WIFO ■ WORKING PAPERS

659/2023

Trade in Times of Uncertainty

Anna Matzner
Birgit Meyer
Harald Oberhofer

Trade in Times of Uncertainty

Anna Matzner, Birgit Meyer, Harald Oberhofer

WIFO Working Papers 659/2023
March 2023

Abstract

This paper analyses the direct and indirect trade volume and trade cost effects of uncertainty on international trade and economic welfare using a structural gravity framework for a panel of 97 developed and developing countries from 2000 to 2018. Our results suggest that an increase in unilateral uncertainty affects average trade costs in a heterogeneous manner, depending on whether the uncertainty originates from the importing or exporting country. Moreover, using a cross-sectional gravity approach, we show that an uncertainty shock directly reduces cross-border trade flows. The paper illustrates the suitability of the proposed modelling approach by means of two counterfactual scenario analyses in which we calculate the general equilibrium trade and welfare effects of uncertainty induced by the unexpected outcome of the Brexit referendum in 2016 and the outbreak of the COVID-19 pandemic in 2020.

E-mail: birgit.meyer@wifo.ac.at, harald.oberhofer@wifo.ac.at

2023/1/W/0

Medieninhaber (Verleger), Hersteller: Österreichisches Institut für Wirtschaftsforschung
1030 Wien, Arsenal, Objekt 20 | Tel. (43 1) 798 26 01-0 | https://www.wifo.ac.at
Verlags- und Herstellungsort: Wien

Trade in Times of Uncertainty*

Anna Matzner† Birgit Meyer‡ Harald Oberhofer§

February 2023

Abstract

This paper analyses the direct and indirect trade volume and trade cost effects of uncertainty on international trade and economic welfare using a structural gravity framework for a panel of 97 developed and developing countries from 2000 to 2018. Our results suggest that an increase in unilateral uncertainty affects average trade costs in a heterogeneous manner, depending on whether the uncertainty originates from the importing or exporting country. Moreover, using a cross-sectional gravity approach, we show that an uncertainty shock directly reduces cross-border trade flows. The paper illustrates the suitability of the proposed modeling approach by means of two counterfactual scenario analyses in which we calculate the general equilibrium trade and welfare effects of uncertainty induced by the unexpected outcome of the Brexit referendum in 2016 and the outbreak of the COVID-19 pandemic in 2020.

JEL Code: F13; F14; F42; E60

Keywords: International Trade; Trade Costs; Gravity; Uncertainty; Counterfactual Scenario Analysis; Brexit; COVID-19

*The authors gratefully acknowledge helpful comments from two anonymous referees, Daniel Mirza, Joschka Wanner as well as from participants of the 2021 Annual Congress of the Austrian Economic Association, the 2021 Annual European Trade Study Group Conference, the 23rd Conference on International Economics of the Spanish Association of International Economics and Finance and the 2022 conference on Economics of Global Interactions organized by the University of Bari Aldo Moro.

†Department of Economics, Vienna University of Economics and Business (WU), Welthandelsplatz 1, 1020 Vienna, Austria. email: anna.matzner@wu.ac.at

‡Austrian Institute of Economic Research (WIFO), Arsenal Objekt 20, 1030 Vienna; email: birgit.meyer@wifo.ac.at

§Corresponding author. Department of Economics, Vienna University of Economics and Business (WU), Welthandelsplatz 1, 1020 Vienna, Austria; Austrian Institute of Economic Research (WIFO); CESifo Munich. email: harald.oberhofer@wu.ac.at

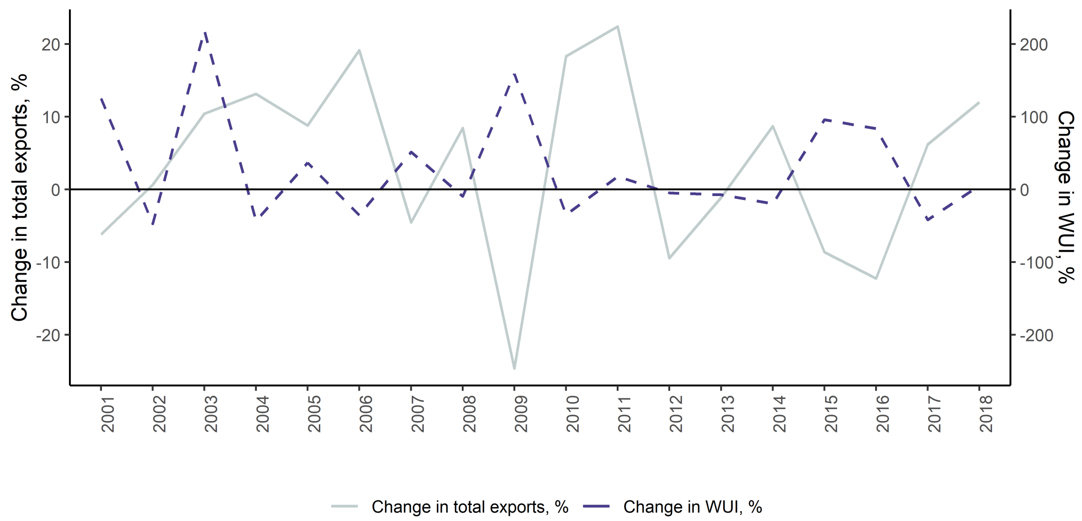
1 Introduction

Economic agents experience uncertainty in times of political and societal change, volatile economic development or due to non-economic phenomena such as climate change induced disasters. Uncertainty often increases following a first-moment shock in the real economy, such as e.g., shocks to demand or supply/productivity. They can have an enduring effect on the economy. This paper studies the effect of uncertainty on bilateral trade flows. We identify the direct and indirect impacts of country-specific uncertainty using structural gravity models. By employing the World Uncertainty Index (WUI) developed by Ahir et al. (2022), we aim at identifying the effect of overall uncertainty on cross-border trade and welfare.

The global financial crisis is a prominent example for such uncertainty shocks: the crisis and the ensuing recession induced a wave of economic studies on the relationship between uncertainty and economic developments (Carriero et al., 2015). The literature agrees that in times of high uncertainty, economic performance deteriorates as output, investment, consumption, and employment declines (see, for example, Bloom, 2009).

A more recent example for a surprising increase in uncertainty is related to the unexpected outcome of the Brexit referendum in the United Kingdom (UK) in 2016. Figure 1 draws the evolution of uncertainty in the UK, based on data from WUI, and juxtaposes it to (percentage) changes in UK's total export flows. A visual inspection of this graph reveals a negative correlation between the two time series. In more uncertain times, characterized by years of a large increase of (relative) uncertainty, UK's cross-border trade declined. This is also visible for 2015 and 2016, where the latter captures the Brexit referendums outcome related surge in uncertainty. In 2015, the UK had a general election in May and the measured increase in uncertainty is mainly driven by election outcome uncertainty during the first quarter of the year. This increase again went hand in hand with a decrease in UK's trade with foreign countries.

Figure 1: Total Exports and uncertainty in the United Kingdom 2001 - 2018



Source: Comtrade, Ahir et al. (2022); own calculations.

The COVID-19 pandemic is yet another example of a first-moment shock that led to sharp increases in uncertainty thereby contributing to a massive economic downturn (Baker et al., 2020). The outbreak of the COVID-19 pandemic in China at the turn of the year 2019 to 2020 was immediately followed by disrupted global value chains, rising trade cost, and a decline in global trade.

In times of crisis, standard models of international trade that typically take on medium- to long-run perspective have yet not been very successful in explaining the severe distortions to trade. This points to a lack of understanding of cross-border trade dynamics in exceptional times (Taglioni and Zavacka, 2013). The focus of the recent literature on trade and uncertainty has been on studying the impact of trade policy uncertainty, foremost by investigating the role of trade agreements in reducing uncertainty (see Handley, 2014, Handley and Limao, 2015, Limão and Maggi, 2015). Since commitment and credibility are key factors in international trade, trade agreements lead to less uncertainty about future trade policy regulation such as increased protectionism. In turn, lower trade policy uncertainty leads to higher trade volumes between the contracting parties. Tam (2018) studies the effect of economic policy uncertainty emanating from China and the US on bilateral trade. Using a global vector autoregressive model, she finds that economic policy uncertainty leads to lower overall levels of trade. She shows that the transmission of US economic policy uncertainty appears through indirect trade linkages while China's economic policy uncertainty is transmitted to the rest of the world more directly via its central position in global value chains. Although the fragmentation of production across countries has become the defining feature of the global economy, trade and economic policy uncertainty account only for a small fraction of general uncertainty (Baker et al., 2016) that might directly and indirectly affect international trade. Against this background, this paper explicitly studies the effect of overall uncertainty on trade.

Uncertainty is expected to have direct and indirect impacts on trade flows (Tam, 2018). For example, an uncertainty-induced economic downturn indirectly leads to lower international trade flows through reduced investment, consumer spending, and GDP growth. Adverse effects on production and consumption affect the demand and supply of goods, including traded ones. Also, consumer as well as business expectations might change in times of pronounced uncertainty, which in turn drives changes in exchange rates and, as a consequence, in trade flows. Novy and Taylor (2019) identify a direct channel of uncertainty. Their findings suggest that higher inventory costs for foreign inputs lead to a larger reduction in foreign orders compared to domestic ones. On the extensive margin, Limão and Maggi (2015) argue that, during periods of high uncertainty, firms cut back on fixed-costs and reduce investments for entering new export markets and technology upgrading, thus providing another direct channel of uncertainty on trade flows. Hence, uncertainty can be expected to discourage exports (Handley and Limao, 2017), imports (Imbruno, 2019) and new foreign market entries. (Limão and Maggi, 2015).

This paper contributes to the literature by investigating the direct and indirect impacts of economic uncertainty on trade flows between 97 countries and for the years from 2000 to 2018. We study the transmission of uncertainty focusing on the impact on trade volumes and trade costs. We analyse how uncertainty influences bilateral and multilateral trade costs using a structural gravity framework. Empirically, we examine the effects of a WUI based measure for uncertainty on a country's imports and exports using the standard Poisson pseudo maximum likelihood (PPML) estimator. Our results suggest that exporter-specific uncertainty increases a country's remoteness to the rest of the world which translates into lower trade with its trading partners. A 10% increase in an exporting country's uncertainty level reduces its average bilateral trade flows by approximately 0.76%. On the other hand, an importer country increase in uncertainty by 10% decreases a country's remoteness by approximately 7.72%. The structural gravity estimates based on a cross-section for 2015 further suggest that uncertainty also negatively impacts cross-border trade flows.

Moreover, we offer a counterfactual scenario analysis that seeks to study the general equilibrium international trade and welfare effects from periods of high uncertainty taking the Brexit referendum in 2016 and the outbreak of the COVID-19 pandemic in 2020 as examples. In the Brexit scenario, we compare a situation with the UK as the only affected economy with an alternative where we also account for uncertainty spillovers to all other countries in the sample. For the scenario related to COVID-19 we solely impose a global shock for 2020, which, however, hitted different sample countries in different magnitudes. The counterfactual scenario shows that periods of high economic uncertainty cause considerable turmoil in international trade leading to strong trade diversion effects.

The remainder of the paper is organised as follows. Section 2 discusses the main theoretical channels trough which uncertainty might affect cross-border trade and domestic sales. The third section introduces the econometric specifications of the gravity model. Section 4 presents the data. A discussion of the estimation results follows in section 5. The findings from the counterfactual scenario analysis are summarized in section 5.3 and robustness checks are provided in section 5.4. A final section concludes.

2 Channels of uncertainty in the gravity framework

Standard international trade theory allows for several channels through which uncertainty might affect trade flows (see, for example, Handley, 2014; Tam, 2018; Novy and Taylor, 2019). To examine the channels of uncertainty on bilateral trade for a multitude of countries, we use a micro-founded structural gravity framework. Following Anderson and Van Wincoop (2003), bilateral trade flows between exporter i and importer j, denoted by X_{ij}, can be expressed by:

$$X_{ij} = \frac{Y_i E_j}{Y} \left(\frac{t_{ij}}{\Pi_i P_j} \right)^{1-\sigma}. \quad (1)$$

The right-hand side of equation (1) can be decomposed into a size and a trade cost term. The size term $Y_i E_j / Y$ refers to trade without any trade frictions and contains the production Y of the exporter country i and the expenditures E of the importer country j normalized by total world production. In a frictionless world, bilateral trade would be solely determined by the joint 'size' of the two economies relative to the world economy.

The trade cost term accounts for bilateral trade costs, t_{ij}, as well as the outward multilateral resistances, Π_i, and inward multilateral resistances, P_j. σ represents the elasticity of substitution. Bilateral trade costs t_{ij} include for instance, distance, trade agreements, colonial, and cultural ties such as sharing a common language, and dominantly affect trade between country i and j directly. The multilateral resistance terms Π_i and P_j influence trade not just bilaterally, but also indirectly by capturing trade and trade costs with all trading partners. Formally the multilateral resistance terms result from the solution of the system of trade equations for all potential trade partners and are defined as:

$$\Pi_i^{1-\sigma} = \sum_j \left(\frac{t_{ij}}{P_j} \right)^{1-\sigma} \frac{E_j}{Y} \tag{2}$$

and

$$P_j^{1-\sigma} = \sum_i \left(\frac{t_{ij}}{\Pi_i} \right)^{1-\sigma} \frac{Y_i}{Y}. \tag{3}$$

In economic terms, the inward and outward multilateral resistances can be interpreted as multilateral trade costs or average trade barriers since they measure trade costs relative to the destination (see equation (2)) or origin price indices (see equation (3)).

By decomposing the gravity equation into its different components, we are able to shed light on the specific channels through which economic uncertainty might influence trade. A decrease in economic uncertainty might improve the overall economic outlook of an economy, which in turn has the potential to increase its production and consumption, i.e. increasing the size terms, which should translate into more exports and imports, respectively. Uncertainty is country-specific and can therefore unilaterally and asymmetrically affect the production and expenditure terms in any given bilateral trade relationship.

Increased uncertainty has a direct influence on bilateral trade frictions. Our trade costs factor, t_{ij}, includes all bilateral trade frictions and hence, might be affected directly by uncertainty since increased contractual uncertainty, increased uncertainties at the border and any changes in regulations have the potential to increase shipping costs from country i to country j. Also, trading partners might be hesitant regarding trade with a country experiencing high levels of uncertainty. Economic agents are unsure about future regulations or agreements and might develop a wait-and-see strategy. The bilateral trade cost factor, t_{ij}, does not only capture truly bilateral trade costs but also unilateral ones (Oberhofer et al., 2021). The latter *inter alia* also include exporter and importer uncertainty. According to Limão and Maggi (2015) and Handley and Limão (2022), uncertainty can drive a wedge between domestic demand and foreign products by affecting tariff regimes altering trade costs and thus trade volumes. Novy and Taylor (2019) suggest that higher inventory costs for foreign inputs might lead to a larger reduction in foreign orders compared to domestic ones, leading to a substitution of imports by domestic production. Handley and Limão (2022) consider an augmented gravity model to model the impact of trade policy uncertainty on bilateral exports. Changes in tariff regimes impact the decision of firms to engage in international markets. They might reduce their fixed investment cost to enter new markets. Carballo et al. (2022) show that trade agreements can mitigate uncertainty in bilateral trade relationships by reducing the total bilateral trade cost vector.

In addition to directly shifting bilateral trade costs, uncertainty has an indirect effect on the sellers' and buyers' total incidence of trade costs to all trading partners. Uncertainty in country j, for instance, affects imports without regard to origin. Any changes in economic uncertainty will therefore also partially affect trade frictions with all trading partners. Intuitively, trade costs of a country with heightened uncertainty will rise, increasing the "remoteness" of the country from and to its trading partners. Thus, the multilateral resistance terms capture any changes in unilateral trade costs due to a change in perceived uncertainty that might also feed back on trade with other countries. Imbruno (2019) shows that the decrease of the perceived trade policy uncertainty of China related to China's accession to the WTO in 2002 influenced the country's import behaviour from all trading partners.

Despite the multitude of empirical and theoretical work, the majority of empirical work has focused on the effect of policy uncertainty for a single country. An exception are Fei et al. (2020) and Borojo et al. (2022), who use a gravity model to estimate the impact of economic policy uncertainty available for a sample of 20 countries, and Gupta et al. (2019), who show that geopolitical risk affect bilateral trade flows negatively. Our research aims to address this gap by analysing the impact of general country-specific uncertainty on trade flows for a panel of 97 countries. In our empirical approach, we take the different channels through bilateral and multilateral trade costs into account and distinguish between uncertainty born in the exporting country and uncertainty originating in the importing economy.

3 Econometric framework

For the empirical analysis of the direct and indirect effects of uncertainty, we rely on two slightly different but complementary approaches using the structural gravity framework. Since we deal with country-specific uncertainty, the identification of the effect is not straight forward. Uncertainty can often be seen as either importer- or exporter-specific. In order to identify the effect of the unilateral uncertainty measure, we use two complementing approaches. First, we analyse how uncertainty impacts average trade costs a country faces with all its trading partners by examining the uncertainty's impact on outward and inward multilateral resistances. Second, we estimate the effect of uncertainty for cross-border trade by using a cross-sectional version of the gravity model for the pre-counterfactual scenario year 2015. Equipped with parameter estimates for this year, we run counterfactual scenario analyses in which we counterfactually modify our uncertainty measures based on their realizations after the Brexit referendum and the beginning of the COVID-19 pandemic. Our gravity models are augmented with data on domestic trade flows. The inclusion of domestic trade flows allows to identify the differential effect of uncertainty for international relative to domestic trade, which is of particular importance for our second approach.

3.1 Uncertainty and multilateral resistances

In this subsection, we focus on the impact of uncertainty on average trade costs of a country with all its trading partners.

Our starting point for the analysis is the specification of a structural gravity model for panel data. For estimation, we follow the best practices recommended by Yotov et al. (2016) and estimate the following generic empirical specification:

$$X_{ijt} = \exp(\lambda_{it} + \psi_{jt} + \mu_{ij} + B_{ij} w_{ijt} \alpha) + v_{ijt} \tag{4}$$

where X_{ijt} denote trade flows from country i to country j in year t. To account for time-invariant bilateral trade costs, country pair fixed effects, μ_{ij}, are included. The country pair fixed effects capture all bilateral characteristics that do not vary over time, such as e.g., geographical distance, a common border or a common language spoken in both countries.

The panel data structure allows us to include time-varying importer fixed effects, ψ_{jt}, and time-varying exporter fixed effects, λ_{it}. The exporter and importer fixed effects account for the respective outward and inward multilateral resistance terms as well as other time-varying country-specific influences such e.g., GDPs, population or political stability. The three-way fixed effects allow us to estimate the model consistently with standard international trade theory and to reduce the scope for omitted variables. Estimation is performed with the Poisson Pseudo-Maximum Likelihood (PPML) estimator. The applied PPML estimator enables us to exploit information on zero trade flows and to account for heteroskedasticity often encountered by trade flows data (Silva and Tenreyro, 2006). w_{ijt} are time-varying bilateral variables, including all kinds of bilateral time-varying trade frictions such as free trade agreements and joint EU-membership of a trading pair. α is a coefficient vector storing the estimated parameter values for the time-varying bilateral variables. v_{ijt} represents the error term.

To identify the effect of uncertainty on average trade costs via multilateral resistances, we follow the two step approach recommended by Head and Mayer (2014) and Kinzius et al. (2019). Since the uncertainty index is either importer- or exporter-specific and time-varying, its effect on average trade costs cannot be directly inferred in one regression. Thus, in the first step, we estimate equation (4) with the full set of fixed effects using the PPML estimator. Since estimation with three-way fixed effects is computationally intensive, we employ the iterative estimation procedure proposed by Larch et al. (2019). From these estimated country-time fixed effects, we construct the multilateral resistance terms by normalizing the inward multilateral resistance terms to one for the USA. In the second step, the estimated multilateral resistance terms are regressed on other country-specific control variables and our measures for uncertainty. Controlling for other time-varying country-specific variables allows us to identify the partial effect of uncertainty on multilateral resistances. We estimate the following equations for the log of the estimated outward ($ln\widehat{\lambda_{it}}$) and inward ($ln\widehat{\psi_{jt}}$) multilateral resistances:

$$ln\widehat{\lambda_{it}} = \alpha_1 + C_{it}\beta_1 + \delta_1 unc_{it} + \gamma_i + \omega_t + \phi_{it} \tag{5}$$

$$ln\widehat{\psi_{jt}} = \alpha_2 + C_{jt}\beta_2 + \delta_2 unc_{jt} + \gamma_j + \omega_t + \eta_{jt} \tag{6}$$

where C_{it} and C_{jt} are vectors including exporter and importer country-specific controls, respectively. We control for the countries' GDP, political stability, and population. β_1 and β_2 are the corresponding vectors of parameters to be estimated. unc_{it} and unc_{jt} capture our uncertainty measures for the exporting and importing countries, respectively. The parameters

δ_1 and δ_2 are the once of most interest. γ_i are country fixed effects for the exporter in equation (5) and γ_j are country fixed effects for the importer in equation (6). ω_t are time fixed effects. ϕ_{it} and η_{jt} denote the respective error terms.

3.2 Structural gravity with intra-national and domestic trade costs

In the second part of our analysis, we aim to (i) quantify the direct trade effects stemming from changes in uncertainty and (ii) to assess its transmission into overall trade and welfare effects by means of a full endowment general equilibrium model. For this purpose, we make use of a structural gravity approach in the spirit of Heid et al. (2021) and Beverelli et al. (2018) focusing on the overall impact of uncertainty on cross-border trade volumes through changes in trade costs. For the estimation of the direct effect, we explicitly make use of the constructed domestic trade flows (i.e, exports from country i to itself). With this data at hand, we are able to identify the effect of uncertainty on cross-border trade flows relative to intra-national trade by introducing an interaction term between the uncertainty measures of interest and a dummy variable which takes on a value of one for cross-border trade flows, and zero for domestic trade. The direct effect of uncertainty for domestic trade is absorbed by the country fixed effect. The interaction term of uncertainty with the border dummy allows to identify its differential impact on cross-border trade. In order to obtain consistent estimates, the border variable must not be correlated with our variable of interest, the uncertainty index. The border variable is independent of any country choice and arguably exogenous. In comparison to the two-step approach, we estimate a cross-sectional specification of the structural gravity model for the year 2015 in this part of the analysis. Our below discussed counterfactual policy scenarios are also estimated for the year 2015 and, therefore, we would like to obtain the structural parameter for uncertainty for this year.[1] Furthermore, we prefer to use a parameter estimate that is not itself affected by one of the policy scenarios we investigate. The Brexit referendum took place in 2016 and this motivates the choice for 2015 as our baseline year.

The cross-sectional version of the gravity model reads as:

$$X_{ij} = \exp(\lambda_i + \psi_j + B_{ij}w_{ij}\alpha + \delta_3 B_{ij}UNC_i) + v_{ij} \tag{7}$$

λ_i and ψ_j capture the exporter and importer fixed effects for 2015. w_{ij} denote bilateral trade costs. In the cross-sectional model, we cannot include a bilateral fixed effect as we observe each directed trade relationship only once. w_{ij}, therefore, now not only subsumes free-trade agreements and joint EU-membership but rather also includes standard bilateral trade cost variables like distance, contiguity, common language and a dummy variable that takes on a value of one for cross-border trade, and zero else.

Due to perfect collinearity of unilateral measures in a gravity model, the estimated coefficients from either the exporter or importer uncertainty are identical and symmetric. Thus, we only include the interaction of exporter uncertainty with the border dummy ($B_{ij}UNC_i$). The effect can be interpreted as the sum of the effect of uncertainty on exports and imports relative to

[1] The estimation of a panel data version of the model with year-specific uncertainty parameters would essentially result in the same parameter values.

intra-national trade (Beverelli et al., 2018). The coefficient δ_3 in equation (7) captures the direct effect of uncertainty on international trade flows relative to domestic trade but does not account for changes in multilateral resistances. The specification does not allow to directly identify the effect of uncertainty on domestic trade as it is absorbed by the exporter fixed effects. The interpretation of the effect is as follows: If δ_3 is negative, cross-border trade is more negatively be affected by an increase in uncertainty relative to domestic trade flows.

Based on the structural gravity specification with domestic trade flows and the underlying full-endowment general equilibrium model from Oberhofer et al. (2021), we are able to simulate the trade and welfare effects of changes in uncertainty based on counterfactual scenarios analysis. The direct trade effect from alternative uncertainty levels associated with the parameter estimate for δ_3 serves as input into the general equilibrium model which then takes all resulting indirect trade diversion and income effects into account. As counterfactual scenarios, we study the effects of Brexit uncertainty and the COVID-19 induced jump in uncertainty around the world. In line with the cross-sectional specification of the gravity model, we choose 2015 as the baseline year for the counterfactual analysis.

4 Data

Our main interest lies in estimating the effect of uncertainty on bilateral trade. To account for uncertainty in our model, we use the World Uncertainty Index (WUI) proposed by Ahir et al. (2022). The index measures country-specific uncertainty and is constructed by counting the frequency of the word "uncertainty" in the quarterly Economics Intelligence Unit country reports. The reports focus on economic and political developments and allow for cross-country comparability. To further enhance cross-country comparison, the frequency is scaled by the total number of words used in each country report. We use the smoothed version[2] of the index which is recommended by the authors for cross-country analysis. The index is quarterly available for 143 economies, including developed and developing countries. The broad country coverage makes it attractive for general equilibrium modeling and is the main reason why we choose to work with the WUI. Ahir et al. (2022) also show that the index is highly correlative with alternative empirical uncertainty measures such as the economic policy uncertainty (EPU) index, stock market volatility, and forecaster disagreement. We use the maximum quarterly value of uncertainty within a year as our measure of uncertainty. This allows for more variation of the WUI index compared to the average annual WUI. We construct an additional dummy variable indicating an uncertainty shock whenever the index exceeds 1.65 times the standard deviation of a country's mean in uncertainty. In our robustness checks, we use an alternative measures for uncertainty, the economic policy uncertainty (EPU) index. The country-level indices are based on the following sources: Australia, Brazil, Canada, France, Germany, India, Italy, Mexico, Russia, UK, United States on Baker et al. (2016), Chile on Cerda et al. (2016), China on Baker et al. (2013), Colombia on Gil and Silva (2018), Greece on Hardouvelis et al. (2018), Japan on Arbatli et al. (2017), The Netherlands on Kroese et al. (2015), Spain on Ghirelli et al. (2019),

[2]The smoothed version of the WUI is a 3-quarter weighted moving average that is computed as follows: 1996Q4= ((1996Q4*0.6) + (1996Q3*0.3) + (1996Q2*0.1))/3.

and Sweden on Armelius et al. (2017). Further, we employ the Overall Country Risk Score by the Economist Intelligence Unit database in our robustness analysis.

Our cross border trade data are from UN Comtrade. We use data on country-level GDP to calculate domestic trade as the difference between GDP and a country's total annual exports. Our data set has annual frequency and spans the period from 2000 to 2018.

Data on bilateral trade costs as well as country-specific control variables are from the Dynamic Gravity Dataset (Gurevich and Herman, 2018). Distance is measured between pairs of major cities and weighted by the country's population living in each city. This methodology introduced by De Sousa et al. (2012) allows to account for the distance goods have to travel between countries and to additionally account for internal distance. To capture trade frictions due to language and cultural barriers, we include an indicator for a common language spoken in the trading partners. To control for the size of the economy of a country, we add real GDP and each country's population. Both approaches feature a bilateral control variable indicating whether a free trade agreement between the trading partners is in force. Data on GDP, population and distance enter our specifications in logs. From the Polity V Project (Marshall and Gurr, 2020), we include the polity2 index measuring the political system of a country, ranging from -10 (strongly autocratic) to 10 (strongly democratic). Table 1 provides an overview of the variables and its definitions.[3]

[3]For an overview on the covered countries, see Appendix A.

Table 1: Data Description for Selected Variables.

Variable	**Description**
World Uncertainty Index	Frequency of the word uncertainty (or its variant) in the Economics Intelligence Unit country reports normalized by the total number of words and rescaled by multiplying by 1,000. Smoothed version. Yearly average of quarterly observations.
Trade	Annual bilateral trade, total of all Harmonized System commodities.
Gross Domestic Product (in US$)	Real GDP with 2010 as the base year.
Polity	Index ranging from -10 (strongly autocratic) to 10 (strongly democratic) denoting a country's level of democracy or autocracy.
Population (in millions)	A country's population in millions.
Trade Agreement exists	Dummy for whether two countries are part of at least one of the following: active preferential trade agreement, custom union, economic integration agreement, free trade agreement.
Joint EU membership	Country pair are both members of the European Union.
Distance	Population-weighted average of city-to-city bilateral distances in kilometers between each major city in the importing and exporting country.
Common language	Indicator for a common language between two countries spoken by at least some residents.

5 Estimation results

In the following, we first provide our results of the impact of uncertainty on trade costs. Then, we discuss our results comparing the effects of cross-border versus domestic trade. In an additional section, we analyze the findings of our counterfactual scenarios. Finally, we provide robustness checks for our estimation results.

5.1 Two-step approach: Uncertainty and multilateral trade costs

The estimates reveal that uncertainty influences average trade costs a country faces with the rest of the world in a heterogeneous manner depending on whether the uncertainty stems from the importer or exporter side, respectively. To assess the impact of uncertainty on trade, we follow the two-step estimation proposed by Head and Mayer (2014). We start with the estimation of the full gravity specification shown in equation (4) with three-way fixed effects. Column (1) of Table 2 shows the effect of trade agreements and joint membership of the European Union

(EU) on bilateral trade flows. Results are in line with the literature (for a summary see Head and Mayer, 2014) and highlight the positive direct trade effects of bilateral trade agreements and EU membership on cross-border trade. Trade agreements as well as joint EU membership mitigate parts of potential negative effects of uncertainty on bilateral trade frictions, as shown by Handley and Limao (2017) and Handley and Limão (2022).

To evaluate how uncertainty impacts average trade costs a country faces with all its trading partners, we examining the uncertainty's impact on outward and inward multilateral resistances in a second estimation step. Inward and outward multilateral resistance terms are derived from the estimated importer-time fixed effects, λ_{it}, and exporter-time fixed effects, ψ_{jt}, respectively, as explained in Section 3.1.

Column (2) and (3) of Table 2 present the impact of exporter-specific uncertainty on the outward multilateral resistance terms, λ_{it}. An increase in the exporter's GDP in general increases the market access of a country and increases bilateral trade.

The size of the exporter's population and the political regime have a negative effect on bilateral exports. This negative relationship indicates that geographically sizeable countries and more democratic countries have on average a lower demand for foreign goods. The size effect is well in line with theoretical predictions as larger economies tend to be more closed to the world economy.

The effect for the governmental system might be counterintuitive at a first glance. Here it is crucial to mention that due to the inclusion of country fixed effects only countries that experience a change in the polity score contribute to the identification of the effect. Around 48% of our sample do not experience such a change between 2000 and 2018 including all most democratized economies in the world. The effect is thus driven by relatively autocratic systems that became a bit more or less autocratic over the time span covered and are not very representative for the world economy. This countries also tend to be relatively resource rich and might therefore behave strategically in their export and import relationships.

Turning to the impact of uncertainty on the outward multilateral resistance term, reveals that an increase of uncertainty in the exporting country by 10%, lowers trade by 0.76% (see column (2)). In a period of an uncertainty shock[4], this effect is twice as strong. We estimate a 1.91% reduction in cross-border trade in times of an uncertainty shock. To summarize, uncertainty increases the outward multilateral resistances of an exporting country and in terms of trade relationships it becomes more "remote" to the rest of the world.

Looking at the inward multilateral resistance term (see Column (4) and (5) in Table 2), we see that the market size and the geographical size of a country (measured by a country's GDP and population) as well as it's political stability increase trade flows by lowering the incidence of trade costs on the consumers in the importing country.

Contrary to the exporter side, we find positive effects of uncertainty on bilateral trade in the importing country. Increases of the WUI index in the importing country result in more bilateral imports. If uncertainty increases by 10%, trade increases by 7.72% (Column (4)). If the importing country experiences an uncertainty shock, its remoteness decreases by 24.35%, on average.

[4]Recall, we define an uncertainty shock as a year t in which uncertainty exceeds the critical value associated with a 1.65 standard deviation from the country's uncertainty mean.

An uncertainty shock born at the importer thus affects trade through changes in trade with all partner countries drastically. Another interpretation of the inward multilateral resistance as price index suggests that consumer prices of the importing country increases relatively to the partner country leading to a higher demand for foreign goods[5]. Our findings suggest that if the uncertainty is high in a country, it tends to increase its imports. One explanation could be that countries cannot any longer rely on production in their home countries and therefore, try to substitute domestic goods by imports. Hence, uncertainty increases the average trade costs for the seller with all their trading partners and seems to lead to trade dispersion for the buyer in the medium and long run.

Table 2: Estimation results: Two-step approach for multilateral resistances

	(1)	(2)	(3)	(4)	(5)
	First Step	Second Step			
	Exports	$ln\widehat{\lambda_{it}}$	$ln\widehat{\lambda_{it}}$	$ln\widehat{\psi_{jt}}$	$ln\widehat{\psi_{jt}}$
(ln) WUI		-0.0760***		0.772***	
		(0.00807)		(0.0459)	
WUI Dummy			-0.0193***		0.218***
			(0.00136)		(0.0136)
(ln) GDP		0.619***	0.619***	0.536***	0.530***
		(0.00349)	(0.00347)	(0.00771)	(0.00748)
Polity		-0.0107***	-0.0107***	0.0284***	0.0284***
		(0.000285)	(0.000287)	(0.000836)	(0.000836)
(ln) Population		-0.475***	-0.474***	0.942***	0.931***
		(0.00750)	(0.00754)	(0.0132)	(0.0127)
Border(=1)*TA exists	0.413***				
	(0.0439)				
Border(=1)*Both EU	1.156***				
	(0.0817)				
Constant	27.82***	-19.27***	-19.29***	13.56***	13.78***
	(0.00486)	(0.0814)	(0.0808)	(0.207)	(0.196)
Observations	158,173	158,173	158,173	158,173	158,173
R-squared		0.990	0.990	0.864	0.865
Country-Year FE	Yes				
Pair FE	Yes				
Year FE		Yes	Yes	Yes	Yes
Country FE		Yes	Yes	Yes	Yes

Bootstrapped standard errors (based on 10,000 replications) in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Observations are weighted down by the inverse of the number of trading partners to estimate exporter and importer specific regressions. The dependent variable in column (1) is bilateral exports, X_{ij}. i and j indicate the exporting and importing country, respectively. λ_{it} are exporter-time fixed effects and ψ_{jt} are importer-time fixed effects.

[5] This interpretation is derived from the microfoundation of the gravity framework by Anderson and Van Wincoop (2003). Note that the interpretation of the inward multilateral resistance term as consumer price index is relative to our reference country, USA, used for normalization in the construction of the inward multilateral resistance term (see section Section 3.1)

5.2 Structural gravity: The direct trade effect of uncertainty

Table 3 presents the results for the estimation of equation (7) evaluating the direct effects of uncertainty on international trade. As mentioned in Section 3.2, only one unilateral variable can be identified when we interact the border dummy with one of the two possible uncertainty measures for the exporter or importer. As they lead to the same parameter estimate, we only include exporter uncertainty. The respective coefficient can be interpreted as the effect of an increase in uncertainty in one of the two countries. Further, the interaction term identifies the effect on international trade relative to changes in domestic trade. The level effect on domestic trade is captured by the exporter and importer fixed effects, respectively.

The Pseudo R-squared measure reported at the bottom of Table 3 indicates that our model is well specified. For both alternative specifications the corresponding goodness-of-fit measure exceeds a value of 0.99. With respect to the bilateral control variables, the parameter estimates are well in line with previous research and theoretical predictions. A country pair in which both partners are simultaneously EU members trade more with each other. In qualitative terms, this is also true for free trade agreements although the parameter estimate is only marginally significant in Column (2). These findings are in line with previous research arguing that trade agreements or customs unions are able to decrease trade policy uncertainty, besides reducing bilateral trade costs, fostering bilateral cross-border trade. Distance decreases bilateral trade, while neighbors tend to trade more witch each other. Common language only has a very small and statistically insignificant effect for bilateral trade flows in the year 2015.

Columns (1) and (2) of Table 3 finally also display the effect of our measure of interest, the WUI. The negative coefficients of the interaction between the border variable and the uncertainty measure indicate that an increase in uncertainty leads to a more negative effect for cross-border trade as compared to domestic trade. Our gravity estimates for the logarithm of continuous variables can be interpreted as the elasticity of bilateral trade with respect to the variable of interest. With respect to the direct effects, an increase in the uncertainty index of 1% leads to a 2.49% larger trade volume reduction for cross-border flows (column (1)). This could be either driven by a shift to domestic trade or by a larger negative cross-border trade reaction as compared to a potential decline in domestic sales. Without prior knowledge on the exporter or importer fixed effect this cannot be ultimately answered by the findings from the gravity model, but will become visible in the counterfactual scenario analysis below. Column (2) shows that, in case of an uncertainty shock, cross-border trade declines by (additional) 50.98% relative to domestic trade. Taken both findings together, the estimates from the cross-sectional gravity model tend to support the descriptive evidence (see, e.g., Figure 1) on a more severe impact of uncertainty on international trade vis-à-vis its effect for the consumption of domestically produced goods.

Table 3: Estimation results: Structural gravity with cross-border and domestic trade flows

	(1) Exports	(2) Exports
Border(=1)	-2.503***	-2.739***
	(0.206)	(0.152)
Border(=1)*(ln) Uncertainty	-2.489**	
	(1.067)	
Border(=1)*Uncertainty Dummy		-0.713***
		(0.169)
Border(=1)*TA exists	0.111	0.177*
	(0.0958)	(0.0928)
Border(=1)*Both EU	0.484***	0.378***
	(0.124)	(0.124)
Border(=1)*(ln) Distance	-0.959***	-0.937***
	(0.0583)	(0.0571)
Border(=1)*Contiguity	0.489***	0.533***
	(0.123)	(0.121)
Border(=1)*Common language	-0.0261	-0.0685
	(0.0851)	(0.0849)
Constant	34.65***	34.50***
	(0.471)	(0.472)
Observations	9,124	9,124
Pseudo R-squared	0.998	0.998
Country FE	Yes	Yes

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. The dependent variable is bilateral exports, X_{ij}. i and j indicate the exporting and importing country, respectively.

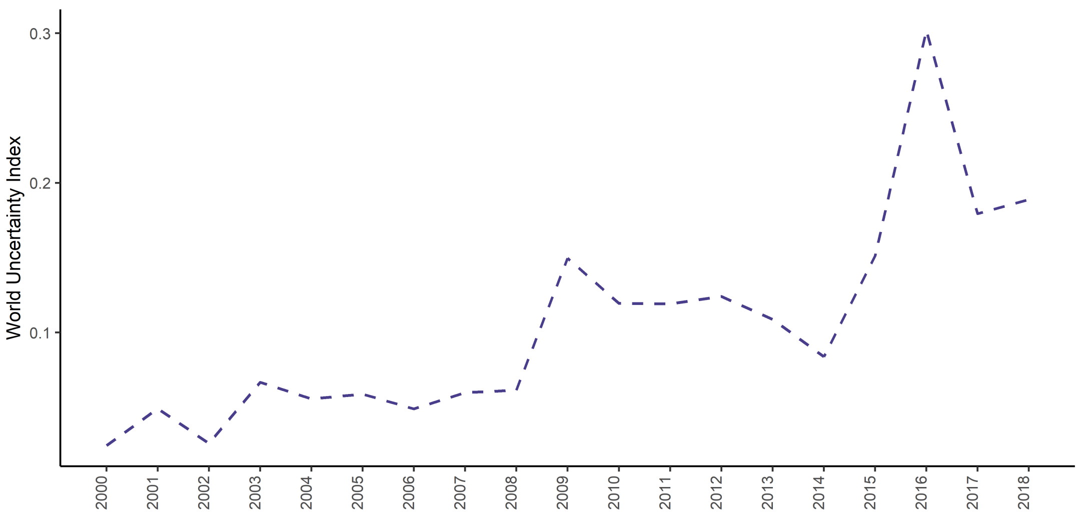
5.3 Counterfactual analysis

In the following, we discuss two events that led to a massive surge in uncertainty which makes them attractive for studying implications of uncertainty for trade and welfare: the Brexit decision of the UK in 2016 and the COVID-19 pandemic in 2020. For this task, we define two counterfactual scenarios: one counterfactual scenario that investigates the uncertainty that refers to the Brexit vote in 2016 and one counterfactual scenario that investigates the reaction of trade flows and welfare due to the COVID-19 crisis in 2020. For each of our counterfactual scenarios, we calculate full-endowment general equilibrium cross-border and domestic trade effects for the actually observed uncertainty values in a baseline year and the year with a sudden shift in uncertainty following Anderson et al. (2015). The corresponding welfare effects due to the increased uncertainty are calculated based on the approach provided by Costinot and Rodríguez-Clare (2014). Note that our counterfactual scenarios focus only on the induced changes in trade and real income due to changes in uncertainty.

5.3.1 Trade and welfare effects of Brexit induced uncertainty

First, we investigate the reaction of trade flows to the outcome of the Brexit referendum in 2016. The surprising outcome of the referendum suddenly and unexpectedly increased uncertainty in the UK. Economic and trade policy uncertainty surrounding future trade relationship with other countries is a key factor in defying UK firms' participation in global markets. Figure 2 displays how uncertainty evolved in the UK between 2000 and 2019. While the increase of uncertainty during the financial crisis in 2008 was relatively moderate, uncertainty surged in 2016 after the Brexit referendum took place. In 2016, the WUI reached a maximum value of 0.41 in the third quarter, right after the referendum took place on June 23. The value implies an increase of 83.8% compared to the its maximum value in the baseline year 2015.

Figure 2: Evolution of the World Uncertainty Index in the United Kingdom 2000-2018



Source: Ahir et al. (2022); own calculations.

In our counterfactual analysis, we study the impact of Brexit-related uncertainty on bilateral trade flows and on welfare. Therefore, we employ data for 2015 for our baseline scenario and construct a counterfactual scenario using the realized maximum uncertainty of the year 2016 as counterfactual for 2015.

First, we estimate a counterfactual scenario where only the UK experienced an increase in uncertainty due to the Brexit decision. This allows us to isolate the sole effect from Brexit-induced uncertainty in the UK. Since the Brexit referendum also induced uncertainty spillover effects especially to other EU member countries, we add a second scenario where we employ the uncertainty experienced by all countries in the sample in 2016 as the counterfactual in 2015. The WUI spiked globally at the time of the Brexit vote (Ahir et al., 2022), suggesting that it caused uncertainty to increase worldwide. Of course, the second scenario does not allow us to isolate Brexit uncertainty per se, as we include any uncertainty experienced by the countries in our sample[6]. The results from the second Brexit referendum scenario thus provides an upper bound estimate for the potential trade and welfare costs associated with the related uncertainty shock.

Table 5a reports regional averages of the estimated full endowment general equilibrium effects from the uncertainty increase in the UK's WUI only. Country-level results are reported in Appendix B. For the UK, the Brexit induced uncertainty translates in an estimated 7.33% reduction in cross-border trade. In the data, we see a change of -12.23% in UK's exports to countries in our sample. Since our model predicts a change of 7.33%, approximately 59.9% of the observed change in UK's exports can be attributed to the uncertainty shock stemming from the UK only. Accounting for export shares in total world trade, the reduction in bilateral trade amounts to 0.28%. The uncertainty about future trade barriers makes countries more remote for trading partners. This reduction in cross-border trade due to the Brexit induced uncertainty is estimated to also have a negative effect on welfare for the UK. Based on our full endowment general equilibrium framework, we estimate an increase in price levels by around 1.32% and a decline of real income by 0.14% for the UK.

The negative effect on bilateral trade of the UK also drives the decline in bilateral trade for Europe which, however, is small in comparison and amounts to 0.09%. In contrast to the decline in UK trade, for the other EU countries, we estimate an increase in bilateral trade flows and a small increase in welfare. In particular important European hubs like the Netherlands, France and Germany, seem to benefit from the increased uncertainty related to the Brexit referendum outcome. For example, the Netherlands experience a 0.68% increase in bilateral trade, Norway by 0.27%, Sweden by 0.24%, Denmark by 0.29% or Germany by 0.28%. Also other regions in the world benefited. For instance, bilateral trade of Euroasia increased by 0.13% and its welfare increased by a small amount of 0.01%. Thus, the increased uncertainty due to the Brexit referendum's outcome not only made the UK less attractive as a trading partner, our results suggest that the increased uncertainty in the UK also led to trade diversion to other countries that benefited from the increased demand for their products. Higher economic, political and trade policy uncertainty that was connected to the Brexit referendum thus lowered the trade volumes with the UK and diverted the trade to other countries.

Table 5b summarizes regional responses to a counterfactual increase in all sample countries' WUI to 2016 levels relative to the baseline scenario of 2015. We estimate a larger decrease in UK's bilateral trade amounting to 10.66% which can be explained by feedback effects for other countries, especially EU member states, experiencing increased uncertainty after the Brexit referendum. The change triggered by uncertainty in 2016 thus is able to explain 87.2% of the actually observed reduction in UK that year. The estimated welfare effect for the UK amounts to -0.19% suggesting additional losses stemming from spillover effects in uncertainty triggered by the UK. Some countries who experienced gains before, now face decreases in bilateral trade. For example, Germany experiences a reduction of 0.32% and Italy of 2.49%. Overall, Europe faces a decrease of 0.02% in welfare if all countries' uncertainty is accounted for. Of course, in this scenario it is more difficult to isolate the effects stemming from the Brexit referendum as

[6]For example, uncertainty induced by the US presidential election in 2016 might also be partly captured in the second scenario.

Table 4: Trade in times of Brexit uncertainty: Full Endowment General Equilibrium Trade and Welfare Effects (% change)

(a) Increase in the United Kingdom's WUI index.

	(1) % change trade	(2) % change trade (weighted)	(3) % changes welfare
United Kingdom	-7.33	-0.28	-0.14
Africa	0.11	0.00	0.01
The Caribbean	0.08	0.00	0.00
Central America	0.06	0.00	0.00
East Asia	0.06	0.01	0.00
Euroasia	0.13	0.00	0.01
Europe	-0.09	-0.01	0.01
Middle East	0.10	0.00	0.01
North America	0.07	0.01	0.00
Pacific	0.06	0.00	0.00
South America	0.06	0.00	0.00
South Asia	0.06	0.00	0.00
South East Asia	0.05	0.00	0.00

(b) Increase in the WUI index of all countries.

	(1) % change trade	(2) % change trade (weighted)	(3) % changes welfare
United Kingdom	-10.66	-0.41	-0.19
Africa	-2.32	0.00	-0.26
The Caribbean	0.98	0.00	0.05
Central America	0.64	0.00	-0.02
East Asia	0.38	0.07	0.01
Euroasia	1.67	-0.02	-0.01
Europe	-0.83	-0.03	-0.02
Middle East	-0.45	0.00	-0.06
North America	-0.27	0.11	-0.06
Pacific	-5.25	-0.02	-0.18
South America	0.58	0.00	0.07
South Asia	-0.90	0.00	-0.05
South East Asia	-0.43	0.00	0.05

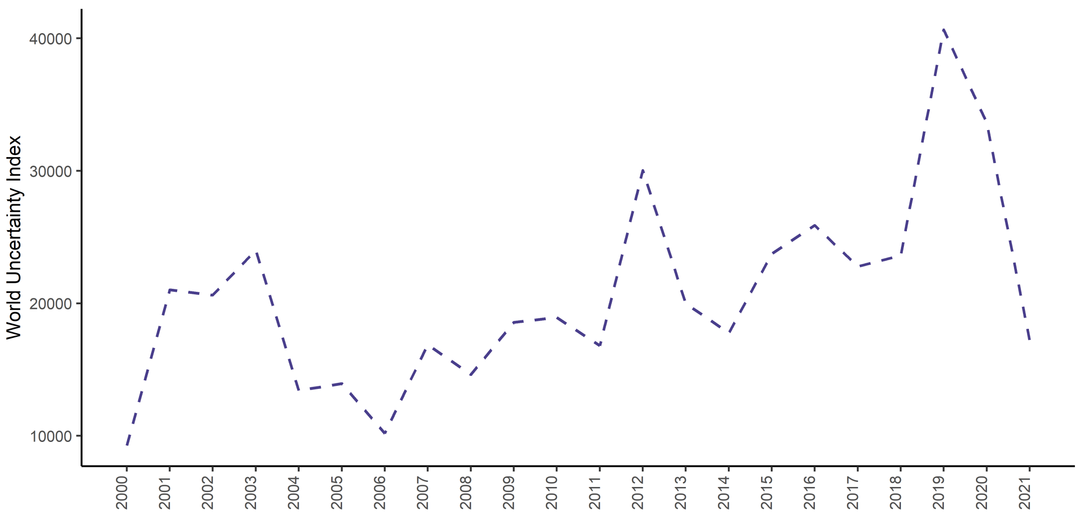
Column (1) shows the percentage change of bilateral trade in the counterfactual scenario relative to trade in the baseline scenario. Column (2) shows the percentage change weighted by the export share of the respective country. Column (3) displays percentage changes of GDP relative to the baseline scenario.

country-specific idiosyncratic reasons might have also shaped each country's specific uncertainty level in 2016. On a regional level, Table 5b further shows that uncertainty in 2016 decreased bilateral trade of Africa, the Middle East, North America, the Pacific region, South Asia, and South East Asia.

5.3.2 Trade in times of COVID-19 uncertainty

The outbreak of the COVID-19 pandemic caused a massive disruption to the world economy. In 2020, when the COVID-19 virus struck, the world economy was characterized by a complex network consisting of manifold production and trade interrelationships. This section provides a counterfactual scenario analysis to illustrate the effects of uncertainty related to the COVID-19 pandemic on international trade and economic welfare. Figure 3 shows the evolution of the global uncertainty index from the year 2000 to 2021. The index reached its historical peak in 2020 at the beginning of the COVID-19 pandemic (Ahir et al., 2022). Other measures of uncertainty also reflect the pandemic's effects for uncertainty. Baker et al. (2020) show that stock market volatility, which builds on the S&P 500 index increased by about 500% from 15 January to 31 March 2020. During the same time period, the Economic Policy Index increased by a factor of 4.

Figure 3: Evolution of the World Uncertainty Index 2000-2021, GDP-weighted average



Source: Ahir et al. (2022); own calculations.

The economic consequences of the COVID-19 pandemic and the related restrictive policy measures for economic activities attracted much attention in economic research. With this counterfactual scenario analysis, we aim at contributing to the debate by highlighting the role uncertainty might have played for the observed trade and welfare effects of COVID-19. To this end, we estimate the effect of the COVID-19 induced uncertainty values by means of a counterfactual scenario analysis using again the full endowment general equilibrium framework.

The counterfactual analysis proceeds as follows. First, we calculate the full-endowment general equilibrium bilateral and domestic trade values for the actually observed uncertainty values of the year 2015. Then, we replace these values by the observed values for 2020 to capture the uncertainty shock stemming from the outbreak of the COVID-19 pandemic and related economic crisis. Based on the 2020 index values, we recalculate the resulting cross-border trade flows. For the calculation of the COVID-19 induced uncertainty effect on trade, we compare the estimated trade volumes by subtracting the counterfactual values from the actual one.

According to our counterfactual analysis, most countries experience a drop in bilateral trade flows due to the COVID-19 pandemic induced increase in uncertainty. Country-level results are shown in Appendix B. Table 6 reports regional averages of the changes in cross-border trade flows. We observe negative effects for Africa, the Carribbean, East Asia, Europe, the Pacific, South America, and North America. The reductions are quite noticeable in size. Overall, the world experienced a decrease in bilateral trade flows of around 0.04% (weighted by the exporter share) and a decline in world real income by around 0.04% due to the increase in the uncertainty induced by the pandemic in 2020. For China, from which the COVID-19 pandemic spread, we estimate a decline in cross-border trade amounting to around 6.7%. This reduction in bilateral trade is accompanied by an increase in multilateral resistance by around 0.12%. Welfare has been reduced by 0.14%. Due to China's ability to substitute international production and consumption, the impact of the uncertainty change for China's welfare was relatively modest. Overall, East Asia experiences a drop in bilateral trade of 3.77% and a welfare loss of 0.07%. Also for the UK, we observe another peak of uncertainty in 2020 (see Figure 2). Our estimates suggest that the COVID-19 induced uncertainty reduced bilateral trade for the UK by 8.16%, leading to an approximate change in real production by 0.15%. The increased uncertainty due to the COVID-19 crises had a significant negative impact on the welfare of the UK. Italy, which was severely hit by the first wave of the COVID-19 pandemic, undergoes a drop in bilateral trade of 4.24% and a welfare loss of 0.18%. Other major economies also face contractions in trade due to COVID-19 uncertainty such as Germany (-4.66%), Canada (-6.59%), or the USA (-2.25%). On a continental level, North America experienced the second largest decline in bilateral trade after East Asia (weighted by the exporter share).

5.4 Robustness checks

In this section, we offer some robustness checks for our estimation results for the indirect and direct effects of uncertainty discussed in Sections 5.1 and 5.2. First, we test whether our estimates are sensitive to the choice of the uncertainty measure. One may argue that the maximum value of uncertainty on country-level does not accurately reflect the behavior of uncertainty given its focus on exceptionally high levels of uncertainty. Second, we address potential issues of endogeneity. Table 7 summarizes the estimated coefficients and standard errors. The section further offers robustness checks with the EPU and a measure of country risk.

First, we apply the standard deviation of annual uncertainty as a measure of volatility. Though the results do not allow a direct comparison since the measure captures a second-order effect, we are still interested if our results hold. Constant high levels of uncertainty might

Table 6: Trade in times of COVID-19 related uncertainty - Full Endowment General Equilibrium Effects of Bilateral Trade (% change)

	(1) % change trade	(2) % change trade (weighted)	(3) % changes welfare
Africa	-0.57	0.00	-0.01
The Caribbean	-1.14	0.00	-0.03
Central America	3.08	0.00	0.13
East Asia	-3.77	-0.53	-0.07
Euroasia	4.63	0.05	0.25
Europe	-0.67	-0.05	0.06
Middle East	1.03	0.00	0.13
North America	-5.09	-0.28	-0.24
Pacific	-0.54	-0.01	0.00
South America	-1.10	-0.01	-0.02
South Asia	1.14	0.01	0.09
South East Asia	1.10	0.03	0.10

Column (1) shows the percentage change of bilateral trade in the counterfactual scenario relative to trade in the baseline scenario. Column (2) shows the percentage change weighted by the export share of the respective country. Column (3) displays percentage changes of GDP relative to the baseline scenario.

cause behavioral changes that are quite different to behavior in times where uncertainty is more volatile. In the first row of Table 7, we see that a high uncertainty volatility increases the exporters remoteness to its trading partners, while a high volatility in the importing country tends to increase the demand for foreign goods. This confirms our findings in the two-step approach for the multilateral resistances. Column (3) looks at the sensitivity of our results in Section 5.2. It indicates that higher volatility of uncertainty within a year has a statistically moderate positive effect on cross-border trade. The finding might imply that there is no shift in the level of uncertainty but rather that uncertainty shocks are short-lived and quickly resolved, while consumption is smoothed in the mid and long-run leading to an increase in trade flows. Additionally, we use the log average annual value of uncertainty within a year to test the robustness of our results. Row (2) of Table 7 shows that the effect is even stronger than in our baseline specification. Thus, enduring uncertainty not only increases average exporting costs to all trading partners, but also directly reduces export flows.

We address the issue of potential endogeneity of the uncertainty measure by employing the index value of the first quarter of each year and the the yearly lagged value of our main measure, i.e. the maximum quarterly value of the previous year. Both measures rule out potential reverse causality issues. Our results are robust to the different specifications of our uncertainty measures, as shown in Table 7 rows (3) and (4).

Ahir et al. (2022) show that the global WUI index is correlated with the economic policy uncertainty (EPU) index and different kinds of risk measures. Correlation between the global EPU index and the global WUI is 0.705 and the relationship is similarly strong when focusing on individual countries. The EPU, which was introduced by Baker et al. (2016), is constructed using three components. One component examines newspaper coverage of policy-related economic

Table 7: Robustness check: Alternative uncertainty measures

	(1)	(2)	(3)
	Two-step approach		One-step approach
	$ln\widehat{\lambda_{it}}$	$ln\widehat{\psi_{jt}}$	Exports
WUI volatility	-0.159***	2.268***	7.424*
	(0.0248)	(0.145)	(4.292)
Annual mean of WUI uncertainty	-0.0808***	0.851***	-3.877***
	(0.0106)	(0.0496)	(1.207)
Lagged maximum quarterly value	-0.100***	0.320***	-5.429***
	(0.00836)	(0.0410)	(1.494)
First quarter of each year	-0.0721***	0.706***	-1.887
	(0.00915)	(0.0590)	(1.226)

The table shows the estimated coefficients for alternative uncertainty measures and their standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. The coefficients of the one step approach in column one represent the interaction of our Border dummy and the respective measure for uncertainty. Column (1) and (2) are bootstrapped standard errors (10.000 replications) and Column (3) are robust standard errors. The full regression tables for each specification can be found in the Appendix C. The full results for the specification of the two stage approach are shown in Table 14. The full results for the specifications of the one step approach are shown in Table 15 and Table 16.

uncertainty. The second component quantifies the number of federal tax code provisions that will expire in the future. The third component reflects disaccord among economic forecasters. Ahir et al. (2022) argue that the construction of the EPU gives higher weight to global developments compared to the WUI index. Given the small country coverage of the EPU, we test for the robustness of our results using the EPU, which, however, is only available for a very small sample of 19 countries.

Ahir et al. (2022) show that the correlation of the WUI with various risk measures is positive albeit lower compared with other measures of risk. They argue that this confirms that risk and uncertainty are related but conceptually distinct concepts. We choose the overall risk score by the Economist Intelligence Unit (EIU) available for 46 countries to check the robustness of our results. The risk score takes a simple average of sovereign risk, currency risk, and banking sector risk scores. For both indices, we find that the negative uncertainty effects on international trade flows are larger than for our baseline estimates using the WUI. The results of our robustness analysis with the EPU and the EIU are summarized in Appendix C, Table 16. Both of these measure are not well suited for a counterfactual policy analysis as the number of included countries is much smaller. General equilibrium models for international trade aim to cover the world economy in a meaningful representation, which is another motivation for choosing the WUI for the counterfactual scenario analysis.

6 Conclusion

This paper proposes the application of two complementary approaches for studying the direct and indirect impacts of uncertainty for international trade. Both approaches rely on standard international trade theory and are thus, empirically implemented by means of structural gravity models. The first approach uses two steps and essentially regresses the outward and inward multilateral resilience terms obtained from the gravity model estimates on exporter- and importer-specific uncertainty. This approach allows to shed some light on the uncertainty effect on average trade costs with all trading partners of a country. The second approach relies on a cross-sectional structural gravity model for the year 2015 and explicitly exploits the availability of domestic trade flows for the identification of the direct (relative) trade effect of unilaterally measured uncertainty following recent innovations in the gravity literature. With this framework, we are able to uncover all structural parameters necessary for running counterfactual policy scenarios by means of a full endowment general equilibrium model. In the subsequent analysis, we study the trade and welfare effects of Brexit referendum induced uncertainty in unilateral and multilateral scenario. In an additional scenario, we investigate the trade and welfare effects from the COVID-19 pandemic induced uncertainty shock.

The findings from both applied approaches allow to draw a clear picture on the damaging effects of uncertainty for the global economy. Higher uncertainty increases a country's multilateral resistance terms implying that average trade costs with all potential trade partners rise. This reduces an economy's competitiveness and in case of a global shock, makes world trade more expensive. Uncertainty not only indirectly but also directly worsens trade relationships. An increase in uncertainty is directly transmitted to less trade with trading partners. The quantitative magnitude of the overall effect of uncertainty is sizable. The Brexit scenarios, for example, demonstrate that up to 87% of the overall decline in UK's foreign trade can be explained by the uncertainty shock following the Brexit referendum.

So far, the economics literature studies the uncertainty trade nexus by means of high-time frequency data and time-series econometric methods like vector autoregression. The advantage of this approach is its ability to narrowly identify uncertainty shocks in the data and to relate those to trade data. Due to lack of data, however, they tend to study only a small set of countries and sectors. From a theoretical point of view, this approach is not able to directly incorporate all relevant general equilibrium effects in a trade theory consistent manner.

In this paper, we propose an alternative approach that allows to incorporate uncertainty within theory consistent gravity models. A limitation of our approach is that we lack high frequency trade flow data and thus, need to rely on annualized uncertainty measures in the structural gravity models. The main advantages of our approach are twofold: First, structural gravity models allow to disentangle direct and indirect trade costs of uncertainty. Second, we can make use of the identified direct effects of uncertainty for cross-border trade in a related general equilibrium model in order to calculate trade diversion and welfare effects in meaningful counterfactual scenario analyses. The findings from the two counterfactual scenarios indicate that such effects are crucial for understanding the overall impact of uncertainty for international trade, particularly in the medium to long run. We believe that our analysis complements the understanding of trade and welfare effects of uncertainty.

References

Ahir, H., Bloom, N., and Furceri, D. (2022). The world uncertainty index. Technical report, National bureau of economic research.

Anderson, J. E., Larch, M., and Yotov, Y. V. (2015). Estimating general equilibrium trade policy effects: Ge ppml.

Anderson, J. E. and Van Wincoop, E. (2003). Gravity with gravitas: A solution to the border puzzle. *American economic review*, 93(1):170–192.

Arbatli, E. C., Davis, S. J., Ito, A., and Miake, N. (2017). Policy uncertainty in Japan. Technical report, National Bureau of Economic Research.

Armelius, H., Hull, I., and Köhler, H. S. (2017). The timing of uncertainty shocks in a small open economy. *Economics Letters*, 155:31–34.

Baker, S., Bloom, N., Davis, S. J., and Wang, X. (2013). A measure of economic policy uncertainty for China. *Work-in-Progress, University of Chicago, Chicago.*

Baker, S. R., Bloom, N., and Davis, S. J. (2016). Measuring economic policy uncertainty. *The Quarterly Journal of Economics*, 131(4):1593–1636.

Baker, S. R., Bloom, N., Davis, S. J., and Terry, S. J. (2020). Covid-induced economic uncertainty. Technical report, National Bureau of Economic Research.

Beverelli, C., Keck, A., Larch, M., and Yotov, Y. (2018). Institutions, trade and development: A quantitative analysis.

Bloom, N. (2009). The impact of uncertainty shocks. *Econometrica*, 77(3):623–685.

Borojo, D. G., Yushi, J., and Miao, M. (2022). The impacts of economic policy uncertainty on trade flow. *Emerging Markets Finance and Trade*, 58(8):2258–2272.

Carballo, J., Handley, K., and Limão, N. (2022). Economic and policy uncertainty: Aggregate export dynamics and the value of agreements. *Journal of International Economics*, 139:103661.

Carriero, A., Mumtaz, H., Theodoridis, K., and Theophilopoulou, A. (2015). The impact of uncertainty shocks under measurement error: A proxy SVAR approach. *Journal of Money, Credit and Banking*, 47(6):1223–1238.

Cerda, R., Silva, A., and Valente, J. T. (2016). Economic policy uncertainty indices for Chile. *Economic Policy Uncertainty working paper.*

Costinot, A. and Rodríguez-Clare, A. (2014). Trade theory with numbers: Quantifying the consequences of globalization. In Gopinath, G., Helpman, E., and Rogoff, K., editors, *Handbook of International Economics*, volume 4 of *Handbook of International Economics*, pages 197–261. Elsevier.

De Sousa, J., Mayer, T., and Zignago, S. (2012). Market access in global and regional trade. *Regional Science and Urban Economics*, 42(6):1037–1052.

Fei, J., Huang, X., and Sun, H. (2020). The effects of economic policy uncertainty on exports: A gravity model approach. *Praque Economic Papers*, 29(5):600–622.

Ghirelli, C., Pérez, J. J., and Urtasun, A. (2019). A new economic policy uncertainty index for Spain. *Economics Letters*, 182:64–67.

Gil, M. and Silva, D. (2018). Economic policy uncertainty indices for Colombia. Technical report, Working Paper.

Gupta, R., Gozgar, G., Kaya, H., and Demir, E. (2019). Effects of geopolitical risk on trade flows: evidence from the gravity model. *Eurasian Econ Review*, 9:515–530.

Gurevich, T. and Herman, P. (2018). The dynamic gravity dataset: 1948–2016. *US International Trade Commission, Office of Economics Working Paper*.

Handley, K. (2014). Exporting under trade policy uncertainty: Theory and evidence. *Journal of international Economics*, 94(1):50–66.

Handley, K. and Limao, N. (2015). Trade and investment under policy uncertainty: theory and firm evidence. *American Economic Journal: Economic Policy*, 7(4):189–222.

Handley, K. and Limao, N. (2017). Policy uncertainty, trade, and welfare: Theory and evidence for China and the United States. *American Economic Review*, 107(9):2731–83.

Handley, K. and Limão, N. (2022). Trade Policy Uncertainty. *Annual Review of Economics*, 14(1):363–395. _eprint: https://doi.org/10.1146/annurev-economics-021622-020416.

Hardouvelis, G. A., Karalas, G., Karanastasis, D., and Samartzis, P. (2018). Economic policy uncertainty, political uncertainty and the greek economic crisis. *Political Uncertainty and the Greek Economic Crisis (April 3, 2018)*.

Head, K. and Mayer, T. (2014). Gravity equations: Workhorse, toolkit, and cookbook. In *Handbook of international economics*, volume 4, pages 131–195. Elsevier.

Heid, B., Larch, M., and Yotov, Y. V. (2021). Estimating the effects of non-discriminatory trade policies within structural gravity models. *Canadian Journal of Economics/Revue canadienne d'économique*, 54(1):376–409.

Imbruno, M. (2019). Importing under trade policy uncertainty: Evidence from China. *Journal of Comparative Economics*, 47(4):806–826.

Kinzius, L., Sandkamp, A., and Yalcin, E. (2019). Trade protection and the role of non-tariff barriers. *Review of World Economics*, 155(4):603–643.

Kroese, L., Kok, S., and Parlevliet, J. (2015). Beleidsonzekerheid in nederland. *Economisch Statistiche Berichten*, 4715:464–467.

Larch, M., Wanner, J., Yotov, Y. V., and Zylkin, T. (2019). Currency unions and trade: A PPML re-assessment with high-dimensional fixed effects. *Oxford Bulletin of Economics and Statistics*, 81(3):487–510.

Limão, N. and Maggi, G. (2015). Uncertainty and trade agreements. *American Economic Journal: Microeconomics*, 7(4):1–42.

Marshall, M. G. and Gurr, T. R. (2020). Polity5: Dataset users' manual. *Center for Systemic Peace*.

Novy, D. and Taylor, A. M. (2019). Trade and uncertainty. *Review of Economics and Statistics*, pages 1–50.

Oberhofer, H., Pfaffermayr, M., and Sellner, R. (2021). Revisiting time as a trade barrier: Evidence from a panel structural gravity model. *Review of International Economics*, 29(5):1382–1417.

Silva, J. S. and Tenreyro, S. (2006). The log of gravity. *The Review of Economics and statistics*, 88(4):641–658.

Taglioni, D. and Zavacka, V. (2013). Innocent bystanders: How foreign uncertainty shocks harm exporters.

Tam, P. S. (2018). Global trade flows and economic policy uncertainty. *Applied Economics*, 50(34-35):3718–3734.

Yotov, Y. V., Piermartini, R., Monteiro, J.-A., and Larch, M. (2016). *An advanced guide to trade policy analysis: The structural gravity model*. World Trade Organization Geneva.

Appendix

A Data

Country coverage World Uncertainty Index (ISO codes, 3-digit):

AGO, ALB, ARG, ARM, AUS, AZE, BEN, BGD, BGR, BLR, BOL, BRA, BWA, CAN, CHE, CHL, CHN, CMR, COL, CRI, CZE, DEU, DNK, DOM, ECU, EGY, ESP, ETH, FIN, FRA, GBR, GEO, GHA, GIN, GRC, GTM, HND, HRV, HTI, IDN, IND, ISR, ITA, JAM, JOR, JPN, KAZ, KEN, KGZ, KHM, LAO, LKA, LSO, LTU, LVA, MAR, MDG, MEX, MLI, MMR, MNG, MWI, NAM, NER, NGA, NIC, NLD, NOR, NPL, NZL, OMN, PAK, PAN, PER, PHL, POL, PRT, PRY, ROU, RUS, SAU, SDN, SLE, SLV, SVN, SWE, TGO, THA, TUN, TUR, TZA, UGA, UKR, USA, ZAF, ZMB.

Country coverage EIU Overall Country Risk Score (ISO codes, 3-digit):

ARG, AUS, AZE, BGR, BRA, CAN, CHE, CHL, CHN, COL, CZE, DEU, DNK, ECU, EGY, ESP, FIN, FRA, GBR, GRC, IDN, IND, ISR, ITA, JPN, KAZ, LKA, MEX, NGA, NLD, NOR, NZL, PAK, PER, PHL, POL, PRT, ROU, RUS, SAU, SWE, THA, TUR, UKR, USA, ZAF.

Country coverage Economic Policy Uncertainty Index (ISO codes, 3-digit):

AUS, BRA, CAN, CHL, CHN, COL, DEU, ESP, FRA, GBR, GRC, IND, ITA, JPN, MEX, NLD, RUS, SWE, USA.

B Full Endowment General Equilibrium Effects

Table 8: Trade in Times of Brexit uncertainty: Full Endowment General Equilibrium Effects of Bilateral Trade and GDP (% change), increase in the UK's WUI index.

(1) Country	(2) % change trade	(3) % change trade (weighted)	(4) % change welfare
ALB	0.12	0.00	0.02
ARG	0.05	0.00	0.00
AUS	0.06	0.00	0.00
BGD	0.05	0.00	0.00
BGR	0.10	0.00	0.02
BIH	0.13	0.00	0.03
BLR	0.12	0.00	0.02
BRA	0.09	0.00	0.00
CAN	0.06	0.00	0.00
CHE	0.22	0.01	0.01
CHL	0.05	0.00	0.00
CHN	0.06	0.01	0.00
CMR	0.11	0.00	0.01
COL	0.06	0.00	0.00
CRI	0.06	0.00	0.00
CZE	0.16	0.00	0.02
DEU	0.28	0.03	0.01
DNK	0.29	0.00	0.02
DOM	0.08	0.00	0.00
ECU	0.05	0.00	0.00
EGY	0.14	0.00	0.00
ESP	0.26	0.01	0.01
ETH	0.10	0.00	0.01
FIN	0.18	0.00	0.01
FRA	0.37	0.02	0.02
GBR	-7.33	-0.28	-0.14
GEO	0.09	0.00	0.02
GHA	0.13	0.00	0.01
GRC	0.13	0.00	0.01
GTM	0.05	0.00	0.00
HRV	0.15	0.00	0.03
IDN	0.06	0.00	0.00
IND	0.07	0.00	0.00
ISR	0.11	0.00	0.00
ITA	0.20	0.01	0.01

Column (2) shows the percentage change of bilateral trade in the counterfactual scenario. Column (3) shows the percentage change weighted by the export share of the respective country. Column (4) is the percentage change of welfare relative to the baseline scenario.

Table 9: Trade in Times of Brexit uncertainty: Full Endowment General Equilibrium Effects of Bilateral Trade and GDP (% change), increase in the UK's WUI index.

(1) Country	(2) % change trade	(3) % change trade (weighted)	(4) % change welfare
JOR	0.09	0.00	0.01
JPN	0.07	0.00	0.00
KEN	0.10	0.00	0.01
KHM	0.04	0.00	0.01
LKA	0.07	0.00	0.00
LTU	0.13	0.00	0.02
LVA	0.17	0.00	0.02
MAR	0.20	0.00	0.02
MDG	0.07	0.00	0.01
MEX	0.04	0.00	0.00
NAM	0.08	0.00	0.02
NIC	0.05	0.00	0.01
NLD	0.68	0.02	0.02
NOR	0.27	0.00	0.02
NZL	0.05	0.00	0.00
OMN	0.08	0.00	0.01
PAK	0.06	0.00	0.01
PAN	0.08	0.00	0.00
PER	0.05	0.00	0.00
PHL	0.06	0.00	0.00
POL	0.18	0.00	0.01
PRT	0.24	0.00	0.02
ROU	0.14	0.00	0.01
RUS	0.12	0.00	0.01
SAU	0.13	0.00	0.01
SVN	0.15	0.00	0.02
SWE	0.24	0.00	0.02
THA	0.05	0.00	0.00
TUN	0.17	0.00	0.02
TUR	0.14	0.00	0.01
TZA	0.08	0.00	0.01
UGA	0.08	0.00	0.01
UKR	0.11	0.00	0.02
URY	0.04	0.00	0.00
USA	0.12	0.02	0.00

Column (2) shows the percentage change of bilateral trade in the counterfactual scenario. Column (3) shows the percentage change weighted by the export share of the respective country. Column (4) is the percentage change of welfare relative to the baseline scenario.

Table 10: Trade in Times of Brexit uncertainty: Full Endowment General Equilibrium Effects of Bilateral Trade and GDP (% change), increase in all countries' WUI index.

(1) Country	(2) % change trade	(3) % change trade (weighted)	(4) % change welfare
ALB	0.65	0.00	0.16
ARG	3.93	0.02	0.15
AUS	-1.27	-0.02	-0.03
BGD	-1.43	0.00	-0.06
BGR	0.87	0.00	0.16
BIH	0.90	0.00	0.21
BLR	-10.24	-0.03	-1.56
BRA	-2.83	-0.05	-0.07
CAN	-0.20	-0.01	0.00
CHE	-0.39	-0.01	-0.02
CHL	3.76	0.02	0.22
CHN	1.07	0.16	0.02
CMR	-5.07	0.00	-0.50
COL	-5.25	-0.02	-0.23
CRI	-4.75	0.00	-0.16
CZE	5.15	0.07	0.63
DEU	-0.32	-0.04	-0.02
DNK	-6.49	-0.05	-0.43
DOM	0.98	0.00	0.05
ECU	2.71	0.00	0.16
EGY	4.19	0.01	0.14
ESP	-8.81	-0.22	-0.44
ETH	-7.07	0.00	-0.47
FIN	3.86	0.02	0.28
FRA	5.04	0.21	0.25
GBR	-10.66	-0.41	-0.19
GEO	-3.11	0.00	-0.36
GHA	-5.00	-0.01	-0.34
GRC	4.12	0.01	0.31
GTM	6.10	0.01	0.33
HRV	-1.74	0.00	-0.18
IDN	-0.52	-0.01	-0.02
IND	1.56	0.03	0.05
ISR	-0.11	0.00	0.01
ITA	-2.49	-0.10	-0.11

Column (2) shows the percentage change of bilateral trade in the counterfactual scenario. Column (3) shows the percentage change weighted by the export share of the respective country. Column (4) is the percentage change of welfare relative to the baseline scenario.

Table 11: Trade in Times of Brexit uncertainty: Full Endowment General Equilibrium Effects of Bilateral Trade and GDP (% change), increase in all countries' WUI index.

(1) Country	(2) % change trade	(3) % change trade (weighted)	(4) % change welfare
JOR	5.48	0.00	0.38
JPN	-0.31	-0.01	0.00
KEN	-0.48	0.00	-0.02
KHM	3.78	0.00	0.42
LKA	-2.52	0.00	-0.12
LTU	5.83	0.01	0.88
LVA	4.01	0.00	0.48
MAR	-0.58	0.00	-0.03
MDG	2.56	0.00	0.38
MEX	-4.41	-0.18	-0.21
NAM	-13.51	0.00	-2.08
NIC	-4.14	0.00	-0.41
NLD	-3.45	-0.13	-0.12
NOR	-13.10	-0.13	-1.15
NZL	-9.23	-0.03	-0.33
OMN	-8.69	-0.01	-0.69
PAK	-1.19	0.00	-0.08
PAN	5.33	0.00	0.18
PER	-3.35	-0.01	-0.19
PHL	-5.45	-0.02	-0.23
POL	-0.29	-0.01	-0.02
PRT	5.26	0.03	0.43
ROU	1.75	0.01	0.17
RUS	-5.00	-0.12	-0.37
SAU	1.52	0.00	0.05
SVN	7.19	0.02	0.82
SWE	0.36	0.00	0.01
THA	0.45	0.01	0.03
TUN	-0.84	0.00	-0.06
TUR	8.35	0.09	0.35
TZA	2.68	0.00	0.27
UGA	-2.43	0.00	-0.20
UKR	-5.57	-0.02	-0.82
URY	5.10	0.00	0.47
USA	3.80	0.50	0.04

Column (2) shows the percentage change of bilateral trade in the counterfactual scenario. Column (3) shows the percentage change weighted by the export share of the respective country. Column (4) is the percentage change of welfare relative to the baseline scenario.

Table 12: Trade in Times of COVID-19 related uncertainty: Full Endowment General Equilibrium Effects of Bilateral Trade and GDP (% change)

(1) Country	(2) % change trade	(3) % change trade (weighted)	(4) % change welfare
ALB	2.45	0.00	0.46
ARG	-0.51	0.00	0.00
AUS	-1.30	-0.02	-0.02
BGD	-0.55	0.00	0.00
BGR	2.56	0.01	0.45
BIH	1.82	0.00	0.39
BLR	-1.63	0.00	-0.10
BRA	-0.14	0.00	0.01
CAN	-6.59	-0.28	-0.40
CHE	-3.00	-0.07	-0.17
CHL	-3.63	-0.02	-0.17
CHN	-6.66	-1.02	-0.14
CMR	0.05	0.00	0.08
COL	0.56	0.00	0.05
CRI	3.21	0.00	0.15
CZE	-1.52	-0.02	-0.10
DEU	-4.66	-0.54	-0.20
DNK	0.59	0.00	0.07
DOM	-1.14	0.00	-0.03
ECU	-3.80	-0.01	-0.19
EGY	1.33	0.00	0.07
ESP	-2.28	-0.06	-0.09
ETH	-5.39	0.00	-0.32
FIN	-3.75	-0.02	-0.24
FRA	-1.27	-0.05	-0.05
GBR	-8.16	-0.32	-0.15
GEO	4.24	0.00	0.62
GHA	0.05	0.00	0.05
GRC	2.80	0.01	0.26
GTM	5.74	0.00	0.35
HRV	0.31	0.00	0.17
IDN	-0.74	-0.01	-0.01
IND	1.42	0.02	0.07
ISR	-0.64	0.00	0.01
ITA	-4.24	-0.17	-0.18

Column (2) shows the percentage change of bilateral trade in the counterfactual scenario. Column (3) shows the percentage change weighted by the export share of the respective country. Column (4) is the percentage change of welfare relative to the baseline scenario.

Table 13: Trade in Times of COVID-19 related uncertainty: Full Endowment General Equilibrium Effects of Bilateral Trade and GDP (% change)

(1) Country	(2) % change trade	(3) % change trade (weighted)	(4) % change welfare
JOR	4.10	0.00	0.34
JPN	-0.89	-0.04	-0.01
KEN	1.76	0.00	0.15
KHM	-1.68	0.00	-0.08
LKA	2.83	0.00	0.18
LTU	-2.56	-0.01	-0.23
LVA	-1.40	0.00	-0.06
MAR	-2.91	-0.01	-0.19
MDG	-3.00	0.00	-0.26
MEX	-6.44	-0.26	-0.31
NAM	-5.81	0.00	-0.67
NIC	-3.33	0.00	-0.24
NLD	-0.23	-0.01	0.01
NOR	-2.53	-0.02	-0.17
NZL	0.22	0.00	0.03
OMN	1.65	0.00	0.20
PAK	0.86	0.00	0.12
PAN	6.69	0.01	0.26
PER	-2.30	-0.01	-0.11
PHL	-1.11	0.00	-0.02
POL	3.25	0.06	0.27
PRT	1.33	0.01	0.15
ROU	-4.16	-0.02	-0.30
RUS	0.59	0.01	0.09
SAU	-1.00	0.00	-0.01
SVN	2.14	0.00	0.30
SWE	0.83	0.01	0.09
THA	7.94	0.13	0.52
TUN	1.72	0.00	0.27
TUR	8.67	0.09	0.41
TZA	6.98	0.00	0.71
UGA	-1.01	0.00	-0.02
UKR	1.68	0.01	0.36
URY	2.12	0.00	0.25
USA	-2.25	-0.30	-0.02

Column (2) shows the percentage change of bilateral trade in the counterfactual scenario. Column (3) shows the percentage change weighted by the export share of the respective country. Column (4) is the percentage change of welfare relative to the baseline scenario.

C Robustness

Table 14: Estimation results: Two-step approach for multilateral resistances

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	First Step	Second Step							
	Exports	$\widehat{ln\lambda_{it}}$	$\widehat{ln\lambda_{it}}$	$\widehat{ln\lambda_{it}}$	$\widehat{ln\lambda_{it}}$	$\widehat{ln\psi_{jt}}$	$\widehat{ln\psi_{jt}}$	$\widehat{ln\psi_{jt}}$	$\widehat{ln\psi_{jt}}$
(ln) WUI		-0.0808***	-0.159***	-0.100***	-0.0721***	0.851***	2.268***	0.320***	0.706***
		(0.0106)	(0.0248)	(0.00836)	(0.00915)	(0.0496)	(0.145)	(0.0410)	(0.0590)
(ln) GDP		0.618***	0.620***	0.589***	0.618***	0.539***	0.521***	0.538***	0.537***
		(0.00351)	(0.00348)	(0.00390)	(0.00350)	(0.00775)	(0.00720)	(0.00773)	(0.00726)
Polity		-0.0107***	-0.0108***	-0.0108***	-0.0107***	0.0283***	0.0288***	0.0284***	0.0282***
		(0.000280)	(0.000285)	(0.000311)	(0.000284)	(0.000841)	(0.000859)	(0.000894)	(0.000836)
(ln) Population		-0.475***	-0.476***	-0.491***	-0.475***	0.945***	0.952***	0.983***	0.945***
		(0.00758)	(0.00750)	(0.00841)	(0.00744)	(0.0133)	(0.0134)	(0.0146)	(0.0130)
TA exists	0.413***								
	(0.0439)								
Joint EU membership	1.156***								
	(0.0817)								
Constant	27.82***	-19.26***	-19.30***	-18.49***	-19.26***	13.49***	13.90***	13.40***	13.54***
	(0.00486)	(0.0811)	(0.0812)	(0.0904)	(0.0815)	(0.208)	(0.193)	(0.207)	(0.198)
Observations	158,173	158,173	158,173	143,563	158,173	158,173	158,173	143,563	158,173
R-squared		0.990	0.990	0.991	0.990	0.864	0.864	0.848	0.864

Bootstrapped standard errors (based on 10,000 replications) in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Observations are weighted down by the inverse of the number of trading partners to estimate exporter and importer specific regressions. The dependent variable in column (1) is bilateral exports, X_{ij}. i and j indicate the exporting and importing country, respectively. λ_{it} are exporter-time fixed effects and ψ_{jt} are importer-time fixed effects. In column (2) and (6), the WUI measure is the annual mean of uncertainty, in column (3) and (7) we employ the standard deviation, in column (4) and (8) we use the maximum quarterly value of the previous year and, in column (5) and (9) we look at the index value of the first quarter of each year.

Table 15: Estimation results: Structural gravity with cross-border and domestic trade flows

	(1) Exports	(2) Exports	(3) Exports	(4) Exports
Border(=1)	-2.406***	-2.597***	-2.451***	-2.898***
	(0.191)	(0.200)	(0.195)	(0.201)
Border(=1)*(ln) Uncertainty	-5.429***	-1.887	-3.877***	7.424*
	(1.494)	(1.226)	(1.207)	(4.292)
Border(=1)*TA exists	0.137	0.0974	0.108	0.0868
	(0.0966)	(0.0969)	(0.0958)	(0.0978)
Border(=1)*EU both	0.578***	0.479***	0.480***	0.414***
	(0.114)	(0.124)	(0.125)	(0.122)
Border(=1)*(ln) Distance	-0.941***	-0.968***	-0.963***	-0.975***
	(0.0519)	(0.0608)	(0.0576)	(0.0625)
Border(=1)*Contiguity	0.500***	0.496***	0.483***	0.531***
	(0.125)	(0.123)	(0.122)	(0.125)
Border(=1)*Common Language	-0.0574	-0.0449	-0.0195	-0.0645
	(0.0900)	(0.0868)	(0.0848)	(0.0870)
Constant	34.55***	34.72***	34.68***	34.76***
	(0.438)	(0.492)	(0.466)	(0.504)
Observations	8,515	9,124	9,124	9,124
Pseudo R-squared	0.988	0.988	0.988	0.988
Country FE	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. The dependent variable is bilateral exports, X_{ij}. i and j indicate the exporting and importing country, respectively. In column (1), we use the maximum quarterly value of the previous year, in column (2), we look at the index value of the first quarter of each year, in column (3), the WUI measure is the annual mean of uncertainty and in column (4), we employ the standard deviation.

Table 16: Estimation results: Structural gravity with cross-border and domestic trade flows

	(1)	(2)	(3)	(4)
	Economic Policy Uncertainty		EIU Overall Risk Score	
	Exports	Exports	Exports	Exports
Border(=1)	1.256*	-2.767***	1.786***	-2.801***
	(0.691)	(0.170)	(0.548)	(0.167)
Border(=1)*(ln) Uncertainty	-0.803***		-1.392***	
	(0.145)		(0.157)	
Border(=1)*Uncertainty Dummy		-2.450***		-1.328***
		(0.242)		(0.232)
Border(=1)*TA exists	-0.0635	0.165	0.159*	0.131
	(0.133)	(0.129)	(0.0940)	(0.101)
Border(=1)*Both EU	0.575***	0.300*	0.414***	0.452***
	(0.187)	(0.175)	(0.121)	(0.131)
(ln) Distance	-0.836***	-0.729***	-0.764***	-0.834***
	(0.0757)	(0.0802)	(0.0652)	(0.0670)
Contiguity	0.524***	0.590***	0.634***	0.592***
	(0.155)	(0.168)	(0.127)	(0.133)
Common language	0.00739	-0.0118	-0.143	-0.0157
	(0.111)	(0.116)	(0.0879)	(0.0919)
Constant	34.33***	33.55***	33.46***	33.84***
	(0.612)	(0.673)	(0.537)	(0.542)
Observations	1,874	1,874	4,479	4,479
Pseudo R-squared	0.992	0.991	0.990	0.988
Country FE	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. The dependent variable is bilateral exports, X_{ij}. i and j indicate the exporting and importing country, respectively.