Complex Europe: Quantifying the Cost of Disintegration*

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January 5, 2022

Abstract

We propose novel estimates of the economic consequences of undoing European goods and services markets integration. Using a quantitative multi-country, multi-sector trade model, we disentangle two important layers of complexity: First, European integration is governed by various, partly overlapping arrangements — the Customs Union, the Single Market, the Common Currency, the Schengen Area, free trade agreements — and fiscal transfers, all of which affect production, trade, and income differently. Second, decades of integration have led to dense cross-border input-output (IO) networks, which endogenously adjust to trade cost shocks. Based on our preferred gravity estimates, we find disintegration to trigger statistically significant welfare losses of up to 23%. In a conservative specification, effects are about half the size. Robustly, the Single Market dominates quantitatively, but the losses from dissolving the Schengen Area are substantial, too. Compared to a model variant without IO linkages, our complex model predicts significantly larger aggregate losses.

JEL Classification: F13, F14, F17

Keywords: Structural Gravity, European Trade Integration, General Equilibrium, Quantitative Trade Models

*We thank two anonymous referees, Ralph Ossa, Peter Egger, Yoto Yotov and Benny Jung for discussion and comments, and participants at the 6th Lindau Nobel Laureate Meeting in Lindau, the Meeting of the European Economic Association in Cologne, the Meeting of the German Economic Association in Vienna, ETSG in Florence, CESifo Venice Workshop on Country Clubs, IIASA Laxenburg, University of Göttingen, Czech National Bank, KU Leuven and ETH Zurich for useful comments and suggestions. All remaining errors are our own. Jasmin Gröschl gratefully acknowledges funding from the German Science Foundation (DFG) under project GR4896/1-1. Inga Heiland gratefully acknowledges funding from the European Research Council under the European Union's Horizon 2020 research and innovation program (grant agreement 715147).

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1 Introduction

Europe is the world region that has experienced the deepest degree of economic integration since World War II. The Customs Union was completed in 1968, the European Single Market was established in 1993, the Schengen Agreement that ended formal border controls between many European countries entered into force in 1995, and the Eurozone was created in 1999. From the early 1990s onwards, the Union expanded from 12 to 28 members in the course of two decades. However, the resulting network is complex as not all EU members are part of all agreements and EU outsiders participate in some of them. Other regional integration schemes such as in South America or in the ASEAN region, also feature overlapping arrangements, but these are less differentiated and the depth of integration is much weaker; see Duer et al. (2014). Moreover, only the EU applies fiscal transfers between member states.

Most of the existing literature on the quantitative effects of European integration ignores this institutional complexity. In this paper, we decompose the economic costs of undoing Europe with the help of a modern quantitative trade model that also accounts for a second source of complexity: the production networks that have emerged over time between countries and sectors.

We strongly anchor our analysis in a comprehensive econometric *ex-post* evaluation of the various steps of European integration – the EU Customs Union, the Single Market, the Common Currency, the Schengen Agreement, and the network of regional trade agreements (RTA) with third parties – using the sector-level gravity equations that our theoretical general equilibrium model implies. To identify treatment effects, we exploit the panel nature of our data. Given the theoretical model, these estimates can be translated into changes in *ad-valorem* tariff equivalents of non-tariff trade costs.

In a second step, we use these estimates to inform our counterfactual analysis. More specifically, we simulate the economic consequences of "undoing Europe", highlighting country-level and sector-level heterogeneity regarding output, trade, and welfare effects, and contrasting models with and without complex IO linkages. We bootstrap the distribution of structurally estimated parameters and the corresponding simulated effects to obtain confidence intervals for our model predictions. Our bootstrap methodology provides a convenient solution to deal with estimated structural parameters that are not individually significant or need to satisfy theoretical constraints. Moreover, the bootstrap methodology permits us to test for the statistical significance of our comparative static results.

In our preferred gravity model, we estimate that membership in the Single Market boosts goods trade by about 46%, which corresponds to an average reduction of non-tariff trade costs of about 13 percentage points (pp), given the estimated trade elasticity. In services trade, the trade creation effects is as high as 64%, corresponding to a 28pp trade cost saving, probably reflecting the reduction in trade policy uncertainty along with lower explicit trade barriers. Membership in the Eurozone yields trade cost savings of about 3pp in goods and of about 10pp in services trade. The evaluation of the Schengen Agreement is more involved; how bilateral trade costs between two countries i and n are affected depends on whether the transit countries between i and n are Schengen members. Accounting for this complication, we find that abolishing border controls between neighbors reduces trade costs by 11pp for goods and by 5pp for services. Across sectors, we detect a large degree of heterogeneity.

In our counterfactual analysis, based on the baseline year of 2014, we find that a complete elimination of all European integration steps would lower trade within the EU by some 25%. Intra-EU production networks would unravel: The domestic value added content in exports would go up by 3 to 7pp as sourcing of inputs from foreign sources falls by more than overall trade. Due to substitution effects, trade with third parties may go up, but this effect is dampened and – in some cases reversed – by negative income effects. Moreover, third country effects are small and mostly not statistically significant.

In scenarios that involve a more partial breakdown of the EU, i.e., a breakdown of individual agreements, trade effects are much smaller. Overall, output losses are substantially more important for new EU members than for old ones and value added contracts less than output in EU countries.[5] A complete breakdown of the EU would generate statistically significant real consumption losses for all EU members. Smaller countries such as Malta, Luxembourg, or Estonia would lose 19%, 18%, and 12% respectively; larger countries such as Germany, France or Italy would lose 5%, 4%, and 4%, respectively. The least exposed EU country is the UK (pre-Brexit; -3%). Reintroducing tariffs equal to current EU most-favored nations (MFN) tariffs could have positive (albeit tiny) effects on real consumption in several countries, such as Cyprus or Greece. Overall, Single Market effects dominate strongly. Moreover, we find that eliminating transfer payments among EU countries leads to adverse terms of trade adjustments for net beneficiaries from the transfer system, and vice versa for net contributors. Hence, our model sides with Keynes in the famous Keynes-Ohlin debate on the welfare effects of transfer payments.

We also study the effects of EU breakdown in simpler versions of our model in order to understand the importance of accounting for sectoral detail and for intersectoral IO linkages. We find that both dimensions of complexity are quantitatively important. Both, the less complex model variant featuring only three aggregate sectors (compared to the 50 sectors in our main model) and the variant without intersectoral production linkages predict substantially smaller real consumption losses. Moreover, the simple model without intersectoral linkages fails to capture the impact of the trade cost increases on upstream services sectors producing inputs for the trade-exposed manufacturing sector, predicting a much bigger decline in manufacturing, in absolute and in relative terms. For example, new (old) EU countries lose 1pp (0.6pp) in the share of manufacturing value added in total value added compared to losses of 0.3pp (0.2pp) in the model with complex IO linkages. We show that these differences are in many cases statistically significant. Hence, accounting for sectoral detail and intersectoral linkages is crucial for the quantification of the welfare effects of EU integration.

Our paper is related to several strands of the literature. First, a large empirical literature estimates the trade effects of integration policies using gravity models; see Head and Mayer (2014) for an overview. The European currency union has received special attention, but the earlier literature has been inconclusive; cf. Micco et al. (2003), Baldwin and Taglioni (2007), Berger and Nitsch (2008), or Bergin and Lin (2012). There has been substantially more consensus on the effects of goods market integration; cf. Baier and Bergstrand (2007a), Egger and Larch (2011), or Bergstrand et al. (2015). In contrast, very few studies exist on

[5] "Old (new) EU countries" refers to the set of countries that joint the EU before (in or after) 2004.

the trade effects of the Schengen Agreement. It is important to acknowledge that, unlike bilateral agreements, Schengen has a spatial dimension. Land-borne trade flows within Europe may cross one border (e.g., France – Spain) or up to eight internal borders (e.g., Portugal – Finland). Hence, Schengen membership treats country pairs heterogeneously, depending on the number of internal Schengen borders to be crossed. This feature is ignored in the small existing literature, which treats Schengen analogously to trade agreements and currency unions, cf. Davis and Gift (2014) or Chen and Novy (2011).

We also relate to a large literature on trade policy analysis in computational general equilibrium (CGE) models. See Whalley and Shoven (1984) and Francois and Kenneth (1998) for excellent methodological contributions and Checchini et al. (1988) for a famous ex-ante analysis related to Europe. Following criticism by Kehoe (2005), quantitative trade modeling has made substantial progress; Costinot and Rodriguez-Clare (2014) and Ottaviano (2014) provide surveys, and Kehoe et al. (2017) a critical discussion. This new incarnation of an old literature builds on a tight integration of estimation and calibration. Many papers have employed such techniques; one particularly noteworthy is the one by Corcos et al. (2012). Specifically, we build on the model proposed by Caliendo and Parro (2015) which is a multi-sector version of the multi-country, multi-goods stochastic technology Ricardian trade model of Eaton and Kortum (2002).[6] Importantly, this model accounts for the rich network of intra- and international IO linkages that characterize trade in goods and services in Europe.

Mayer et al. (2019) is the paper most closely related to ours. However, we go beyond their work by offering five main contributions: (i) we obtain the key model parameters – policy estimates of the different EU integration agreements – for our simulation exercises from a structural gravity model that relies on exactly the same base data (same set of countries, sectoral decomposition and time period) as the simulation exercise; (ii) the scenario definitions of collapsing the various EU integration agreements are based on the economic analysis of those data, as we calculate trade cost changes in non-tariff barriers from our structural gravity estimates; (iii) our model features multiple sectors and an IO structure that facilitates matching international IO linkages at the most detailed level at which data are available; (iv) we make use of bootstrapping methods to quantify parameter uncertainty of our simulation exercise and thus provide confidence intervals for our predictions. We show that accounting for sectoral detail and complex intersectoral IO relationships is important: Welfare losses are underestimated by up to 6pp without intersectoral IO linkages. Our bootstrap exercise shows that the differences between predictions obtained by the models with and without these linkages are statistically significant. And finally, (v) our model features tariff income and income transfers. The latter permits us to include the effects of ending within-EU transfer payments.

Our paper focuses in maximum detail on two of the four dimensions of European integration: goods and services trade. We do not account for the integration of labor and capital markets. Our analysis, therefore, captures only a part of the welfare effects that the European project has spawned. Caliendo et al. (2021) provide a first paper that captures both, trade and labor market integration in a quantitative model. It focuses on the Eastern Enlargement of the

[6]The model belongs to a class of tractable frameworks that Ottaviano (2014) has characterized as "New Quantitative Trade Model" (NQTM).

EU and studies the interaction between lower costs of trade and labor mobility. However, it does not feature the institutional complexity that we account for; it has no sectoral detail and does not model production networks. It would be a promising step forward to embed our framework into a quantitative spatial model with trade and migration alike the ones developed by Caliendo et al. (2019) and Monte et al. (2018).

As regards the effects of capital market integration in Europe, Bruno et al. (2021) provide empirical gravity estimates for FDI originating within and outside the EU. Neary (2002) discusses several mechanisms through which EU trade integration shapes the incentives for FDI. However, to the best of our knowledge there is no quantitative evidence on the joint effects of the four freedoms. We view the development of a quantitative framework that facilitates such an analysis as a milestone for future research.

The remainder of the paper is structured as follows. In Chapter 2 we describe the model. Chapter 3 contains a sectoral ex-post evaluation of EU integration steps. Chapter 4 discusses the main quantitative results. Chapter 5 highlights the role of sectoral heterogeneity and complex IO structures for our results. Chapter 6 concludes.

2 Model

The model builds on Caliendo and Parro (2015), who develop a multi-sector version of the Eaton and Kortum (2002) gravity model with IO linkages. We extend their setup by allowing for services trade. Moreover, we introduce an explicit description of non-tariff trade barriers (NTB) to bridge the gap between trade cost in the model and gravity-based estimates of NTB reductions caused by economic integration agreements. In this section, we present a redux of the model, focusing on the relevant mechanisms. Section B.1 in the Online Appendix lays out the details.

There are N countries indexed by i, n and J sectors indexed by j, k. Every country produces final and intermediate goods using domestic and imported varieties of J differentiated goods from all other countries. Intermediate goods production also uses labor. Let X_n^j denote country n's total expenditure on varieties of good j. Then, country n's imports of sector-j varieties from country i are given by

$$X_{in}^j = \pi_{in}^j X_n^j, \qquad \text{where} \qquad \pi_{in}^j = \frac{\lambda_i^j \left[c_i^j \kappa_{in}^j\right]^{\frac{-1}{\theta^j}}}{\sum_{i=1}^N \lambda_i^j \left[c_i^j \kappa_{in}^j\right]^{\frac{-1}{\theta^j}}} \tag{1}$$

equals the share country n's total expenditure devoted to varieties from sector j in country i and $\theta_j > 0$. Equation (1) is a sectoral gravity equation. Exports from i to n in sector j depend on the size of the destination market captured by X_n^j, and the relative competitiveness of i as a source country, captured by π_{in}^j. In this Ricardian world with perfect competition, competitiveness is entirely determined by cost. The cost of serving market n faced by a representative firm from country i's sector j depends on trade cost κ_{in}^j, input prices c_i^j, and an inverse measure of average productivity λ_i^j. The trade friction κ_{in}^j consists of iceberg trade costs $d_{in}^j \geq 1$ and ad-valorem tariffs $\tau_{in}^j \geq 0$ such that $\kappa_{in}^j = (1 + \tau_{in}^j) d_{in}^j$. We extend this formulation of trade cost by modeling NTBs as a function of bilateral distance, RTAs and other observable trade cost proxies, as it is common in the empirical gravity literature.

Specifically, we assume that $d_{in}^j = {D_{in}}^{\rho^j} \, e^{\delta^j \mathbf{Z}_{in}}$, where D_{in} is bilateral distance, and $\mathbf{Z}_{in}$ is a vector collecting trade cost shifters (such as RTAs or other trade policies). Input prices contain wages w_i and the prices of intermediate inputs in accordance with the following cost function

$$c_i^j = \Upsilon_i^j \; {w_i}^{\beta_i^j} \left[\prod_{k=1}^{J} {p_i^k}^{\gamma_i^{k,j}} \right]^{(1-\beta_i^j)}, \tag{2}$$

where Υ_n^j is a constant, p_i^k, is the price of the sectoral good k in i, $\gamma_i^{k,j}$ is the share of intermediate goods expenditure sector j producers spend on the good from sector k, and β_i^j is cost share of labor. The prices of sectoral goods are aggregates of the prices of varieties from that sector sourced from all countries, given by

$$p_n^j = A^j \left(\sum_{i=1}^{N} \lambda_i^j \left(c_i^j \kappa_{in}^j \right)^{\frac{-1}{\theta^j}} \right)^{-\theta^j}, \tag{3}$$

where $A^j = \Gamma\left[1 + \theta(1-\eta^j)\right]^{\frac{1}{1-\eta^j}}$ is a constant.

The system of equations (1)-(3) pins down the pattern of trade as functions of fundamental cost parameters, $\lambda_i^j, \kappa_{in}^j$, wages w_i and expenditures levels X_n^j under full consideration of intersectoral and international production linkages described, respectively, in (2) and (3).

To close the model, expenditure levels and wages are determined by goods market clearing conditions and a macroeconomic closure condition. Total expenditure on sector j goods in i is given by

$$X_i^j = \sum_{k=1}^{J} \gamma_i^{j,k} (1 - \beta_i^k) Y_i^k + \alpha_i^j I_i. \tag{4}$$

The first term on the right-hand side is the expenditure on intermediate inputs of type j, a share $\gamma_i^{j,k}(1-\beta_i^k)$ of each sector k's production value Y_k. The second term denotes final goods expenditure, given by a constant share α_i^j of country i's income I_i. Sectoral goods market clearing $Y_n^j = \sum_{i=1}^{N} \frac{\pi_{ni}^j}{(1+\tau_{ni}^j)} X_i^j$ now pins down expenditure levels as functions of the above trade patterns and wages.

The final step towards general equilibrium is to pin down wages. To that end, we invoke an income-equals-expenditure condition demanding that the value of total imports and domestic demand has to equal the value of total exports including domestic sales plus transfers,

$$\sum_{j=1}^{J} \sum_{i=1}^{N} \frac{\pi_{in}^j}{(1+\tau_{in}^j)} X_n^j = \sum_{j=1}^{J} \sum_{i=1}^{N} \frac{\pi_{ni}^j}{(1+\tau_{ni}^j)} X_i^j + T_n, \tag{5}$$

and the definition of income $I_i = w_i L_i + R_i + T_i$, which derives from wages, tariff rebates $R_i = \sum_{j=1}^{J} X_i^j \left(1 - \sum_{n=1}^{N} \frac{\pi_{ni}^j}{(1+\tau_{ni}^j)}\right)$ and potential transfers T_i. The role of T_i is to accommodate a potential wedge between income and expenditure in this static framework. This is crucial in order for the model to match the reality of imbalanced trade and particularly relevant for our analysis of the EU, where actual income transfers are prevalent. In a deviation from

Caliendo and Parro (2015), we assume that this transfer is equal to a constant share t_i of non-transfer income, that is, $T_i = t_i(w_i L_i + R_i)$, rather than being constant in levels. This modification provides for the equilibrium being homogenous of degree one in prices.[7]

2.1 Comparative Statics in General Equilibrium

Comparative statics in this model can be done in terms of global changes, following Dekle et al. (2008). In this section we limit the discussion to the mechanisms. Analytical details, which closely track Caliendo and Parro (2015), are provided in Appendix B.1.

Consider an increase in bilateral trade cost, κ_{in}^j. As a direct consequence, country i's relative competitiveness in serving market n with sector j goods is reduced. Hence, the trade share π_{in}^j in equation (1) declines. At the same time, other countries' relative competitiveness in market n increases as the denominator in equation (1) declines as well. Furthermore, there are multiple indirect adjustments. First, higher prices for imported intermediate inputs in accordance with equation (3) raise the production cost of all sectors in the importing country, with the strength of the increase controlled by $\gamma_n^{k,j}$. These cost increases are passed on further along the value chain to all sectors in all countries. The resulting differential cost changes feed back into relative competitiveness changes in equation (1) of all sectors from all countries in all destination markets. Second, countries experiencing greater losses in competitiveness experience a decline in demand for their goods, widening their trade deficit. The corresponding decline in demand for labor reduces wages. Exports increase as lower wages partly restore competitiveness and imports decline due to lower incomes until equation (5) holds again. Third, income changes and output changes caused by changes in relative competitiveness spill over to other countries via changes in demand for imports in equation (1) operating through X_n^j. Given the richness of direct and indirect mechanisms, general equilibrium adjustments to a trade cost shock are very diverse. Yet, as a general tendency, a country i experiencing a positive trade cost shock $\hat{\kappa}_{in}^j$ sees wages decline in order to restore competitiveness. Third countries benefit from greater market access in n, but tend to lose if they rely strongly on inputs from n or if they rely strongly on demand from i.

As a measure of welfare changes we use changes in real consumption, obtained as

$$\hat{W}_n = \frac{\hat{I}_n}{\prod_{j=1}^{J} \left(\hat{p}_n^j\right)^{\alpha_n^j}}. \tag{6}$$

The model provides static level effects on real consumption and trade. As dynamic effects of trade disintegration are not taken into account, it provides a lower bound for the potential

[7] Thereby, we circumvent the problem that the counterfactual results depend on the choice of the units in which the deficits are held constant, which was pointed out by Ossa (2014). However, this modelling choice implies that the condition that global transfers sum to zero cannot be enforced in the counterfactual equilibrium. We show below that, in our application, the results are very similar to those obtained with the approach of Ossa (2014) which is to start the counterfactual analysis from a simulated baseline with balanced trade. We also show that holding deficits constant in nominal terms leads to substantially different predictions for some countries.

effects of a dismantling of the European integration process. Contrary to trade agreements, where effects occur after a phase-in, disintegration effects potentially occur immediately.[8]

3 Estimation

3.1 Empirical Strategy, Data and Identification

The empirical strategy is built around the gravity equation (1). Inserting a functional form for κ_{in}^{j} that is standard in the gravity literature and adding a time index, we obtain

$$X_{in,t}^{j} = \exp\left[-\frac{1}{\theta^{j}}\ln(1+\tau_{in,t}^{j}) + \frac{\delta_{SingleMarket}^{j}}{\theta^{j}}SingleMarket_{in,t} + \frac{\delta_{Euro}^{j}}{\theta^{j}}Euro_{in,t} + \frac{\delta_{Schengen}^{j}}{\theta^{j}}Schengen_{in,t} + \frac{\delta_{RTA}^{j}}{\theta^{j}}RTA_{in,t} + \nu_{in}^{j} + \nu_{i,t}^{j} + \nu_{n,t}^{j}\right] + \varepsilon_{in,t}^{j}, \tag{7}$$

where $X_{in,t}^{j}$ is the value of imports of country i to country n in sector j at time t, $1+\tau_{in,t}^{j}$ is an ad-valorem tariff factor, and $1/\theta^{j} > 0$ is the sectoral trade elasticity. The terms $\nu_{i,t}^{j}$ and $\nu_{n,t}^{j}$ are year-specific exporter and importer fixed effects which control for average prices in the importing country (the denominator in equation(1)) as well as for unit costs and absolute productivity in the exporting country. Following common practice (Baier and Bergstrand, 2007a), we exploit variation within country pairs and sectors over time to identify the effects of policy changes. Hence, the presence of directional bilateral fixed effects ν_{in}^{j}, which absorb time-invariant determinants of the level of trade between two countries, separately for imports and exports. $\varepsilon_{in,t}^{j}$ is a random disturbance.

We estimate equation (7) by the Poisson Pseudo Maximum Likelihood (PPML) method as recommended by Santos Silva and Tenreyro (2006), Head and Mayer (2014), and Yotov et al. (2016). Standard errors allow for clustering at the country-pair level. The setup allows inference about the Frechet parameter θ^{j} and, given that parameter, about trade cost effects of various integration steps δ_{k}^{j} for each sector. Our estimation is based on yearly data covering the period 2000-2014 from the World Input-Output Database (WIOD) described by Timmer et al. (2015), which also contains the key data for the model calibration. We aggregate sectoral trade flows for 50 industries and 43 countries.[9] Applied tariffs (preferential and MFN) are taken from the World Integrated Trade Solutions (WITS-TRAINS) and the WTO's Integrated Database (IDB).[10] We use binary variables to capture membership in RTAs, the EU Single Market, or the Eurozone and obtain the relevant information from the WTO and the EU Commission.

[8] This is particularly relevant for non-tariff trade costs. Evidence from existing RTAs shows that this phasing-in process usually takes between 10 and 12 years (see, e.g., Jung, 2012).

[9] The original data have 56 sectors. Aggregation deals with zero output values, mainly in services sectors, which are theoretically inadmissible. For a list of sectors see Table B1 in the Appendix.

[10] As tariffs are not available for every year and every pair within our time frame, we interpolate tariff levels forward and backward.

Contrary to the other integration measures, we do *not* define $Schengen_{in,t}$ as a binary variable equal to one if both countries in a pair have ratified Schengen. Such a definition misrepresent the treatment and misses systematic treatment heterogeneity: A land-borne trade flow in Europe from i to n may cross one, two, or up to eight internal Schengen borders. Moreover, the pair i, n may benefit from lower transit costs, even if both are outsiders to Schengen. We therefore use a count variable $Schengen_{in,t} = \{1, \ldots, 8\}$ registering the number of Schengen border crossings that land-borne trade between i and n involves; see Felbermayr et al. (2018) for further details.

Identifying variation arises from changes in applied tariff rates and in the architecture of Europe over time. Between 2000 and 2014, there were 13 EU accessions (10 Eastern European countries in 2004, Romania and Bulgaria in 2007, and Croatia in 2013). Six countries adopted the Euro (Greece in 2001, Slovenia in 2007, Cyprus in 2008, the Slovak Republic in 2009, Estonia in 2011 and Latvia in 2014). 15 countries became members of the Schengenzone (the Nordic countries in 2001, several new EU members in 2007, and Switzerland in 2008).[11] Figure 1 illustrates what is sometimes called the variable geometry of Europe. Importantly, there is little overlap in the timing of individual countries' accessions to different agreements. This facilitates identification. In total, 33 RTAs entered into force; two of them involve the EU of which the most important one is the EU-Korea RTA in 2011. In the gravity analysis, we therefore separately estimate three RTA effects: one for the EU-Korea RTA, one for the EU Pre-Accession Preferential Trade Agreements (PTAs) of the Eastern European Countries with the EU, and one for all other RTAs. Moreover, there has been substantial variation in applied tariff rates resulting from regional integration, unilateral liberalization in countries such as India or Brazil, and – in the early years of our sample – tariff phase-in from the Uruguay round.

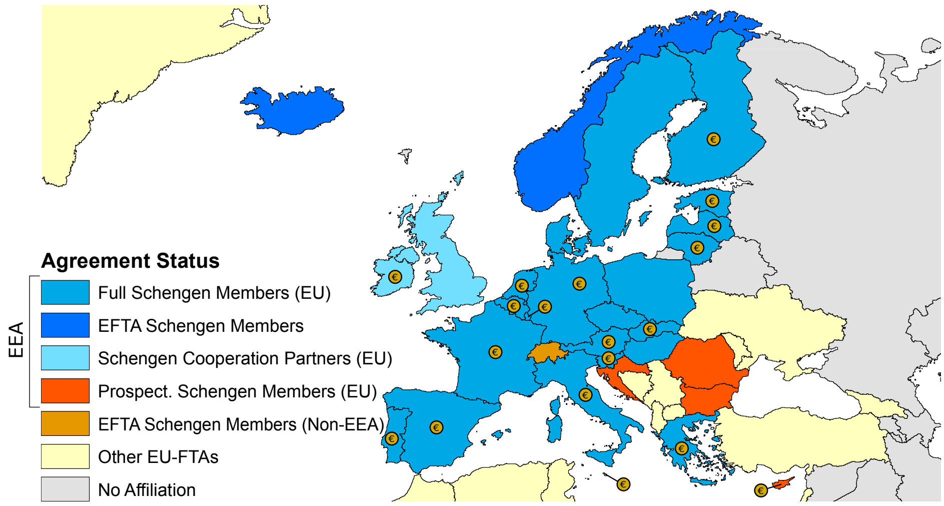
It is, however, well known from the gravity literature that estimates obtained from a regression such as the one in Equation (7) have to interpreted with caution. For identification, we have to assume that the conditions

$$\begin{aligned} \operatorname{cov}\left(\mathbf{POL}_{in,t}, \varepsilon^j_{in,t} \middle| \nu^j_{it}, \nu^j_{nt}, \nu^j_{in}\right) &= 0 \\ \operatorname{cov}\left(\tau^j_{in,t}, \varepsilon^j_{in,t} \middle| \nu^j_{it}, \nu^j_{nt}, \nu^j_{in}\right) &= 0 \end{aligned}$$

hold, where $\mathbf{POL}_{in,t} = \left\{SingleMarket_{in,t}, Euro_{in,t}, Schengen_{in,t}, RTA_{in,t}\right\}$. Essentially, we require that trade policies do not correlate with pair-specific shocks that affect bilateral trade. The fact that we work with sectoral data but policy variables have no sector variance provides some protection. The presence of fixed effects in our sectoral regressions helps against omitted variable bias as time-invariant bilateral or time-dependent country-level factors that affect trade are accounted for (cf. Baier and Bergstrand, 2007b). Still, we have to worry about the endogenous timing of entry. One concern is that taste shocks might correlate with policy, so that we wrongly attribute growth in trade flows to trade costs while it stems from preferences. More generally, country pairs that experience a disproportionate increase in their bilateral trade volume may have a stronger incentive to sign a trade agreement in a given

[11] Table B2 in the Online Appendix provides an overview of accessions to the EU Single Market, the Euro, and Schengen; Table B3 shows the change in the number of continental borders affected by Schengen accessions over time by country.

Figure 1: Europe: Overlapping Integration Agreements



Note: The Euro icons mark whether a country is a member of the Eurozone. Data as of December 2020.

year. Another concern is that bilateral trade growth may improve diplomatic relationships, making it easier to conclude agreements. However, even though the selection of country pairs into integration agreements may not be random, joining a plurilateral agreement such as the European Single Market or Schengen is not a pure bilateral decision and the entry decision itself as well as the timing is often driven by political considerations. Reverse causality may thus not be a major issue. As Berlingieri et al. (2018) argue, the recent generation of EU integration agreements and the recent EU enlargement waves in particular were driven more by geopolitical concerns than by economic factors, reflecting the desire to tie the former communist states closer to the West. In contrast, the EU's trade agreements with other countries reflected the desire to keep up with the pace at which the US was signing new trade agreements.

Nonetheless, remaining selection effects could bias the estimated trade effects upwards, leading us to overestimate the costs of disintegration. As to date no convincing instruments for trade policy measures exist, we follow the suggestion by Head and Mayer (2014) and add pair-specific time trends to control for potential confounding bilateral factors that change over time in a robustness check. Specifically, we include directional bilateral trends to account for trends in imports and exports of a country pair that might affect the decision to join an agreement or to change bilateral tariffs. By construction, the pair-specific trends reduce the estimated trade effect of the agreements even in the absence of a selection problem. We may thus interpret the estimates as lower bounds and use them to generate a lower bound on the simulated welfare effects later on.

3.2 Bootstrap Distribution of Parameter Estimates

The estimated cost effects and dispersion parameters which we use, respectively, to inform the counterfactual scenarios and to calibrate the model comprise substantial standard errors. Some estimates are not statistically different from zero. Furthermore, the sectoral dispersion parameters need to satisfy the theoretical constraint $1/\theta_j > 0$. With structural estimation of unobserved model parameters constituting one of its building blocks, these issues naturally arise in structurally estimated quantitative trade models and require a choice regarding the treatment of insignificant or theoretically inadmissible parameter estimates. The issue is particularly relevant in settings like ours, where a large number of parameters is estimated. A common approach is to set inadmissible estimates equal to some average estimate at a higher level of aggregation and to take insignificant parameter estimates at face value (see, e.g. Caliendo and Parro, 2015) or to set them equal to zero (see, e.g. Mayer et al., 2019). Moreover, with few exceptions, uncertainty surrounding estimated model parameters is typically disregarded from the calibration stage onwards.[12]

We propose a bootstrap methodology to jointly address the issues of parameter uncertainty, insignificant estimates, and theoretically inadmissible values. Just like we use the baseline data and the model's equilibrium conditions to inform the parameters, we translate the uncertainty implied by fitting the structural gravity equation to the baseline data into confidence bounds for the model predictions. That is, we use the bootstrapped distribution of our estimates to generate a distribution of model predictions, allowing us to construct confidence intervals. Hence, we do not need to take a stand on insignificant point estimates or joint significance of the estimated parameters. Our bootstrapping strategy naturally takes into account the correlation with other estimates (from the same sectoral regression), and does not require us to make distributional assumptions. Regarding theoretically inadmissible values, the bootstrap yields the (highly non-normal) joint distribution of a set of parameters of which some are constrained.

In practice, we proceed as follows. For every sector j we draw a sample from the original dataset and run regression (7). If $1/\theta_j$ violates the constraint, we reestimate (7) based on the same sample with $1/\theta_j$ constrained to zero.[13] We repeat this procedure 1,000 times to obtain the joint distribution of the sectoral estimates. To account for a potential correlation of standard errors within country pairs, we draw random clusters formed by all observations of a country pair rather than random observations. We draw samples that are smaller than the original one ("m out of n bootstrap") to account for the concern raised by Andrews (2000) regarding consistency of the bootstrap in the presence of parameters that are located at the boundary of the parameter space.

3.3 Econometric Results

Aggregate Trade in Goods and Services. To set the stage, we present estimation results for aggregate goods and services trade (cf. Table A1 in Appendix A). The results reveal a number of important facts. First, Single Market membership as captured by a dummy variable suggests an increase in trade of about 53% ($100 \times (\exp(0.427) - 1)$). Controlling for tariffs and adding our Schengen variable as well as binary variables for Eurozone membership and RTAs reduces that effect to 46%. The tariff elasticity is -3.65, a reasonable number that

[12] Noteworthy exceptions in the literature are Ossa (2015) and Baier et al. (2019).

[13] While the model needs $1/\theta_j > 0$, we include the boundary case of $1/\theta_j = 0$ in the estimated distribution. In the subsequent model simulations, we set $1/\theta$ to a value that is very close to zero.

compares well with the literature. Taking into account that trade values in WIOD do not include tariffs, the implied aggregate estimate for $1/\theta$ is 2.65.[14] These estimates imply that the effect of the Single Market on NTBs is a reduction by 13pp. Moreover, results imply that the average tariff reduction due to the Single Market has been about 4%; a number very close to the average MFN tariff applied by the EU. This is also a lower bound to the effects of being part of the EU Customs Union only, such as is the case of Turkey. The other coefficients can be similarly transformed into trade cost effects. For instance, Eurozone membership reduces trade costs by about 3pp. Interestingly, we find a substantial Schengen effect (however, still lower than those found in previous studies; cf. Davis and Gift (2014) or Chen and Novy (2011)).

Overall, our estimated effects of the EU integration agreements on NTBs are sizable. For a judgment of the magnitude it is important to note that our estimates include the effects of a reduction in policy uncertainty on top of the actual non-tariff trade cost. As Handley and Limão (2015) argue, a key benefit of the European integration process is that it locks in certain market access concessions and makes them much less reversible than an ordinary deep trade agreement. Handley (2014) and Handley and Limão (2015, 2017) have shown that the trade-creating effects from a reduction in policy uncertainty are substantial.

For services trade the regression reveals sensible results of the various integration steps, too. The trade effect of the Single Market is equal to 64%; which is much higher than what we find for goods. This also tends to be true for other forms of integration. Of course, in services trade there are no tariffs, so that we cannot identify a trade elasticity in our gravity model.

Sector-Level Results. The aggregate results are informative, but for the simulations, we take parameters for 22 goods and 28 services sectors. Table 1 reports coefficient averages from 1,000 bootstraps of Equation (7) at the sectoral level. By and large, the estimates are sensible. The largest effects of Single Market membership are found in Computer and Information Services, Financial Services, Land Transport, and Fishing and Agriculture; of the Eurozone on Mining & Quarrying; of the Schengen Agreement on Education Services and Coke and Refined Petroleum; and of the EU-Korea RTA on Textiles, Apparel, Leather, the transportation services sectors, Business Services, and Administration & Support Services. The largest trade elasticities can be sustained in Pharmaceuticals, Machinery & Equipment, and Electronics and Optical Products (cf. Table A2 in the Appendix A). The smallest trade elasticities obtain in Crops & Animals, Fishing & Aquaculture, Mining & Quarrying, and Wood & Cork, with the constraint $1/\theta_j \geq 0$ binding in the majority of draws.[15] The sectoral estimates compare well to the magnitudes found in the literature (cf. Broda and Weinstein (2006) or Caliendo and Parro (2015)).

Lower Bounds. As discussed above, we have to worry about the endogenous timing of trade agreements and thus need to be careful when interpreting our gravity results. To assess the potential for upward bias due to selection based on expected trade growth or other

[14] With $X^j_{in,t}/(1+\tau_{ij,t})$ on the left-hand side of (7), the structural interpretation of the estimated tariff elasticity is $-\frac{1}{\theta}-1$.

[15] The last column of Table A2 shows the share of draws where the constraint is binding.

Table 1: EU Integration Steps and Bilateral Imports (2000 - 2014)

Dep. var.: Bilateral imports

Sector description	Sector	Single Market	Euro	Schengen	EU-KOR PTA	EU PTAs	Other RTAs
Crops & Animals	1	0.58***	0.20	0.09**	0.05	0.33	-0.02
Forestry & Logging	2	-0.02	0.47*	0.08	-0.15	0.57**	-0.23
Fishing & Aquaculture	3	0.72**	0.12	0.03	-0.17	0.49	-0.24
Mining & Quarrying	4	0.50	0.75*	-0.03	1.72*	0.18	-0.46*
Food, Beverages & Tabacco	5	0.50***	0.05	0.13**	-0.07	0.29*	-0.00
Textiles, Apparel,Leather	6	0.09	-0.12	0.04	0.09	0.62***	-0.01
Wood & Cork	7	0.10	0.11	-0.01	0.27	0.24	-0.11
Paper	8	0.35***	0.05	0.03	0.15	0.01	-0.14
Recorded Media Reproduction	9	0.15	-0.20	0.02	0.71	-0.06	-0.21
Coke, Refined Petroleum	10	-0.01	0.26	0.15**	0.52	0.02	-0.12
Chemicals	11	0.38***	0.12	0.08*	0.23*	0.25	0.00
Pharmaceuticals	12	0.56***	0.10	0.12	-0.06	0.40*	0.16
Rubber & Plastics	13	0.25**	0.06	0.10***	0.12	0.38**	0.14
Other non-Metallic Mineral	14	0.11	0.14	0.04	-0.06	0.41**	0.07
Basic Metals	15	0.22	0.17	0.07	0.24*	0.51**	0.15
Fabricated Metal	16	0.17*	0.10	0.04	0.23**	0.36**	0.12*
Electronics & Optical Products	17	0.15	-0.15	-0.03	-0.22	0.41*	-0.01
Electrical Equipment	18	0.26**	0.02	0.06*	0.17	0.54***	0.09
Machinery & Equipment	19	0.18*	-0.01	0.04	0.07	0.42**	0.05
Motor Vehicles	20	0.23	-0.10	0.09	0.19	0.61**	0.16
Other Transport Equipment	21	-0.10	0.28	-0.02	0.15	0.52*	-0.07
Furniture & Other Manufacturing	22	0.12	0.04	0.07	-0.51	0.12	-0.14
Electricity & Gas	23	0.38*	-0.09	0.13	0.35	0.54	0.08
Water Supply	24	0.37***	0.16	0.08	0.31	0.07	-0.30
Sewerage & Waste	25	0.40***	0.10	0.03	-0.06	0.42	0.14
Construction	26	0.43**	-0.03	0.06	-0.17	0.67*	-0.08
Trade & Repair of Motor Vehicles	27	0.63***	-0.08	0.26	0.47	0.17	-0.09
Wholesale Trade	28	0.55***	0.06	0.12*	0.31	0.56**	0.02
Retail Trade	29	0.54***	-0.10	0.12	0.24	0.44**	0.07
Land Transport	30	0.75***	0.34**	-0.03	0.28	0.64***	-0.21
Water Transport	31	0.47**	-0.12	-0.00	0.26	1.13**	-0.16
Air Transport	32	0.54**	-0.10	0.05	0.09	0.53*	-0.25
Aux. Transportation Services	33	0.45***	-0.19	0.09**	0.13	0.54***	-0.25
Postal and Courier	34	0.06	-0.21	0.30	0.10	0.78***	0.30
Accomodation and Food	35	0.24	0.20	-0.15	-0.40	0.43	-0.31
Publishing	36	0.47***	-0.42*	0.01	-0.17	-0.01	-0.33
Media Services	37	0.54**	0.17	-0.05	0.14	0.05	-0.06
Telecommunications	38	0.22*	0.20	0.08	0.46*	0.51**	-0.16
Computer & Information Services	39	0.73***	0.12	0.11	0.63	0.26	-0.25
Financial Services	40	0.73***	0.41	0.02	0.25	0.47	-0.24
Insurance	41	0.19	0.44*	-0.08	0.49	0.56	-0.19
Real Estate	42	0.45***	0.12	-0.00	0.24	0.53	-0.13
Legal and Accounting	43	0.20*	-0.05	0.09	0.20	0.35*	0.06
Business Services	44	0.37***	-0.00	0.03	0.52**	0.73***	0.40
Research and Development	45	0.16	0.10	0.05	-0.15	0.42*	-0.00
Admin. & Support Services	46	0.48***	0.12	0.07	-0.12	0.70**	-0.06
Public & Social Services	47	0.25	0.05	0.08	0.33	0.21	0.12
Education	48	0.35	0.22	0.18**	0.48	0.34	-0.06
Human Health and Social Work	49	0.28	0.35	0.20	0.69**	0.31	-0.12
Other Serivces, Households	50	0.83**	-0.13	-0.01	0.40	0.42	0.27

Coefficient averages from 1000 bootstraps of the sectoral gravity equation, estimated under the constraint that $1/\theta \geq 0$ with a Poisson Pseudo Maximum Likelihood (PPML) estimator. ***, **, * denote significance at the 1%, 5%, 10% level, respectively, according to the bootstrapped distribution of the coefficients. We bootstrap clusters (country pairs) rather than observations to account for correlation of errors within pairs.

bilateral trends, we compare our baseline estimates to the results obtained from a regression including bilateral time trends (cf. Tables A3 and A4 in the Appendix A). As expected, the results including pair-specific time trends turn out to be smaller than our baseline estimates. Our sectoral estimates also become less statistically significant; cf. also findings by Mayer et al. (2019) at the aggregate level. As in our baseline, Financial Services and Computer & Information Services benefit tremendously from a Single Market membership. Postal and Courier now has a strong effect regarding the Single Market, the Euro, and the Schengen Agreement. We find that in this conservative specification, only services sectors gain from the Schengen Agreement. And, we find no individually significant sectoral effects of the EU-Korea PTA. The dispersion parameters also become smaller as we include the pair-specific time trends. The largest trade elasticities obtain in Recorded Media Reproduction, and, as in our baseline, in Pharmaceuticals, Electronics & Optical Products, and Machinery & Equipment. We interpret these gravity estimates as lower bounds.

3.4 Calibration

To calibrate the dispersion parameters, we use the estimated θ^j from the gravity regressions for the manufacturing sectors. Since there are no tariffs on services trade flows, we cannot estimate θ^j for services sectors in a similar fashion. Instead, we rely on an estimate for the aggregate service sector provided by Egger et al. (2012).[16] Besides values for θ^j, we need information on expenditure shares (the matrices $\boldsymbol{\alpha}, \boldsymbol{\beta}, \boldsymbol{\gamma}$), baseline trade shares $\boldsymbol{\pi}$, transfers $\mathbf{T}$ (trade surpluses), and sectoral value added ($\mathbf{VA}$). These data can be directly observed in the WIOD dataset which we also use for estimation purposes. Information on net fiscal transfers of EU member states to the EU stems from the European Commission (Table B5 in the Online Appendix). All these data are from the year 2014.[17] Hence, the baseline of our simulation is the year 2014.

4 Counterfactual Analysis

4.1 Scenarios

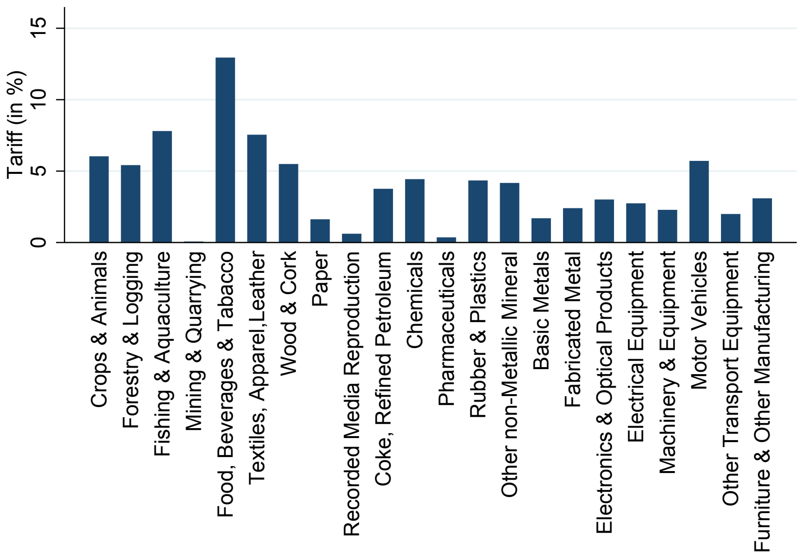
We look at seven different counterfactual scenarios: (1) collapse of the European Customs Union (tariff-free trade replaced by MFN tariffs), (2) dismantling the European Single Market, (3) dissolution of the Eurozone, (4) breakup of the Schengen Agreement, (5) undoing all RTAs with third countries, (6) complete collapse of all European integration steps, and (7) complete EU collapse including the termination of fiscal transfers.

All scenarios have in common that they assume an undoing of trade cost savings that are inferred from historical accessions or policy changes in the EU from 1990 to 2014. Figure 3 shows the changes in iceberg trade costs that, according to our estimates in Tables 1 and A2, would result from reintroducing trade barriers. In using these estimates as our trade cost shocks, we equate disintegration effects with the negative of integration effects – an assumption that makes sense in the long-run only; short-run effects could be smaller (e.g., if

[16] Egger et al. (2012) exploit properties of a structural gravity model akin to ours to estimate the difference between the trade elasticity of goods and services, $\beta = \hat{\sigma}_G - \hat{\sigma}_S$. They find $\hat{\beta} = 2.026$. Applying our own estimate of the trade elasticity $-1/\hat{\theta}_G$, we find $1/\hat{\theta}_S = 0.6189$.

[17] The exception is net transfers which we average over 2010-2014 to smooth year-to-year variation.

Figure 2: Averages Sectoral EU MFN-Tariffs



Note: Trade-weighted averages of sectoral bilateral tariffs of the product-level MFN tariffs imposed by the EU in 2014.

divergence of regulatory rules happens only gradually), or bigger (e.g., if firms can mitigate unexpected negative effects over time). Moreover, it is important to bear in mind that the disintegration scenarios occur in a world parametrized to technologies as observed in the year 2014 while the integration effects are measured at older technologies. We consider this as justifiable as technological regress is unlikely, even in the face of higher trade costs. However, unlike in the model, future technological progress might depend on trade costs, most likely negatively. Since we are not accounting for this, we might underestimate the costs of disintegration.

In **Scenario S1**, EU members lose existing tariff preferences (currently zero tariffs) with each other due to a collapse of the EU Customs Union. We assume that they apply most-favored nation tariffs to each other, as currently granted by the EU to third countries under the rules of the WTO.[18] Figure 2 shows the sectoral trade-weighted MFN tariffs granted at the product level by the EU to third countries in 2014, which we use for the simulation exercise.

Scenario S2 undoes the EU Single Market by introducing non-tariff barriers for intra-EU trade flows and trade flows between the EU and EFTA members. The depth of integration provided by the Single Market goes well beyond the tariff reductions of regular trade agreements as it addresses behind-the-border non-tariff trade impediments, e.g., through mutual recognition of market admissions of products, common frameworks for competition policy,

[18]Note that in this case, EU countries would be able to set their own tariffs unrelated to each other, but they would also need to negotiate these individually with the WTO. Hence, we assume MFN tariffs of the EU at the current state in 2014.

regulation, and so on.

Scenario S3 dissolves the European Monetary Union. This affects only countries of the Eurozone and re-establishes transaction costs related to currency exchange between them. See Figure 3 for the expected additional NTBs as predicted by our gravity model. Effects on and through monetary policy are not included in our model.

Scenario S4 re-establishes border controls at all border posts internal to the current Schengen zone. This not only affects the NTBs of Schengen members, but also those of geographically European countries' trade flows that pass through the Schengen area; see Figure 3 for sectoral estimates.

Scenario S5 takes back all RTAs between EU members and third countries covered by our data that were in force in 2014 (these are the RTAs with Korea, Mexico, and Turkey). MFN Tariffs and NTBs are re-introduced between the EU members and these countries.

Scenario S6 simulates a world where the EU with all its trade-related integration agreements and other RTAs no longer exists. Related sectoral trade-cost changes (net of tariffs) of a complete collapse of the EU as calculated from the various integration steps in the gravity equation are depicted in the bottom panel of Figure 3.

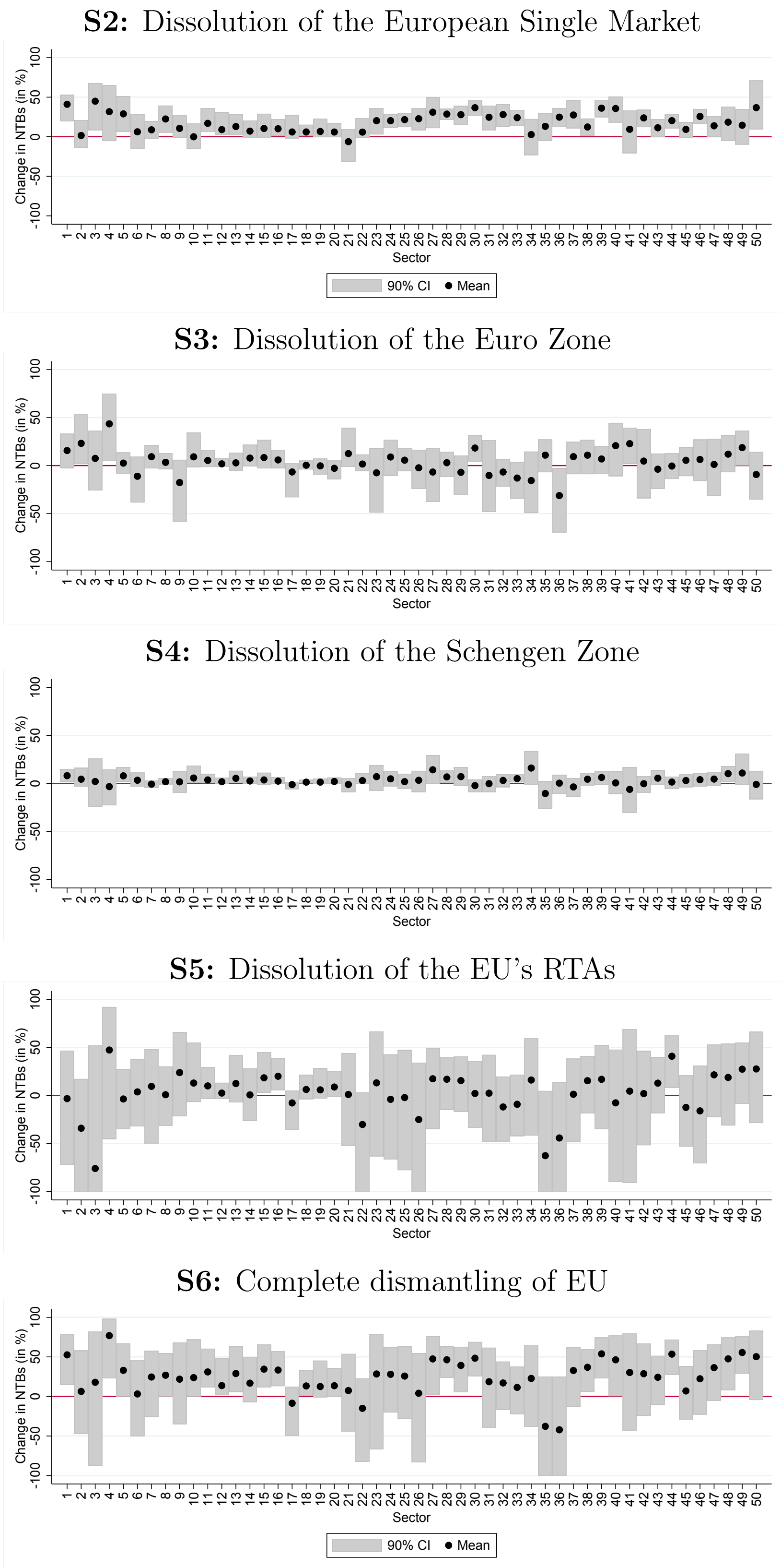
Scenario S7 is equivalent to **S6** but additionally assumes an end to transfer payments from any EU country to another. We account for the stop of transfer payments by subtracting fiscal transfers of EU member states (total expenditures – total own resources, see Table B5 in the Online Appendix)) net of the model-consistent tariff incomes from the EU countries' observed deficits. We are thus in a situation where EU countries no longer receive or pay transfers and instead retain their tariff incomes.

4.2 Simulated Changes in Output and Gross Trade Flows

We start with a brief description of the status quo in order to set the stage for the counterfactual general equilibrium analysis of the shocks described in the preceding section.[19] In 2014, old EU countries exported 6.3 trillion USD corresponding to 20% of their total production value. About half of these exports were directed to fellow old (45%) and new EU countries (6%). Both shares are slightly larger (51% and 8%, respectively) on the importing side, implying that about 60% of imports (which in turn make up 18% of total expenditure in these countries) come from (old and new) EU countries and are thus directly susceptible to cost increases caused by dismantling the integration agreements. Exports to fellow EU countries are relatively more important for new EU members, accounting for 19% (80%) of their total production (exports). A very similar pattern emerges on the expenditure (import) side. In terms of value added (VA), old EU members exported 4.3 trillion USD in 2014, corresponding to 27% of the VA generated in these countries. VA exports to other EU countries make up 12% of old EU countries' total VA. For new EU members, exported VA constitutes a larger share of total VA (38%) and, likewise, a greater share goes to fellow EU countries (22%). Larger gross trade shares with fellow EU countries suggest that new EU members are more susceptible to increasing costs on intra-European trade flows and suffer

[19]Tables A6 and A7 in the Appendix provide details.

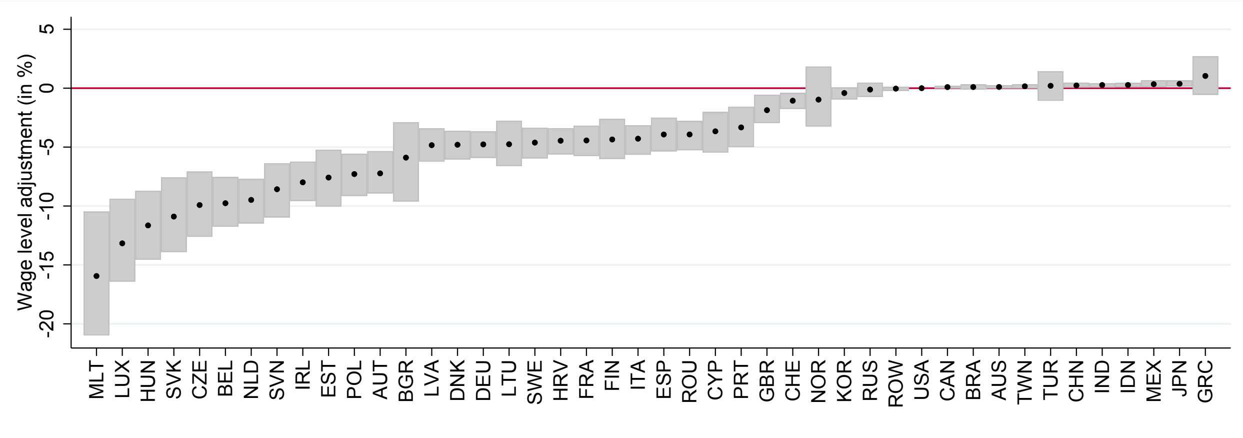
Figure 3: Effects of Disintegration on Trade Costs



Note: Figures show the average increase in trade costs (as valorem tariff equivalents) by sector that would result from undoing the different integration steps. The estimates are based on the gravity estimates of policy measures and trade elasticities reported in Tables 1 and A2. Bootstrapped 90% confidence intervals.

relatively more from a decline in production activity in other EU countries. Moreover, as a larger share of their VA is consumed in other EU countries, they are also more susceptible to negative spillover effects of declining income and consumption in the EU.

Figure 4: Relative Wage Adjustments in Full Collapse Scenario



Note: The figure shows wage changes relative to the U.S. Grey bars indicate bootstrapped 90% confidence intervals.

The production and trade effects of dissolving the major steps of European integration are displayed in Table 2. Since our equilibrium changes are homogenous of degree zero in prices, we normalize all nominal changes using U.S. value added as our numéraire. This implies that the output and export changes discussed below are informative in relative terms, but not in absolute terms.

The first column reports the output change in our seven scenarios. Six patterns become evident, which hold more broadly in our analysis. First, output losses are substantially more important for new EU members than for old ones. Second, the dissolution of the Single Market is quantitatively more important than all the other disintegration steps taken together, even accounting for net transfers. For old EU members, a full disintegration of the EU would result in output losses of 5.2%, the end of the Single Market accounting for 3pp thereof. For new members, the total loss would be 9%, 5.3pp thereof due to the Single Market alone. Third, summing the effects of the separate steps (S1 to S5) yields larger losses (in absolute value) than what would follow from the full dissolution scenario S6. This reflects complementarity of the separate integration steps. For example, the losses due to imposing tariffs are smaller when the Single Market is also dissolved because of tax base effects. Fourth, with few exceptions, the simulated effects are statistically significant at the 1%-level. Hence, parameter uncertainty does not seem to play an overly important role. Fifth, third countries tend to benefit from a collapse of the EU. In S6, non-EU countries would register an output gain of about 0.15%. Sixth, as shown in column two, value added contracts less than output in the EU countries. VA is directly related to domestic welfare, while the value of gross output also contains VA produced in other countries. We show below that the narrowing gap between output and VA evolves due to a shift in the sectoral composition of output towards sectors that use less intermediate goods and due to a reduction in the share of foreign VA in production.

Equilibrium value added changes mirror the change in global demand for a country's output

Table 2: Changes in Aggregate Output, Gross Trade Flows and VAX-Ratios

	Output		**Exports to**					
			old EU		new EU		non-EU	
	gross (in %)	VA/Output (in pp)	gross (in %)	VAX (in pp)	gross (in %)	VAX (in pp)	gross (in %)	VAX (in pp)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
S1 Customs Union (MFN tariffs)								
old EU	-0.86***	0.53***	-7.83***	2.27***	-8.86***	2.96***	0.17	-0.57***
new EU	-1.86***	1.04***	-8.19***	2.17***	-8.91***	3.91***	0.24	-1.22***
non-EU	0.04	-0.01	0.34	-0.27	-0.07	0.15	0.08***	-0.06***
S2 Single Market								
old EU	-2.94***	0.19***	-13.10***	1.29**	-13.98***	1.40*	-0.87***	-0.47***
new EU	-5.32***	0.40**	-13.30***	1.29	-14.13***	2.16*	-1.04*	-1.26***
non-EU	0.11***	-0.06***	-0.13	-0.44**	-1.38*	-0.80***	0.20***	0.05
S3 Euro								
old EU	-0.58	0.06	-1.87	0.24	-0.82**	-0.04	-0.28*	-0.12
new EU	-0.20**	0.00	-0.58**	0.04	-0.34*	0.23*	-0.10	0.00
non-EU	0.01	-0.00	-0.23	0.09	0.19	-0.12	0.03	0.01
S4 Schengen								
old EU	-0.93*	0.05	-4.17***	0.73**	-5.45***	1.05*	-0.81*	0.08
new EU	-1.82**	0.17	-5.20***	0.99	-3.66***	1.25**	-0.93*	-0.21
non-EU	0.02	-0.03*	-0.75*	0.06	-1.08*	-0.14	0.07	0.00
S5 RTAs								
old EU	-0.13**	0.01	0.09	-0.02	0.21**	0.02	-0.69***	0.23***
new EU	-0.17***	0.04***	-0.10*	0.10***	0.02	0.11***	-1.02***	0.41***
non-EU	-0.04**	0.03***	-0.84***	0.18*	-1.59***	0.63***	-0.01	-0.00
S6 All								
old EU	-5.24***	0.77***	-25.22***	3.81***	-26.99***	4.54***	-2.51***	-0.75***
new EU	-9.06***	1.51***	-25.73***	3.90***	-25.55***	6.53***	-2.83***	-2.06***
non-EU	0.15**	-0.08***	-1.62**	-0.31	-4.06***	-0.16	0.33***	0.02
S7 All w Transfers								
old EU	-5.90***	0.71***	-26.08***	3.81***	-31.12***	1.42	-2.21***	-0.64***
new EU	-11.96***	-0.59**	-23.75***	4.13***	-27.20***	3.42**	0.85	-1.66***
non-EU	-0.01	-0.01	-2.73***	-0.38	-9.06***	-3.89***	0.12	0.09**

Note: ***,**,* denote statistical significance at the 1%,5%,10%-level based on 1,000 bootstrap replications. Results on domestic sales and total exports can be found in Table B6 in the Online Appendix. VAX means domestic value added content of exports. New EU members are the 13 mostly Eastern European countries who joined after 2003.

caused by the trade cost hikes. In accordance with the income-equals-expenditure condition (5), the global reduction in demand for a country's exports must be offset by lower imports. This requires a downward adjustment in wages, which brings down expenditure on the import side and restores some of the eroded competitiveness on the export side. Figure 4 displays all countries' wage adjustments relative to the U.S. in the complete EU breakdown scenario (S6). In line with the previous results, new EU members experience the largest downward adjustment in wages. Yet, the smallest and relatively open Benelux countries also face wage declines around 10%.

Next, we turn to adjustments in gross exports, displayed in columns (3), (5) and (7) of Table 2. Exporters are listed in rows. As laid out in the model section, trade flow changes are the consequence of two effects; changes in competitiveness, reflected in trade shares π, and demand effects due to changes in production and income across countries. Changes in competitiveness are driven by trade cost changes, which, thanks to the international IO structure, potentially affect production costs in all sectors and countries. Besides these direct trade cost effects, relative competitiveness losses tend to be dampened by the general equilibrium adjustments in wages described above. Focusing on the complete EU breakdown scenario (S6), direct losses of competitiveness, enhanced by output and demand reductions, culminate in the collapse of trade within Europe (25-31%). As global production shifts to non-EU countries and intra-EU trade preferences are eroded, non-EU countries gain in relative importance both as destinations for exports and sources of imports. Exports to and imports from non-EU countries drop only by a fraction of the decline in intra-EU trade.

Comparing the contributions of the individual integration agreements to the trade effects, we find that the Single Market breakdown (S2) accounts for more than half of the collapse of intra-EU trade, tariffs (S1) and the Schengen agreement (S4) are responsible for about a quarter of the total decline. The reintroduction of intra-EU tariffs would stimulate exports to and imports from non-EU countries as intra-EU trade preferences are eroded. Conversely, the dissolution of the EU's RTAs with outsiders (S5) mitigates the erosion of intra-EU trade preferences. It leads to more intra-EU trade and less trade with outsiders. The dissolution of the Schengen agreement in turn would hurt EU countries' trade with both insiders and the rest of the world, as many shipments have to cross Schengen borders on the way to their final destination, even if this lies outside of Europe. The effect of the Euro is small compared to the other agreements, yet stronger for the group of old EU countries which contains the majority of Euro members. In scenario S7, the termination of fiscal transfers is added to the trade cost effects of dissolving all agreements. We find similar effects to the baseline of the EU breakdown scenario for the old EU members. In contrast, new EU member states, that are predominantly net recipients in the transfer systems, lose close to 3 additional pp in terms of output and between 1.7pp in terms of exports to other new EU members. This differential effect of ending transfers on output and export is due to the fact that the loss of transfers directly reduces real consumption in the new EU countries. The ensuing reduction in expenditure primarily hurts domestic sales which make up the largest chunk of production. In contrast, the trade cost changes make domestic sales relatively more competitive. Moreover, with the loss of transfers, larger downward adjustments in wages are warranted, which is to the benefit of exports to the old EU countries and to the rest of the world.

Given the prevalence of global value chains and the use of (foreign) intermediate goods in production, gross production and trade values are only partly informative about the VA effects of trade cost changes for participating countries. Therefore, we additionally discuss changes in VA exports, focusing on the now well-established concept of the "VAX-ratio", the ratio of VA exports relative to gross exports.[20] VAX-ratios can be seen as indicators for the aggregate importance of trade along the value chain. Table A6 reveals Europe's strong engagement in global value chains. In 2014, both the old and the new EU countries exhibited significantly smaller VAX-ratios of total exports than the rest of the world (68% respective 61% compared to 73%), implying high shares of foreign VA in EU exports. Moreover, the

[20]This concept was introduced by Johnson and Noguera (2012). Aichele and Heiland (2018) show how the measure can be structurally derived within the present model framework.

smaller VAX-ratios also reflect the intensive intra-European production network. Production networks facilitate repeated back-and-forth trade of intermediate goods, inflating gross export values over their VA content. Comparing initial VAX-ratios of the old EU countries' exports across destinations, we find that these are significantly smaller for intra-European trade than for the trade with the rest of the world (57% compared to 80%).

Clearly, VAX-ratios of aggregate bilateral trade depend also on the sectoral composition of trade flows. The dependence on (imported) intermediate inputs varies greatly across sectors, being more important for complex manufacturing goods than for raw materials or services; see Table A7 in the Appendix. Note, however, that also at the sectoral level, VAX-ratios of intra-EU trade are smaller than for extra-EU trade, confirming that back-and-forth trade along the value chain and foreign value added usage is relatively important for intra-EU trade. Changes in the VAX-ratios displayed in Table 2 may thus reflect adjustments in the sectoral composition of exports (production), the foreign VA content, and the intensity of back-and-forth trade. Focusing on the complete breakdown scenario (S6) in Table 2, we find that the VA changes are less spatially concentrated than the changes in gross measures. VA exports decrease by 4 to 7pp less than gross exports for intra-EU trade. Whereas they decrease by 1 to 2pp more for exports to non-EU countries. Intuitively, bilateral VA exports are less dependent on the direct bilateral trade costs between a country pair, as those do not inhibit the VA that travels through different countries. More specifically, while the reintroduction of trade barriers within Europe inhibits direct VA flows, it does not affect VA that is exported first to a non-EU country as an intermediate, processed there and then exported to a (different) EU country. Likewise, the EU countries' gain in relative competitiveness in non-EU countries caused by the downward adjustment in wages does not equally benefit VA that travels through another EU country before reaching consumers in non-EU markets. The fact that double-counting also drives a wedge between VA exports and gross exports adds to this "sluggishness" of VA flows, since more (less) trade means a greater (smaller) degree of inflation of gross values over their total (domestic plus foreign) VA content. Lastly, the trade cost increases for EU countries plus the downward adjustment in wages imply that sourcing intermediates domestically becomes more attractive. Table B6 in the Online Appendix shows that domestic sales decline much less than output and exports and, hence, foreign VA is replaced by domestic VA. As value chains partly unravel, the gap between gross and value added measures narrows.

4.3 Simulated Changes in Sectoral Variables

Changes in the sectoral composition of exports and total production also add to these adjustments at the bilateral level. Table 3 shows that for the EU countries manufacturing exports are hit harder than services and agriculture exports (focusing on the complete breakdown scenario).[21] This is true in spite of the fact that the estimated trade cost changes are smaller in manufacturing. It owes, in parts, to an uneven impact of the general equilibrium changes in relative competitiveness. As labor cost are depressed in the EU, its gain in competitiveness in third markets disproportionately benefits sectors with large cost shares for labor: services and agriculture. Manufacturing does not benefit from the decline in wages to a similar

[21]Table B7 in the Online Appendix presents the results for all scenarios.

Table 3: Changes in Sectoral Trade Flows and VAX-Ratios, Full Collapse (S6)

Exports to:		EU		non-EU		World	
Region	Sector	gross (in%)	VAX (in pp)	gross (in%)	VAX (in pp)	gross (in%)	VAX (in pp)
old EU	Agric.	-17.85***	0.30	0.05	-4.25*	-12.11***	0.48
	Manuf.	-26.70***	4.30***	-4.38***	-0.33	-16.68***	4.32***
	Serv.	-23.67***	2.28	-0.02	-2.32***	-10.31***	0.18
new EU	Agric.	-17.07***	0.04	0.84	-3.80***	-11.31***	-0.23
	Manuf.	-26.30***	4.51**	-5.52***	-1.87**	-20.72***	5.02***
	Serv.	-25.29***	3.84**	0.68	-4.10***	-14.84***	1.73*

Note: ***,**,* denote statistical significance at the 1%,5%,10%-level based on 1,000 bootstrap replications. Results for all scenarios can be found in Table B7 in the Online Appendix.

extent. Since manufacturing relies more on intermediate goods, which are largely sourced from fellow EU countries, it is subjected more to the positive trade cost shock. The growth in exports to non-EU markets is primarily driven by services and agriculture. As regards intra-EU trade, these differences in the production technology across sectors do not play out (on average), since the relevant competitors (namely, EU countries) are hit by structurally similar shocks and experience similar adjustments in labor cost.

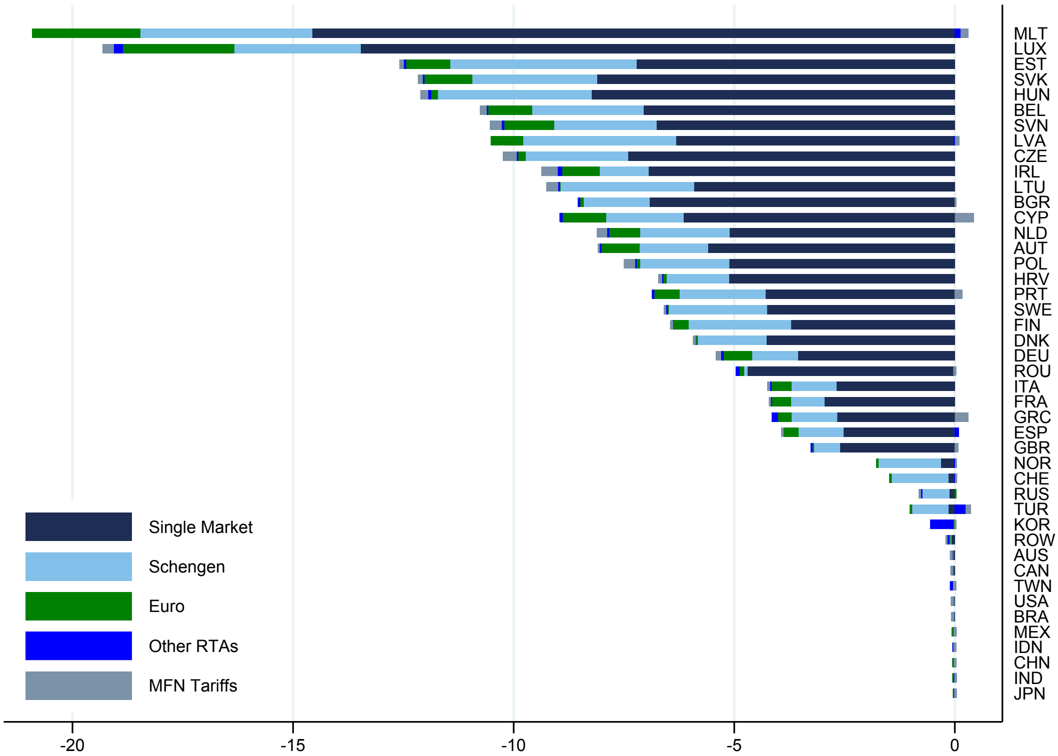
Table 4: Changes in Sectoral Value Added and Shares in Total Value Added

Scenario: Region	Sector	Baseline	Customs Union	Single Market	Euro	Schengen	Other RTAs	All	All w Transfers
			(S1)	(S2)	(S3)	(S4)	(S5)	(S6)	(S7)
		Value added (in bn. USD)	Value added change (in %)						
new EU	Agric.	69	-1.30***	-4.21***	-0.07	-1.34**	-0.13**	-7.01***	-11.69***
	Manuf.	299	-1.92***	-5.08***	-0.16*	-1.79**	-0.17***	-8.80***	-11.39***
	Serv.	1027	-0.45	-4.92***	-0.22**	-1.62**	-0.11**	-7.22***	-12.96***
old EU	Agric.	331	-1.09***	-2.97***	-0.88*	-0.63	-0.17*	-5.52***	-6.49***
	Manuf.	2460	-1.20***	-3.15***	-0.58	-1.02*	-0.14**	-5.87***	-6.50***
	Serv.	13109	-0.15	-2.66***	-0.50	-0.86*	-0.11**	-4.18***	-4.90***
		VA share (in %)	Change in value added share (in pp)						
new EU	Agric.	5.0	-0.02*	0.04*	0.01	0.02*	-0.00	0.03	0.05
	Manuf.	21.4	-0.24***	-0.04	0.01	-0.03	-0.01***	-0.28***	0.27**
	Serv.	73.6	0.27***	-0.00	-0.02*	0.02	0.01***	0.25***	-0.32***
old EU	Agric.	2.1	-0.02***	-0.00	-0.01	0.01	-0.00	-0.02	-0.03
	Manuf.	15.5	-0.13***	-0.06***	-0.01	-0.02*	-0.00	-0.22***	-0.20***
	Serv.	82.4	0.15***	0.07***	0.02	0.02	0.00*	0.24***	0.23***

Note: ***,**,* denote statistical significance at the 1%,5%,10%-level based on 1,000 bootstrap replications.

Table 4 shows sectoral value added growth and changes in the sectors' shares in total value added, confirming that manufacturing in the EU shrinks both in absolute and in relative terms, and disproportionally so in the new EU countries. In the complete breakdown scenario (S6), manufacturing would lose 0.2pp (0.3pp) of its share in total value added in the old (new) EU countries. Columns (S1-S5) show that dismantling the Single Market, the Schengen Agreement or the Customs Union contribute to the relative decline of manufacturing in the EU. A substantial difference occurs with regards to the structural change in the new

Figure 5: Change in Real Consumption in % for Various Scenarios



Note: Figures show the simulated real consumption changes of the various disintegration scenarios as % of the level in the baseline year 2014.

EU countries when transfer payments are terminated (column S7). The loss of transfers materializes as a shock to final consumption expenditure, which disproportionately goes to domestic services. Accordingly, services value added is hit much harder in these countries, undoing the relative (but not the absolute) decline of the manufacturing sector.

4.4 Changes in Real Consumption

Next, we turn to changes in real consumption displayed in Table 5 and Figure 5. Alike the trade effects, real consumption effects differ vastly across countries and integration agreements. Overall, the breakdown of the Single Market accounts for the largest share for member states, followed by the Schengen Agreement and the Eurozone. Generally, it appears that the effect of a complete EU breakdown (S6) is smaller than the sum of the effects of dissolving individual agreements (S1-S5). The reason is that summing over individual effects ignores their dependence on a specific baseline. Since the effect of dissolving an individual agreement is stronger the more integrated the affected countries are in the baseline equilibrium, any given individual disintegration step reduces the negative effect of the subsequent steps of disintegration.

Zooming into the dissolution of the Single Market (S2), we find significant and sizeable negative welfare effects for EU member states. The largest effects on consumption relative to the status quo in the base year 2014 occur in the smallest economies: Malta (-14.6%) and Luxembourg (-13.5%). Most new EU members experience large reductions in real consumption if the EU Single Market is resolved. Our simulations predict large effects for Hungary (-8.2%), Slovakia (-8.1%), Czech Republic (-7.4%), Estonia (-7.2%), Bulgaria (-6.9%), or Slovenia (-6.8%). But long established small EU members, such as Belgium (-7.1%), Ireland (-6.9%), and Austria (-5.6%) also experience similar negative effects. The welfare effects on large EU economies, such as Germany (-3.6%), France (-3.0%), or Italy (-2.7%) are in comparison much smaller. Some third countries would see significant but small negative effects, like the United States (-0.03%). Note that these numbers reflect the effect of a change in a stock variable (trade cost) on a flow variable (real consumption). Hence, the predicted losses (or gains) occur repeatedly in the sense that every year (our period for measuring flow variables) following the breakdown of an integration agreement, annual real consumption is smaller by a given percentage than if the agreement was still in place.

Dissolving the EU Customs Union and replacing tariffs on intra-EU trade flows by MFN tariffs (S1) leads to much smaller effects on consumption compared to the previous scenario.[22] The biggest losses occur in Ireland (-0.4%), the Czech Republic, Luxembourg, Poland, and Slovenia (-0.3% each), while most other EU countries experience negligibly small negative effects relative to the status quo. Non-EU countries tend to gain slightly. Interestingly, a few EU countries (Cyprus, Malta, Portugal, Greece and the UK) experience positive real consumption effects. These are not implausible, given that the re-introduction of (small) tariffs, in contrast to the other steps of dismantling EU integration, has a positive first-order effect on income.

In the scenario where we break up the Eurozone (S3), we find negative effects on all member states. However, only in the case of Luxembourg (-2.53%) and Germany (-0.7%) are the effects statistically significant. Outsiders to the Monetary Union, in particular non-Euro EU countries, tend to lose as well. Countries outside of Europe are hardly affected.

Dismantling the Schengen Agreement affects members to the agreement but also all other geographically European countries negatively. The predicted losses are statistically significant for most countries, ranging between -4.2% in Estonia to -0.6% in Russia. Peripheral and poorer members of the agreement, such as Hungary, Slovakia, the Czech Republic and the Baltic countries lose most from a breakdown of the Schengen Agreement. Small but richer economies (Austria, Belgium, Netherlands, Portugal, Poland, Slovenia, Switzerland and the Nordic countries) also lose a significant share of their real consumption due to their strong dependency on intra-European trade; between -1.4% and -3.1%. At the lower end are large European economies, like Germany, France, Spain, or Italy. Due to its geography, Greece has the smallest loss among Schengen members with -1.0%. Geographically European countries that are outsiders to the agreement, like Turkey (-0.8%), Russia (-0.6%), Cyprus (-1.8%), Ireland (-1.0%) and Croatia (-1.4%), also lose in terms of consumption, as they trade a lot

[22] One reason for why the effects are small is that EU MFN rates are already very low and thus play a minor role compared to low behind-the-border barriers. Note also that the EU's current MFN rates might not be optimal for each and every of its members. In the case of a collapse of the Customs Union, each country could set their own "optimal" tariffs, to be negotiated with the WTO.

Table 5: Changes in Real Consumption in %, Baseline Year 2014

Scenario:	Customs Union	Single Market	Euro	Schengen	Other RTAs	All	All w Transfers
	(S1)	(S2)	(S3)	(S4)	(S5)	(S6)	(S7)
AUS	-0.01	-0.05***	-0.00	-0.02	-0.01	-0.08	-0.04
AUT^o	-0.04	-5.60***	-0.88	-1.55***	-0.02	-7.76***	-7.57***
BEL^o	-0.15	-7.06***	-0.99	-2.53***	-0.04	-10.20***	-10.61***
BGR^n	0.03	-6.92***	-0.08	-1.50	-0.05	-8.30***	-14.54***
BRA	-0.00	-0.03	-0.01	-0.01	-0.00	-0.05	-0.02
CAN	-0.01	-0.04	-0.00	-0.02	-0.01	-0.07	-0.03
CHE	0.02	-0.14	-0.06	-1.29***	0.02	-1.46***	-1.41***
CHN	0.01	-0.02	-0.01	-0.01	0.00	-0.02	-0.01
CYP^n	0.43***	-6.15***	-1.02	-1.76*	-0.00	-8.12***	-9.95***
CZE^n	-0.31**	-7.40***	-0.16	-2.33***	-0.04	-9.86***	-12.88***
DEU^o	-0.12***	-3.55***	-0.65*	-1.04***	-0.05	-5.23***	-5.00***
DNK^o	-0.00	-4.27***	-0.03	-1.56***	-0.04	-5.71***	-5.66***
ESP^o	-0.05	-2.53***	-0.34	-1.02***	0.09	-3.69***	-4.50***
EST^n	-0.10	-7.22***	-1.00	-4.23***	-0.05	-11.79***	-15.52***
FIN^o	-0.00	-3.72***	-0.35	-2.32***	-0.04**	-6.07***	-5.97***
FRA^o	-0.02	-2.96***	-0.44	-0.75***	-0.02	-4.07***	-4.03***
GBR^o	0.08***	-2.61***	-0.04	-0.58	-0.04	-3.12***	-3.29***
GRC^o	0.31***	-2.67***	-0.30	-1.04***	-0.14	-3.72***	-8.27***
HRV^n	-0.08***	-5.12***	-0.10*	-1.41***	-0.01	-6.51***	-7.63***
HUN^n	-0.17	-8.24***	-0.16	-3.48***	-0.07	-11.53***	-19.23***
IDN	0.00	-0.01	-0.00	-0.00	-0.01	-0.02	-0.00
IND	0.01	-0.02	-0.01	-0.01	0.01	-0.01	0.01
IRL^o	-0.37***	-6.94***	-0.86	-1.11**	-0.09***	-8.97***	-9.45***
ITA^o	-0.06***	-2.69***	-0.46	-1.02***	-0.03	-4.09***	-4.28***
JPN	0.01	-0.01	-0.01	0.00	0.00	0.00	0.02
KOR	0.03	-0.02	-0.01	0.00	-0.53***	-0.55***	-0.54***
LTU^n	-0.27***	-5.91***	-0.03	-3.03***	-0.02	-8.82***	-15.51***
LUX^o	-0.25***	-13.47***	-2.53*	-2.86	-0.20	-18.06***	-18.71***
LVA^n	0.10	-6.32***	-0.73	-3.47***	0.00	-9.85***	-14.89***
MEX	0.00	-0.03	-0.01	-0.01	0.01	-0.04	-0.01
MLT^n	0.18***	-14.56***	-2.45	-3.90	0.13	-19.38***	-22.62***
NLD^o	-0.23***	-5.11***	-0.70	-2.03***	-0.06*	-7.70***	-7.75***
NOR	0.04	-0.31**	-0.05	-1.42**	0.01	-1.73***	-1.69**
POL^n	-0.25***	-5.11***	-0.08	-2.03***	-0.03	-7.18***	-12.09***
PRT^o	0.18***	-4.29***	-0.59	-1.95***	-0.01	-6.34***	-9.19***
ROU^n	0.00	-4.70***	-0.10	-0.08	-0.08	-4.94***	-9.44***
ROW	-0.03	-0.10*	-0.02	-0.02	-0.04	-0.16	-0.11
RUS	-0.05***	-0.13	0.04	-0.61***	-0.03***	-0.76***	-0.73***
SVK^n	-0.11	-8.11***	-1.09	-2.83***	-0.03	-11.57***	-14.40***
SVN^n	-0.26	-6.76***	-1.13	-2.32***	-0.06	-9.99***	-13.40***
SWE^o	-0.05***	-4.26***	-0.04	-2.23***	-0.02	-6.29***	-5.89***
TUR	0.12	-0.14*	-0.05*	-0.82***	0.24	-0.74	-0.71
TWN	0.01	-0.04	-0.02	-0.01	-0.00	-0.06	-0.05
USA	-0.00	-0.03***	-0.01	-0.01	-0.00	-0.05***	-0.03

Note: Table shows average effects by country obtained from 1,000 simulations based on bootstrapped parameter estimates. ***,**,* denote statistical significance at the 1%,5%,10%-level according to bootstrapped distribution of simulated effects. ^{o} Old EU member states, ^{n} New EU member states.

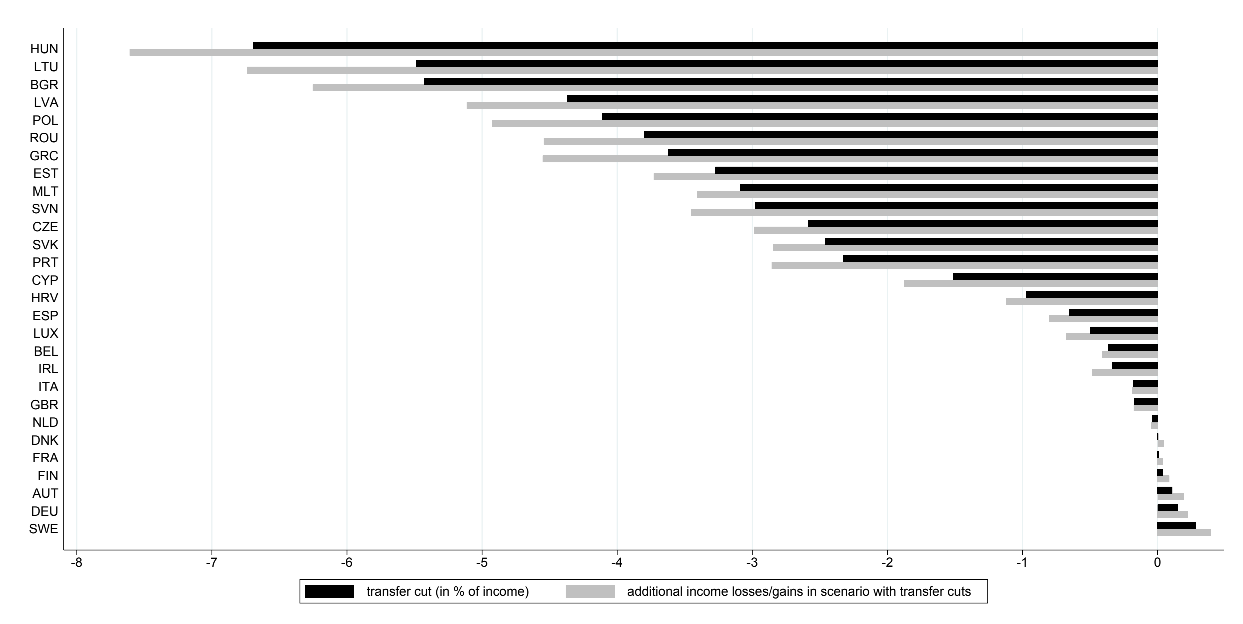
with other European countries and thus benefit from open borders.

Next, we look at a collapse of all RTAs which the EU has signed with third countries (S5).

While Korea (partner to the EU's most comprehensive third-country agreement) experiences a sizeable loss in real consumption (-0.5%) due to the reintroduction of NTBs and MFN tariffs, EU countries experience insignificant or small welfare losses of -0.1% at the maximum (Ireland). We do not find negative effects on the EU's other RTA partners, Turkey and Mexico.

In S6 (complete dissolution of all EU integration steps), we find that all members to the EU experience significant losses in real consumption, but heterogeneity exists across countries depending on their degree of integration and economic structure. Small economies like Malta (-19.4%) and Luxembourg (-18.1%), as well as new EU members (Estonia -11.8%, Slovakia -11.6%, Hungary -11.5%, Slovenia -10.0%, Latvia -9.9%, or the Czech Republic -9.9%) lose most, while established EU economies show a wider spread: Belgium (-10.2%) with the largest and the UK (-3.1%) with the smallest losses in real consumption relative to the status quo in 2014. Among outsiders to the agreements, the EFTA members Switzerland (-1.5%), Norway (-1.7%), and other countries close to the EU such as Russia (-0.8%) as well as U.S. (-0.05%), which is an important trade partner for the EU, are also negatively affected. Consumption in the other countries from the Americas and in Asia would not be affected by a collapse of all the European integration agreements.

Figure 6: Additional Real Consumption Effects of Transfer Cuts



Note: The figure shows transfer cuts by EU member state implemented in S7 and difference in real consumption growth (in pp) between the EU collapse scenarios with and without transfers.

Finally, we include fiscal transfers into the complete EU collapse scenario (S7); see the last column of Table 5. Figure 6 shows the transfers cuts implemented in S7 and the differential effect on real consumption in comparison to S6. Unsurprisingly, net transfer recipients in the baseline lose more in terms of real consumption and the additional losses correlated strongly with the transfer cuts. For countries like Hungary, Lithuania, and Bulgaria, where transfers account for more than 5% of real income, the welfare losses almost double. Net contributors like Germany and Sweden, on the other hand, lose less. However, the benefits that net contributors can reap from ending transfer payments are far from compensating for the losses from a dissolution of the EU agreements. In the case of Germany, for example, these benefits amount to only 0.2pp, compared to a loss 5.2% from the collapse of the EU.

Figure 6 also reveals systematic terms-of-trade adjustments: Net recipients experience real consumption losses that exceed the direct losses from ending transfer payments, implying a worsening of their terms of trade. In order to retain a constant deficit (net of transfers), these countries need to make up for the lost transfer income by means of higher net exports achieved through a decline in the relative wage level. The exact opposite happens for net contributors, who reap (small) terms-of-trade gains in addition to the direct effect of retained transfer payments. Our model thus sides with Keynes in the famous Keynes-Ohlin debate. Higher transfer payments (or, in our case, lower transfer receipts) force adverse terms-of-trade adjustments that add to the welfare loss, just as Keynes predicted would happen to Germany as a consequence of war reparations; see Brakman and Marrewijk (1998).[23]

4.5 Patterns of Heterogeneity in the EU28

Figure 7 shows how important country characteristics correlate with the simulated effects of a complete reversal of all EU integration steps including the end of fiscal transfers (S7). The upper-left diagram examines the role of population as of 1995.[24] The graph shows a very clear positive correlation: smaller countries suffer more from a dissolution of Europe (cf. Felbermayr and Jung, 2018), regardless of whether observations are population weighted or not. The weighted regression features a slope of 2.52, indicating that an increase in population by 1% lowers the absolute size of the loss by 0.03pp ($R^2 = 0.4$). The upper-right diagram looks at the relationship with the initial level of per capita income. Regardless of whether observations are weighted or not, the correlation is statistically significant. When weighted by population, the slope is equal to 3.1 and the adjusted R^2 is 0.54. The lower-left diagram looks at the log of the weighted average distance from other EU members. The correlation is positive but insignificant. The slope of the fitted curve equals 5.3 if observations are weighted. Finally, the lower-right figure studies the relation of losses and openness, defined as the ratio of exports over GDP in percent. The plot shows a strong and negative correlation. The regression slope equals -0.17 and is statistically significant at the 1% level. More open countries clearly suffer more from a collapse of the EU.[25]

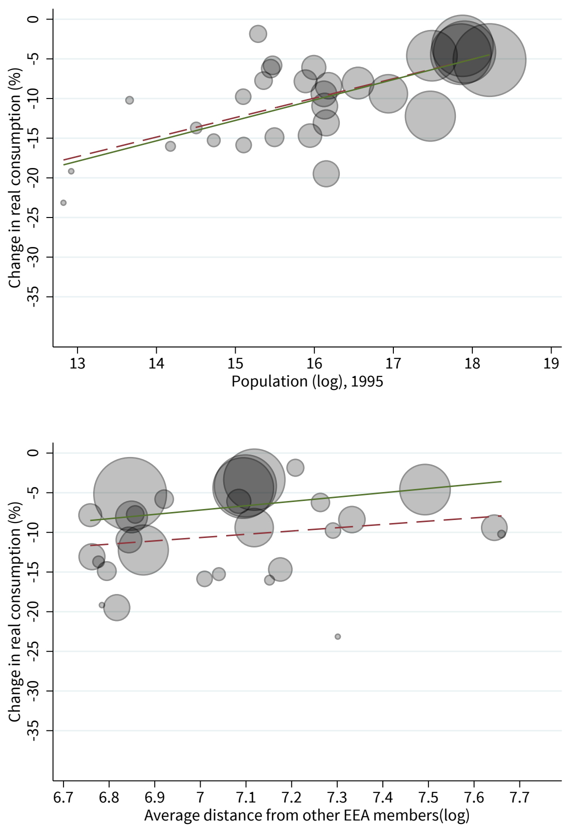
A simple population-weighted regression of percentage losses on all four variables featuring in Figure 7 explains almost 85% of the variation resulting from our simulations. All variables have a statistically significant partial effect on relative losses.

[23] In the presence of trade costs, transfers reduce relative demand for goods produced by transferring countries and increases it for receiving countries.

[24] 1995 is the first year in which data for all EU countries are available.

[25] This is true with regard to multilateral openness (more open countries suffer more when EU disintegration raises their production costs) and openness with other EU countries (a larger share of transactions is burdened by additional costs).

Figure 7: Real Consumption Losses in the EU: The Roles of Size, Initial Income, Remoteness, and Openness



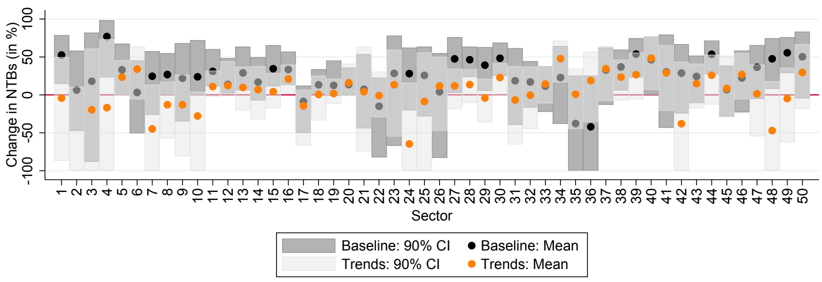
Note: The figure plots correlations between the simulated losses of a complete breakdown of European integration including the end of fiscal transfers (in % of baseline real expenditure) and various characteristics of the EU member states. The size of the population (in logs) as of 1995, income per capita in thousand US dollars (in logs) as of 1995, average distance (in km) to all other EU member states (in logs), and trade openness (exports relative to GDP, in %) in 1995. Size of circles denotes population size. Solid lines represent fitted population-weighted linear regressions; dashed lines represent fits of unweighted regressions. All slopes are statistically different from zero (at least at the 5%-level) except for regressions on log average distance (lower left diagram).

4.6 Brexit

We analyze how costly a complete EU collapse would be after Brexit. To this end, we first simulate a new equilibrium where pre-EU trade barriers between the EU27 and the UK have been reestablished and the UK also leaves the EU trade agreements with third countries. In a second step, we analyze the welfare effects of a complete EU breakdown conditional on Brexit having taken place.[26] Column (1) of Table A8 in the Appendix shows the effect

[26]Our treatment of the UK in the first stage is the same as given to all EU countries in the complete EU breakdown scenario. Arguably, in view of different possible versions of Brexit, our scenario is the hardest possible and should thus be viewed as an upper bound of the possible effects of Brexit on our analysis.

Figure 8: Comparison of Sectoral Changes in NTBs for the Full Collapse scenario (S6), in %



Note: The Figure compares the average increase in trade costs (ad-valorem tariff equivalents) by sector that would result from undoing all steps of the EU integration obtained from our baseline estimation (Table 1 and A2) and obtained from an estimation including bilateral trends (Table A3 and A4.). Bootstrapped 90% confidence intervals.

of Brexit on real consumption by country. We find a sizeable and negative effect for the UK (-2.4%), but also for geographically close and small, open, service-oriented nations of Ireland (-2.7%), Luxembourg (-2.6%) and Malta (-3.9%). The second column shows real consumption effects of a complete EU breakdown conditional on Brexit. For comparison, column (3) provides the corresponding real consumption effects of the scenario pre-Brexit (our main specification), and the fourth column shows the difference between the two. For EU countries, a complete breakdown implies significantly smaller losses conditional on Brexit, albeit the relative importance of Brexit is very heterogeneous. For the UK, Brexit makes up 77% of the total losses of the EU collapse; for Ireland this number stands at 31%. Brexit also accounts for substantial shares of the losses from a EU breakdown for other old EU members (7% on average), but for smaller shares of new EU members' losses (5% on average).

4.7 Other Robustness Checks

4.7.1 Lower Bound Gravity Estimates

We rerun our simulation based on the cost effects and the dispersion parameters obtained from a gravity estimation with country-pair-specific time trends (cf. Tables A3 and A4). This estimation specification takes care of potential selection based on trend growth in bilateral trade or on other bilateral trends, but, at the same time, absorbs some of the trade-generating effect of the agreements. We may thus interpret the cost effects and the resulting model predictions as lower bounds (in absolute terms). Figure 8 shows that the estimated NTB reductions in the full collapse scenario (S6) are indeed smaller on average.

Column (5) of Table A8 presents the welfare effects from the corresponding simulation of scenario (S6), i.e., full disintegration (but unchanged transfers). We find that the welfare effects are about half the size of the baseline prediction (repeated from above in column 3 of the same table). However, the effects remain negative, sizeable and strongly statistically significant.

4.7.2 On the Treatment of Trade Deficits

As discussed in Section 2, we explore alternative approaches to dealing with the exogenous trade imbalances in the counterfactual analysis. Column (6) of Table A8 shows the real consumption effects of (S6) obtained from a model simulation where trade deficits are held constant in nominal terms (as in Caliendo and Parro, 2015). Column (7) presents the counterfactual changes starting from a simulated baseline with balanced trade (as in Ossa, 2014). Comparing column (7) to the results from our baseline specification in column (3), we find very small differences that rarely exceed one tenth of one percentage point. In the non-homogenous case, column (6), in contrast, we find large deviations for some countries; 5.1pp for Luxembourg, and differences above 1pp for the Czech Republic, Hungary, Ireland, and the Netherlands. So, it is indeed important to make sure that the equilibrium is homogeneous of degree one in prices, as argued by Ossa (2014). Regarding the comparison between our main specification (trade deficits constant as share of income, but $\sum_{i=1}^{N} T_i = 0$ not enforced in the counterfactual equilibrium) and the approach chosen by Ossa (2014) (simulated baseline and balanced trade in the baseline and the counterfactual equilibrium), we conclude that, for our analysis, the differences are negligible.

5 Sectoral Heterogeneity and Intersectoral IO Linkages

In this section, we analyze the importance of the detailed sectoral structure of our model and the importance of intersectoral IO linkages. Compared to the aggregate model used by Mayer et al. (2019), which features three sectors (manufacturing, tradable services, and non-tradable services) and no intersectoral IO linkages, our model is able to match differences in the production structure, differences in the intermediate and final goods demand structure, differences in sectoral trade patterns, and differences between the trade cost effects of the EU integration agreements across a large number of sectors.[27]

To provide intuition for the different welfare predictions obtained from more or less complex models, we turn to the real wage decomposition derived by Caliendo and Parro (2015), which reads

$$\ln\left(\frac{\widehat{w}_n}{\Pi_{j=1}^{J}(\hat{p}_n^j)^{\alpha_n^j}}\right) = -\sum_j \alpha_n^j \theta_j \ln \widehat{\pi}_{nn}^j - \sum_j \frac{\alpha_n^j \theta_j (1-\beta_n^j)}{\beta_n^j} \ln \widehat{\pi}_{nn}^j - \sum_j \frac{\alpha_n^j}{\beta_n^j} \ln \prod_{k=1}^{J} \left(\frac{\widehat{p}_n^k}{\widehat{p}_n^j}\right)^{\gamma_n^{k,j}} . \tag{8}$$

This decomposition generalizes the gains-from-trade formula in Arkolakis et al. (2012). It implies that a model with intersectoral linkages yields additional welfare gains (larger or smaller) compared to the nested model with a simple IO structure (only intermediates from the same sector), conditional on changes in domestic expenditure shares. The last term in (8), a geometric weighted average of the changes of intermediate input price indices across

[27]There are several other differences between the model environment of Mayer et al. (2019) and ours. In Mayer et al. (2019), the intermediate input shares do not vary across countries and the trade elasticity is the same for services and manufacturing.

sectors, describes the contribution of intersectoral linkages to the real wage change. In the simple IO model this term is zero.[28] The decomposition also shows why sectoral detail may matter. Conditional on the same average decline in import shares, the real wage decline is larger if the sector-specific import shares decline more in those sectors that account for a large share of final or intermediate goods expenditure, or that feature a large trade elasticity.[29]

To assess the importance of the disaggregated sectoral structure and the intersectoral ("complex") IO linkages, we conduct a step-wise comparison between the results generated by a three-sector model without complex IO linkages (model (a)) with three alternatives: (b) a three-sector model with complex IO linkages; (c) a model with 50 sectors as in our main specification, featuring heterogeneity in expenditure and value added shares ($\boldsymbol{\beta}, \boldsymbol{\alpha}$), trade shares ($\boldsymbol{\pi}$), and in the estimated cost effects and trade elasticities ($\boldsymbol{\delta}, \boldsymbol{\theta}$) within manufacturing and services, but no complex IO linkages; (d) our main model (the same as (c) but with complex IO linkages).[30]

5.1 Real Consumption Changes: Simple vs. Complex Models

Figure 9 compares the welfare effects in scenario S6 predicted by the four models. Countries are ordered along the x-axes by decreasing magnitude of the real consumption effects in our main model (d). Panel (a) shows the real consumption change predicted by model (a), the simplest model with three aggregate sectors and intermediate sourcing only from the same sector. In panel (b), we add complex IO linkages to the three-sector model. We find that the welfare effects are qualitatively and quantitatively different from the three-sector model with simple IO linkages, and the differences are statistically significant for most European countries at the 10% level (at least).[31] In particular, we find that the model with simple IO linkages understates the negative welfare effects. In view of the real wage decomposition in Equation (8), this can be linked to the fact that the simple model does not capture disproportionately large price increases in sectors that are key inputs in important sectors.

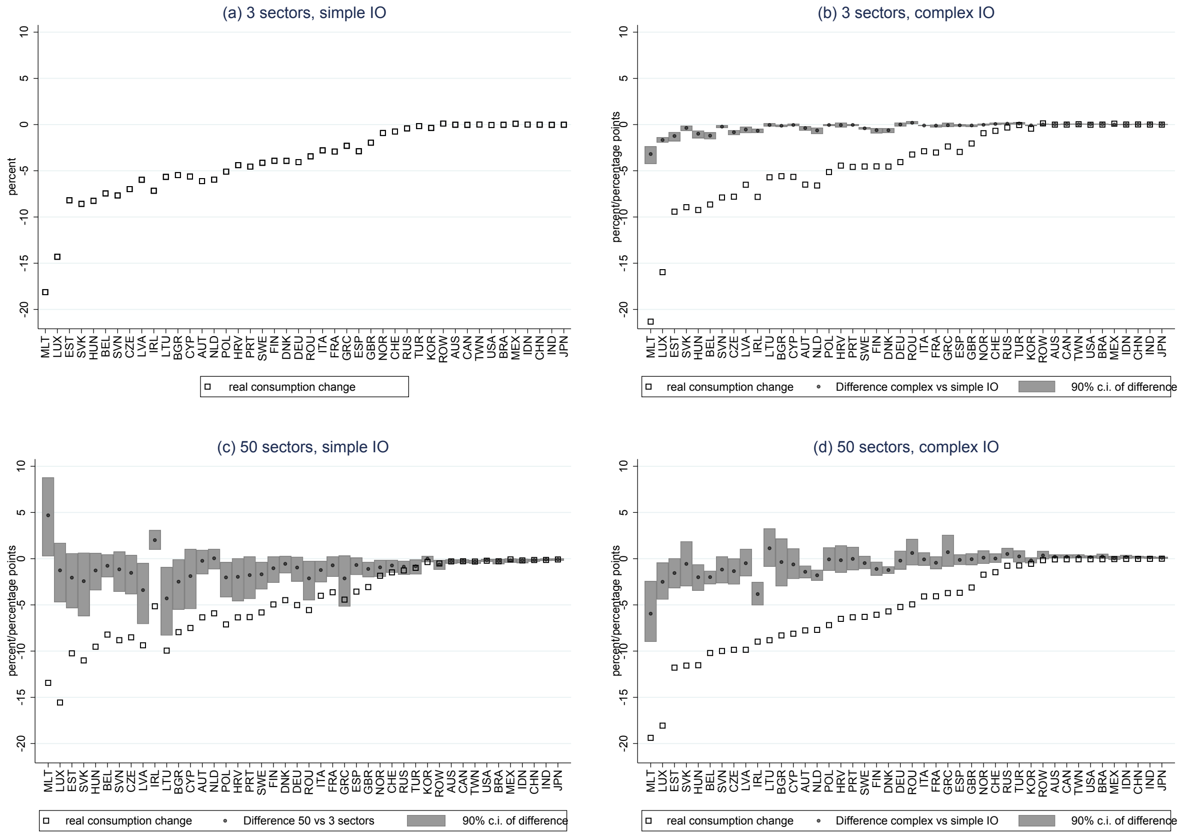
[28] As Caliendo and Parro (2015) point out, this term is generally close to zero if the IO structure is sufficiently similar across sectors.

[29] Due to the presence of transfers and tariff income, real wage changes are not identical to real consumption changes. The decomposition of real wage changes is informative nevertheless since it reveals the key channels via which the welfare effects predicted by the simple model and more complex models differ, including a completely new channel that is only active in models with complex IO linkages.

[30] The two models without complex IO linkages are calibrated to match the same trade shares and sectoral value added data as the full model. We set $\gamma_n^{k,j} = 1$ for $k = j$ and $\gamma_n^{k,j} = 0$ for $k \neq j$ and recalibrate $X_n^j \; \forall \; n, j$ to generate the new baseline equilibrium consistent with the simplified IO structure. For both versions of the three-sector model, we also adjust the baseline for the fact that WIOD actually contains some trade flows in the sectors included in the aggregated non-traded service sector in Mayer et al. (2019). These flows are small in many cases, but rarely exactly zero. We thus start from a simulated baseline where we impose very large trade costs in the aggregate non-traded services sector such that these flows are zero. To calibrate the trade elasticity and trade cost changes in the three-sector model, we use a weighted average of the sectoral estimates from the 50-sector model. As weights, we use sectoral shares in global production. The resulting average coefficients are presented in Table A5. As a robustness check, we present results using the aggregate estimates presented in Table A1 and discussed in Section 3.3.

[31] Our bootstrap methodology permits us to test for statistical significance of the differences in model predictions in view of the uncertainty surrounding our parameter estimates.

Figure 9: Real Consumption Changes: Simple vs. Complex Models



Note: The figure shows the real consumption effects (in %) in the full collapse scenario generated by models (a)-(d). Dots and confidence bounds refer to $\hat{W}^{(b)} - \hat{W}^{(a)}$ in panel (b), to $\hat{W}^{(c)} - \hat{W}^{(a)}$ in panel (c), and to $\hat{W}^{(d)} - \hat{W}^{(c)}$ in panel (d), and differences are measured in pp. Countries are ordered along the x-axis by decreasing magnitude of the real consumption effects in our main model (d).

Panel (c) shows the effect of adding sectoral detail to the simple model in (a). We find that accounting for heterogeneity within the aggregate sectors also tends to increase the negative welfare effects, although not all differences are statistically significant. In view of Equation (8), this indicates that imports decline more in sectors that account for large shares of countries' expenditure and/or feature a large trade elasticity. For a few countries, however, the opposite is true. In particular, the three-sector model overstates the losses for Malta and Ireland (by 5pp and 2pp, respectively). Panel (c) also shows that sectoral detail comes at the cost of greater parameter uncertainty. This is due to the fact that we estimate many more parameters based on the same dataset. It underscores the usefulness of taking parameter uncertainty into account.

Panel (d) shows that adding complex IO linkages leads to larger predicted welfare losses also in the 50-sector model. In terms of magnitude, the average effect of adding complex IO linkages is of about the same size as the effect of adding sectoral heterogeneity. The ranking of countries, however, changes substantially when moving from (c) to (d). Moreover, the differences in (d) turn out larger than in panel (b). This is due to the fact that the two dimensions of model complexity which we analyze here are not independent. By construction, applying average effects to aggregated sectors partly mutes a systematic correlation between the predicted price changes and the economic importance of different sectors (if present).

Detailed welfare effects and pairwise comparisons are presented in Table B10. Column (d)-(a) compares our main model against the simplest one and shows that the differences are statistically significant for all European countries except Malta, and also for a range of third countries. Lastly, Table B10 also presents the predictions based on an alternative calibration of the three-sector model using the elasticities obtained from the aggregate regressions (cf. Table A1) instead of weighted averages of the sectoral estimates. We check whether the predictions obtained with the two different sets of estimates differ.[32] Column (f) in Table B10 presents the corresponding predicted real consumption effects for scenario S6 and column (f)-(a) the difference with respect to the prediction of model (a). The differences are very small; below 0.5pp in most cases and 0.84pp at the maximum.

Table 6: Changes in Sectoral Value Added: Simple IO, Scenario: All (S6)

Region	Sector	Value added change (in %)	Change in value added share (in pp)
new EU	Agric.	-6.31***	0.05***
	Manuf.	**-11.52*****	**-1.04*****
	Serv.	-6.72***	**0.99*****
old EU	Agric.	-4.49***	0.00
	Manuf.	**-7.84*****	**-0.64*****
	Serv.	-3.71***	**0.64*****

Note: ***,**,* denote statistical significance at the 1%,5%,10%-level based on 1,000 bootstrap replications. Bold-faced changes are statistically significantly different at the 1%-level from their counterparts in Table 4.

5.2 Sectoral Adjustment: Simple vs. Complex IO Structure

We also find that the predictions regarding the sectoral composition of production in Europe obtained from the simplified IO model differ qualitatively, quantitatively, and in terms of statistical significance from the predictions of the general model with a complex IO structure. In particular, the simple model predicts a much larger decline in manufacturing, both in absolute and in relative terms. Table 6, column (1), shows that the decline in manufacturing value added in the new and old EU countries is more than 30% or 3pp larger than in the simulation using the complex IO table (see column (S6) in Table 4, upper panel). The difference is statistically significant.[33] Column (2) shows that the result is a loss of 1pp

[32]We did not choose this calibration for the above comparison of the three-sector model with the 50-sector model because we want to focus on the differences in sectoral detail while keeping the trade elasticity as similar as possible. Moreover, using an average over the sectoral estimates allows us to test whether the differences in the model predictions are statistically significant, since we can compute the prediction of both models for each individual draw in our bootstrap exercise.

[33]In Table 6, bold numbers indicate that the values are statistically different from their counterparts in Table 4 at the 10% significance level. As before, stars indicate whether values are statistically different

(0.6pp) in the share of manufacturing value added in total value added in the new (old) EU countries, compared to losses of 0.3pp (0.2pp) in the model with the complex IO table. Intuitively, the simple-IO model forces the manufacturing sector to fully bear the burden of the trade barriers on its own, as demand shocks are transmitted to intermediate manufacturing goods producers upstream, but not to the other sectors. Above, we have discussed that interconnected global value chains help flatten the distribution of value added effects of reestablishing trade barriers in Europe by spreading cost shocks and demand shocks across the globe. In a similar manner, intersectoral production linkages help flatten the distribution of value added growth across sectors; from hard-hit manufacturing exporters to input producers in the service and raw materials sectors.

6 Conclusion

In this paper we carry out a quantitative assessment of the trade and welfare effects of European integration. We use a New Quantitative Trade Model (NQTM) (Ottaviano, 2014) to simulate the general equilibrium effects of reversing various milestones such as the introduction of the Euro, the creation of the Schengen Agreement, the Single Market, the Customs Union, and the conclusion of trade agreements with third parties. The integration of parameter estimation and scenario definition based on sector-level gravity equations allows us to bootstrap confidence intervals for all endogenous variables.

We find that output losses are substantially larger for new EU members than for old ones. The Single Market dominates the trade and welfare effects and is quantitatively more important than all other EU disintegration steps taken together, even accounting for net transfers. For old EU members, a full disintegration of the EU would result in output losses of 5.2%, the end of the Single Market accounting for 3pp thereof. For new EU members, the total loss would be 9%, 5.3pp of which can be attributed to the Single Market alone. Due to complementarity of the separate integration steps, we find that summing the effects of the separate steps (S1 to S5) yields larger losses than what would follow from the full EU dissolution scenario (S6). Generally, third countries tend to benefit from a collapse of the EU; non-EU countries would on average gain about 0.15% in output. In EU countries, value added contracts less than output as trade along the value chain is hampered and foreign inputs are substituted with domestic ones.

To establish lower bounds to the estimated costs of a EU breakup, we add country-pair-specific time trends to our gravity model to absorb trends that may have driven both an increase in trade and the decision to conclude an agreement. Simulations based on this conservative setup imply that the welfare costs of disintegration are still substantial, even if about halved compared to our preferred specification. Qualitatively, our results are robust.

Our analysis shows that accounting for sectoral heterogeneity and intersectoral IO linkages is important for the quantification of the production and consumption effects of the EU disintegration. For example, new (old) EU countries lose 1pp (0.6pp) in the share of manufacturing value added in total value added compared to losses of 0.3pp (0.2pp) in the model

from zero.

with the complex IO structure. We find that simpler model versions with few aggregate sectors or without complex intermediate goods linkages underpredict consumption losses for the majority of European countries (2pp on average for both alternatives). Most important, we show that these differences are statistically significant. Hence, accounting for sectoral detail and intersectoral linkages is crucial for the quantification of the welfare losses from trade disintegration in Europe.

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A Appendix

Table A1: The Impact of EU Integration on Bilateral Imports (2000 - 2014)

Dep. var.:	Bilateral Imports			
	Goods			Services
	(1)	(2)	(3)	(4)
Both Single Market	0.427***	0.381***	0.603***	0.492***
	(0.04)	(0.03)	(0.03)	(0.03)
Both Euro		0.072**		0.158***
		(0.03)		(0.06)
Schengen		0.087***		0.075***
		(0.01)		(0.02)
EU-KOR RTA		0.098		0.329***
		(0.07)		(0.06)
EU PTAs		0.414***		0.552***
		(0.07)		(0.08)
Other RTAs		0.021		-0.058
		(0.05)		(0.07)
Tariffs		-3.645***		
		(0.95)		

Note: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. All models estimated using Poisson Pseudo Maximum Likelihood (PPML) methods. Robust standard errors (in parentheses) allow for clustering at the country-pair level. All regressions include country-pair, importer-year and exporter-year fixed effects. Number of observations: 27,735.

Table A2: Dispersion parameter $1/\theta$

Dep. var.: Bilateral imports

Sector description	Sector	$-1/\theta$	90% c.i.	At constraint
Crops & Animals	1	-0.18	[-1.27; 0.00]	0.80
Forestry & Logging	2	-2.04	[-8.07; 0.00]	0.46
Fishing & Aquaculture	3	-0.58	[-4.18; 0.00]	0.81
Mining & Quarrying	4	-0.62	[-4.22; 0.00]	0.79
Food, Beverages & Tabacco	5	-0.97	[-3.12; 0.00]	0.37
Textiles, Apparel,Leather	6	-0.49	[-2.45; 0.00]	0.59
Wood & Cork	7	-0.13	[-0.96; 0.00]	0.86
Paper	8	-0.84	[-4.01; 0.00]	0.53
Recorded Media Reproduction	9	-1.11	[-5.06; 0.00]	0.54
Coke, Refined Petroleum	10	-4.02	[-9.24; 0.00]	0.22
Chemicals	11	-1.63	[-3.84; 0.00]	0.14
Pharmaceuticals	12	-9.16	[-20.27; -0.49]	0.04
Rubber & Plastics	13	-1.64	[-4.81; 0.00]	0.25
Other non-Metallic Mineral	14	-1.38	[-4.67; 0.00]	0.32
Basic Metals	15	-1.54	[-4.18; 0.00]	0.22
Fabricated Metal	16	-0.88	[-2.78; 0.00]	0.23
Electronics & Optical Products	17	-4.89	[-11.55; 0.00]	0.21
Electrical Equipment	18	-4.41	[-8.73; -0.98]	0.01
Machinery & Equipment	19	-5.08	[-12.03; 0.00]	0.13
Motor Vehicles	20	-3.97	[-7.98; -0.81]	0.01
Other Transport Equipment	21	-2.33	[-7.10; 0.00]	0.34
Furniture & Other Manufacturing	22	-3.88	[-11.55; 0.00]	0.15
Services (23-50)	23-50	-0.62	-	-

Note. Coefficient averages and 90% confidence bounds from 1000 bootstraps of the sectoral gravity equation, estimated under the constraint that $1/\theta_j \geq 0$ with a Poisson Pseudo Maximum Likelihood (PPML) estimator. Last column shows the share of draws were the constraint is binding. We bootstrapped clusters (country pairs) rather than observations to account for correlation of errors within pairs. Estimate for the services sector trade elasticity is triangulated using results in Egger et al. (2012) and Table A1.

Table A3: EU Integration Steps and Bilateral Imports (2000 - 2014): with trends

Dep. var.: Bilateral imports

Sector description	Sector	Single Market	Euro	Schengen	EU-KOR PTA	EU PTAs	Other RTAs
Crops & Animals	1	0.27***	0.04	0.05	-0.37	0.32	0.05
Forestry & Logging	2	-0.17	0.24	0.07	-0.67	0.10	-0.36
Fishing & Aquaculture	3	0.26	-0.26	-0.01	0.06	0.10	-0.02
Mining & Quarrying	4	0.10	-0.15	0.00	0.22	0.09	0.01
Food, Beverages & Tabacco	5	0.23**	-0.05	0.02	0.01	0.32**	0.11
Textiles, Apparel,Leather	6	0.15	0.02	-0.00	0.35	0.39**	0.02
Wood & Cork	7	-0.00	-0.03	-0.00	-0.13	0.06	-0.17
Paper	8	0.13	-0.10	-0.01	-0.03	0.06	-0.10
Recorded Media Reproduction	9	0.03	-0.03	-0.01	0.11	-0.06	-0.28
Coke, Refined Petroleum	10	-0.02	-0.11	0.10	-0.62	0.17	-0.08
Chemicals	11	0.11	-0.01	-0.01	0.10	0.21*	0.03
Pharmaceuticals	12	0.28**	0.01	0.04	-0.03	0.36**	0.04
Rubber & Plastics	13	0.06	-0.03	-0.00	0.12	0.29**	0.02
Other non-Metallic Mineral	14	-0.04	-0.03	-0.00	0.12	0.23	0.06
Basic Metals	15	0.05	0.08	0.01	-0.17	0.25	0.11
Fabricated Metal	16	0.09	0.02	-0.00	0.14	0.17	0.07
Electronics & Optical Products	17	-0.06	0.06	0.01	-0.32**	0.17	0.06
Electrical Equipment	18	0.04	-0.07	-0.03	0.05	0.30*	0.03
Machinery & Equipment	19	0.09	-0.05	0.00	-0.09	0.22	0.04
Motor Vehicles	20	0.18	-0.09	-0.01	0.17	0.76***	0.16
Other Transport Equipment	21	0.15	0.13	0.08	-0.06	0.46	0.03
Furniture & Other Manufacturing	22	0.03	-0.06	-0.06**	0.08	0.14	-0.03
Electricity & Gas	23	0.24	-0.02	0.05	-0.30	0.32	0.40*
Water Supply	24	0.08	-0.00	0.06	-0.71	0.11	-0.13
Sewerage & Waste	25	0.19	0.03	0.05	-0.65	0.41	0.44
Construction	26	0.48**	-0.05	0.08	0.08	0.10	-0.30
Trade & Repair of Motor Vehicles	27	0.04	-0.03	0.05	0.11	0.28	0.07
Wholesale Trade	28	0.09	0.01	0.07*	0.05	0.28	0.04
Retail Trade	29	-0.01	-0.13	0.05*	-0.11	0.21	0.16*
Land Transport	30	0.29	-0.03	0.06	0.19	0.69***	-0.07
Water Transport	31	0.17	0.01	0.04	-0.29	0.60	0.03
Air Transport	32	0.21	0.05	0.05	-0.24	0.33	-0.03
Aux. Transportation Services	33	0.25**	0.06	0.02	-0.05	0.64***	-0.01
Postal and Courier	34	0.94***	0.30*	0.28***	-0.28	0.86***	-0.09
Accomodation and Food	35	0.19	0.07	0.04	-0.10	0.59*	-0.14
Publishing	36	0.55***	-0.10	0.09	-0.41	0.25	0.31
Media Services	37	0.57*	-0.05	0.17**	-0.04	0.33	0.14
Telecommunications	38	0.24*	0.01	0.12*	0.21	0.59**	-0.11
Computer & Information Services	39	0.50***	0.02	0.09*	0.16	0.25	-0.21
Financial Services	40	0.60**	0.42	0.14	0.15	0.03	-0.10
Insurance	41	0.40	0.14	-0.09	0.15	0.32	0.08
Real Estate	42	0.40	-0.25	0.16*	-0.45	-0.10	-0.21
Legal and Accounting	43	0.22	0.13	0.03	0.01	0.21	-0.09
Business Services	44	0.22*	-0.04	0.07	0.03	0.48*	0.26
Research and Development	45	0.32**	0.06	0.14***	-0.35	0.15	0.04
Admin. & Support Services	46	0.46***	0.15	0.12**	-0.30	0.27	0.14
Public & Social Services	47	0.27	0.01	0.12**	-0.23	0.18	-0.09
Education	48	-0.08	0.04	0.05	-0.45	0.64	-0.10
Human Health and Social Work	49	0.18	0.04	0.08	-0.26	0.87*	-0.05
Other Serivces, Households	50	0.18	0.32	0.12	0.05	0.39	0.02

Coefficient averages from 1000 bootstraps of the sectoral gravity equation including bilateral time trends in addition to the fixed importer-time, exporter-time, and pair fixed effects, and estimated under the constraint that $1/\theta_j \geq 0$ with a Poisson Pseudo Maximum Likelihood (PPML) estimator. ***, **, * denote significance at the 1%, 5%, 10% level, respectively, according to the bootstrapped distribution of the coefficients. We bootstrapped clusters (country pairs) rather than observations to account for correlation of errors within pairs.

Table A4: Dispersion parameter $1/\theta$ – with trends

Dep. var.: Bilateral imports

Sector description	Sector	$-1/\theta$	90% c.i.	At constraint
Crops & Animals	1	-0.02	[0.00; 0.00]	0.96
Forestry & Logging	2	-1.25	[-5.07; 0.00]	0.50
Fishing & Aquaculture	3	-0.13	[-1.00; 0.00]	0.90
Mining & Quarrying	4	-3.33	[-13.97; 0.00]	0.52
Food, Beverages & Tabacco	5	-0.15	[-1.04; 0.00]	0.76
Textiles, Apparel,Leather	6	-0.21	[-1.38; 0.00]	0.76
Wood & Cork	7	-0.07	[-0.52; 0.00]	0.88
Paper	8	-0.19	[-1.37; 0.00]	0.78
Recorded Media Reproduction	9	-4.65	[-10.79; 0.00]	0.10
Coke, Refined Petroleum	10	-4.10	[-8.37; 0.00]	0.06
Chemicals	11	-1.80	[-5.00; 0.00]	0.42
Pharmaceuticals	12	-4.77	[-13.80; 0.00]	0.23
Rubber & Plastics	13	-0.97	[-3.73; 0.00]	0.48
Other non-Metallic Mineral	14	-0.42	[-2.03; 0.00]	0.58
Basic Metals	15	-1.96	[-6.59; 0.00]	0.32
Fabricated Metal	16	-0.56	[-2.36; 0.00]	0.48
Electronics & Optical Products	17	-4.10	[-11.73; 0.00]	0.41
Electrical Equipment	18	-1.58	[-6.47; 0.00]	0.50
Machinery & Equipment	19	-3.91	[-10.78; 0.00]	0.31
Motor Vehicles	20	-2.00	[-4.71; 0.00]	0.10
Other Transport Equipment	21	-2.58	[-8.17; 0.00]	0.34
Furniture & Other Manufacturing	22	-2.25	[-6.83; 0.00]	0.20
Services (23-50)	23-50	-0.62	-	-

Note. Coefficient averages and 90% confidence bounds from 1000 bootstraps of the sectoral gravity equation including bilateral time trends in addition to the fixed importer-time, exporter-time, and pair fixed effects, and estimated under the constraint that $1/\theta_j \geq 0$ with a Poisson Pseudo Maximum Likelihood (PPML) estimator. Last column shows the share of draws were the constraint is binding. We bootstrapped clusters (country pairs) rather than observations to account for correlation of errors within pairs. † Estimate for the services sector trade elasticity is triangulated using results in Egger et al. (2012) and Table A1.

Table A5: Aggregate Elasticities: Weighted Averages of Sectoral Estimates

Dep. var.: Bilateral imports

Sector description	Single Market	Euro	Schengen	Other RTA	EU-KOR PTA	$-1/\theta$
Manufacturing	0.29***	0.13*	0.06***	-0.02	0.26**	-2.28***
Services (tradable)	0.47***	0.11	0.04	-0.09	0.25**	-0.62†
Services (non-tradable)	–	–	–	–	–	-0.62†

Coefficient averages and 90% confidence bounds from 1000 bootstraps of the sectoral gravity equation including bilateral time trends in addition to importer-time, exporter-time, and pair fixed effects, and estimated under the constraint that $1/\theta_j \geq 0$ with a Poisson Pseudo Maximum Likelihood (PPML) estimator. Last column shows the share of draws were the constraint is binding. We bootstrapped clusters (country pairs) rather than observations to account for correlation of errors within pairs. † Estimate for the services sector trade elasticity is triangulated using results in Egger et al. (2012) and Table A1.

Table A6: Gross and Value Added Trade in Baseline Year 2014 (in bn. USD)

Region	Output	Domestic Sales	Exports to old EU	new EU	non-EU
old EU	31263	24929	2852	403	3071
new EU	3098	2239	452	141	266
non-EU	126637	111769	2322	255	10788

Region	Value added	Domestic absorption	Value Added Exports to old EU	new EU	non-EU
old EU	15900	11578	1635	222	2464
new EU	1396	871	243	59	222
non-EU	57486	47702	1720	183	7882

Note: Domestic sales (absorption) sums all group members' domestic consumption and does not include sales (VA exports) to other members of the same group. The difference between output (VA) and the sum of domestic sales (absorption) and (VA) exports is due to changes in the inventory stock.

Table A7: Trade Flows and VAX-Ratios in the Baseline Year 2014 (in bn. USD)

Exports to:		EU		non-EU	
Region	Sector	gross (bn. USD)	VAX (in %)	gross (bn. USD)	VAX (in %)
old EU	Agric.	130	68.8	62	118.6
	Manuf.	2154	33.3	1762	49.7
	Serv.	971	108.2	1247	121.6
new EU	Agric.	22	88.9	10	117.8
	Manuf.	414	30.5	152	53.1
	Serv.	156	100.0	103	124.8
non-EU	Agric.	361	110.6	1679	101.4
	Manuf.	1396	42.4	6720	40.1
	Serv.	820	111.1	2389	146.0

Note: Source: WIOD and own calculations.

Table A8: Changes in Real Consumption in %; Brexit and other Robustness

Robustness:	Brexit				Trends	Trade imbalances	
	Brexit	All EU post-Brexit	All EU pre-Brexit (baseline)	Difference post-pre-Brexit	All EU	All EU constant	All EU balanced
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
AUS	0.01	-0.06	-0.08	0.01	-0.07***	-0.06	-0.05
AUT^{o}	-0.16***	-7.61***	-7.76***	0.15	-3.37***	-8.00***	-7.74***
BEL^{o}	-0.77***	-9.51***	-10.20***	0.69***	-5.04***	-10.73***	-10.24***
BGR^{n}	-0.22***	-8.11***	-8.30***	0.20	-4.06**	-8.04***	-8.60***
BRA	0.01	-0.04	-0.05	0.01	-0.05***	-0.07	-0.03
CAN	-0.01	-0.05	-0.07	0.02	-0.06	-0.03	-0.04
CHE	0.01	-1.46***	-1.46***	-0.00	-0.90***	-1.38***	-1.41***
CHN	0.02	-0.02	-0.02	0.00	-0.03	0.09**	-0.01
CYP^{n}	-1.29***	-7.08***	-8.12***	1.04***	-4.88***	-7.89***	-8.44***
CZE^{n}	-0.30***	-9.72***	-9.86***	0.14	-4.68***	-10.92***	-9.78***
DEU^{o}	-0.31***	-4.91***	-5.23***	0.31***	-2.37***	-5.66***	-5.15***
DNK^{o}	-0.50***	-5.23***	-5.71***	0.48***	-2.93***	-6.09***	-5.68***
ESP^{o}	-0.19***	-3.50***	-3.69***	0.19*	-1.71***	-3.69***	-3.75***
EST^{n}	-0.41***	-11.67***	-11.79***	0.12	-5.37***	-11.90***	-11.72***
FIN^{o}	-0.27***	-5.87***	-6.07***	0.20	-3.04***	-6.08***	-6.05***
FRA^{o}	-0.38***	-3.66***	-4.07***	0.41***	-1.88***	-4.02***	-4.12***
GBR^{o}	-2.39***	-0.75	-3.12***	2.37***	-1.96***	-3.09***	-3.18***
GRC^{o}	-0.13	-3.48***	-3.72***	0.23*	-1.72**	-3.94***	-4.04***
HRV^{n}	-0.15*	-6.32***	-6.51***	0.19**	-3.44***	-6.49***	-6.61***
HUN^{n}	-0.30***	-11.42***	-11.53***	0.11	-5.20***	-12.66***	-11.54***
IDN	-0.00	-0.01	-0.02	0.01	-0.04	0.00	-0.01
IND	0.11	-0.01	-0.01	-0.00	-0.01	0.00	0.01
IRL^{o}	-2.74***	-6.40***	-8.97***	2.58***	-5.78***	-11.38***	-8.93***
ITA^{o}	-0.23***	-3.84***	-4.09***	0.25***	-1.84***	-4.19***	-4.06***
JPN	0.03	0.00	0.00	0.00	-0.01	-0.02	0.02
KOR	-0.13	-0.37***	-0.55***	0.18***	-0.03	-0.43**	-0.55***
LTU^{n}	-0.04	-8.71***	-8.82***	0.10	-4.42***	-9.08***	-8.72***
LUX^{o}	-2.57***	-15.68***	-18.06***	2.38***	-13.04***	-22.86***	-17.92***
LVA^{n}	-0.44***	-9.54***	-9.85***	0.32**	-4.43***	-9.73***	-10.00***
MEX	-0.02	-0.04	-0.04	0.00	-0.08	-0.02	-0.02
MLT^{n}	-3.92***	-15.96***	-19.38***	3.43***	-15.53***	-19.01***	-19.50***
NLD^{o}	-0.62***	-7.13***	-7.70***	0.57***	-3.70***	-9.54***	-7.67***
NOR	-0.18*	-1.72***	-1.73***	0.01	-0.99**	-1.72**	-1.66**
POL^{n}	-0.34***	-6.81***	-7.18***	0.37***	-3.39***	-7.47***	-7.23***
PRT^{o}	-0.29***	-6.06***	-6.34***	0.28**	-2.45***	-6.26***	-6.54***
ROU^{n}	-0.15***	-4.69***	-4.94***	0.25***	-2.64***	-4.93***	-5.02***
ROW	-0.23***	-0.08	-0.16	0.08**	-0.17***	-0.28***	-0.14
RUS	-0.06	-0.72***	-0.76***	0.04	-0.36	-0.67**	-0.75***
SVK^{n}	-0.28***	-11.47***	-11.57***	0.09	-4.36***	-12.35***	-11.53***
SVN^{n}	-0.18***	-9.81***	-9.99***	0.18*	-4.08***	-10.69***	-10.10***
SWE^{o}	-0.43***	-5.89***	-6.29***	0.40***	-3.35***	-6.50***	-6.20***
TUR	0.08**	-0.78*	-0.74	-0.05	-0.24	-0.67	-0.73
TWN	0.06	-0.04	-0.06	0.03	-0.05	0.23***	-0.06
USA	0.02	-0.04	-0.05***	0.01	-0.04***	-0.08***	-0.03

Note: Table shows average effects by country obtained from 1000 simulations based on bootstrapped parameter estimates. ***,**,* denote statistical significance at the 1%,5%,10%-level according to the bootstrapped distribution of simulated effects. ^{o} Old EU member states, ^{n} New EU member states. Col. 1: Brexit; Col. 2: full collapse scenario from simulated baseline after Brexit; Col. 3: baseline full collapse scenario (S6); Col. 4: Difference between Cols. 2 and 3; Col. 5: Based on gravity estimations with bilateral time trends; Col 6: trade deficits held constant in nominal terms; Col. 7: scenario starting from simulated baseline with balanced trade.

B Online Appendix

B.1 The Model

B.1.1 Consumption and production

There are N countries indexed by i, n and J sectors indexed by j, k. The representative consumer utility over final goods consumption C_n^j follows Cobb-Douglas preferences, with α_n^j denoting sectoral expenditure shares

$$u(C_n) = \prod_{j=1}^{J} {C_n^j}^{\alpha_n^j}, \tag{9}$$

with $\sum_j \alpha_n^j = 1$. The labor force L_n of a country is mobile across sectors, i.e. $L_n = \sum_{j=1}^{J} L_n^j$, but not between countries.

In each sector j, a continuum of goods ω^j is produced with labor $l_n^j(\omega^j)$ and a composite intermediate input $m_n^{k,j}(\omega^j)$ of each source sector k according to the following production function:

$$q_n^j(\omega^j) = x_n^j(\omega^j)^{-\theta^j} \left[l_n^j(\omega^j)\right]^{\beta_n^j} \left[\prod_{k=1}^{J} m_n^{k,j}(\omega^j)^{\gamma_n^{k,j}}\right]^{(1-\beta_n^j)}, \tag{10}$$

where $\beta_n^j \geq 0$ is the value added share in sector j in country n and $\gamma_n^{k,j}$ denotes the cost share of source sector k in sector j's intermediate costs, with $\sum_{k=1}^{J} \gamma_n^{k,j} = 1$. It implies sectors are interrelated because sector j uses sector k's output as intermediate input, and vice versa. $x_n^j(\omega^j)$ is the inverse efficiency of good ω^j in sector j and country n. θ^j describes the dispersion of efficiencies in a sector j. A higher θ^j implies higher dispersion of productivity across goods ω^j. The dual cost c_n^j of an input bundle depends on a country's wage rate w_n and the price of the composite intermediate goods k country n has to pay

$$c_n^j = \Upsilon_n^j \, {w_n}^{\beta_n^j} \left[\prod_{k=1}^{J} {p_n^k}^{\gamma_n^{k,j}}\right]^{(1-\beta_n^j)}, \tag{11}$$

where Υ_n^j is a constant. Note that sectoral goods ω^j only differ in their efficiency $x_n^j(\omega^j)$. Consequently, we re-label goods with x_n^j.

Let κ_{in}^j denote trade costs of delivering sector j goods from country i to country n. They consist of iceberg trade costs $d_{in}^j \geq 1$ and ad-valorem tariffs $\tau_{in}^j \geq 0$ such that $\kappa_{in}^j = (1 + \tau_{in}^j)d_{in}^j$. Following other gravity applications, we model iceberg trade costs as a function of bilateral distance, RTAs and other observable trade cost proxies as $d_{in}^j = {D_{in}}^{\rho^j} e^{\delta^j \mathbf{Z}_{in}}$, where D_{in} is bilateral distance, and $\mathbf{Z}_{in}$ is a vector collecting trade cost shifters (such as RTAs or other trade policies). Perfect competition and constant returns to scale imply that firms charge unit costs

$$p_{in}^j(x_i^j) = \kappa_{in}^j \left[x_i^j\right]^{\theta^j} c_i^j. \tag{12}$$

We label a particular intermediate good with the vector of efficiencies $x^j = (x_1^j, \ldots, x_N^j)$. Country n searches across all countries for the supplier with the lowest costs. Consequently, the price n pays for good x^j is

$$p_n^j(x^j) = \min_i \left\{ p_{in}^j(x_i^j); i = 1, \dots, N \right\}. \tag{13}$$

Comparative advantage is introduced by assuming that countries differ in their productivity across sectors. The set of goods a country produces follows an exponential cumulative distribution function. The productivity distribution is assumed to be independent across countries, sectors, and goods. The joint density of x^j is

$$\phi^j(x^j) = \left(\prod_{n=1}^{N} \lambda_n^j \right) \exp\left\{ - \sum_{n=1}^{N} \lambda_n^j x_n^j \right\}, \tag{14}$$

where λ_n^j shifts the location of the distribution, and thus, measures absolute advantage. In contrast, $\theta^j > 0$ indexes productivity dispersion, hence, comparative advantage.

The composite intermediate good q_n^j in each sector j is produced with a Dixit-Stiglitz CES technology. Let η^j denote the elasticity of substitution and $r_n^j(x^j)$ the demand for intermediate good x^j. The sum of costs for all intermediate goods x^j are minimized subject to

$$\left[\int r_n^j(x^j)^{\frac{\eta^j - 1}{\eta^j}} \phi^j(x^j) dx^j \right]^{\frac{\eta^j}{\eta^j - 1}} \geq q_n^j. \tag{15}$$

As usual, demand for x^j depends on a variety's price relative to the sectoral price index $p_n^j = \left[\int p_n^j(x^j)^{(1-\eta^j)} \phi^j(x^j) dx^j \right]^{\frac{1}{1-\eta^j}}$:

$$r_n^j(x^j) = \left(\frac{p_n^j(x^j)}{p_n^j} \right)^{-\eta^j} q_n^j. \tag{16}$$

Note that $r_n^j(x^j)$ is the demand for intermediates of n from the respective lowest cost supplier of x^j. The composite intermediate good q_n^j is either used to produce intermediate input of each sector k or to produce the final consumption good.

B.1.2 Exports

Solving for the price distribution and integrating over the sets of goods where each country i is the lowest cost supplier to country n, we get the composite intermediate goods price

$$p_n^j = A^j \left(\sum_{i=1}^{N} \lambda_i^j \left(c_i^j \kappa_{in}^j \right)^{\frac{-1}{\theta^j}} \right)^{-\theta^j}, \tag{17}$$

where $A^j = \Gamma\left[1 + \theta(1 - \eta^j)\right]^{\frac{1}{1-\eta^j}}$ is a constant. Prices are correlated across all sectors (via c_i^j). The correlation strength depends on the IO table coefficients $\gamma_n^{k,j}$.

Similarly, a country n's expenditure share π_{in}^j for source country i's goods in sector j is

$$\pi_{in}^j = \frac{\lambda_i^j \left[c_i^j \kappa_{in}^j \right]^{\frac{-1}{\theta^j}}}{\sum_{i=1}^{N} \lambda_i^j \left[c_i^j \kappa_{in}^j \right]^{\frac{-1}{\theta^j}}}. \tag{18}$$

These shares apply to gross exports, which follow the usual gravity equation.

B.1.3 General equilibrium

Let Y_n^j denote the value of gross production of varieties in sector j. For each county n and sector j, Y_n^j has to equal the value of demand for sectoral varieties from all countries $i = 1, \dots, N$.[34] The goods market clearing condition is given by

$$Y_n^j \quad = \quad \sum_{i=1}^{N} \frac{\pi_{ni}^j}{(1+\tau_{ni}^j)} X_i^j \qquad \text{with} \qquad X_i^j = \sum_{k=1}^{J} \gamma_i^{j,k}(1-\beta_i^k)Y_i^k + \alpha_i^j I_i, \tag{19}$$

where $I_i = w_i L_i + R_i + T_i$ is national income and X_i^j is country i's expenditure on sector j goods. The first term on the right hand side gives demand of sectors k in all countries i for intermediate usage of sector j varieties produced in n, the second term denotes final demand. Tariff rebates are $R_i = \sum_{j=1}^{J} X_i^j \left(1 - \sum_{n=1}^{N} \frac{\pi_{ni}^j}{(1+\tau_{ni}^j)}\right)$.[35]

We close the model with an income-equals-expenditure condition that takes into account trade imbalances for each country n. The value of total imports and domestic demand net of transfers has to equal the value of total exports including domestic sales, which is equivalent to total output Y_n:

$$\sum_{j=1}^{J}\sum_{i=1}^{N} \frac{\pi_{in}^j}{(1+\tau_{in}^j)} X_n^j - T_n = \sum_{j=1}^{J}\sum_{i=1}^{N} \frac{\pi_{ni}^j}{(1+\tau_{ni}^j)} X_i^j = \sum_{j=1}^{J} Y_n^j \equiv Y_n \tag{20}$$

B.1.4 Comparative Statics in General Equilibrium

Two conditions are needed to close the model, a goods market clearing condition for all countries' composite goods from all sectors and an income-equals-expenditure condition for every country. Comparative statics with respect to trade policy changes affecting trade cost κ_{in}^j reveals the adjustment in trade flows, wages, sectoral value added, production, and tariff income, in due consideration of general equilibrium effects running through changes in all countries relative competitiveness and demand spillovers. Trade along the value chain as featured in our model implies that a change in one country pairs' bilateral trade costs affect every producer's effective production cost, albeit to a varying extent. Moreover, trade along the value chain implies that trade creation effects spill over to third countries not only through changes in consumer demand, but also through changes in demand for intermediate goods.

In accordance with Dekle et al. (2008), we denote the relative (global) change in a variable from its initial level z to counterfactual z' by $\hat{z} \equiv z'/z$. Moreover, let $\hat{\kappa}_{in}^j = \frac{1+\tau_{in}^{j'}}{1+\tau_{in}^j} e^{\delta^j (Z_{in}' - Z_{in})}$ denote the change in trade cost due to the dismantling of trade integration agreements. We

[34] Our exposition differs from Caliendo and Parro (2015) in that they use total expenditure on composite goods instead of total production of varieties as endogenous variable. Hence, the value of gross production in Caliendo and Parro (2015) comprises all foreign varieties that are bundled into the composite good without generating value added.

[35] Instead of the goods market clearing condition, one can also use the expenditure equation $X_i^j = \left(\sum_{k=1}^{J} \gamma_i^{j,k}(1-\beta_i^k)(F_i^k X_i^k + S_i^k) + \alpha_i^j I_i\right)$ as in Caliendo and Parro (2015), where S_i^k is the trade surplus.

can solve for counterfactual changes in all variables of interest using the following system of equations:[36]

$$\hat{c}_n^j = \hat{w}_n^{\beta_n^j} \left(\prod_{i=1}^{N} [\hat{p}_n^j]^{\gamma_n^{k,j}} \right)^{1-\beta_n^j}, \tag{21}$$

$$\hat{p}_n^j = \left(\sum_{i=1}^{N} \pi_{in}^j [\hat{\kappa}_{in}^j \hat{c}_i^j]^{-1/\theta^j} \right)^{-\theta^j}, \tag{22}$$

$$\hat{\pi}_{in}^j = \left(\frac{\hat{c}_i^j}{\hat{p}_n^j} \hat{\kappa}_{in}^j \right)^{-1/\theta^j}, \tag{23}$$

$$X_n^{j'} = \sum_{j=1}^{J} \gamma_n^{j,k} (1-\beta_n^k) \left(\sum_{i=1}^{N} \frac{\pi_{ni}^{k'}}{1+\tau_{ni}^{k'}} X_i^{k'} \right) + \alpha_n^j I_n', \tag{24}$$

$$\sum_{j=1}^{J} F_n^{j'} X_n^{j'} - T_n = \sum_{j=1}^{J} \sum_{i=1}^{N} \frac{\pi_{ni}^{j'}}{1+\tau_{ni}^{j'}} X_i^{j'}, \tag{25}$$

$$I_n' = \hat{w}_n w_n L_n + \sum_{j=1}^{J} X_n^{j'} (1 - F_n^{j'}) + T_n' \tag{26}$$

where $F_n^j \equiv \sum_{i=1}^{N} \frac{\pi_j^{in}}{(1+\tau_{in}^j)}$ and $T_n' = t_n'(\hat{w_n} w_n L_n + \sum_{j=1}^{J} X_n^{j'} (1 - F_n^{j'}))$.

The shift in unit costs due to changes in input prices (i.e., wage and intermediate price changes) is laid out in equation (21). Trade cost changes directly affect the sectoral price index p_n^j, while changes in unit costs have an indirect effect (see equation (22)). Trade shares change as a reaction to changes in trade costs, unit costs and prices. The productivity dispersion θ^j indicates the intensity of the reaction. Higher θ^j's imply bigger trade changes. Equation (24) ensures goods market clearing in the new equilibrium and the counterfactual income-equals-expenditure or balanced trade condition is given by equation (25).

To solve the system of equations for multiple sectors, we again relate to Caliendo and Parro (2015), who extend the single-sector solution algorithm proposed by Alvarez and Lucas (2007). We start with an initial guess about a vector of wage changes. Using (21) and (22), it computes changes in prices, trade shares, expenditure levels, evaluates the trade balance condition (25), and updates the change in wages based on deviations in the trade balance.

[36]See also Caliendo and Parro (2015). Solving for counterfactual changes rather than levels strongly reduces the set of parameters and moments that have to be estimated or calibrated. In particular, no information on price levels, iceberg trade costs, or productivity levels is needed.

B.2 Additional Tables

Table B1: List of Sectors

Sector ID	Sectorname	ISIC Rev. 4
1	Crops & Animals	A01
2	Forestry & Logging	A02
3	Fishing & Aquaculture	A03
4	Mining & Quarrying	B
5	Food, Beverages & Tobacco	C10-C12
6	Textiles, Apparel,Leather	C13-C15
7	Wood & Cork	C16
8	Paper	C17
9	Recorded Media Reproduction	C18
10	Coke, Refined Petroleum	C19
11	Chemicals	C20
12	Pharmaceuticals	C21
13	Rubber & Plastics	C22
14	Other non-Metallic Mineral	C23
15	Basic Metals	C24
16	Fabricated Metal	C25
17	Electronics & Optical Products	C26
18	Electrical Equipment	C27
19	Machinery & Equipment	C28,C33
20	Motor Vehicles	C29
21	Other Transport Equipment	C30
22	Furniture & Other Manufacturing	C31_C32
23	Electricity & Gas	D35
24	Water Supply	E36
25	Sewerage & Waste	E37-E39
26	Construction	F
27	Trade & Repair of Motor Vehicles	G45
28	Wholesale Trade	G46
29	Retail Trade	G47
30	Land Transport	H49
31	Water Transport	H50
32	Air Transport	H51
33	Aux. Transportation Services	H52
34	Postal and Courier	H53
35	Accommodation and Food	I
36	Publishing	J58
37	Media Services	J59_J60
38	Telecommunications	J61
39	Computer & Information Services	J62_J63
40	Financial Services	K64
41	Insurance	K65_K66
42	Real Estate	L68
43	Legal and Accounting	M69_M70
44	Business Services	M71,M73-M75
45	Research and Development	M72
46	Admin. & Support Services	N
47	Public & Social Services	O84
48	Education	P85
49	Human Health and Social Work	Q
50	Other Services, Households	R-U

Table B2: Membership Accessions EU, Euro, Schengen 2000 - 2014 (WIOD Country Sample)

EU		Euro		Schengen	
Country	Accession	Country	Accession	Country	Accession
CZE	2004	GRC	2001	DNK	2001
CYP	2004	SVN	2007	FIN	2001
EST	2004	CYP	2007	ISL	2001
HUN	2004	MLT	2008	NOR	2001
LTU	2004	SVK	2009	SWE	2001
LVA	2004	EST	2011	CZE	2007
MLT	2004	LVA	2014	EST	2007
POL	2004			HUN	2007
SVK	2004			LTU	2007
SVN	2004			LVA	2007
BGR	2007			MLT	2007
ROU	2007			POL	2007
HRV	2013			SVK	2007
				SVN	2007
				CHE	2008

Source: European Commission.

Table B3: Comparison of Schengen Borders (WIOD Country Sample, Geographical Europe), 2000 and 2014

Country	Total Number of Borders	# of Schengen Borders 2000	# of Schengen Borders 2014	Share of Schengen to Total Borders 2000	Share of Schengen to to Total Borders 2014
AUT	85	29	67	34.1	78.8
BEL	106	56	88	52.8	83.0
BGR	138	17	68	12.3	49.3
CHE	87	10	69	11.5	79.3
CYP	180	22	56	12.2	31.1
CZE	87	15	69	17.2	79.3
DEU	72	24	54	33.3	75.0
DNK	95	23	77	24.2	81.1
ESP	107	59	89	55.1	83.2
EST	147	18	129	12.2	87.8
FIN	151	18	132	11.9	87.4
FRA	80	32	62	40.0	77.5
GBR	126	49	80	38.9	63.5
GRC	141	23	67	16.3	47.5
HRV	112	18	69	16.1	61.6
HUN	95	19	77	20.0	81.1
IRL	155	51	81	32.9	52.3
ITA	86	36	74	41.9	86.0
LTU	106	16	88	15.1	83.0
LUX	95	47	78	49.5	82.1
LVA	125	16	107	12.8	85.6
MLT	113	36	101	31.9	89.4
NLD	100	51	82	51.0	82.0
NOR	118	23	101	19.5	85.6
POL	88	16	69	18.2	78.4
PRT	136	88	118	64.7	86.8
RUS	118	16	49	13.6	41.5
SVK	92	24	74	26.1	80.4
SVN	98	20	76	20.4	77.6
SWE	114	23	96	20.2	84.2
TUR	155	21	65	13.5	41.9

Note: Schengen borders counted considering the shortest travel and road distance, also considering ferry connections. Total number of borders counts number of potentially treated borders in geographical Europe. Intercontinental borders are considered to be zero.

Table B4: RTAs: 2000 - 2014 (within WIOD Country Sample)

Country codes		year	Treaty
CHE	MEX	2001	EFTA - Mexico
EST	HUN	2001	Pre-EU Accession Treaties
MEX	NOR	2001	EFTA - Mexico
BGR	LTU	2002	Pre-EU Accession Treaties
CHE	HRV	2002	EFTA-Croatia (Pre-EU Accession) until 2012
CHN	IND	2002	Asia Pacific Trade Agreement (APTA) - Accession of China
CHN	KOR	2002	Asia Pacific Trade Agreement (APTA) - Accession of China
EST	BGR	2002	Pre-EU Accession Treaties
HRV	EU	2002	Pre-EU Accession Treaties
HRV	NOR	2002	EFTA-Croatia (Pre-EU Accession) until 2012
BGR	HRV	2003	Pre-EU Accession Treaties
CHN	IDN	2003	ASEAN - China
CZE	HRV	2003	Pre-EU Accession Treaties
HRV	POL	2003	Pre-EU Accession Treaties
HRV	ROU	2003	Pre-EU Accession Treaties
HRV	SVK	2003	Pre-EU Accession Treaties
HRV	TUR	2003	Croatia - Turkey (Pre-EU Accession)
HUN	HRV	2003	Pre-EU Accession Treaties
LVA	BGR	2003	Pre-EU Accession Treaties
AUS	USA	2005	United States - Australia
MEX	JPN	2005	Japan - Mexico
KOR	CHE	2006	EFTA - Korea, Republic of
NOR	KOR	2006	EFTA - Korea, Republic of
IDN	JPN	2008	Japan - Indonesia
CAN	NOR	2009	EFTA - Canada
CHE	CAN	2009	EFTA - Canada
CHE	JPN	2009	Japan - Switzerland
IDN	AUS	2010	ASEAN - Australia
IND	JPN	2011	India - Japan
KOR	EU	2011	EU - Korea, Republic of
KOR	USA	2012	Korea, Republic of - United States
CHE	CHN	2014	Switzerland - China
KOR	AUS	2014	Korea, Republic of - Australia

Table B5: Operating Budgetary Balance, Million Euro, 2010-2014

Country	Transfer
AUT	-1009.5
BEL	-1469.8
BGR	+1260.8
CYP	+29.5
CZE	+2597.0
DEU	-11901.2
DNK	-938.2
ESP	+3048.8
EST	+610.7
FIN	-604.8
FRA	-7169.7
GBR	-6425.8
GRC	+4653.6
HRV	+104.6
HUN	+4216.7
IRL	+435.3
ITA	-4756.4
LTU	+1459.6
LUX	-37.1
LVA	+792.5
MLT	+91.8
NLD	-2759.5
POL	+11477.0
PRT	+3652.3
ROU	+2678.2
SVK	+1281.0
SVN	+542.0
SWE	-1799.1

Source: European Commission.

Table B6: Changes in Domestic Sales, Gross Trade Flows and VAX-ratios

	Domestic Sales		**Total Exports**	
	gross (in %)	VAX (in pp)	gross (in %)	VAX (in pp)
S1 Customs Union (MFN tariffs)				
old EU	-0.06	0.22	-4.01***	1.40***
new EU	-0.39*	0.45	-5.68***	2.01***
non-EU	0.03	0.00	0.12*	-0.09**
S2 Single Market				
old EU	-1.85***	-0.24**	-7.21***	1.39***
new EU	-3.67***	-0.39***	-9.62***	1.91**
non-EU	0.11***	-0.06***	0.11	-0.04
S3 Euro				
old EU	-0.46*	0.02	-1.03	0.14
new EU	-0.12	-0.04	-0.39**	0.09*
non-EU	0.01	-0.01	-0.01	0.03
S4 Schengen				
old EU	-0.51	-0.15**	-2.62***	0.69***
new EU	-1.12*	-0.21***	-3.62***	0.97*
non-EU	0.04	-0.03**	-0.09	0.02
S5 RTAs				
old EU	-0.09*	-0.01	-0.28**	0.05
new EU	-0.09*	0.01	-0.37***	0.11***
non-EU	-0.02	0.03***	-0.18***	0.05***
S6 All				
old EU	-2.94***	-0.14	-14.29***	3.29***
new EU	-5.41***	-0.16	-18.57***	4.55***
non-EU	0.17**	-0.09***	-0.09	-0.01
S7 All w Transfers				
old EU	-3.64***	-0.21	-14.80***	3.33***
new EU	-10.16***	-2.62***	-16.66***	4.87***
non-EU	0.05	-0.01	-0.55***	-0.03

Note: ***,**,* denote statistical significance at the 1%,5%,10%-level based on 1,000 bootstrap replications. VAX means domestic value added content of exports. New EU members are the 13 mostly Eastern European countries who joined after 2003.

Table B7: Changes in Sectoral Trade Flows and VAX-ratios

Exports to:		EU		non-EU		World	
Scenario		gross	VAX	gross	VAX	gross	VAX
Region	Sector	(in%)	(in pp)	(in%)	(in pp)	(in%)	(in pp)
S1 Customs Union (MFN tariffs)							
old EU	Agric.	-6.46***	0.17	0.14	-1.04***	-4.35***	0.44
	Manuf.	-11.31***	2.89***	0.12	-0.81***	-6.17***	2.15***
	Serv.	-0.73***	-2.98***	0.22**	-0.43***	-0.19***	-1.45***
new EU	Agric.	-7.53***	0.27	0.31	-1.38***	-5.00***	0.16
	Manuf.	-11.32***	2.97***	0.12	-1.93***	-8.25***	2.66***
	Serv.	-0.64***	-2.93***	0.42**	-0.81***	-0.21***	-1.89***
S2 Single Market							
old EU	Agric.	-7.99**	0.22	0.51	-2.42**	-5.27**	0.09
	Manuf.	-11.41***	0.96	-1.66***	-0.27	-7.03***	1.42*
	Serv.	-17.88***	4.62***	0.16	-1.13***	-7.69***	1.69***
new EU	Agric.	-7.36**	-0.16	0.64	-1.69**	-4.79**	-0.21
	Manuf.	-11.48***	1.20	-2.39***	-0.89*	-9.04***	1.72
	Serv.	-19.70***	5.68***	0.74**	-2.50***	-11.48***	3.12***
S3 Euro							
old EU	Agric.	-3.25**	0.60	0.18	-1.21**	-2.16**	0.22
	Manuf.	-1.69	0.39	-0.55*	0.04	-1.18	0.33
	Serv.	-1.64	0.07	0.06	-0.37**	-0.68	-0.15
new EU	Agric.	-0.97	0.88**	0.09	-0.06	-0.63	0.59**
	Manuf.	-0.26	-0.02	-0.15	0.04	-0.23*	0.02
	Serv.	-1.13**	0.50	-0.06	-0.05	-0.70**	0.31
S4 Schengen							
old EU	Agric.	-1.33	-0.53	0.00	0.08	-0.91	-0.09
	Manuf.	-4.55***	0.99*	-1.19*	0.14	-3.05***	0.91**
	Serv.	-4.22***	0.49	-0.32	-0.27	-2.02***	0.14
new EU	Agric.	-1.77	-0.83	0.04	-0.48	-1.19	-0.57
	Manuf.	-5.05**	1.04	-1.40	-0.23	-4.07**	1.06
	Serv.	-4.69***	0.80	-0.34	-0.53	-2.94***	0.45
S5 RTAs							
old EU	Agric.	-0.12	0.02	-0.68	0.09	-0.30	-0.02
	Manuf.	0.22*	0.01	-1.14***	0.46***	-0.39**	0.10
	Serv.	-0.13**	0.14***	-0.06	-0.26***	-0.09*	-0.09***
new EU	Agric.	-0.15	0.09	-0.22	-0.21	-0.17	-0.03
	Manuf.	-0.05	0.14***	-1.75***	0.80***	-0.50***	0.15***
	Serv.	-0.14***	0.12***	-0.05	-0.35***	-0.10**	-0.09***
S6 All							
old EU	Agric.	-17.85***	0.30	0.05	-4.25*	-12.11***	0.48
	Manuf.	-26.70***	4.30***	-4.38***	-0.33	-16.68***	4.32***
	Serv.	-23.67***	2.28	-0.02	-2.32***	-10.31***	0.18
new EU	Agric.	-17.07***	0.04	0.84	-3.80***	-11.31***	-0.23
	Manuf.	-26.30***	4.51**	-5.52***	-1.87**	-20.72***	5.02***
	Serv.	-25.29***	3.84**	0.68	-4.10***	-14.84***	1.73*
S7 All w/ Transfers							
old EU	Agric.	-19.01***	0.05	-0.03	-3.89*	-12.94***	0.63
	Manuf.	-28.04***	3.87***	-3.90***	-0.24	-17.20***	4.41***
	Serv.	-24.77***	1.82	0.03	-2.07***	-10.76***	0.17
new EU	Agric.	-18.28***	0.66	1.87	-1.89	-11.80**	1.04
	Manuf.	-24.53***	4.38**	-0.27	-1.41*	-18.02***	5.68***
	Serv.	-25.57***	4.42***	2.36***	-2.69***	-14.33***	2.81***

Note: ***,**,* denote statistical significance at the 1%, 5%, 10%-level based on 1,000 bootstrap replications.

Table B8: Changes in Value Added for EU28, Goods (in %)

Sector Description	Sector ISIC	Sector	Single Market	Customs Union	Euro	Schengen	Other RTAs	All	All w Transfers
Crops & Animals	A01	1	-1.43***	-3.01***	-0.47	-1.02*	-0.11	-5.83***	-7.89***
Forestry & Logging	A02	2	-1.27***	-2.82***	-0.43*	-1.04*	-0.16***	-5.64***	-6.91***
Fishing & Aquaculture	A03	3	-1.27***	-2.71***	-0.45	-0.83	-0.07	-5.16***	-7.50***
Mining & Quarrying	B	4	-0.54	-3.61**	-1.31**	-0.19	-0.26**	-5.76*	-6.57**
Food, Beverages & Tabacco	C10-C12	5	-1.38***	-3.11***	-0.48	-0.99*	-0.10	-5.79***	-7.46***
Textiles, Apparel,Leather	C13-C15	6	-1.08***	-2.59***	-0.26	-0.93*	-0.24***	-5.05***	-6.64***
Wood & Cork	C16	7	-1.50***	-2.74***	-0.45	-0.95*	-0.21***	-5.73***	-6.83***
Paper	C17	8	-0.86***	-2.94***	-0.46*	-0.91*	-0.14	-5.17***	-6.15***
Recorded Media Reproduction	C18	9	-0.31**	-2.78***	-0.46*	-0.89*	-0.11**	-4.45***	-5.55***
Coke, Refined Petroleum	C19	10	-1.37***	-5.07***	-1.82**	-0.49	0.20	-8.14**	-9.14**
Chemicals	C20	11	-3.28***	-5.26***	-1.25**	-1.82**	-0.40***	-11.15***	-11.95***
Pharmaceuticals	C21	12	0.72	-4.07***	-0.49	-1.10*	0.34	-4.68*	-4.75
Rubber & Plastics	C22	13	-2.24***	-3.68***	-0.59	-1.35**	-0.25***	-7.70***	-8.52***
Other non-Metallic Mineral	C23	14	-0.95***	-2.89***	-0.56*	-0.95*	-0.21***	-5.40***	-6.48***
Basic Metals	C24	15	-1.55***	-4.64***	-1.31*	-1.57	-0.36***	-9.01***	-9.49***
Fabricated Metal	C25	16	-0.97***	-2.88***	-0.51	-1.04**	-0.20***	-5.44***	-6.24***
Electronics & Optical Products	C26	17	-1.56***	-2.65*	0.28	-0.30	-0.14**	-4.35**	-4.84**
Electrical Equipment	C27	18	-1.68***	-4.53***	-0.56	-1.58**	-0.16*	-8.19***	-8.51***
Machinery & Equipment	C28,C33	19	-0.70***	-2.79***	-0.48	-1.05**	-0.14**	-5.01***	-5.56***
Motor Vehicles	C29	20	-2.18***	-3.54***	-0.25	-1.57**	-0.24***	-7.48***	-8.18***
Other Transport Equipment	C30	21	-0.37*	-1.93**	-0.68*	-0.64	-0.07	-3.67***	-4.43***
Furniture & Other Manufacturing	C31&C32	22	-0.60***	-2.84***	-0.46	-1.00**	0.07	-4.69***	-5.54***

Note: ***,**,* denote statistical significance at the 1%,5%,10%-level based on 1,000 bootstrap replications. Given changes in value added for EU28 are weighted averages.

Table B9: Changes in Value Added for EU28, Services (in %)

Sector Description	Sector ISIC	Sector	Single Market	Customs Union	Euro	Schengen	Other RTAs	All	All w Transfers
Electricity & Gas	D35	23	-0.46***	-3.10***	-0.51*	-0.99*	-0.12**	-5.04***	-6.41***
Water Supply	E36	24	-0.23	-2.86***	-0.47	-0.97*	-0.11	-4.53***	-5.96***
Sewerage & Waste	E37-E39	25	-0.48***	-3.14***	-0.66*	-0.97*	-0.14**	-5.22***	-6.20***
Construction	F	26	-0.08	-2.91***	-0.48	-0.92*	-0.11**	-4.41***	-5.66***
Trade & Repair of Motor Vehicles	G45	27	-0.30	-2.89***	-0.43	-1.03*	-0.12**	-4.65***	-5.91***
Wholesale Trade	G46	28	-0.51***	-3.03***	-0.51*	-1.06*	-0.13**	-5.08***	-6.17***
Retail Trade	G47	29	-0.13	-2.85***	-0.45	-0.95*	-0.10*	-4.40***	-5.60***
Land Transport	H49	30	-0.42***	-2.91***	-0.53*	-0.96*	-0.13**	-4.82***	-5.93***
Water Transport	H50	31	-0.00	-1.68***	-0.12	-0.40	0.03	-2.16***	-2.49***
Air Transport	H51	32	0.00	-2.74***	-0.29	-0.71	-0.08**	-3.76***	-4.46***
Aux. Transportation Services	H52	33	-0.43***	-2.96***	-0.45	-1.03**	-0.12**	-4.87***	-5.83***
Postal and Courier	H53	34	-0.21	-2.61***	-0.44*	-0.84*	-0.11**	-4.11***	-5.03***
Accomodation and Food	I	35	-0.02	-2.69***	-0.45	-0.88*	-0.08	-4.04***	-5.47***
Publishing	J58	36	-0.18	-2.84***	-0.30	-0.80*	-0.09**	-4.14***	-4.98***
Media Services	J59&J60	37	-0.08	-2.72***	-0.44*	-0.78*	-0.11**	-4.06***	-4.95***
Telecommunications	J61	38	-0.11	-2.79***	-0.44	-0.90*	-0.10*	-4.25***	-5.61***
Computer & Information Services	J62&J63	39	-0.14	-2.30***	-0.39	-0.76*	-0.10**	-3.63***	-4.39***
Financial Services	K64	40	-0.21	-2.38***	-0.34	-0.85*	-0.11**	-3.81***	-4.83***
Insurance	K65&K66	41	-0.10	-2.78***	-0.54*	-0.70	-0.10**	-4.12***	-4.98***
Real Estate	L68	42	-0.07	-2.70***	-0.47	-0.87*	-0.11**	-4.14***	-5.25***
Legal and Accounting	M69&M70	43	-0.34**	-2.75***	-0.58*	-0.87	-0.11**	-4.50***	-5.29***
Business Services	M71,M73-M75	44	-0.35**	-2.88***	-0.45*	-0.88*	-0.15**	-4.59***	-5.46***
Research and Development	M72	45	-0.06	-2.80***	-0.48	-0.89*	-0.10**	-4.27***	-5.04***
Admin. & Support Services	N	46	-0.33**	-2.92***	-0.51	-0.90*	-0.11**	-4.65***	-5.42***
Public & Social Services	O84	47	-0.08	-2.96***	-0.52	-0.96*	-0.11**	-4.53***	-5.81***
Education	P85	48	-0.02	-2.91***	-0.47	-0.95*	-0.10*	-4.37***	-5.60***
Human Health and Social Work	Q	49	-0.04	-2.92***	-0.50	-0.95*	-0.11**	-4.44***	-5.33***
Other Serivces, Households	R-U	50	-0.06	-2.75***	-0.46	-0.88*	-0.11*	-4.18***	-5.28***

Note: ***,**,* denote statistical significance at the 1%,5%,10%-level based on 1,000 bootstrap replications. Given changes in value added for EU28 are weighted averages.

Figure B1: Percentage Change in Real Consumption relative to Status Quo, Various Scenarios

Note: The figure depicts percentage changes in real consumption relative to the baseline year 2014. The dashed lines are the 90% confidence bounds based on 1,000 bootstrap replications.

Table B10: Changes in Real Consumption in S6; Alternative Models

Robustness:	Alternative Models								Aggregate Estimation	
	$\hat{W}$				Difference				$\hat{W}$	Difference†
# sectors	3	3	50	50					3	3
IO structure	simple	complex	simple	complex					complex	complex
	(a)	(b)	(c)	(d)	(b)-(a)	(c)-(a)	(d)-(c)	(d)-(a)	(f)	(f)-(a)
MLT^n	-18.13***	-21.32***	-13.43***	-19.38***	-3.19***	4.70*	-5.95***	-1.25	-22.80***	-1.49
LUX^o	-14.30***	-15.97***	-15.56***	-18.06***	-1.67***	-1.26	-2.50**	-3.76**	-16.85***	-0.88
EST^n	-8.19***	-9.42***	-10.24***	-11.79***	-1.24***	-2.05	-1.55	-3.60***	-9.89***	-0.46
SVK^n	-8.58***	-8.94***	-11.01***	-11.57***	-0.36***	-2.43	-0.56	-2.99***	-9.09***	-0.16
HUN^n	-8.25***	-9.24***	-9.52***	-11.53***	-0.99***	-1.27	-2.00**	-3.28***	-10.04***	-0.80
BEL^o	-7.45***	-8.64***	-8.21***	-10.20***	-1.20***	-0.76	-1.99***	-2.76***	-8.88***	-0.24
SVN^n	-7.66***	-7.88***	-8.82***	-9.99***	-0.22***	-1.15	-1.17	-2.33**	-8.02***	-0.14
CZE^n	-6.98***	-7.81***	-8.51***	-9.86***	-0.83***	-1.53	-1.35	-2.88***	-8.58***	-0.78
LVA^n	-5.97***	-6.51***	-9.37***	-9.85***	-0.54***	-3.40**	-0.49	-3.89***	-7.04***	-0.53
IRL^o	-7.16***	-7.82***	-5.15***	-8.97***	-0.66***	2.01***	-3.83***	-1.82***	-8.26***	-0.44
LTU^n	-5.66***	-5.70***	-9.95***	-8.82***	-0.04	-4.29***	1.13	-3.16***	-6.35***	-0.65
BGR^n	-5.46***	-5.58***	-7.95***	-8.30***	-0.12*	-2.48*	-0.36	-2.84**	-6.41***	-0.82
CYP^n	-5.62***	-5.66***	-7.50***	-8.12***	-0.04	-1.88	-0.62	-2.50**	-6.21***	-0.55
AUT^o	-6.12***	-6.49***	-6.34***	-7.76***	-0.38***	-0.23	-1.41***	-1.64**	-6.70***	-0.21
NLD^o	-5.96***	-6.59***	-5.91***	-7.70***	-0.63***	0.05	-1.79***	-1.74***	-6.73***	-0.14
POL^n	-5.09***	-5.13***	-7.11***	-7.18***	-0.05	-2.02**	-0.07	-2.09***	-5.77***	-0.64
HRV^n	-4.39***	-4.43***	-6.35***	-6.51***	-0.05	-1.96	-0.16	-2.12***	-5.18***	-0.74
PRT^o	-4.54***	-4.58***	-6.32***	-6.34***	-0.04	-1.77	-0.02	-1.79**	-4.78***	-0.20
SWE^o	-4.13***	-4.53***	-5.82***	-6.29***	-0.40***	-1.69**	-0.47	-2.16***	-5.08***	-0.54
FIN^o	-3.92***	-4.52***	-4.95***	-6.07***	-0.60***	-1.03	-1.11***	-2.15***	-4.78***	-0.26
DNK^o	-3.92***	-4.54***	-4.48***	-5.71***	-0.61***	-0.56	-1.23***	-1.78***	-5.09***	-0.56
DEU^o	-4.06***	-4.06***	-5.02***	-5.23***	0.01	-0.96	-0.21	-1.17***	-4.30***	-0.24
ROU^n	-3.43***	-3.24***	-5.56***	-4.94***	0.20**	-2.13**	0.62	-1.51***	-3.94***	-0.71
ITA^o	-2.78***	-2.88***	-4.01***	-4.09***	-0.10***	-1.23**	-0.07	-1.30***	-3.04***	-0.15
FRA^o	-2.91***	-3.02***	-3.63***	-4.07***	-0.11	-0.72	-0.44	-1.16***	-3.18***	-0.16
GRC^o	-2.30***	-2.37***	-4.43***	-3.72***	-0.07	-2.13	0.71	-1.42**	-2.62***	-0.26
ESP^o	-2.88***	-2.96***	-3.56***	-3.69***	-0.08	-0.68	-0.13	-0.81**	-3.07***	-0.11
GBR^o	-1.96***	-2.04***	-3.07***	-3.12***	-0.09	-1.11***	-0.05	-1.16**	-2.38***	-0.34
NOR	-0.91**	-0.93**	-1.84***	-1.73***	-0.02	-0.93**	0.11	-0.82**	-1.06*	-0.13
CHE	-0.75**	-0.68*	-1.48***	-1.46***	0.07	-0.73**	0.02	-0.71***	-0.85	-0.17
RUS	-0.41***	-0.31**	-1.27***	-0.76***	0.10***	-0.86**	0.51*	-0.35*	-0.40*	-0.09
TUR	-0.16	-0.05	-0.98	-0.74	0.12	-0.82**	0.25	-0.57**	-0.17	-0.12
KOR	-0.36***	-0.44***	-0.36*	-0.55***	-0.08**	0.00	-0.19	-0.19	-0.24	0.20
ROW	0.11	0.13	-0.52	-0.16	0.02	-0.63***	0.35	-0.27***	0.05	-0.08
AUS	-0.02	-0.00	-0.29***	-0.08	0.01	-0.28***	0.21***	-0.06***	-0.03	-0.03
CAN	-0.03	0.00	-0.28***	-0.07	0.03	-0.25***	0.21***	-0.04	-0.03	-0.03
TWN	0.01	0.04	-0.30***	-0.06	0.04***	-0.31***	0.24***	-0.07*	0.00	-0.04
USA	-0.04	-0.02	-0.22***	-0.05***	0.02	-0.18***	0.16***	-0.01	-0.03	-0.01
BRA	-0.02	0.00	-0.29	-0.05	0.03	-0.26**	0.23**	-0.03	-0.02	-0.02
MEX	0.09	0.10	-0.08	-0.04	0.01	-0.17	0.04	-0.13**	0.07	-0.03
IDN	0.00	0.01	-0.19	-0.02	0.01	-0.19	0.17	-0.03	-0.02	-0.03
CHN	-0.01	0.02	-0.14**	-0.02	0.03***	-0.13	0.12**	-0.01	-0.01	-0.03
IND	-0.03	0.01	-0.13	-0.01	0.03	-0.11	0.12**	0.01	-0.01	-0.02
JPN	-0.01	-0.00	-0.08	0.00	0.01	-0.07	0.09	0.02	-0.02	-0.02

Note: Table shows average effects by country obtained from 1000 simulations based on bootstrapped parameter estimates. ***,**,* denote statistical significance at the 1%,5%,10%-level according to the bootstrapped distribution of simulated effects. ^{o} Old EU member states, ^{n} New EU member states. Real consumption effects $\hat{W}$ in %, differences in pp. † Significance levels cannot be computed because model (f) and (a) are not based on the same set of estimates.