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Abstract

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JEL Classification: F13, F14, F17

Keywords: structural gravity, European Trade Integration, General Equilibrium, quantitative trade models

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Complex Europe: Quantifying the Cost of Disintegration*

Gabriel Felbermayr[†], Jasmin Gröschl[‡], and Inga Heiland[§]

August 24, 2020

Abstract

We propose novel estimates of the economic consequences of undoing European Integration. Using a quantitative general equilibrium trade model for 43 countries and 50 goods and services sectors, we disentangle and decompose two important layers of complexity: First, European integration is governed by various, partly overlapping arrangements – the customs union, the single market, the common currency union, the Schengen Area, free trade agreements – and fiscal transfers, all of which affect trade costs, terms-of-trade, and gains from trade differently. Second, more than any other geography, decades of integration have led to dense cross-border input-output (IO) networks, which would endogenously readjust. We find disintegration to trigger statistically significant welfare losses of up to 21% of the 2014 baseline, but with a strong degree of heterogeneity across EU insiders. The welfare effects from undoing the Single Market dominate quantitatively, but the losses from dissolving the Schengen area or the Eurozone are substantial for many countries as well. Compared to a model variant without IO-linkages, the more complex model predicts statistically significant smaller losses from disintegration in the manufacturing sector but larger aggregate ones, a lesson that may carry over to other integration agreements.

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1 Introduction

Europe has been a major playground for regional economic integration since World War II. Following the end of communism in the early 1990s, the Union expanded from 12 to 28 members in the course of two decades. 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. 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 knows fiscal transfers between member states.

One objective of this paper is to disentangle and decompose these layers of integration that previous literature mostly ignores. We do so by accounting for sector-level heterogeneity of impacts. Another objective is methodological; relating to the role of rich cross-border input-output linkages in shaping the welfare losses from regional disintegration. 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 causal 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 the 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. Exploiting the estimated variance-covariance structures of the gravity coefficients, we bootstrap standard errors for the outcome variables of the simulation.

In the gravity analysis, we find that membership in the single market has boosted goods trade by about 33%, which corresponds to an average reduction of non-tariff trade costs of about 8 percentage points (pp), given the estimated trade elasticity. In services trade, the trade creation effects is as high as 70%, corresponding to a 31pp trade cost saving. Membership in the Eurozone yields trade cost savings of about 2pp 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 at one border reduces trade costs by 3pp for goods and by 5pp for services. Across sectors, we detect a large degree of heterogeneity.

In our counterfactual analysis, we find that a complete elimination of all European integration steps would lower trade within the EU by some 40%. Intra-EU production networks would unravel: The domestic value added content in exports would go up by 5 to 9pp 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. A complete breakdown of the EU would generate statistically significant real consumption losses for all EU members. Smaller countries such as Malta, Luxembourg, or Hungary would lose 20%, 19%, and 13% respectively; larger countries such as Germany, France or Italy would lose 5%, 4%, and 4%, respectively. The least exposed EU country is Greece (-3%). Reintroducing tariffs equal to current EU MFN tariffs could have positive (albeit tiny) effects on real consumption in several countries, such as Cyprus or Portugal. Overall, Single Market effects dominate strongly.

Our analysis shows that ignoring heterogeneity in sectoral trade elasticity estimates and cost shocks does not produce qualitatively different effects. However, applying a model with a simplified input-output structure (ignoring intersectoral linkages) yields economically and statistically different predictions than the general model with the complex input-output structure. In particular, the simple model predicts a much bigger decline in manufacturing, in absolute and in relative terms. For example, new (old) EU countries lose 0.9pp (0.6pp) in the share of manufacturing value added in total value added compared to losses of 0.4pp (0.2pp) in the model with the complex IO structures. Ignoring intersectoral input-output relations leads to an underestimation of welfare losses between 1 to 4pp for EU countries. Most important, we show that these differences are statistically significant. Hence, accounting for intersectoral linkages is crucial for the quantification of the welfare losses from trade disintegration in Europe.

We use a model that belongs to a class of tractable frameworks that Ottaviano (2014) has characterized as "New Quantitative Trade Model" (NQTM) and that Costinot and Rodriguez-Clare (2014) have recently reviewed. A major advantage of this framework is that it can be solved in changes, so that the calibration of the level of some unobserved parameters such as non-tariff trade costs is not needed. We go a step further than the toolbox outlined in Costinot and Rodriguez-Clare (2014) and structurally estimate almost all relevant model parameters on the same data that describes our baseline. We build on the NQTM 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). Of particular relevance, this model accounts for the rich network of intra- and international input-output linkages that characterize trade in goods and services in Europe.

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 little literature exists on the trade effects of the Schengen Agreement. It is important to acknowledge a special characteristic of Schengen: unlike bilateral agreements, Schengen has a spatial dimension. Land-borne trade flows within Europe may cross one (e.g., France – Spain) or up to eight internal border (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 a survey of NQTM, 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). Methods very similar to ours have been employed by Caliendo and Parro (2015) on NAFTA and by Dhingra et al. (2017) on Brexit. Mayer et al. (2019) is the paper most closely related to ours. However, we go beyond their work by offering four 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 input-output structure that facilitates matching international input-output linkages at the most detailed level at which data is available; (iv) we make use of bootstrapping methods to quantify parameter uncertainty of our simulation exercise and thus provide confidence intervals for our estimates. We show that accounting for sectoral detail and complex intersectoral input-output relationships is important: Welfare losses are underestimated by up to 4pp without intersectoral input-output linkages. Our bootstrap exercise shows that the differences between predictions obtained by the models with and without these linkages are statistically significant. As a final point of distinction from Mayer et al. (2019), our model features tariff income and income transfers. The latter permits us to include the effect of ending within-EU transfer payments into our scenario.

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 input-output structures for our results.

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 input-output 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 mechanism. 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. 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 aggregate 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

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

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 X_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 the 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 total expenditure $X_i = w_i L_i + R_i + T_i$, 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 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.

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, δ_{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 increases in market n 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) increase 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 will 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 δ^j_{in} will see 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 we use changes in real consumption, obtained as

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

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 effects of a dismantling of the European integration process. Contrary to trade agreements, where effects occur after a phase-in[5], disintegration effects potentially occur immediately.

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^j_{in} that is standard in the gravity literature and adding a time index, we obtain

$$X^j_{in,t} = \exp\left[-\frac{1}{\theta^j}\ln(1+\tau^j_{in,t}) + \frac{\delta^j_{EU}}{\theta^j}EU_{in,t} + \frac{\delta^j_{Euro}}{\theta^j}Euro_{in,t} + \frac{\delta^j_{Schengen}}{\theta^j}Schengen_{in,t} + \frac{\delta^j_{RTA}}{\theta^j}RTA_{in,t} + \nu^j_{in} + \nu^j_{i,t} + \nu^j_{n,t}\right] + \varepsilon^j_{in,t}, \tag{7}$$

where $X^j_{in,t}$ is the value of imports of country i to country n in sector j at time t, $1+\tau^j_{in,t}$ is an ad valorem tariff factor, and $1/\theta^j > 0$ is the sectoral trade elasticity. The terms $\nu^j_{i,t}$ and $\nu^j_{n,t}$ 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 appropriate fixed effects ν^j_{in}. $\varepsilon^j_{in,t}$ is a random disturbance.

We estimate equation (7) by the Poisson Pseudo Maximum Likelihood (PPML) method as recommended by Santos Silva and Tenreyro (2006) and Head and Mayer (2014). 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^j_k for each sector. Our estimation is based on yearly data covering the period

[5] 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).

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.[6] Applied tariffs (preferential and MFN) are taken from the World Integrated Trade Solutions (WITS-TRAINS) and the WTO's Integrated Database (IDB).[7] We use binary variables to capture membership in RTAs, the EU, or the Eurozone and obtain the relevant information from the WTO and the EU Commission.

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 mismeasures 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 in 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).[8] Figure 1 illustrate 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 the EU-Korea RTA, any EU Pre-Accession Preferential Trade Agreements (PTAs) of the Eastern European Countries with the EU, and cluster together any other RTAs that went into force. And 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.

For proper identification we assume that the conditions

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

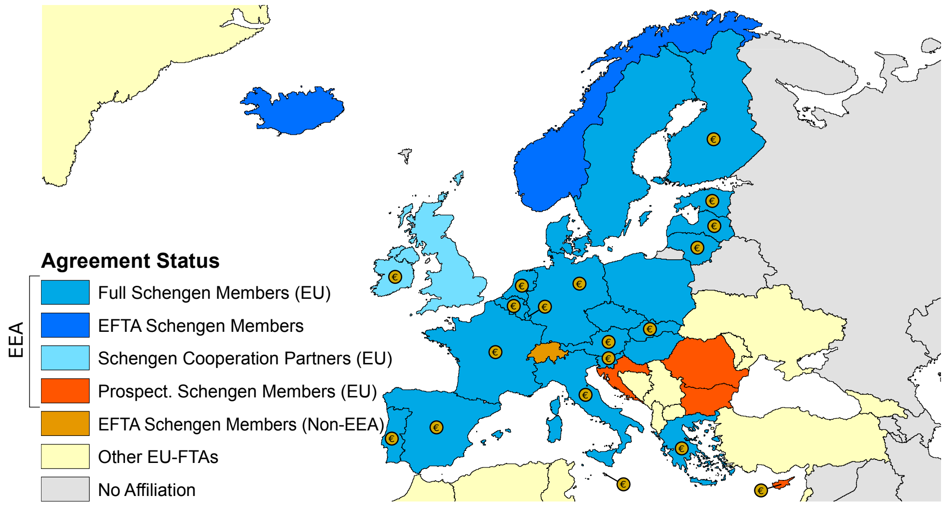
hold, where $\mathbf{POL}_{in,t} = \{EU_{in,t}, Euro_{in,t}, Schengen_{in,t}, RTA_{in,t}\}$. Essentially, we require that trade policies do not correlate with sectoral shocks. The presence of bilateral fixed effects in

[6]The original data has 56 sectors. Aggregation deals with zero output values, mainly in services sectors, which are theoretically inadmissible. For a list of sectors see Table A1 in the Appendix.

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

[8]Table B1 in the Online Appendix provides an overview of accessions to the EU, the Euro, and Schengen; Table B2 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 August 2020.

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). Moreover, even though the selection of country pairs into integration agreements may not be random, joining a plurilateral agreement such as the EU or Schengen is not a pure bilateral decision. Reverse causality may thus not be a major issue. The main concern is that taste shocks might correlate with policy, so that we wrongly attribute variance in the trade flows to trade costs while it stems from preferences. However, the fact that we work with sectoral data but policy variables have no sector variance provides some protection.

3.2 Econometric Results

Here, we discuss results of aggregate goods and services trade. The results reveal a number of important facts (cf. Table A2 in Appendix A). First, a general EU dummy is associated with substantial trade increases of about 53% ($100 \times (\exp(0.427) - 1)$). Controlling for tariffs reduces that effect to 39%. The tariff elasticity is -3.68, a reasonable number that compares well with the literature. The results imply that the average tariff reduction due to EU membership 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. Regression (3) adds our Schengen variable as well as binary variables for Eurozone membership and RTAs. Interestingly, we find a substantial Schengen effect (however, still lower than those found in previous studies). This affects the general EU effect and the tariff elasticity only slightly. The estimates imply that the effect of EU membership on NTBs amounts to about 8pp, which is also comparable to what bottom-up estimates of NTBs tend to find. The other coefficients can be similarly transformed into trade cost effects. For instance, Eurozone membership reduces trade costs by about 2pp. For services trade the regression reveals sensible results of the various integration steps, too. The trade effect of EU membership is equal to 70%; which is much higher than what we find for goods. EU membership seems to make a much larger difference. 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.

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

Dep. var.:	Bilateral Imports							
Sector Description	Sector	EU	Euro	Schengen	EU-KOR RTA	EU PTAs	Other RTAs	Tariff
Crops & Animals	1	0.880***	0.237**	0.164***	0.219	0.546***	0.077	−3.467***
Forestry & Logging	2	−0.080	0.410***	0.166***	−0.131	0.432**	−0.269*	−3.467***
Fishing & Aquaculture	3	0.802***	0.104	0.018	−0.245	0.482**	−0.216	−3.467***
Mining & Quarrying	4	0.069	0.950***	−0.001	2.353***	−0.167	−0.485***	−3.467***
Food, Beverages & Tobacco	5	0.700***	0.066	0.213***	0.034	0.649***	0.069	−3.467***
Textiles, Apparel & Leather	6	0.167	−0.059	0.055	0.077	0.085	0.028	−3.467***
Wood & Cork	7	0.199	0.132**	0.01	0.326**	0.212**	0.012	−3.467***
Paper	8	0.283***	0.032	0.038***	0.192	0.296**	−0.095	−3.467***
Recorded Media Reproduction	9	−0.031	−0.179	0.05	0.706**	0.163	−0.22	−1.202
Coke & Refined Petroleum	10	−0.073	0.197*	0.217***	0.493**	0.004	−0.11	−6.028***
Chemicals	11	0.452***	0.131**	0.106***	0.304***	0.389***	0.023	−3.544***
Pharmaceuticals	12	0.953***	0.015	0.178***	−0.068	0.374**	0.309**	−11.480 ***
Rubber & Plastics	13	0.596***	0.071*	0.154***	0.284***	0.305***	0.282***	−2.270**
Other non-Metallic Mineral	14	0.374***	0.180***	0.069***	0.029	0.242***	0.183**	−1.375*
Basic Metals	15	0.568***	0.154	0.130***	0.280***	0.058	0.277***	−3.206***
Fabricated Metal	16	0.447***	0.122***	0.065***	0.266***	0.170**	0.214***	−1.558***
Electronics & Optical Products	17	0.134	−0.184	−0.028	−0.228*	0.241**	−0.045	−7.772***
Electrical Equipment	18	0.535***	0.058	0.091***	0.326***	0.340***	0.199***	−6.012***
Machinery & Equipment	19	0.270***	0.038	0.064***	0.124*	0.325***	0.047	−7.865***
Motor Vehicles	20	0.529***	−0.089	0.118**	0.293***	0.501***	0.249***	−4.610***
Other Transport Equipment	21	−0.034	0.268**	−0.046	0.291	0.665***	0.014	−2.916
Furniture & Other Manuf.	22	0.009	0.079	0.129***	−0.619***	−0.034	−0.16	−3.713***
Electricity & Gas	23	0.728**	−0.177	0.063	0.004	1.333***	0.394	−1.441***
Water Supply	24	−0.086	0.104	0.113**	0.626***	0.185	−0.543***	−1.441***
Sewerage & Waste	25	0.821***	0.084	0.015	−0.007	1.028***	0.351**	−1.441***
Construction	26	1.139***	−0.002	0.102	0.129	1.468***	0.622***	−1.441***
Trade & Repair of Motor Vehicles	27	0.756***	−0.043	0.519***	0.787***	0.423	−0.074	−1.441***
Wholesale Trade	28	0.783***	0.091	0.215***	0.562***	0.915***	0.175**	−1.441***
Retail Trade	29	0.753***	−0.074	0.198***	0.477**	0.157	0.099	−1.441***
Land Transport	30	0.628***	0.283**	−0.041	0.325*	1.050***	−0.251***	−1.441***
Water Transport	31	0.793***	0.047	−0.017	0.221	1.604***	0.117	−1.441***
Air Transport	32	0.358**	−0.099	0.053	0.054	0.785***	−0.294**	−1.441***
Aux. Transportation Services	33	0.233*	−0.203**	0.077***	0.032	0.716***	−0.351***	−1.441***
Postal and Courier	34	0.629***	−0.357**	0.444***	0.3	1.644***	0.600***	−1.441***
Accommodation and Food	35	−0.252	0.353***	−0.305***	−0.702***	0.125	−0.454***	−1.441***
Publishing	36	0.205	−0.504***	−0.015	−0.199	0.441***	−0.352***	−1.441***
Media Services	37	0.370**	0.238*	−0.086	0.071	0.242	−0.147	−1.441***
Telecommunications	38	0.169	0.266***	0.100**	0.414**	0.621***	−0.142	−1.441***
Computer & Information Services	39	0.845***	0.209**	0.151***	0.692**	1.418***	−0.108	−1.441***
Financial Services	40	0.719***	0.514***	−0.064	0.177	0.557	−0.091	−1.441***
Insurance	41	−0.214	0.500***	−0.144	−0.065	0.436*	−0.252	−1.441***
Real Estate	42	0.415	0.183	−0.01	0.19	0.916**	−0.099	−1.441***
Legal and Accounting	43	0.460***	−0.018	0.142***	0.141	0.801***	0.231*	−1.441***
Business Services	44	1.086***	−0.024	0.06	0.649***	1.530***	0.602***	−1.441***
Research and Development	45	0.148**	0.104	0.034	−0.305**	0.474***	−0.023	−1.441***
Admin. & Support Services	46	0.370***	0.201	0.129***	−0.198	0.815***	−0.142	−1.441***
Public & Social Services	47	0.546***	0.024	0.084**	0.381	0.784**	0.271*	−1.441***
Education	48	0.585***	0.256*	0.290***	0.624*	0.702**	0.017	−1.441***
Human Health and Social Work	49	0.397*	0.307*	0.453***	0.981***	0.606	0.023	−1.441***
Other Services, Households	50	0.888*	−0.226**	−0.094	0.458*	0.982	0.063	−1.441***

Note: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. All models estimated using Poisson Pseudo Maximum Likelihood (PPML) methods. Robust standard errors (not reported) allow for clustering at the country-pair level. Pair as well as year specific importer and exporter fixed effects included but not reported. Number of observations vary between 23,085 and 27,735. Estimates for services sector trade elasticities are triangulated using results in Egger et al. (2012). In eight sectors, sector level trade elasticities did not satisfy theoretical restrictions and were replaced by aggregate ones.

The aggregate results are informative, but for the simulations, we take parameters for 22 goods and 28 services sectors. Table 1 reports the results of applying equation (7) at the sector level. By and large, the estimates are sensible. The largest effects of EU membership are found in Construction, Business Services, and Pharmaceuticals; of the Eurozone on Mining & Quarrying and Financial Services; of the Schengen Agreement on Trade & Repair of Motor Vehicles and Human Health & Social Work; and of the EU-Korea RTA on Mining & Quarrying and Human Health & Social Services. The largest trade elasticities can be sustained in Pharmaceuticals and Machinery & Equipment. These results compare well to the literature (cf. Broda and Weinstein (2006) or Caliendo and Parro (2015)). However, in eight sectors (Crops & Animals, Forestry & Logging, Fishing & Aquaculture, Mining & Quarrying, Food, Beverages & Tobacco, Textiles, Apparel & Leather, Wood & Cork, and Paper) we find theoretically inadmissible estimates. To proceed, we replace them by aggregate elasticities from Table A2 column (3) in the Appendix A.

3.3 Calibration

Since there are no tariffs on services trade flows, we cannot estimate the Frechet parameter θ^j for services sectors with equation (7). The literature has not yet found convincing ways to estimate those. Egger et al. (2012) are one exception, and we rely on their estimates. However, they do not allow for any variation within the services sector.[9] Results in Table 1 show that parameter estimates come with substantial standard errors which vary in relative size across sectors. Some are not statistically significant.[10] We deal with this issue by using the variance-covariance matrix of the sectoral regressions. Assuming joint normality, we draw 1,000 times for each sector and obtain 1,000 sets of parameters which we use to simulate the model 1,000 times.[11] This provides us with a distribution of simulated endogenous variables and gives us the possibility to report confidence intervals and standard errors.[12]

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 $\mathbf{VA}$. This 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 comes from the European Commission (Table B4 in the Online Appendix). All these data are from the year 2014.[13] Hence, the baseline of our simulation is the year 2014.

[9] Egger et al. (2012) exploit properties of a structural gravity model akin to ours to econometrically estimate the difference between the trade elasticity of goods and services, $\beta = \theta_G - \theta_S$. They find $\hat{\beta} = 2.026$. Applying our own estimate $\hat{\theta}_G$, we find $\hat{\theta}_S = 1.442$. We use the t-value from Egger et al. (2012) (equal to 6.4035) to proxy the standard error of θ_S as 0.225.

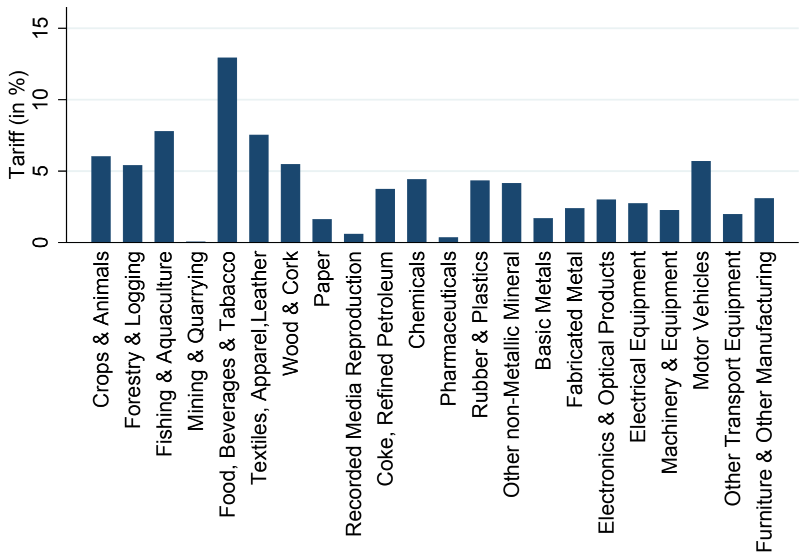
[10] Alternatively, one could simply set insignificant parameters to zero; but this requires an arbitrary choice of a minimum significance level. Or one could use parameter estimates at face value, ignoring their distribution and the fact that uncertainty varies across sectors. Our strategy avoids these problems.

[11] If a draw results in a value that violates the model-imposed parameter constraints, especially the constraint that $\theta > 0$, we draw again. This comes at the cost of a small upward bias of the mean parameter estimate and a downward bias of the standard errors.

[12] For the trade elasticity in the service sectors we draw 1,000 values from a normal distribution with $\mu = 1.442$ and $\sigma = 0.225$ corresponding to Egger et al. (2012)'s structural gravity estimates as explained above.

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

Figure 2: Average EU Tariffs



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

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.[14] 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. While in this scenario, trade policy changes can be directly observed, in other scenarios trade cost shocks have to be estimated.

Scenario S2 undoes the EU Single Market by introducing non-tariff barriers for intra-EU trade flows. 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-

[14]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.

tariff trade impediments, e.g., through mutual recognition of market admissions of products, common frameworks for competition policy, regulation, and so on. The top panel in Figure 3 shows the changes in iceberg trade costs that, according to our estimates in Table 1, would result from undoing the EU Single Market.

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. The expected additional NTBs are calculated from estimated Euro effects in the sectoral gravity equations are presented in Figure 3. 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. For the respective trade costs calculated from the sectoral gravity estimations; see Figure 3.

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, Norway, Switzerland, and Turkey). MFN Tariffs and NTBs are re-introduced between the EU members and these countries. Figure 3 shows the NTB changes and Figure 2 the tariff increases.

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.

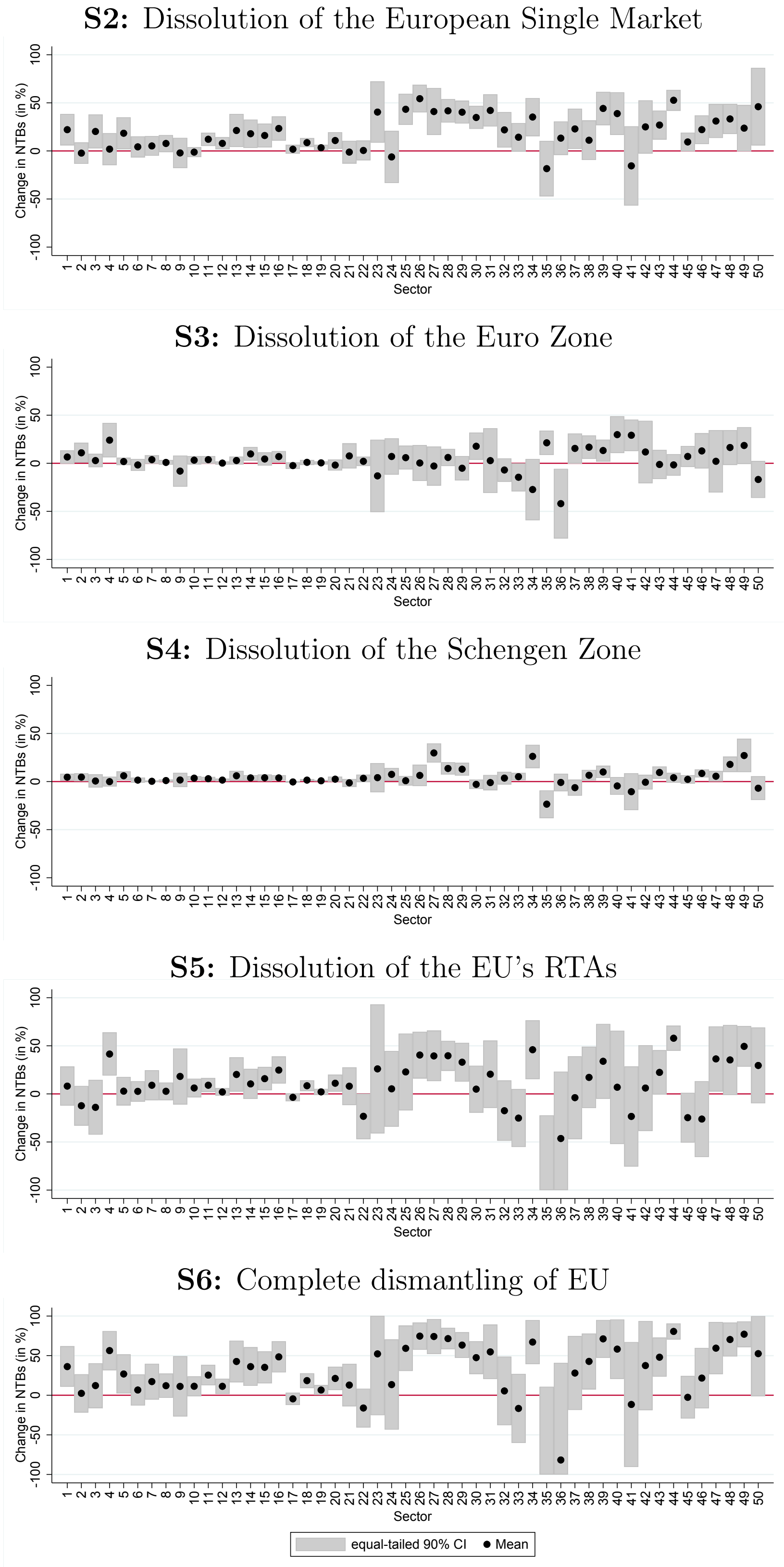
Scenario S7 is equivalent to **S6** but additionally assumes an end to net payments from any EU country to another. These additional effects come on top of trade effects. We account for this by subtracting fiscal transfers of EU member states (total expenditures – total own resources) from our model-consistent tariff incomes. We are thus in a situation where countries withhold their tariff income and subtract the corresponding amount from fiscal transfers (Table B4 in the Online Appendix).

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.[15] 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

[15]Tables A3 and A4 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 Table 1. Bootstrapped 90% confidence intervals.

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 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.

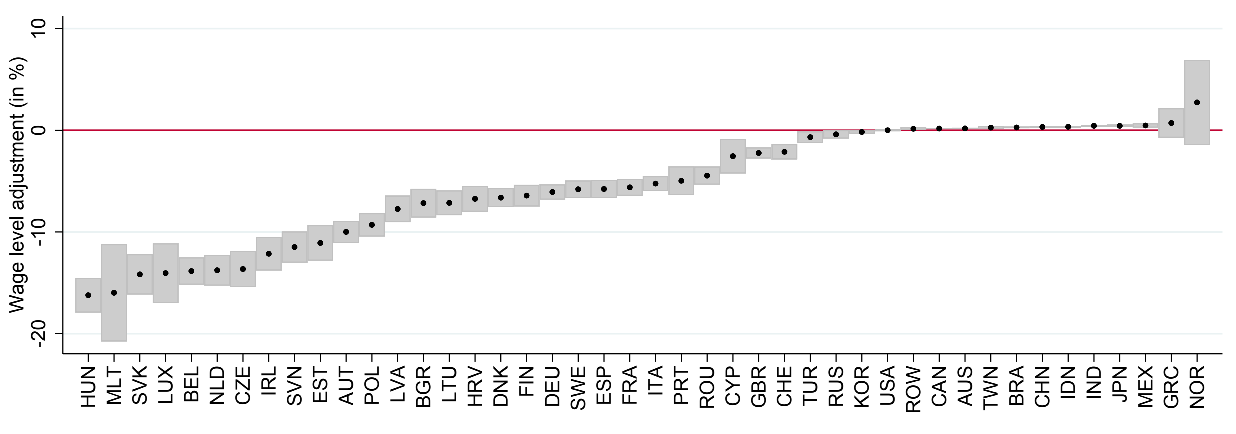
The production and trade effects of dissolving the major steps of European integration are displayed in Table 2. Since our equilibrium changes are homogenous of degree zero in prices, we normalize all nominal changes using U.S. value added as our numéraire. This implies that the output and export changes 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 (those who have entered the EU after 2000) 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 6.6%, the end of the Single Market accounting for 3.9pp thereof. For new members, the total loss would be 11.4%, 7.2pp 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 .3%. 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 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 and Ireland also face wage declines above 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

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.

consequence of two effects; changes in competitiveness, reflected in trade shares π, and trade creation due to changes in production and income across countries. Changes in competitiveness are driven by trade cost changes, which, thanks to the international input-output 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 (almost 40%). 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 little less than 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 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 more than 2pp in terms of output and between 3 to 5pp in terms of exports. Exports to non-EU countries even increase. This differential effect of ending transfers on output and export owes to the fact that the loss of transfers directly reduces real consumption in the new

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	-1.01***	0.49***	-9.79***	2.71***	-10.59***	3.32***	0.41***	-0.63***
new EU	-2.00***	0.91***	-9.63***	2.16***	-10.84***	4.41***	0.51***	-1.36***
non-EU	0.08***	-0.03***	0.72***	-0.45***	0.42***	-0.20**	0.07***	-0.02***
S2 Single Market								
old EU	-3.88***	0.20***	-21.61***	2.62***	-23.84***	3.35***	-0.49*	-0.75***
new EU	-7.18***	0.58***	-22.15***	2.60***	-23.58***	4.65***	-0.62	-2.05***
non-EU	0.21***	-0.09***	0.70**	-0.89***	-0.51	-1.57***	0.28***	0.08***
S3 Euro								
old EU	-0.53***	0.00	-2.90***	0.06	-0.84***	-0.28***	-0.09	-0.21***
new EU	-0.13***	0.02	-0.59***	0.05	-0.13	0.30***	-0.05	0.06*
non-EU	0.02*	0.01	0.05	0.17**	0.21**	0.19**	0.01	0.04***
S4 Schengen								
old EU	-1.49***	0.08***	-7.59***	1.43***	-9.55***	1.82***	-1.31***	0.10**
new EU	-2.64***	0.18**	-8.95***	1.49***	-5.98***	2.23***	-1.37***	-0.39***
non-EU	0.03***	-0.05***	-1.24***	0.17***	-1.50***	-0.22**	0.13***	-0.02
S5 RTAs								
old EU	-0.21***	-0.04***	0.23***	-0.21***	0.49***	-0.07**	-1.29***	0.30***
new EU	-0.28***	0.03***	-0.10*	0.09***	0.11***	0.12***	-1.70***	0.52***
non-EU	-0.03***	0.03***	-1.53***	0.64***	-2.68***	1.17***	-0.03	0.07***
S6 All								
old EU	-6.55***	0.55***	-37.23***	4.96***	-39.58***	6.17***	-2.77***	-0.97***
new EU	-11.43***	1.42***	-37.31***	5.01***	-36.84***	9.29***	-3.08***	-2.81***
non-EU	0.27***	-0.13***	-1.38***	-0.23	-4.20***	-0.47**	0.44***	0.14***
S7 All w Transfers								
old EU	-7.07***	0.67***	-38.00***	5.12***	-43.12***	6.21***	-2.45***	-0.88***
new EU	-13.73***	2.36***	-35.21***	5.49***	-37.65***	9.69***	1.29**	-2.39***
non-EU	0.13***	-0.05***	-2.40***	-0.11	-9.13***	-0.33	0.24***	0.21***

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 B7 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 2000.

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.

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.[16] VAX-ratios can be seen as indicators for the aggregate importance of trade along the value chain. Table A3 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 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 A4 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 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 3, we find that the VA changes are less spatially concentrated than the changes in gross measures. VA exports decreased by 5 to 9pp less than gross exports for intra-EU trade. Whereas they decreased by 1 to 3pp 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 B7 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.

[16] 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.

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.	-53.97***	9.19***	-0.43	-6.28***	-36.88***	8.23***
	Manuf.	-41.52***	6.14***	-5.01***	-0.22	-25.11***	6.41***
	Serv.	-26.48***	-2.75***	0.22	-2.91***	-11.38***	-2.71***
new EU	Agric.	-43.67***	7.86***	4.91***	-5.02***	-28.12***	5.55***
	Manuf.	-40.38***	6.39***	-6.29***	-3.18***	-31.21***	7.16***
	Serv.	-27.88***	-0.69	0.77*	-4.83***	-16.33***	-1.45*

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 B8 in the Online Appendix.

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).[17] Despite the fact that the estimated trade cost changes are smaller. This owes, in parts, to an uneven impact of the general equilibrium changes in relative competitiveness: As labor cost are depressed in the EU, its 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 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 general adjustments in labor cost.

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 .2pp. (.4pp) 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 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.

[17]Table B8 in the Online Appendix presents full results for all scenarios.

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	-1.52***	-4.89***	0.22**	-1.86***	-0.51***	-8.09***	-8.14***
	Manuf.	299	-2.20***	-7.33***	-0.09***	-2.73***	-0.29***	-11.74***	-11.18***
	Serv.	1027	-0.72***	-6.51***	-0.15***	-2.42***	-0.23***	-9.62***	-11.66***
old EU	Agric.	331	-1.12***	-3.19***	-2.70***	-1.13***	-1.61***	-8.98***	-9.38***
	Manuf.	2460	-1.36***	-4.37***	-0.50***	-1.60***	-0.21***	-7.39***	-7.70***
	Serv.	13109	-0.34***	-3.57***	-0.48***	-1.38***	-0.22***	-5.66***	-6.08***
		VA share (in %)	Change in value added share (in pp)						
new EU	Agric.	5.0	-0.02***	0.09***	0.02***	0.03***	-0.01***	0.10***	0.17***
	Manuf.	21.4	-0.24***	-0.16***	0.01	-0.06***	-0.01**	-0.40***	0.04
	Serv.	73.6	0.27***	0.07**	-0.02***	0.03**	0.02***	0.29***	-0.22***
old EU	Agric.	2.1	-0.01***	0.01	-0.05***	0.01	-0.03***	-0.06***	-0.06***
	Manuf.	15.5	-0.13***	-0.11***	0.00	-0.03***	0.01	-0.22***	-0.20***
	Serv.	82.4	0.14***	0.10***	0.04***	0.02***	0.02***	0.28***	0.27***

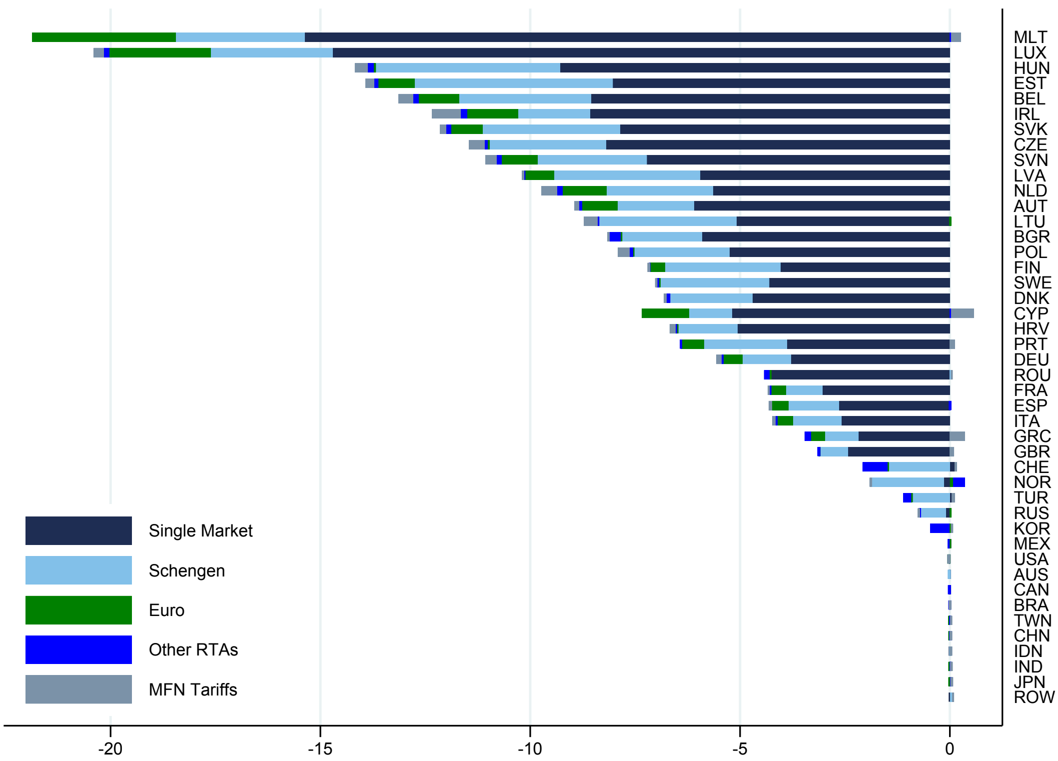
Note: ***,**,* denote statistical significance at the 1%,5%,10%-level based on 1,000 bootstrap replications.

4.4 Change in Real Consumption

Next, we turn to changes in real consumption displayed in Table 5. Figure 5 shows that alike the trade effects, real consumption effects differ vastly across countries and integration agreements. Overall, the breakdown of the EU Single Market has 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 sizable 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 (-15.4%) and Luxembourg (-14.7%). Besides, most new EU members experience large reductions in real consumption if the EU Single Market is resolved. Our simulations predict large effects for Hungary (-9.3%), Czech Republic (-8.2%), Estonia (-8.0%), Slovak Republic (-7.9%), Slovenia (-7.2%), or Poland (5.3%). But long established small EU members, such as Austria (-6.1%), Belgium, or Ireland (both -8.6%), also experience similar negative effects. The welfare effects on large EU economies, such as Germany (-3.8%), France (-3.0%), or Italy (-2.6%) are in comparison much smaller. Some third countries would see significant but small negative effects, like the United States (-.02%), but several others could reap significant benefits

Figure 5: Change in Real Consumption in % for Various Scenarios, Baseline Year 2014



from a collapse of the EU Single Market: Switzerland would see its consumption increase by 0.1%, Korea by 0.03%, and Japan by 0.02%. 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.[18] The biggest losses are experienced in Ireland (-.8%), Luxembourg, the Czech Republic, and the Netherlands (-.5% each), while most other EU countries experience negligibly small negative effects relative to the status quo. Non-EU countries tend to slightly gain. Interestingly, a few EU countries (Cyprus, Malta, Portugal, or Greece) experience positive real consumption effects. These are not implausible, given that the re-introduction of tariffs, in contrast to the other steps of dismantling EU integration, has a positive first-order effect on income.

[18] A reason might be 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. In this scenario, we set EU MFN tariffs as prevalent in the year 2014.

In the scenario where we break up the Eurozone (S3), we find clear negative effects on member states. Significant losses per annum range between -3.4% in Malta and -.3% in Greece. All Eurozone countries are predicted to lose. Effects are statistically different from zero. Outsiders to the monetary union, in particular non-Euro EU countries, tend to lose as well. Most other outsiders to the agreement remain largely unaffected relative to the status quo; Norway (+.08%) and Russia (+.04%) are predicted to gain.

Dismantling the Schengen Agreement affects members to the agreement but also all other geographically European countries negatively – except Romania, who do not show an effect that is statistically different from zero. Effects range between -4.7% in Estonia to -0.6% in Russia. But, we also see small gains for countries far away from Europe, who would win if the Schengen Agreement is abolished, e.g., India and Indonesia (both +0.01%). We find substantial heterogeneity among geographically European countries. Peripheral and poorer countries to the agreement, such as Hungary, Estonia, Slovakia, Latvia, Lithuania, or the Czech Republic lose most from a breakdown of the Schengen Agreement. Small but richer economies (Austria, Belgium, Netherlands, Portugal, Poland, Slovenia, Switzerland and the Nordic countries) lose a significant share of their real consumption due to their trade structure with other European countries; between -1.5% and -3.1%. At the lower end are large European economies, like Germany, France or Spain. Due to its geography, Greece has the smallest loss among Schengen members with -.8%. Geographically European countries that are outsiders to the agreement like Turkey (-0.9%), Russia (-0.6%), the UK (-0.7%), Cyprus (-1.0%), Ireland (-1.7%) and Croatia (-1.4%) also lose consumption, as they trade a lot with European countries and thus benefit from open borders.

Next, we look at a collapse of all RTAs which EU members have jointly signed with third countries and a reintroduction of NTBs and MFN tariffs (S5). While Switzerland, Turkey and Korea (all partner countries to agreements with the EU) experience large losses in real consumption (-0.6%, -0.2%, and -0.5%, respectively), most EU countries experience small welfare losses of about -0.1 to -0.3%. Bulgaria has the highest loss. Some Asian countries, such as Taiwan, China, India, Japan (0.01% each) not in any RTAs with the EU until 2014 would gain from a dissolution of existing EU RTAs with third countries.

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 (-20.0%) and Luxembourg (-18.6%), as well as new EU members (Hungary -13.1%, Estonia -12.5%, Slovakia -11.2%, Czech Republic -10.7%, Slovenia -10.1%, or Latvia -9.2%) lose most, while established EU economies show a wider spread: Belgium (-12.1%) with the largest and Greece (-2.9%) with the smallest losses in real consumption relative to the status quo in 2014. Among outsiders to the agreements, countries close to the EU such as Switzerland (-1.9%), Norway (-1.5%), Turkey (-1.0%), or Russia (-.7%), who have a high degree of trade integration with EU countries, lose as well. The U.S. are also negatively affected (-.02%). Nearly all Asian countries would experience positive changes in their consumption from a collapse of all the European integration agreements, namely China (.03%), Indonesia (.04%), India (.05%), and Japan (.06%).

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

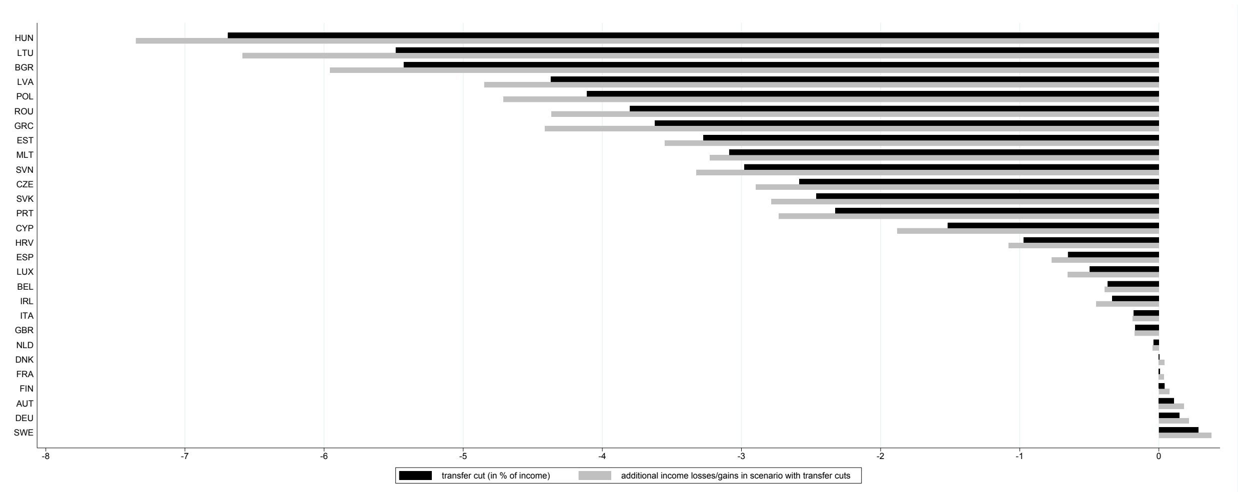
Table 5: Changes in Real Consumption in %, Baseline Year 2014

Scenario:	Customs Union	Single Market	Euro	Schengen	Other RTAs	All	All w Transfers
	(S1)	(S2)	(S3)	(S4)	(S5)	(S6)	(S7)
AUS	0.00	-0.01*	0.00	-0.00	0.00	-0.01	0.02*
AUT^{o}	-0.11***	-6.10***	-0.85***	-1.82***	-0.07***	-8.32***	-8.14***
BEL^{o}	-0.35***	-8.55***	-0.97***	-3.15***	-0.13	-12.07***	-12.46***
BGR^{n}	-0.05*	-5.90***	-0.01	-1.93***	-0.26***	-7.60***	-13.55***
BRA	0.01**	0.00	0.00	0.00	-0.00	0.01	0.03***
CAN	0.00	-0.01	0.00	0.00	-0.00	-0.00	0.03**
CHE	0.05***	0.11**	-0.03*	-1.46***	-0.59*	-1.88***	-1.85***
CHN	0.01***	0.01	-0.01**	0.00	0.01***	0.02**	0.03***
CYP^{n}	0.54***	-5.20***	-1.12***	-1.02**	0.03	-6.37***	-8.25***
CZE^{n}	-0.37***	-8.20***	-0.05	-2.77***	-0.08***	-10.73***	-13.63***
DEU^{o}	-0.12***	-3.78***	-0.45***	-1.16***	-0.05	-5.19***	-4.98***
DNK^{o}	-0.06**	-4.70***	0.00	-1.96***	-0.09	-6.38***	-6.34***
ESP^{o}	-0.08***	-2.64***	-0.39***	-1.21***	0.01	-3.93***	-4.70***
EST^{n}	-0.21***	-8.03***	-0.86***	-4.72***	-0.10**	-12.48***	-16.03***
FIN^{o}	-0.01	-4.04***	-0.35***	-2.75***	-0.03	-6.46***	-6.39***
FRA^{o}	-0.05***	-3.04***	-0.37***	-0.86***	-0.02	-4.06***	-4.02***
GBR^{o}	0.10***	-2.43***	-0.01	-0.68***	-0.00	-2.89***	-3.07***
GRC^{o}	0.36***	-2.18***	-0.34***	-0.80***	-0.15	-2.90***	-7.31***
HRV^{n}	-0.14***	-5.06***	-0.02	-1.43***	-0.03**	-6.26***	-7.34***
HUN^{n}	-0.31***	-9.29***	-0.06	-4.38***	-0.14***	-13.06***	-20.41***
IDN	0.01***	0.01	0.00	0.01***	0.00	0.03***	0.04***
IND	0.01***	0.01	-0.00	0.01**	0.01**	0.03***	0.05***
IRL^{o}	-0.69***	-8.58***	-1.22***	-1.71***	-0.15***	-11.47***	-11.93***
ITA^{o}	-0.07***	-2.58***	-0.36***	-1.16***	-0.05***	-3.88***	-4.07***
JPN	0.01***	0.02***	-0.01***	0.01	0.01***	0.04***	0.06***
KOR	0.02***	0.03***	-0.01**	0.01	-0.46***	-0.42***	-0.41***
LTU^{n}	-0.32***	-5.08***	0.02	-3.28***	-0.03	-7.82***	-14.41***
LUX^{o}	-0.24***	-14.71***	-2.42***	-2.90***	-0.13	-18.75***	-19.40***
LVA^{n}	-0.05	-5.95***	-0.71***	-3.48***	-0.01	-9.15***	-14.00***
MEX	0.00	-0.00	-0.00	0.00	-0.04	-0.05	-0.02
MLT^{n}	0.23***	-15.37***	-3.42***	-3.07*	0.03	-20.02***	-23.25***
NLD^{o}	-0.37***	-5.64***	-1.05***	-2.54***	-0.13**	-8.85***	-8.90***
NOR	-0.02**	-0.14**	0.08***	-1.74***	0.28	-1.51***	-1.49***
POL^{n}	-0.28***	-5.25***	-0.01	-2.29***	-0.07***	-7.28***	-12.00***
PRT^{o}	0.12***	-3.89***	-0.54***	-1.97***	-0.02	-5.67***	-8.40***
ROU^{n}	0.03	-4.25***	-0.05***	0.03	-0.13***	-4.38***	-8.75***
ROW	0.04***	0.01	0.00	0.05**	0.00	0.09**	0.14***
RUS	-0.02***	-0.09***	0.04***	-0.60***	-0.04***	-0.68***	-0.66***
SVK^{n}	-0.15*	-7.86***	-0.75***	-3.27***	-0.12***	-11.15***	-13.93***
SVN^{n}	-0.26***	-7.22***	-0.85***	-2.61***	-0.13***	-10.17***	-13.50***
SWE^{o}	-0.02***	-4.30***	-0.01	-2.62***	-0.06	-6.46***	-6.08***
TUR	0.08***	0.04	-0.02*	-0.90***	-0.19*	-1.01***	-0.99***
TWN	0.02***	0.01	-0.01**	-0.00	0.01*	0.03	0.04*
USA	-0.00	-0.02***	-0.00	-0.01**	0.00	-0.02***	-0.00

Note: ^{o} Old EU member states, ^{n} New EU member states. ***,**,* denote statistical significance at the 1%,5%,10%-level based on 1,000 bootstrap replications.

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

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.

account for more than 5% 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.

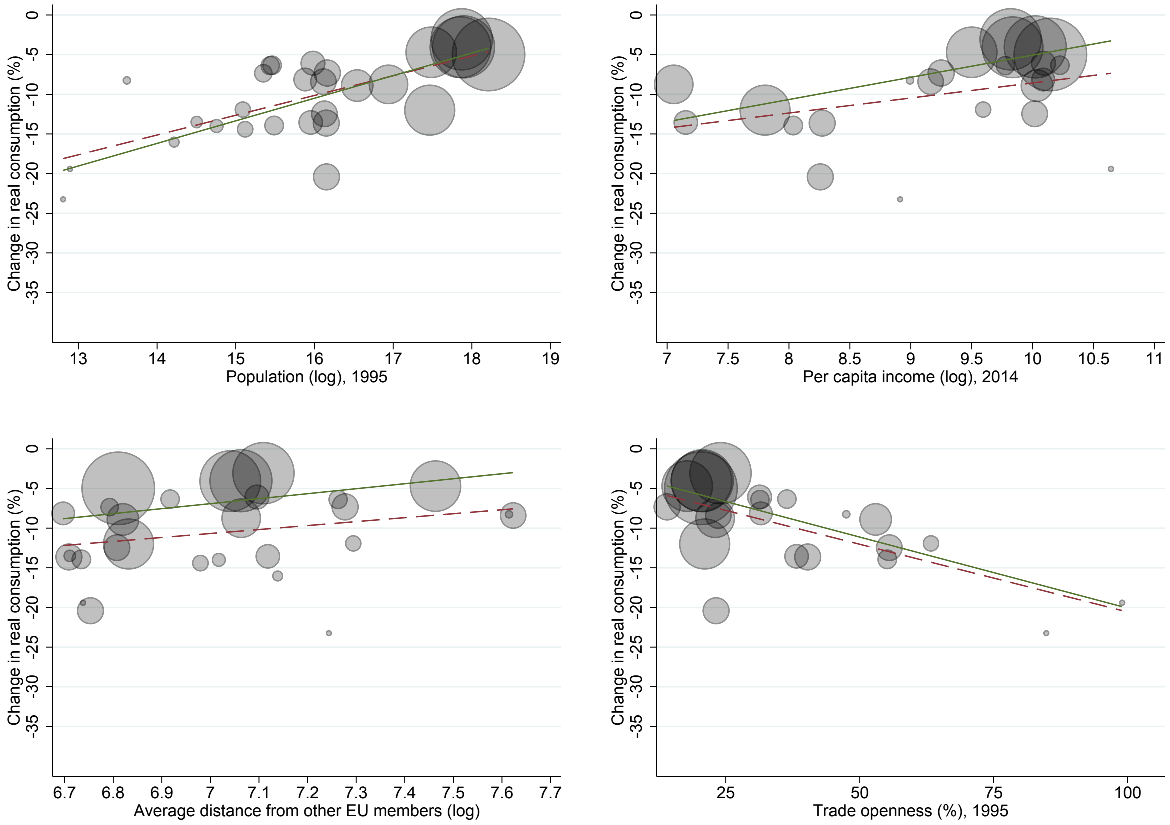
Figure 6 also reveals systematic terms-of-trade adjustments: Net recipients experience real consumption losses that exceed the direct losses from ending transfer payments, implying a worsening of their terms of trade. In order to remain a constant deficit (net of transfers), these countries need to make up for the lost transfer income by means of higher exports, that are 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.

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.[19] 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 2.85, indicating that an increase in population by 1% lowers the absolute size of the loss by .03pp ($R^2 = .46$). The upper-right diagram looks at the relationship with the initial level of per capita income. The correlation

[19] 1995 is the first year in which data for all EU countries is available.

Figure 7: Correlating Losses and Country Characteristics: Size, the Level of Real Consumption, 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 2014, 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 the one for the unweighted regression on log per capita income.

is statistically significant when observations are weighted by population. In that case, the slope is equal to 2.8 and the adjusted R^2 is .46. The lower-left diagram looks at the log of the weighted average distance from other EU members and finds a positive correlation. The slope of the fitted curve equals 6.3 if observations are weighted and is statistically significant at the 10% level. So, more central countries lose more from an end of the EU (cf. Felbermayr and Jung, 2018). 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 -.18 and is statistically significant at the 1% level. More open countries clearly suffer more from a collapse of the EU.

A simple population-weighted regression of percentage losses on all four variables featuring in Figure 7 explains almost 83% of the variation resulting from our simulations. Except for population, all variables have a statistically significant partial effect on relative losses.

4.6 Brexit

We analyze how costly a complete EU collapse would be after the now seemingly unavoidable 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.[20] Column (1) of Table A5 in the Appendix shows the effect of Brexit on real consumption by country. We find a sizable and negative effect for the UK (-2.3%), but also for geographically close and small, open, service-oriented nations of Ireland (-3.9%), Luxembourg (-3.4%) and Malta (-4.6%). The second column shows real consumption effects of a complete EU breakdown conditional on Brexit. For comparison, column (3) provides corresponding real consumption effects of the scenario pre-Brexit, 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 80% of the total losses of the EU collapse; for Ireland this number stands at 30%. Brexit also accounts for substantial shares of the losses from a EU breakdown for other old EU members (8% on average), but for smaller shares of new EU members' losses (6% on average).

5 Sectoral Heterogeneity and Input-Output Linkages

We analyze two dimensions of sectoral heterogeneity: The importance of heterogeneous parameter estimates by sectors, and the importance of cross-sectoral input output linkages.

5.1 Sectoral Parameter Heterogeneity

To assess the importance of the sectoral heterogeneity of parameter estimates, we simulate the full collapse scenario (S6) assuming (i) constant values for θ^j and the trade cost parameters δ^j_{EU}, δ^j_{Euro}, $\delta^j_{Schengen}$, δ^j_{RTA}, δ_{EUKor} across sectors *within* manufacturing and *within* services, and (ii) the same θ and the $\boldsymbol{\delta}$ across *all* sectors. In i), we use the global-output-weighted average of the 22 sectoral estimates within manufacturing (including agriculture and raw materials) and the 28 sectoral estimates within services; for (ii) we use the global-output-weighted average across all 50 sectors.

We find that ignoring heterogeneity in sectoral parameter estimates does not produce qualitatively different effects. Focusing on welfare effects, we find only small quantitative differences, which are rarely statistically significant.[21] Irrespective of whether we shut down

[20] 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.

[21] This result might be surprising at first sight in view of the finding in Ossa (2015), that sectoral heterogeneity

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.	-7.25***	0.14***
	Manuf.	**-14.92*****	**-0.91*****
	Serv.	-10.81***	**0.78*****
old EU	Agric.	-8.02***	**-0.01****
	Manuf.	**-10.45*****	**-0.64*****
	Serv.	-6.32***	**0.65*****

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.

heterogeneity across all sectors or only within manufacturing and services (see columns (6) and (5) of Table A5 in the Appendix).

5.2 Simple Versus Complex Input-Output Structures

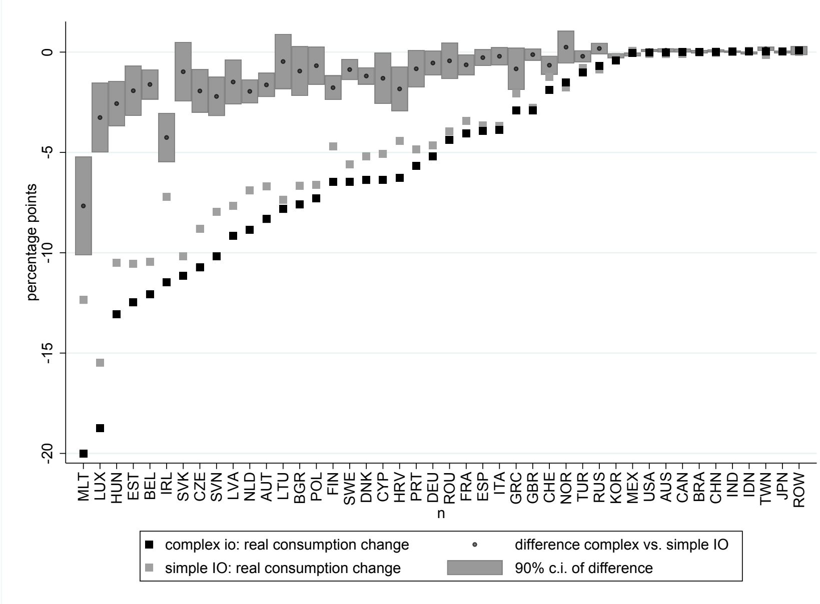
To assess the importance of the IO model, we simulate a nested model with a simplified input-output structure that features no intersectoral production linkages. This simplified model assumes that only intermediates from the own sector are used, akin to Mayer et al. (2019). In practice, we set $\gamma_n^{k,j} = 1$ for $k = j$ and $\gamma_n^{k,j} = 0$ for $k \neq j$, recalibrate X_n^j $\forall$ n, j, and then simulate the full collapse scenario (S6). The predictions of the simplified model regarding the sectoral composition of production in Europe are qualitatively, quantitatively, and significantly different from the predictions of the general model with the complex IO structure.[22] In particular, the simple model predicts a much bigger decline in manufacturing, 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) and this difference is statistically significant.[23] Column (2) shows that the result is a loss of 0.9pp (0.6pp) in the share of manufacturing value added in total value added in the new (old) EU countries, compared to losses of 0.4pp (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 manufacturing intermediate producers upstream, but not to the other sectors. In the above, we discussed that interconnected global value chains help flatten the distribution of the value added growth induced by 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 value added growth across sectors; from hard-hit manufacturing exporters to input producers in the service and raw materials sectors.

in trade elasticities is important for the quantification of the gains from trade. However, our exercise is different in that we homogenize the estimated trade cost shocks together with the trade elasticities.

[22] 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.

[23] In Table 6, bold numbers indicate that the values are statistically different from their counterparts in Table 4 at the 1% significance level. As before, stars indicate whether values are statistically different from zero.

Figure 8: Real Consumption Changes: Simple vs Complex IO Structures



Note: The figure shows simulated changes in real consumption in the full-collapse scenario based on the model with and without intersectoral linkages (in %), the difference between the two (in pp), and 90% confidence intervals for the difference based on standard errors from 1,000 bootstrap replications.

Finally, we show that the simple IO model also yields economically and statistically different welfare effects. Figure 8 shows that predicted welfare losses in the EU are much smaller when intersectoral linkages are ignored; for the majority of EU countries the difference lies between 1 to 4pp (black dots) and the difference is significant at the 10% (or smaller) significance level as indicated by the confidence bounds (grey bars). Table A5 has the details.

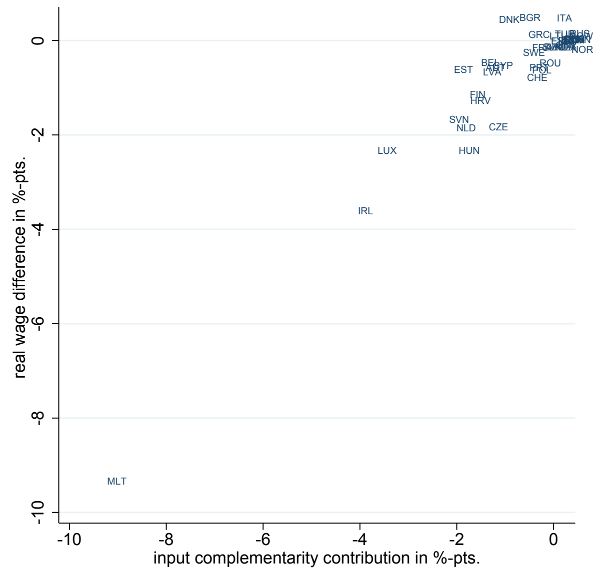
To understand what is driving these differences, we turn to the real wage decomposition provided by Caliendo and Parro (2015), which reads

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

This decomposition generalizes the gains-from-trade formula in Arkolakis et al. (2012) and 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, conditional on the changes in domestic expenditure shares. The last term in (8), a geometric weighted average of the changes of intermediate input price indices across sectors, describes the contribution of intersectoral linkages to the real wage change. In the simple IO model this term is zero.[24]

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

Figure 9: Sectoral Linkages and Differential Real Wage Growth



Note: The figure plots the difference between in real wage changes predicted by the models with and without intersectoral linkages against the contribution of input complementarity in the real wage decomposition (8).

Comparing our simulated real wage effects for all countries generated by the simple IO model to the general model, we find that the intersectoral linkages contribution accounts for nearly all of the variation in the differential real wage growth across the models (cf. Figure 9). It follows that, quantitatively, differences in the general equilibrium adjustments in π_n^j and p_n^j across the two models play only a marginal role for the real wage differences. Moreover, it underscores that accounting for intersectoral linkages is crucial for the quantification of the welfare losses from trade disintegration in Europe.

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 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 calibration and scenario definition based on the estimation of sector-level gravity equations allows to account for parameter uncertainty for all endogenous variables.

We find that output losses are substantially more important 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 6.6%, the end of the Single Market accounting for 3.9pp thereof. For new EU members, the total loss would be 11.4%, 7.2pp 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 .3% in output. In EU countries, value added contracts less than output as value added is directly related to domestic welfare, while the value of gross output also contains value added produced in other countries.

Our analysis shows that ignoring heterogeneity in sectoral parameter estimates does not produce qualitatively different effects. But applying a model with a simplified input-output structure – hence, ignoring intersectoral linkages – yields economically and statistically different predictions than the general model with the complex input-output structure. For example, new (old) EU countries lose 0.9pp (0.6pp) in the share of manufacturing value added in total value added compared to losses of .4pp (.2pp) in the model with the complex IO structures. Ignoring intersectoral input-output relations leads to an underestimation of welfare losses between 1 to 4 pp for EU countries. Most important, we show that these differences are statistically significant. Hence, accounting for intersectoral linkages is crucial for the quantification of the welfare losses from trade disintegration in Europe.

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A Appendix

Table A1: 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 A2: The Impact of EU Integration on Bilateral Imports (2000 - 2014)

Dep. var.:	Bilateral Imports				
		Goods			Services
	(1)	(2)	(3)	(4)	(5)
Both EU	0.427***	0.326***	0.288***	0.603***	0.532***
	(0.04)	(0.04)	(0.07)	(0.03)	(0.07)
Both Euro			0.060*		0.145**
			(0.04)		(0.06)
Schengen			0.089***		0.075***
			(0.01)		(0.02)
EU-KOR RTA			0.102		0.330***
			(0.07)		(0.06)
EU PTAs			0.235***		0.884***
			(0.07)		(0.09)
Other RTAs			0.024		−0.032
			(0.05)		(0.07)
Tariffs		−3.679***	−3.467***		
		(0.90)	(0.92)		

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. Pair as well as year specific importer and exporter fixed effects included but not reported. Number of observations: 27,735.

Table A3: Gross and Value Added Trade in Baseline Year 2014 (in bn. USD)

Region	Output	Domestic Sales	Exports to old EU	Exports to new EU	Exports to 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	Value Added Exports to new EU	Value Added Exports to 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 A4: Trade Flows and VAX-Ratios in the Baseline Year 2014 (in bn. USD)

Exports to:		EU		non-EU	
		gross	VAX	gross	VAX
Region	Sector	(bn. USD)	(in %)	(bn. USD)	(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 A5: Changes in Real Consumption in %; Brexit and other Robustness

Robustness:	Brexit				less sectoral heterogeneity		Simple IO
	Brexit	All EU post-Brexit	All EU pre-Brexit	Difference post-pre-Brexit	All EU manuf.& serv.	All EU single	All EU
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
AUS	-0.00	-0.01	-0.01	0.00	0.01*	**-0.05*****	-0.10*
AUT^{o}	-0.21***	-8.13***	-8.32***	0.19***	-8.50***	-8.76***	**-6.69*****
BEL^{o}	-0.97***	-11.21***	-12.07***	0.86***	-12.66***	**-10.48*****	**-10.46*****
BGR^{n}	-0.32***	-7.30***	-7.60***	0.30***	-7.35***	-8.83***	-6.65***
BRA	0.00	0.01	0.01	0.00	0.02***	**-0.02*****	-0.01
CAN	0.00	-0.00	-0.00	0.00	0.02***	**-0.04*****	-0.08
CHE	-0.01	-1.87***	-1.88***	0.01	-2.18***	-2.05***	**-1.23*****
CHN	0.00	0.02**	0.02**	0.00	**0.05*****	0.03***	-0.04
CYP^{n}	-1.02***	-5.40***	-6.37***	0.97***	-7.04***	-7.65***	-5.07***
CZE^{n}	-0.36***	-10.41***	-10.73***	0.32***	-10.03***	-10.98***	**-8.80*****
DEU^{o}	-0.37***	-4.84***	-5.19***	0.35***	-5.11***	-5.39***	-4.65***
DNK^{o}	-0.64***	-5.77***	-6.38***	0.60***	-6.08***	-6.22***	**-5.19*****
ESP^{o}	-0.21***	-3.73***	-3.93***	0.20***	-3.88***	-4.20***	-3.66***
EST^{n}	-0.40***	-12.13***	-12.48***	0.35***	-12.60***	-12.94***	**-10.55*****
FIN^{o}	-0.35***	-6.13***	-6.46***	0.33***	-6.63***	-6.33***	**-4.69*****
FRA^{o}	-0.43***	-3.65***	-4.06***	0.41***	-4.05***	-4.35***	**-3.43*****
GBR^{o}	-2.31***	-0.59***	-2.89***	2.30***	-3.04***	-3.30***	-2.77***
GRC^{o}	-0.25***	-2.65***	-2.90***	0.25***	-2.97***	-3.22***	-2.07***
HRV^{n}	-0.24***	-6.04***	-6.26***	0.23***	-6.08***	-7.08***	**-4.43*****
HUN^{n}	-0.48***	-12.64***	-13.06***	0.42***	-12.10***	-12.47***	**-10.49*****
IDN	0.00	0.03***	0.03***	0.00	0.03***	0.02***	0.07*
IND	0.00	0.02***	0.03***	-0.01**	0.03***	**-0.01***	0.00
IRL^{o}	-3.92***	-7.92***	-11.47***	3.56***	-10.93***	**-8.58*****	**-7.22*****
ITA^{o}	-0.27***	-3.62***	-3.88***	0.26***	-3.91***	-3.98***	-3.68***
JPN	0.01	0.04***	0.04***	0.00	0.05***	0.04***	0.04
KOR	-0.10	-0.31***	-0.42***	0.10***	-0.43***	-0.46***	**-0.24*****
LTU^{n}	-0.28***	-7.56***	-7.82***	0.26***	-6.95***	-8.43***	-7.35***
LUX^{o}	-3.37***	-15.92***	-18.75***	2.83***	-21.12***	-20.12***	**-15.48*****
LVA^{n}	-0.39***	-8.79***	-9.15***	0.36***	-9.01***	-10.11***	**-7.66*****
MEX	-0.01	-0.04	-0.05	0.01	-0.00	-0.06*	**0.07**
MLT^{n}	-4.62***	-16.14***	-20.02***	3.88***	-21.71***	-19.52***	**-12.35*****
NLD^{o}	-0.81***	-8.11***	-8.85***	0.74***	-8.68***	-8.77***	**-6.90*****
NOR	0.12	-1.63***	-1.51***	-0.12	-2.38***	-2.57***	-1.76***
POL^{n}	-0.41***	-6.90***	-7.28***	0.38***	-6.45***	-8.05***	-6.61***
PRT^{o}	-0.34***	-5.35***	-5.67***	0.32***	-5.65***	-6.62***	-4.84***
ROU^{n}	-0.20***	-4.19***	-4.38***	0.19***	-3.80***	-5.30***	-3.94***
ROW	-0.00	0.10***	0.09**	0.01	0.08***	0.01	0.02
RUS	-0.02	-0.67***	-0.68***	0.02**	-0.51***	-0.83***	-0.87***
SVK^{n}	-0.35***	-10.84***	-11.15***	0.31***	-10.16***	-11.93***	-10.17***
SVN^{n}	-0.23***	-9.97***	-10.17***	0.20***	-9.91***	-10.95***	**-7.96*****
SWE^{o}	-0.46***	-6.02***	-6.46***	0.43***	-6.57***	-6.27***	**-5.59*****
TUR	-0.02	-0.99***	-1.01***	0.02	-0.69***	-1.16***	-0.80***
TWN	0.01	0.02	0.03	-0.01	**0.09*****	0.05***	**-0.13****
USA	-0.00	-0.02***	-0.02***	0.00*	-0.01**	**-0.06*****	-0.10***

Note: ^{o} Old EU member states, ^{n} New EU member states. ***,**,* denote statistical significance at the 1%,5%,10%-level. Bold values are statistically different from the predictions of the general model zero at $\alpha = 1\%$.

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

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

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 input-output 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 $i = 1, \ldots, N$.[25] The goods market clearing condition is given by

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

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 $R_i = \sum_{j=1}^{J} X_i^j \left(1 - \sum_{n=1}^{N} \frac{\pi_{ni}^j}{(1+\tau_{ni}^j)}\right)$.[26]

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

[25] 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. So in Caliendo and Parro (2015) the value of gross production comprises all foreign varieties that are bundled into the composite good without generation of value added.

[26] 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_n is the trade surplus.

can solve for counterfactual changes in all variables of interest using the following system of equations:[27]

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

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

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

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

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

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

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.

[27] 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: 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 B2: 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 B3: 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 B4: 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 B5: EU Integration Steps and Bilateral Imports, Goods (2000 - 2014)

Dep. var.:	Bilateral Imports																
Sector Description	Sector	EU	s.e.	Euro	s.e.	Schengen	s.e.	EU-KOR	s.e.	EU PTAs	s.e.	RTAs	s.e.	Tariff	s.e.	Obs.
Crops & Animals	1	0.880***	(0.13)	0.237**	(0.09)	0.164***	(0.03)	0.219	(0.28)	0.546***	(0.17)	0.077	(0.11)	-3.467***	(0.92)	27735
Forestry & Logging	2	-0.080	(0.18)	0.410***	(0.16)	0.166***	(0.05)	-0.131	(0.24)	0.432**	(0.18)	-0.269*	(0.15)	-3.467***	(0.92)	26490
Fishing & Aquaculture	3	0.802***	(0.24)	0.104	(0.11)	0.018	(0.10)	-0.245	(0.33)	0.482**	(0.24)	-0.216	(0.16)	-3.467***	(0.92)	25755
Mining & Quarrying	4	0.069	(0.26)	0.950***	(0.29)	-0.001	(0.08)	2.353***	(0.35)	-0.167	(0.22)	-0.485***	(0.17)	-3.467***	(0.92)	27705
Food, Beverages & Tobacco	5	0.700***	(0.17)	0.066	(0.06)	0.213***	(0.03)	0.034	(0.18)	0.649***	(0.17)	0.069	(0.10)	-3.467***	(0.92)	27735
Textiles, Apparel & Leather	6	0.167	(0.16)	-0.059	(0.10)	0.055	(0.04)	0.077	(0.08)	0.085	(0.11)	0.028	(0.14)	-3.467***	(0.92)	27735
Wood & Cork	7	0.199	(0.14)	0.132**	(0.05)	0.010	(0.01)	0.326**	(0.15)	0.212**	(0.10)	0.012	(0.14)	-3.467***	(0.92)	27735
Paper	8	0.283***	(0.09)	0.032	(0.04)	0.038***	(0.01)	0.192	(0.12)	0.296**	(0.12)	-0.095	(0.07)	-3.467***	(0.92)	27735
Recorded Media Reproduction	9	-0.031	(0.15)	-0.179	(0.12)	0.050	(0.06)	0.706**	(0.30)	0.163	(0.14)	-0.220	(0.14)	-1.202	(1.56)	26520
Coke & Refined Petroleum	10	-0.073	(0.13)	0.197*	(0.11)	0.217***	(0.04)	0.493**	(0.25)	0.004	(0.28)	-0.110	(0.11)	-6.028***	(1.25)	26795
Chemicals	11	0.452***	(0.08)	0.131**	(0.06)	0.106***	(0.03)	0.304***	(0.07)	0.389***	(0.14)	0.023	(0.06)	-3.544***	(0.60)	27735
Pharmaceuticals	12	0.953***	(0.15)	0.015	(0.09)	0.178***	(0.05)	-0.068	(0.10)	0.374**	(0.16)	0.309**	(0.13)	-11.480***	(2.78)	26310
Rubber & Plastics	13	0.596***	(0.10)	0.071*	(0.04)	0.154***	(0.02)	0.284***	(0.09)	0.305***	(0.10)	0.282***	(0.08)	-2.270**	(1.02)	27735
Other non-Metallic Mineral	14	0.374***	(0.10)	0.180***	(0.04)	0.069***	(0.01)	0.029	(0.09)	0.242***	(0.09)	0.183**	(0.09)	-1.375*	(0.81)	27735
Basic Metals	15	0.568***	(0.10)	0.154	(0.09)	0.130***	(0.04)	0.280***	(0.07)	0.058	(0.14)	0.277***	(0.08)	-3.206***	(0.86)	27735
Fabricated Metal	16	0.447***	(0.05)	0.122***	(0.04)	0.065***	(0.01)	0.266***	(0.07)	0.170**	(0.07)	0.214***	(0.04)	-1.558***	(0.48)	27090
Electronics & Optical Products	17	0.134	(0.16)	-0.184	(0.12)	-0.028	(0.03)	-0.228*	(0.12)	0.241**	(0.11)	-0.045	(0.10)	-7.772***	(1.63)	27735
Electrical Equipment	18	0.535***	(0.10)	0.058	(0.07)	0.091***	(0.03)	0.326***	(0.09)	0.340***	(0.11)	0.199***	(0.08)	-6.012***	(0.92)	27090
Machinery & Equipment	19	0.270***	(0.09)	0.038	(0.06)	0.064***	(0.02)	0.124*	(0.07)	0.325***	(0.09)	0.047	(0.08)	-7.865***	(1.31)	27735
Motor Vehicles	20	0.529***	(0.12)	-0.089	(0.12)	0.118**	(0.05)	0.293***	(0.11)	0.501***	(0.17)	0.249***	(0.07)	-4.610***	(0.96)	27735
Other Transport Equipment	21	-0.034	(0.15)	0.268**	(0.13)	-0.046	(0.04)	0.291	(0.23)	0.665***	(0.18)	0.014	(0.11)	-2.916	(1.89)	27090
Furniture & Other Manuf.	22	0.009	(0.16)	0.079	(0.07)	0.129***	(0.04)	-0.619***	(0.13)	-0.034	(0.12)	-0.160	(0.16)	-3.713***	(1.20)	27735

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. Pair as well as year specific importer and exporter fixed effects included but not reported. In eight sectors, sector level trade elasticities did not satisfy theoretical restrictions and were replaced by aggregate ones.

Table B6: EU Integration Steps and Bilateral Imports, Services (2000 - 2014)

Dep. var.:	Bilateral Imports														
Sector Description	Sector	EU	s.e.	Euro	s.e.	Schengen	s.e.	EU-KOR	s.e.	EU PTAs	s.e.	RTAs	s.e.	Obs.
Electricity & Gas	23	0.728**	(0.36)	-0.177	(0.23)	0.063	(0.11)	0.004	(0.43)	1.333***	(0.49)	0.394	(0.37)	27225
Water Supply	24	-0.086	(0.18)	0.104	(0.15)	0.113**	(0.05)	0.626***	(0.22)	0.185	(0.19)	-0.543***	(0.17)	23085
Sewerage & Waste	25	0.821***	(0.17)	0.084	(0.10)	0.015	(0.04)	-0.007	(0.33)	1.028***	(0.27)	0.351**	(0.17)	24435
Construction	26	1.139***	(0.17)	-0.002	(0.14)	0.102	(0.09)	0.129	(0.21)	1.468***	(0.27)	0.622***	(0.16)	27210
Trade & Repair of Motor Vehicles	27	0.756***	(0.28)	-0.043	(0.14)	0.519***	(0.08)	0.787***	(0.16)	0.423	(0.35)	-0.074	(0.25)	25770
Wholesale Trade	28	0.783***	(0.10)	0.091	(0.07)	0.215***	(0.04)	0.562***	(0.13)	0.915***	(0.15)	0.175**	(0.09)	27285
Retail Trade	29	0.753***	(0.10)	-0.074	(0.09)	0.198***	(0.05)	0.477**	(0.20)	0.157	(0.25)	0.099	(0.07)	25740
Land Transport	30	0.628***	(0.10)	0.283**	(0.11)	-0.041	(0.03)	0.325*	(0.18)	1.050***	(0.14)	-0.251***	(0.08)	27630
Water Transport	31	0.793***	(0.17)	0.047	(0.26)	-0.017	(0.06)	0.221	(0.28)	1.604***	(0.24)	0.117	(0.12)	27480
Air Transport	32	0.358**	(0.16)	-0.099	(0.08)	0.053	(0.05)	0.054	(0.12)	0.785***	(0.19)	-0.294**	(0.13)	27735
Aux. Transportation Services	33	0.233*	(0.12)	-0.203**	(0.09)	0.077***	(0.03)	0.032	(0.13)	0.716***	(0.14)	-0.351***	(0.11)	27525
Postal and Courier	34	0.629***	(0.20)	-0.357**	(0.17)	0.444***	(0.11)	0.300	(0.30)	1.644***	(0.40)	0.600***	(0.17)	23475
Accommodation and Food	35	-0.252	(0.17)	0.353***	(0.11)	-0.305***	(0.07)	-0.702***	(0.19)	0.125	(0.18)	-0.454***	(0.14)	25455
Publishing	36	0.205	(0.15)	-0.504***	(0.16)	-0.015	(0.06)	-0.199	(0.27)	0.441***	(0.15)	-0.352***	(0.13)	24270
Media Services	37	0.370**	(0.18)	0.238*	(0.13)	-0.086	(0.06)	0.071	(0.24)	0.242	(0.23)	-0.147	(0.15)	24165
Telecommunications	38	0.169	(0.16)	0.266***	(0.10)	0.100**	(0.04)	0.414**	(0.19)	0.621***	(0.19)	-0.142	(0.16)	27720
Computer & Information Services	39	0.845***	(0.19)	0.209**	(0.09)	0.151***	(0.04)	0.692**	(0.35)	1.418***	(0.31)	-0.108	(0.18)	26955
Financial Services	40	0.719***	(0.25)	0.514***	(0.19)	-0.064	(0.06)	0.177	(0.32)	0.557	(0.59)	-0.091	(0.23)	27015
Insurance	41	-0.214	(0.23)	0.500***	(0.14)	-0.144	(0.12)	-0.065	(0.21)	0.436*	(0.25)	-0.252	(0.19)	26370
Real Estate	42	0.415	(0.25)	0.183	(0.26)	-0.010	(0.05)	0.190	(0.22)	0.916**	(0.36)	-0.099	(0.23)	23565
Legal and Accounting	43	0.460***	(0.14)	-0.018	(0.11)	0.142***	(0.05)	0.141	(0.17)	0.801***	(0.19)	0.231*	(0.13)	24960
Business Services	44	1.086***	(0.07)	-0.024	(0.08)	0.060	(0.04)	0.649***	(0.13)	1.530***	(0.17)	0.602***	(0.06)	25635
Research and Development	45	0.148**	(0.07)	0.104	(0.08)	0.034	(0.03)	-0.305**	(0.14)	0.474***	(0.11)	-0.023	(0.06)	24647
Admin. & Support Services	46	0.370***	(0.13)	0.201	(0.14)	0.129***	(0.03)	-0.198	(0.18)	0.815***	(0.19)	-0.142	(0.12)	26910
Public & Social Services	47	0.546***	(0.16)	0.024	(0.23)	0.084**	(0.04)	0.381	(0.30)	0.784**	(0.32)	0.271*	(0.16)	25785
Education	48	0.585***	(0.15)	0.256*	(0.15)	0.290***	(0.06)	0.624*	(0.36)	0.702**	(0.30)	0.017	(0.10)	25950
Human Health and Social Work	49	0.397*	(0.22)	0.307*	(0.16)	0.453***	(0.16)	0.981***	(0.24)	0.606	(0.39)	0.023	(0.13)	26160
Other Services, Households	50	0.888*	(0.51)	-0.226**	(0.11)	-0.094	(0.08)	0.458*	(0.24)	0.982	(0.60)	0.063	(0.30)	27495

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. Pair as well as year specific importer and exporter fixed effects included but not reported.

Table B7: Changes in Aggregate Output, 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	-0.03	0.07	-4.88***	1.61***
new EU	-0.21	0.17*	-6.67***	2.11***
non-EU	0.07***	-0.02***	0.19***	-0.10***
S2 Single Market				
old EU	-1.96***	-0.60***	-11.47***	2.30***
new EU	-3.92***	-0.95***	-15.68***	3.31***
non-EU	0.20***	-0.09***	0.33***	-0.12***
S3 Euro				
old EU	-0.31***	-0.06**	-1.40***	0.07
new EU	-0.05	-0.03***	-0.35***	0.12***
non-EU	0.02*	-0.00	0.02	0.07***
S4 Schengen				
old EU	-0.69***	-0.30***	-4.66***	1.18***
new EU	-1.31***	-0.50***	-6.10***	1.48***
non-EU	0.05***	-0.05***	-0.14***	0.01
S5 RTAs				
old EU	-0.14**	-0.05***	-0.49***	-0.03
new EU	-0.17***	-0.01*	-0.57***	0.09***
non-EU	0.00	0.01**	-0.34***	0.19***
S6 All				
old EU	-2.98***	-0.88***	-20.61***	4.18***
new EU	-5.61***	-1.19***	-26.56***	5.95***
non-EU	0.30***	-0.15***	0.03	0.06
S7 All w Transfers				
old EU	-3.53***	-0.77***	-21.03***	4.40***
new EU	-9.70***	0.16	-24.24***	6.78***
non-EU	0.19***	-0.07***	-0.40***	0.14***

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 2000.

Table B8: 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.	-12.41***	2.16*	0.47***	-0.97***	-8.29***	2.19**
	Manuf.	-13.80***	3.52***	0.52***	-0.90***	-7.36***	2.56***
	Serv.	-0.91***	-3.83***	0.26***	-0.37***	-0.25***	-1.85***
new EU	Agric.	-13.63***	2.15*	1.17***	-1.69***	-8.89***	1.48*
	Manuf.	-13.14***	3.24***	0.53***	-2.18***	-9.46***	2.90***
	Serv.	-0.89***	-3.65***	0.42***	-0.75***	-0.36***	-2.33***
S2 Single Market							
old EU	Agric.	-28.73***	8.91***	1.82**	-1.59	-18.98***	7.66***
	Manuf.	-22.54***	2.45***	-1.28***	-0.77***	-12.98***	2.87***
	Serv.	-19.55***	1.02	0.50*	-1.34***	-8.21***	-0.23
new EU	Agric.	-28.06***	7.08***	3.78***	-2.07**	-17.87***	5.30***
	Manuf.	-22.68***	3.04***	-2.05***	-2.54***	-17.13***	3.59***
	Serv.	-21.23***	2.19**	1.01***	-2.83***	-12.27***	0.80
S3 Euro							
old EU	Agric.	-14.61***	2.02**	0.43*	-3.25***	-9.81***	1.36*
	Manuf.	-2.25***	0.45	-0.23	-0.02	-1.34***	0.40
	Serv.	-1.95***	-0.21	0.08	-0.28***	-0.80***	-0.24
new EU	Agric.	-0.19	0.60***	0.08	0.21**	-0.10	0.47***
	Manuf.	-0.24**	-0.02	-0.06	0.10	-0.19***	0.05
	Serv.	-1.16***	0.54***	-0.05	0.02	-0.71***	0.35***
S4 Schengen							
old EU	Agric.	-8.48***	1.79**	-0.79	-0.07	-6.03***	1.81***
	Manuf.	-8.85***	2.04***	-2.04***	0.46***	-5.79***	1.87***
	Serv.	-5.51***	-0.52	-0.31	-0.69***	-2.56***	-0.59***
new EU	Agric.	-9.27***	1.51	-0.13	-0.79***	-6.34***	1.12
	Manuf.	-9.05***	1.80***	-2.20***	-0.30**	-7.20***	1.88***
	Serv.	-5.98***	-0.15	-0.31	-1.05***	-3.69***	-0.34
S5 RTAs							
old EU	Agric.	-1.81***	-0.43*	-2.26***	-0.80	-1.96***	-0.64*
	Manuf.	0.59***	-0.09**	-2.06***	0.73***	-0.60***	0.09*
	Serv.	-0.18***	0.21***	-0.19	-0.49***	-0.18***	-0.19***
new EU	Agric.	-0.92***	0.20***	-0.26	-0.95**	-0.71***	-0.19*
	Manuf.	0.06	0.20***	-2.87***	1.11***	-0.73***	0.17***
	Serv.	-0.24***	0.20***	-0.17	-0.62***	-0.21***	-0.16***
S6 All							
old EU	Agric.	-53.97***	9.19***	-0.43	-6.28***	-36.88***	8.23***
	Manuf.	-41.52***	6.14***	-5.01***	-0.22	-25.11***	6.41***
	Serv.	-26.48***	-2.75***	0.22	-2.91***	-11.38***	-2.71***
new EU	Agric.	-43.67***	7.86***	4.91***	-5.02***	-28.12***	5.55***
	Manuf.	-40.38***	6.39***	-6.29***	-3.18***	-31.21***	7.16***
	Serv.	-27.88***	-0.69	0.77*	-4.83***	-16.33***	-1.45*
S7 All w/ Transfers							
old EU	Agric.	-55.01***	9.35***	0.07	-6.11***	-37.43***	8.57***
	Manuf.	-42.75***	6.27***	-4.46***	-0.17	-25.54***	6.67***
	Serv.	-27.37***	-2.75**	0.21	-2.62***	-11.77***	-2.54***
new EU	Agric.	-42.47***	9.38***	11.47***	-4.22***	-25.21***	7.08***
	Manuf.	-38.26***	7.17***	0.26	-2.92***	-27.90***	8.33***
	Serv.	-28.35***	0.89	1.78***	-2.72***	-16.20***	0.42

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

Table A9: 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	-1.74***	-4.66***	-0.60***	-1.90***	-0.22***	-7.77***	-8.50***
Forestry & Logging	A02	2	-1.80***	-4.09***	-0.48***	-1.81***	-0.25**	-7.97***	-8.31***
Fishing & Aquaculture	A03	3	-1.87***	-5.09***	-0.45***	-1.15***	-0.31	-7.82***	-8.84***
Mining & Quarrying	B	4	-0.02	-1.10	-5.59***	0.04	-3.94***	-11.00***	-10.60***
Food, Beverages & Tabacco	C10-C12	5	-1.65***	-4.38***	-0.48***	-1.67***	-0.21***	-7.28***	-8.02***
Textiles, Apparel,Leather	C13-C15	6	-2.02***	-3.86***	-0.15	-1.72***	-0.48***	-7.86***	-8.35***
Wood & Cork	C16	7	-1.62***	-3.66***	-0.50***	-1.42***	-0.49***	-7.23***	-7.36***
Paper	C17	8	-1.00***	-4.17***	-0.44***	-1.43***	-0.18**	-6.74***	-6.97***
Recorded Media Reproduction	C18	9	-0.48***	-3.56***	-0.42***	-1.40***	-0.21***	-5.72***	-6.20***
Coke, Refined Petroleum	C19	10	-1.50***	-4.23***	-1.18***	-2.02**	0.74	-7.57***	-7.54***
Chemicals	C20	11	-3.71***	-7.23***	-1.28***	-2.96***	-0.51***	-14.08***	-14.27***
Pharmaceuticals	C21	12	0.72***	-4.09***	-0.27	-1.09***	0.29***	-4.02***	-3.66**
Rubber & Plastics	C22	13	-2.36***	-5.41***	-0.52***	-2.09***	-0.39***	-9.74***	-10.01***
Other non-Metallic Mineral	C23	14	-1.12***	-3.94***	-0.48***	-1.54***	-0.38***	-6.98***	-7.46***
Basic Metals	C24	15	-1.57***	-9.14***	-1.28***	-3.00***	-0.50***	-14.21***	-14.13***
Fabricated Metal	C25	16	-1.09***	-4.12***	-0.45***	-1.58***	-0.37***	-7.10***	-7.41***
Electronics & Optical Products	C26	17	-1.94***	-3.28**	0.66	-0.29	-0.11	-5.00***	-4.92***
Electrical Equipment	C27	18	-1.64***	-6.89***	-0.55*	-2.17***	-0.29***	-10.75***	-10.71***
Machinery & Equipment	C28,C33	19	-0.74***	-4.21***	-0.40***	-1.62***	-0.14*	-6.64***	-6.57***
Motor Vehicles	C29	20	-2.18***	-5.38***	-0.20	-2.17***	-0.31***	-9.47***	-9.77***
Other Transport Equipment	C30	21	-0.45***	-2.63***	-0.87***	-0.75***	-0.17*	-4.71***	-5.03***
Furniture & Other Manufacturing	C31&C32	22	-0.75***	-3.54***	-0.49***	-1.71***	0.06	-6.06***	-6.44***

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 A10: 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	-0.65***	-4.19***	-0.52***	-1.58***	-0.23***	-6.74***	-7.30***
Water Supply	E36	24	-0.42***	-3.89***	-0.47***	-1.56***	-0.16**	-6.08***	-6.75***
Sewerage & Waste	E37-E39	25	-0.63***	-4.67***	-0.60***	-1.59***	-0.23***	-7.20***	-7.67***
Construction	F	26	-0.28***	-3.84***	-0.44***	-1.47***	-0.22***	-5.93***	-6.54***
Trade & Repair of Motor Vehicles	G45	27	-0.48***	-3.86***	-0.41***	-1.61***	-0.22***	-6.21***	-6.80***
Wholesale Trade	G46	28	-0.73***	-4.14***	-0.48***	-1.71***	-0.26***	-6.84***	-7.30***
Retail Trade	G47	29	-0.35***	-3.82***	-0.44***	-1.52***	-0.22***	-6.00***	-6.57***
Land Transport	H49	30	-0.60***	-3.81***	-0.46***	-1.52***	-0.27***	-6.23***	-6.71***
Water Transport	H50	31	-0.05***	-1.80***	-0.11	-0.53***	-0.11**	-2.50***	-2.62***
Air Transport	H51	32	-0.15***	-3.07***	-0.25***	-1.06***	-0.17***	-4.47***	-4.85***
Aux. Transportation Services	H52	33	-0.63***	-3.78***	-0.41***	-1.54***	-0.17***	-6.11***	-6.55***
Postal and Courier	H53	34	-0.39***	-3.46***	-0.41***	-1.34***	-0.28***	-5.57***	-6.01***
Accomodation and Food	I	35	-0.22***	-3.60***	-0.45***	-1.39***	-0.22***	-5.56***	-6.30***
Publishing	J58	36	-0.43***	-3.78***	-0.31***	-1.29***	-0.15***	-5.62***	-6.05***
Media Services	J59&J60	37	-0.27***	-3.55***	-0.42***	-1.26***	-0.19***	-5.40***	-5.84***
Telecommunications	J61	38	-0.31***	-3.72***	-0.45***	-1.44***	-0.21***	-5.80***	-6.45***
Computer & Information Services	J62&J63	39	-0.32***	-3.18***	-0.36***	-1.25***	-0.19***	-5.04***	-5.42***
Financial Services	K64	40	-0.40***	-3.35***	-0.35***	-1.47***	-0.25***	-5.48***	-5.96***
Insurance	K65&K66	41	-0.28***	-3.44***	-0.55***	-1.12***	-0.20***	-5.27***	-5.71***
Real Estate	L68	42	-0.26***	-3.60***	-0.44***	-1.37***	-0.22***	-5.60***	-6.17***
Legal and Accounting	M69&M70	43	-0.52***	-3.65***	-0.51***	-1.43***	-0.24***	-5.96***	-6.34***
Business Services	M71,M73-M75	44	-0.54***	-4.02***	-0.45***	-1.41***	-0.26***	-6.27***	-6.67***
Research and Development	M72	45	-0.26***	-3.71***	-0.44***	-1.39***	-0.20***	-5.69***	-6.11***
Admin. & Support Services	N	46	-0.50***	-3.80***	-0.52***	-1.44***	-0.21***	-6.09***	-6.48***
Public & Social Services	O84	47	-0.30***	-3.98***	-0.51***	-1.52***	-0.22***	-6.18***	-6.84***
Education	P85	48	-0.24***	-3.90***	-0.47***	-1.50***	-0.21***	-6.02***	-6.65***
Human Health and Social Work	Q	49	-0.27***	-3.92***	-0.51***	-1.52***	-0.22***	-6.11***	-6.59***
Other Serivces, Households	R-U	50	-0.26***	-3.65***	-0.43***	-1.39***	-0.22***	-5.66***	-6.22***

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 and approximate normal distribution.