{\beta}_k}{2}\frac{\tilde{k}-\tilde{k}_0}{\tilde{k}_0}\right)\right]+e \tag{B.7}$$

The first bracketed term captures the option value effect; the two first inner terms in parentheses represent the first and second order effects of ω_k^{BR} and the third represents the cross effect. The second bracketed term captures any deviation in country-industry costs due to the approximation around a $\tilde{k}_0$ common to all. This last term is present even under the EU regime and is controlled for by exporter-industry effects.

Re-introducing the subscripts for country and industry and re-arranging we obtain the equivalent of equation (13) in the main text.

$$\ln U_{ixVt} = \frac{\tilde{\beta}_k}{\sigma-1}(m_0 \ln m_t)\,\omega_{ixV,k}^{BR} + \alpha_{ixV,k} + e_{ixVt}^{U} \tag{B.8}$$

where $\alpha_{ixV,k}$ captures all terms other than the interaction of the time varying probability and risk, since those other terms vary only by ixV, and it also includes the constant, $\ln U(\mathbf{u}_0)$. Lastly, we continue to assume that our probability measure is proportional to exporter beliefs, $\ln m_t = r^b \ln B_t$ where $r^b > 0$. We must now assume that the cost is proportional to the trade restrictiveness measure, $1-\frac{k_k^{MFN}}{k_k^{EU}} = \varepsilon_k\left(1-\frac{\tilde{\tau}^{MFN}}{\tilde{\tau}^{EU}}\right)$ where $\varepsilon_k > 0$ is the elasticity of costs with respect to the policy around the EU state, so we have $\omega_k^{BR} = \eta_k\varepsilon_k\left(1-\frac{\tilde{\tau}^{MFN}}{\tilde{\tau}^{EU}}\right)$. Replacing these in equation (B.8) we obtain

$$\ln U_{ixVt} = \frac{\tilde{\beta}_k}{\sigma-1} \times m_0 r^b \times \eta_k \times (-\varepsilon_k) \times \left[\ln B_t \times \left(\frac{\tilde{\tau}^{MFN}}{\tilde{\tau}^{EU}}-1\right)\right] + \alpha_{ixV,k} + e_{ixVt}^{U}.$$

Using the above expression in the export equation (12) we obtain the coefficient on the interaction described in the text.

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