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The costs and benefits of leaving the EU

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The Costs and Benefits of Leaving the EU

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The Costs and Benefits of Leaving the EU

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Abstract

What would be the economic effects of the UK leaving the European Union on living standards of British people? We focus on the effects of trade on welfare net of lower fiscal transfers to the EU. We use a standard quantitative static general equilibrium trade model with multiple sectors, countries and intermediates, as in Costinot and Rodriguez-Clare (2013). Static losses range between 1.13% and 3.09% of GDP, depending on the assumptions used in our counterfactual scenarios. Including dynamic effects could more than double such losses.

Keywords: Trade, European Union, welfare

JEL Classification: F13 F17 F60

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1 Introduction

In January 2013 Britain's Prime Minister David Cameron committed to a referendum on EU membership in 2017. The ruling Conservative party received a boost in opinion polls following this speech and many argue that "Brexit" would be beneficial for the UK. Many of these reasons are political - for example repatriating powers back from Brussels. Supporters of the EU also argue that being part of the EU is important for geopolitical reasons, like supporting a union that reduces the risk of tyranny and conflict. Here we focus purely on economic arguments.

Eurosceptics (Morris, 2013) believe that trade with EU countries would not be highly affected by an exit because UK's trade deficit with the EU provides enough bargaining power to allow the negotiation of a free trade agreement between the two parties, similar to that enjoyed by Norway or Switzerland. Secondly, Britain would be able to expand its trade with non-EU countries through the negotiations of new trade agreements that would not be subjected to constraints imposed by other EU members. Thirdly, the UK country would be free from the regulatory burden and the costs associated with the EU membership.

Supporters of EU membership (Springford and Tilford, 2014) argue that it is unrealistic to expect the same trade terms as smaller countries like Norway or Switzerland, that the UK's ability to strike trade deals with other countries will be weakened, not strengthened outside the EU and that the costs of regulation solely due to the EU are vastly exaggerated. Furthermore, there are many other aspects that need to be taken into consideration (Harari and Thompson, 2013).

In this paper we focus on the welfare gains arising from trade openness with EU countries to quantify some of the effects associated with an eventual withdrawal from the EU. Our methodology is based on Costinot and Rodriguez-Clare (2013). We define distinct scenarios and calculate the changes in welfare, measured by real consumption, generated by a UK exit from the EU. We find that bilateral increases of tariffs and non-tariff barriers between the UK and EU generally lead to a drop in UK welfare even after accounting for lower fiscal transfers to the EU. We also find that the UK has even more to lose in a scenario where non-tariff trade costs within EU countries continue to fall more over time than in other OECD countries, something that seems likely to occur. The static welfare changes range from -1.13% in an optimistic scenario, to -3.09% in a pessimistic one.

In our setup, trade liberalization tends to increase welfare due to an expansion in the set of feasible allocations that leads to Pareto superior outcomes. This superiority translates into the availability of cheaper consumption goods and/or inputs (Eaton and Kortum, 2002). Our baseline

calculations, however, leave out many factors that could lead to further losses following an exit from the EU. For example, the fall in the number of varieties available for consumption (Krugman, 1980) and productivity decreases due to fall in competition from abroad (Melitz, 2003), together with the presence of vertical production chains in the UK (Melitz and Redding, 2014), will most likely increase such losses. Furthermore, contrary to popular belief, ceasing migration flows between UK and other EU countries, one of the EU most basic principles, will also tend to decrease welfare not only in the source region but also in the destination one (di Giovanni, Levchenko, and Ortega, 2012).

Our analysis is also static in nature and gains from trade can be considerably larger when we factor in dynamic effects. Trade openness can increase growth rates due to a rise in investment (Wacziarg, 1998), increases in technology diffusion (Sampson, 2013; Wacziarg, 1998), export learning effects (Albornoz, Calvo Pardo, Corcos, and Ornelas, 2012; Egger, Larch, Staub, and Winkelmann, 2011) and greater investment in R&D (Bloom, Draca, and Van Reenen, 2011; Keller, 1999, 2002).

An alternative way to evaluate the impact of an exit and take into account *part* of these dynamic effects is to use the results of simple, less theory-based empirical studies of the effects of EU membership. Baier, Bergstrand, Egger, and McLaughlin (2008) find that after controlling for other determinants of bilateral trade, EU members trade substantially more with other EU countries than they do with members of the European Free Trade Association (EFTA). Their estimates imply that, if the UK leaves the EU and joins EFTA, its trade with countries in the EU will fall by about a quarter. Combining this with the estimates from Feyrer (2009) implies that leaving the EU (and joining EFTA) will reduce UK income by between 6.3% and 9.5%. These estimates are much higher than the costs obtained from the static structural trade model, implying that dynamic effects from trade are important.

The structure of the paper is as follows. We describe the data and present our counterfactual analysis in Section 2. In Section 3 we use alternative non-structural approaches to calculate welfare losses. We offer concluding comments in Section 4. Section

2 Empirical Analysis

We quantify the effects of changes in tariff and/or trade costs that will affect the EU-UK relationship in the case of an exit. Our methodology is heavily based on Costinot and Rodriguez-Clare (2013)

- please check Section 4 of that paper for details on the methodology used here.

2.1 Data

We use the World Input-Output Database (WIOD)[1]. This database encompasses 40 countries and an additional region denominated the 'rest of the world'. It covers 35 sectors, which we further aggregate into 31 sectors as in Costinot and Rodriguez-Clare (2013) to account for small trade in some sectors around the world.

We collect information on the applied most favoured nation (MFN) tariff by the EU from the World Trade Organization (WTO) website, which provides information on tariffs at the *product* level (HS classification) for all tradable goods. We also use the United Nations (UN) Comtrade bilateral database at the product level. These two datasets permit us to calculate an average MFN tariff at the sector level for UK imports (exports), from (to) the EU by using import (export) value at the product level as weights. The resulting average MFN tariffs for imports and exports from/to the EU can be seen in Table 1, that summarizes the UK trade information at the sector level. The table split the sectors between 'Goods' and 'Services'. We can note that there is a substantial amount of trade even under the Services sectors.

From this point on, whenever we mention EU the reader should have in mind that it encompasses the EU 28 countries *minus the UK and Croatia*. The most intensively traded good in the UK/EU bilateral relationship is 'Transport Equipment', that includes automobiles, amounting to 95.7 billion of US dollars in 2011. This sector also possesses one of the highest average tariffs: 8.09% for imports from the EU and 7.22% for exports to the EU. Note that most part of this trade is composed by imports (60.4 billion, or 63%). On the other hand, the trade champion among services, the sector 'Renting of Machinery and Equip. and Other Business Services', is more intensively exported (USD 53 billions) than imported (USD 28 billion) by the UK. Financial services also are responsible for a significant trade share. Together, the two former sectors are responsible for more than two thirds of the flows of services between the UK and the EU. In general, we can see that the UK holds a deficit among goods and a surplus among services, with reasonable variability within the two groups.

[1]For more details on how this database is constructed, see Dietzenbacher, Los, Stehrer, Timmer, and de Vries (2013).

Table 1: UK Trade Statistics in 2011

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Total		*Imports*			*Exports*	
Sector	*EU Trade*	*Non-EU*	*EU*	*MFN Tariff*	*Non-EU*	*EU*	*MFN Tariff*
Goods							
Transport Equipment	95,723	30,753	60,382	8.09%	49,468	35,341	7.22%
Chemicals and Chemical Products	74,797	17,079	34,854	2.71%	24,265	39,943	2.16%
Electrical and Optical Equipment	61,506	36,176	38,057	1.97%	27,783	23,449	1.55%
Food, Beverages and Tobacco	56,463	14,706	42,294	7.26%	14,479	14,168	4.96%
Coke, Refined Petroleum and Nuclear Fuel	45,610	12,432	17,194	2.69%	11,299	28,416	2.81%
Basic Metals and Fabricated Metal	44,769	16,890	26,150	2.05%	18,202	18,619	1.89%
Machinery, Nec	39,624	13,809	24,717	2.05%	24,328	14,907	2.13%
Mining and Quarrying	28,679	48,929	8,512	0.00%	17,976	20,167	0.00%
Textiles and Textile Products; Leather, Leather and Footwear	20,178	23,282	11,912	9.58%	4,074	8,267	9.70%
Rubber and Plastics	16,042	5,400	9,290	5.35%	4,133	6,751	5.05%
Manufacturing, Nec; Recycling	15,909	9,188	9,730	1.71%	6,889	6,179	1.69%
Pulp, Paper, Paper , Printing and Publishing	15,538	4,516	10,539	0.04%	7,546	4,999	0.10%
Agriculture, Hunting, Forestry and Fishing	11,432	6,968	8,080	5.90%	1,677	3,352	5.63%
Other Non-Metallic Mineral	5,673	1,909	3,553	3.78%	1,959	2,120	3.32%
Wood and Products of Wood and Cork	3,413	1,493	2,942	2.35%	237	471	3.62%
Total Trade in Goods	*535,356*	*243,530*	*308,206*		*214,315*	*227,149*	
Services							
Renting of Machinery & Equip. and Other Business Activities	72,628	28,017	19,618	-	31,989	53,009	-
Financial Intermediation	50,145	18,285	3,281	-	50,761	46,864	-
Services Nec (4)	13,561	10,790	6,524	-	8,548	7,036	-
Post and Telecommunications	8,733	5,094	2,521	-	2,146	6,212	-
Air Transport	8,304	5,922	6,790	-	6,073	1,514	-
Hotels and Restaurants	6,196	18,319	4,312	-	10,352	1,884	-
Retail, Wholesale and Repair Activities Nec (1)	4,701	3,770	4,110	-	2,302	591	-
Other Supporting and Auxiliary Transport Activities (3)	4,321	1,318	1,706	-	1,742	2,615	-
Construction	3,760	587	1,890	-	383	1,869	-
Electricity, Gas and Water Supply	2,025	686	1,563	-	340	462	-
Retail Trade, Except of Motor Vehicles and Motorcycles (2)	1,216	457	936	-	989	280	-
Inland Transport	1,002	6,703	782	-	3,335	220	-
Real Estate Activities	967	1,752	191	-	97	776	-
Health and Social Work	906	2,007	831	-	410	74	-
Education	357	856	214	-	3,323	142	-
Water Transport	341	3,705	256	-	13,588	85	-
Total Trade in Services	*179,163*	*108,268*	*55,525*		*136,378*	*123,633*	
Total Trade	*714,519*	*351,798*	*363,731*		*350,693*	*350,782*	

Source: WIOD, WTO and UN Comtrade.

Notes: Table provides 2011 UK import and export values with EU and non-EU, as well as tariff costs for all WIOD sectors. All values in millions of USD. EU is defined as EU 28 minus the UK and Croatia. Column (1) equals the sum of columns (3) and (6). Tariffs by product are collected from the WTO database. Tariffs shown are weighted averages of products tariffs, where we use the import and export values by product between the UK and the EU as weights to compute the numbers seen in columns 5 and 8, respectively. Trade by product comes from UN Comtrade.

(1) Retail Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Commission Trade, Except of Motor Vehicles and Motorcycles

(2) Includes 'Repair of Household Goods'

(3) Includes 'Activities of Travel Agencies'

(4) Public Admin and Defence; Compulsory Social Security; Other Community, Social and Personal Services; Private Households with Employed Persons

2.2 Counterfactuals

In this section we present counterfactual exercises associated with the UK leaving the EU. We aim to quantify changes in welfare (real UK consumption) coming from three distinct sources: i) changes in goods tariffs, ii) changes in non-tariff barriers, and iii) future rises/falls in non-tariff barriers. We assume that firms are perfectly competitive throughout the analysis.

We consider two different scenarios one optimistic and another pessimistic. In the pessimistic case we assume that the UK will apply the MFN tariffs seen in column (4) of Table 1 on goods imported from the EU, while the EU will apply the tariffs observed in column (7) on goods originating from the UK. This seems reasonable in a first moment after the withdrawal, but it is likely that the UK will be able to negotiate a better tariff deal in the medium term such as Norway or Switzerland. Hence, in our optimistic scenario we consider that tariffs on goods continue to be zero between the two parts.

Another important source of trade costs around the world is due to non-tariff barriers. Non-tariff barriers are related to language, if countries share a border, if countries share a common currency, legal barriers, transport for goods, travel for (many) services, search and other transaction costs for both goods and services, etc (Anderson and van Wincoop, 2004; Head and Mayer, 2013). Many authors point out that such costs are higher than the tariff ones (Anderson and van Wincoop, 2004; Novy, 2013; LooiKee, Nicita, and Olarreaga, 2009). In fact, most part of the negotiations regarding the Transatlantic Trade and Investment Partnership between the EU and the USA aims to diminish non-tariff barriers between the two parts.

To incorporate non-tariff barriers we use information provided by Berden, Francois, Tamminen, Thelle, and Wymenga (2009, 2013). The authors calculate detailed tariff equivalents of non-tariff barriers between the *USA* and the EU+ (including the UK), using econometric technics and business surveys. They also calculate which part of these costs could be reduced since some of the expenses are linked to distance and other components that cannot be changed. We collect information on sectors that can be easily matched to our classification shown in Table 1. The sectors used, their non-tariff costs (in tariff equivalent terms) and the share of the costs that can be reduced are shown in Table A.1 in the Appendix.

Certainly, we do not believe that the UK would face the same costs as the US in a case of withdrawal. So, in our optimistic scenario we assume that the UK would face one quarter (1/4) of the reducible cost faced by the USA, while in our pessimistic scenario we assume that they

would face two thirds (2/3). We calculate a weighted average of these cost shares, having a total EU/UK trade in each sector as weights and considering the subset of sectors shown in the Appendix table, which include several of the relevant sectors in the EU/UK relationship. This calculation leads to an increase of non-tariff costs of 2% and 5.37% in our optimistic and pessimistic scenarios, respectively. We then apply such costs to *all sectors* in our economy.

We also consider that the intra-EU trade costs are falling over time (Ilzkovitz, Dierx, Kovacs, and Sousa, 2007), and this rate is approximately 40% faster than in other OECD countries according to Méjean and Schwellnus (2009), which use a panel data of French firms to study price convergence in different markets between 1995 and 2004. We consider that in 10 years from now non-tariff barriers inside the EU would be relatively smaller and the UK would not benefit from this fact. In our pessimistic scenario we assume that intra-EU non-tariff costs continue to fall 40% faster than in the rest of the world. This may not necessarily be true since OECD does not include countries like China, which has seen a rapid decrease in trade costs. Hence, in our optimistic scenario we assume that intra-EU barriers fall only 20% faster than in the rest of the world.

To calculate this last counterfactual we have to assume a measure of price differences across the European Union. We use a rough measure from Eaton and Kortum (2002) of 49%[2], meaning that if the UK imported (exported) all goods from (to) other European countries prices would be 49% higher. Naturally, part of this price difference may not be reducible. In all our scenarios we assume that just part of this cost can in fact potentially fall over time, 55%, which is the same share of non-tariff barriers that are actionable in the EU-USA trade case. To be even more conservative, in our pessimistic case we further assume that two thirds of the potentially reducible share will actually diminish throughout the years, while in the optimistic case we assume that such share is only one half. Then, using the estimates from Méjean and Schwellnus (2009), we calculate that future falls in non-tariff barriers in the next ten years will lead to a fall of 10.54% and 5.68% in our pessimistic and optimistic scenarios, respectively[3].

[2]Table II, UK row average of the trade cost values.

[3]For example, in the pessimistic case we start from trade cost of $\tau = 0.49$. Given our assumptions, only $0.49 * 0.55 * 2/3 = 0.18$ p.p. can fall over time. This implies that the price ratio between the UK and other EU countries is equal to 1.18. To find the change over time, we use the values of Méjean and Schwellnus (2009) (Table 1, column 3) to calculate reduction in price dispersion in ten years from now: $1.18 - (1.18)^{(1-0.182)^{10}} = 0.16$, where -0.182 comes from their estimation equation. Finally, the total change in trade cost is given by $(1 + 0.49 - 0.16)/(1 + 0.49) - 1$, which is close to -0.1054.

Table 2: Welfare Changes due to UK Withdrawal from the EU

	Multiple Sectors Intermediates
Panel A: Optimistic Scenario	
Due to Increase in EU/UK Tradable Tariffs (0%)	0%
Due to Increase in EU/UK Non-Tariff Barriers (+2.01%)	-0.4%
Due to Future Falls in EU/UK Non-Tariff Barriers (-5.68%)	-1.26%
Due to Fiscal Benefit	0.53%
Total Welfare Change	*-1.13%*
Panel B: Pessimistic Scenario	
Due to Increase in EU/UK Tradable Tariffs (MFN EU Tariffs)	-0.14%
Due to Increase in EU/UK Non-Tariff Barriers (+5.37%)	-0.93%
Due to Future Falls in EU/UK Non-Tariff Barriers (-10.54%)	-2.55%
Due to Fiscal Benefit	0.53%
Total Welfare Change	*-3.09%*

Notes: Counterfactuals changes in welfare, measured by changes in real GDP. Methodology based on Costinot and Rodriguez-Clare (2013). Fiscal benefit information comes from Treasury (2013). EU is defined as EU 28 minus the UK and Croatia.
Panel A shows an optimistic scenario: tariff on goods remain zero, non-tariff barriers are equal to 1/4 of the reducible barriers faced by USA exporters to the EU (2.01% increase), and that in the next ten years the intra-EU non-tariff barriers will fall 20% faster than in the rest of the world (fall of 5.68%).
Panel B shows a pessimistic scenario: tariff on goods are the MFN tariffs imposed by the EU (see Table 1), non-tariff barriers are equal to 2/3 of the reducible barriers faced by USA exporters to the EU (5.37% increase), and that in the next ten years the intra-EU non-tariff barriers will fall 40% faster than in the rest of the world (fall of 10.54%).

Our counterfactual welfare calculations are shown in Table 2. All our results consider that the economy is composed by multiple sectors and that intermediate goods can be traded across countries. In our optimistic scenario we can see that an increase in non-tariff barriers lead to a welfare fall of 0.4%. Future falls of intra-EU non-tariff barriers over the next 10 years could lead to additional benefits not reaped by the UK of 1.26%. How large are these numbers when compared to some costs generated by the EU membership? For example, Treasury (2013) predicts that future fiscal deficits of the UK with the EU will be around 0.53% (or £ 8.6 billion) of the UK GDP (2013). Taking this benefit into account, the UK would be loosing a total of 1.13% of its GDP in the case of an exit.

In our pessimistic scenario, however, we see that costs of a withdrawal can be much higher. Panel B shows that if the EU and the UK impose MFN tariffs on goods, the drop in real GDP would be around 0.14%. The increase in non-tariff barriers would lead to an additional loss of 0.93% and future falls in intra-EU trade barriers to 2.55% potential gains not internalized by the UK. Discounting the fiscal benefits implies a total welfare fall of 3.09%. This is a pessimistic scenario, but not an unrealistic one. So the UK has a lot at stake here. Moreover, the numbers presented

should be seen as *a lower bound for losses*, since there are many other sources of gains from trade not considered in our counterfactual analysis.

3 Non-structural estimates

In the previous section we attempted to quantify the welfare effects of the UK leaving the EU using a quantitative model of international trade. An alternative approach is to use existing empirical estimates of the effects of EU membership to infer the impact of leaving the EU on UK income. In particular, we can decompose the question into two parts. First, what effect will leaving the EU have on the UK's trade with the rest of the world? Second, what is the effect of changes in trade levels on income? There exist substantial literatures addressing both the effect of joining an economic integration agreement (EIA), such as the EU, on trade and the effect of trade on income.

Suppose that if the UK leaves the EU it will become a member of the European Free Trade Association (EFTA). Does EU membership cause a country to trade more with other EU members than EFTA membership? Baier, Bergstrand, Egger, and McLaughlin (2008) address exactly this question using a gravity model of bilateral trade augmented with dummy variables for which EIAs the exporter and importer belong to. In particular, they include dummy variables for both countries being in the EU, both countries being in EFTA, one country being in the EU and the other in EFTA and for both countries belonging to any other EIA. Importantly, they control for endogeneity of selection into the formation of EIAs using country-pair fixed effects with panel data. They find robust evidence that being a member of the EU leads a country to trade significantly more with other members of the EU than if it were only a member of EFTA. Quantitatively, their estimates imply that leaving the EU and joining EFTA will reduce the UK's trade with EU members by 25%.[4]

To predict the change in the UK's overall trade we also need to know how leaving the EU would affect the UK's trade with non-EU members. Baier, Bergstrand, Egger, and McLaughlin (2008) estimates suggest that whether a country is a member of the EU or EFTA does not have a significant effect on its trade with EFTA members. However, their estimates do not address how EU membership affects trade with countries outside of both the EU and EFTA. Structural gravity models such as that developed by Egger, Larch, Staub, and Winkelmann (2011) can be used to

[4]This figure is calculated using the estimates in Table 6, column 1. Both countries being in the EU increases trade by $e^{0.48} - 1 = 62\%$, while one country being in the EU and the other in EFTA increases trade by $e^{0.19} - 1 = 21\%$. Therefore, if a country leaves the EU and joins EFTA trade with EU members declines by $(e^{0.19} - e^{0.48})/e^{0.48} = 25\%$.

infer the general equilibrium effects of EIAs on trade between all country-pairs, but we are not aware of any work that applies the structural gravity methodology to estimate the effects of EU membership. Instead, we will rely on reduced form gravity model estimates of the trade diversion effects of EIAs. Studies of trade diversion typically find little evidence that joining an EIA leads to a reduction in trade with countries outside of the EIA. For example, Magee (2008) fails to find robust evidence of significant trade diversion effects from EIAs. Therefore, we will assume that leaving the EU will not affect the UK's trade with the rest of the world.

To quantify the effect of trade on income we will use the estimates of Feyrer (2009). Using data on the air and sea distances between countries, Feyrer uses changes in the cost of shipping goods via air relative to sea as an instrument for trade in a regression of income on trade. Since the instrument is time varying, Feyrer is able to improve upon the cross-section estimates of Frankel and Romer (1999) by using country fixed effects to control for time invariant unobservables that affect income levels. Feyrer concludes that the elasticity of trade to income is probably between one-half and three-quarters. Feyrer's estimation strategy implies that his estimates capture both the direct effect of higher trade on income and also other indirect effects of increased proximity between countries such as variation in FDI and knowledge diffusion. Thus, the estimates we obtain in this section should be interpreted as including some of the non-trade channels through which leaving the EU will affect UK income in addition to the direct effect of changes in the UK's trade.

Combining these numbers we can obtain a reduced form estimate of the effect of leaving the EU and joining EFTA on UK income. Since 50.4% of the UK's trade is with the EU, a 25% fall in trade with EU members will reduce the UK's overall trade by 12.6%. Combining this with Feyrer's estimate that the elasticity of income to trade is between one-half and three-quarters implies that leaving the EU and joining EFTA will reduce the UK's income by between 6.3% and 9.5%.

The reduced form approach used in this section has two principal advantages over the structural approach used earlier in the paper. First, it requires less detailed assumptions about what the relationship between the UK and the EU would be following a UK exit. The structural estimates required assumptions about both the future level of tariffs between the EU and the UK and the extent to which the UK would share in future reductions in non-tariff barriers within the EU. By contrast, the reduced form estimates are based on the simple and plausible assumption that if the UK leaves the EU it will join EFTA. Second, while the quantitative trade model used above is designed to capture only the static gains from trade, reduced form estimates of the effect of trade on income should capture both static and dynamic effects. The disadvantage of the reduced form

approach is that it relies on the existence of unbiased empirical estimates. While we have based our calculations on estimates obtained using best practice empirical methodologies, sampling error and identification challenges inevitably mean that some degree of uncertainty must be attached to the estimates. Overall, the calculations in this section should be viewed as a robustness check on the plausibility of the predictions obtained from the quantitative trade model. The reduced form estimates of the income effect of leaving the EU are higher than those obtained from the quantitative trade model, but they reinforce the conclusion that leaving the EU is likely to have a sizeable negative effect on UK welfare.

4 Conclusion

Withdrawing from the EU is a dangerous move for the UK. Using the Costinot and Rodriguez-Clare (2013) methodology, we generate counterfactual scenarios and show that UK future losses due to this move can sum up to 1.23% of the GDP in real terms in our optimistic scenario, and to a drop of 3.09% in our pessimistic one. When we factor in more realistic dynamic losses from lower productivity growth, a conservative estimate would double losses to 2.2% of GDP even in the most optimistic case. In the pessimistic case, there would be income falls of 6.3% to 9.5% of GDP, a loss of a similar size to that resulting from the global financial crisis of 2008/09. These numbers show that leaving the EU appears to be a risky gamble.

In any case, we should have in mind that these numbers are likely to be larger in reality, since many other welfare improving channels associated with EU trade such as immigration, increases in productivity, increases in R&D intensity, vertical production chains, to cite just a few, are not considered in our analysis.

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Appendix

Table A.1: Sector and Non-tariff Barriers (NTB) used in the Counterfactuals

Sector	*NTB Cost EU+/USA (tariff equivalent)*	*Reducible share of NTB*	*Weight (total trade UK/EU)*
Transport Equipment	22.1%	0.53	95723
Chemicals and Chemical Products	23.9%	0.63	74797
Post and Telecommunications	11.7%	0.70	8733
Electrical and Optical Equipment	6.5%	0.41	61506
Financial Intermediation	11.3%	0.49	50145
Food, Beverages and Tobacco	5.8%	0.53	56463
Construction	4.6%	0.38	3760
Renting of Machinery & Equip. and Other Business Activities	14.9%	0.51	72628
Services Nec (*)	4.4%	0.37	13561
Basic Metals and Fabricated Metal	11.9%	0.62	44769
Textiles and Textile Products; Leather, Leather and Footwear	19.2%	0.50	20178
Wood and Products of Wood and Cork	11.3%	0.60	3413

Source: WIOD and Author's compilation of a subset of the sectors presented in Tables 3.3 and 4.2 of Berden, Francois, Tamminen, Thelle, and Wymenga (2009).

Notes: Table provides non-tariff costs (in tariff equivalent terms) of trade flows from the USA to the EU+ (column 1). Also provides the share of costs that are potentially reducible (column 2). In our counterfactuals we assume either (i) that after the exit the UK faces 1/4 of the reducible costs seen by the USA (optimistic scenario) or (ii) that after the exit the UK faces 2/3 of the reducible costs seen by the USA (pessimistic scenario). We then use total EU trade as weights (column 3) to compute a weighted average of these costs and apply to all sectors in all our counterfactuals. EU is defined as EU 28 minus the UK and Croatia. EU+ includes the UK.

(*) Includes 'Repair of Household Goods'

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