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1 Introduction

On June 23th the United Kingdom (UK) will hold a referendum on its European Union's (EU) membership. Brexit will occur in the event of a leave vote and this will have far-reaching consequences. Brexit will affect all legal, economic and political relationships between the UK and the EU.

In this paper we focus on the medium- to long-term trade consequences of Brexit. In particular, we look at the potential trade and macroeconomic effects that Brexit will have for the Netherlands. The results of this study are used to analyse the economic policy consequences of Brexit for the Netherlands in the CPB Policy Brief 2016/07 (Bollen et al., 2016).

How Brexit will affect the trade policy of the UK with the EU and the rest of the world is of special interest to the UK's trading partners. However, since there is no precedent of a country leaving the EU, the consequences of Brexit are highly uncertain. The 2009 Lisbon Treaty established formal procedures for leaving the EU. A country most notify the EU of its intention to leave and this will trigger negotiations over a withdrawal agreement that can take up to two years (Dhingra and Sampson, 2016). Nevertheless, it is not clear what will be the political and economic reaction of the EU to Brexit and thus, what this withdrawal agreement will entitle. It is also not certain how trade policy and agreements negotiated by the European Commission (EC) on behalf of EU member states will be affected. This includes WTO membership and 36 free trade agreements that define the EU trade relationships with 58 countries.

The UK is one of the main trading partners of the Netherlands (representing around 9% of total Dutch exports), and as such, Brexit will directly affect the bilateral trade flows and consequently the Dutch economy. The most important trade issue related to Brexit is how the current free trade agreement imbedded in the EU's single market will be affected.

Given the uncertainties surrounding the trade policy consequences of Brexit, we employ a scenario-based analysis that simulates the expected economic effects of the most likely trade policy outcomes. This has been the main approach taken by recent assessments of the trade consequences of Brexit (Kierzenkowski et al., 2016; HM Treasury, 2016; Dhingra et al., 2016b). In particular, we use two main scenarios. In the first scenario, the UK's trade with the EU will be bounded only by WTO rules –i.e. tariffs will increase to the most-favoured nation levels and non-tariff barriers (NTB) costs will increase as a consequence of the UK leaving the EU's single market. In the second scenario, the UK successfully negotiates a free trade agreement (FTA) with the EU, but only after 10 years after Brexit. Once this new FTA is in place, tariff levels will return to zero, but NTB costs will remain half-way between EU membership and the non-EU NTB levels.

As with previous studies that analysed the trade implications of Brexit (e.g. HM Treasury, 2016; Dhingra et al., 2016b; Kierzenkowski et al., 2016) we find that Brexit will represent a significant real income loss for the UK. The scale of the income losses will be conditional on which alternative scenario is used to forecast the trade costs between the UK and the EU. As expected, scenarios where trade costs increase the most, as when the UK-EU trade is regulated only by World Trade Organisation (WTO) rules, derive in the highest economic losses. In our WTO scenario, the bilateral trade flows between the Netherlands and the UK are reduced by around 55%. Total British trade will decrease by 23% and this will translate into a GDP reduction of 4.1% by 2030. Dutch total trade is decreasing by around 4% and GDP by 1.2%. When the more benign FTA scenario is simulated, bilateral Dutch-British trade is reduced by around 30%. The GDP changes in this scenario amount to -3.4% for the UK and -0.9% for the Netherlands. Lower total Dutch trade, which is mainly driven by less trade with the UK, will also translate in some sectoral readjustment of output. The lower overall production in the Netherlands is also associated with average wages reduction of around 1% in the WTO option, and 0.7% in the FTA option.

This paper proceeds as follows. We first explain in Section 2 our main Brexit scenarios. Section 3 explains our methodological approach. We summarise our main results in Section 4 and conclude in Section 5.

2 Brexit trade scenarios

As explained above, the uniqueness of the Brexit referendum implies that there is great uncertainty regarding the changes in trade policy that the UK will experience if it leaves the EU.

We can divide these trade policy uncertainties into two groups. First, there will need to be a new set of trade rules between the EU and the UK that replaces the EU's single market setting. Given that the single market is considered to be a very deep and broad free trade agreement, which allows for the highest degree of integration of any multi-country trade agreement in existence, it is almost certain that leaving it will increase the costs of trading between the UK and the EU. These trade costs can be broadly defined as market access measures (tariffs and quotas) and behind-the-borders rules that define the extent of non-tariff barriers (NTBs) to trade.

Second, the trade relationship between the UK and the rest of the world may also be affected. Most studies take for granted that the UK will remain a member of the WTO, but this is also uncertain.[1] In the same vein, the EU has negotiated in the last decades 36 free trade agreements with 58 different countries. If the UK leaves the EU it is debatable whether it will be legally part of these FTAs and if not, it will have to re-negotiate trade deals with all these countries –a very time-consuming and costly process.[2]

However, since the scope of our paper is to assess the bilateral trade changes between the UK and the EU in case of Brexit, we centre our analysis on the first uncertainty: what kind of trade deal can we expect between the UK and the EU after Brexit? In this sense, we construct different scenarios that evaluate potential new UK-EU trade arrangements, regarding tariffs and NTBs.

This also implies that we assume throughout our analysis that the UK will retain its

[1] In a recent interview (Financial Times, 2016b) the director-general of the WTO, Roberto Azevêdo, implied that a Brexit will lead to a re-negotiation of the UK's WTO membership with the remaining 161 countries.

[2] For instance, the UK government will also need to create and set-up a trade negotiating office/team, since the required capacity and skills are not currently available to the UK civil service.

WTO membership and that it will also remain part of the FTAs it is currently part of as a EU member. If on the contrary the UK does not retain its WTO membership, it can face any level of trade protection by other WTO members –i.e. other countries are not bound to apply WTO rules in their trade relations with the UK. Furthermore, if the UK loses its preferential trade access to the countries that currently have a FTA with the EU, it will directly experience an increase in trade costs with these countries, while the extent of the trade cost increase will be conditional on WTO membership. If any or both cases occur, British exporters will certainly face increased trade costs that would also have significant economic consequences. However, these trade changes between the UK and non-EU countries will only have an indirect and secondary effect on the trade relation between the UK and the Netherlands, and as such, we abstract from them here.

2.1 Trade arrangements outside EU membership

To construct our trade scenarios we follow recent studies on the trade implications of Brexit for UK-EU trade (e.g. HM Treasury, 2016; Dhingra et al., 2016b; Kierzenkowski et al., 2016). There are several alternative trade arrangements to EU membership.[3] These alternative trade arrangements can be classified into three main groups:

1. Membership of the EEA (like Norway)
2. Free trade agreements (as with Switzerland, Turkey and Canada)[4]
3. WTO membership (default relationship)

EEA membership, however, is not very likely: the UK would have exchanged EU membership for something very much similar to EU membership (EU contributions, free movement of people, and will have to follow EU regulations) but without representation nor a direct influence on decisions. The UK, in addition, would have to satisfy 'rules of origin' requirements to enter the EU duty free. With the growing complexity of global supply chains, verifying a product's origin has become increasingly costly (Dhingra and Sampson, 2016, p.5). More importantly, being able to move away from EU immigration rules, contributions to the EU budget and EU regulations are central to the "Leave" campaign.

Therefore, we disregard the EEA scenario as politically implausible and inconsistent with the political implications of a Brexit vote, and thus, we consider that the two last options are the most likely possibilities after Brexit.

[3] For an in depth description of Brexit trade alternatives see Global Counsel (2015), HM Treasury (2016) and Dhingra and Sampson (2016).

[4] Note that the specific FTA arrangements vary by country. See Bollen et al. (2016) for further details.

2.2 Main scenarios and associated trade costs

After evaluating the different scenarios proposed in the literature, we use two main scenarios. Each of these scenarios is associated with a specific certain trade cost increase, which in all cases is above the currently low trade costs associated with EU membership and participation in the single market. In what follows, we divide overall trade costs into two main components: tariffs and non-tariff barriers (NTBs).

1. WTO option. This is expected to be the default option without any negotiated trade agreement after Brexit. Tariffs will increase to WTO's most favoured nation (MFN) levels and NTB costs will experience a moderate increase.
2. FTA option. The UK negotiates a free trade agreement (FTA) with the EU after 10 years of Brexit. When the new UK-EU FTA comes into tariff level will return to zero and NTB costs will be reduced but will not reach the levels currently associated with the EU's single market.

For all our scenarios we assume that the legal procedure for Brexit will begin in 2017 and after the two year gap allowed under the Lisbon Treaty for an arrangement deal, the official Brexit year will be 2019. Hence, the new trade costs under the WTO option will be imposed from 2019 onwards, while the trade costs associated with the FTA option will only start in 2029. Thus, in the FTA option, trade costs between 2019 and 2029 will be the same as the trade costs in the WTO option, and only in 2029 will the new trade costs from the FTA come into effect.

As explained above, we assume that the UK will retain its WTO membership and all other WTO members will be bounded to apply the MFN tariff levels. In this scenario, the MFN tariffs will be applied reciprocally between the UK and the EU. In Appendix A.1 we describe how we estimated the bilateral MFN tariffs levels.

NTB costs levels for manufacturing goods are taken from the gravity estimations in Egger et al. (2015), where they obtain intra-EU NTB ad-valorem equivalent savings. For NTB levels in services we use the World Bank estimations from **?** that are also reported in Egger et al. (2015). These values show how much belonging to the EU's single market saves in NTB costs for each member country. In this respect, in our WTO scenario the UK will lose access to the internal market and this intra-EU NTB costs savings will be lost and thus, we increase the NTB values for bilateral trade values. In our FTA scenario, we assume that the new UK-EU trade deal will cut these NTB cost levels by half –i.e. given that the level of integration between the UK and the EU will be diminished with Brexit, only a fraction of the NTB costs savings associated with the single market will be regained. Tables 7 and 8 in the Appendix show the applied NTB AVE applied in both scenarios.

Finally, the FTA option is based on a 10-year gap between Brexit and the implementation of the new UK-EU FTA. We find this to be a reasonable negotiating time, given that most multi-country FTAs take between 5 to 10 years to be negotiated and ratified by national parliaments. Therefore, we assume that during the first 10 years in the FTA option, the trade costs from the WTO option will apply and after that period, the new UK-EU FTA will be implemented with its associated trade cost reductions.

Compared to other Brexit studies, the tariffs and NTB cost levels we use for our simulations are similar to the overall trade costs levels used in the HM Treasury (2016) report, which are directly taken from gravity estimations. Our two main scenarios, in addition, are also comparable to the optimistic (FTA option) and pessimistic (WTO option) scenarios from the LSE/CEP study (Dhingra et al., 2016a,b).[5]

2.3 Alternative economic mechanisms

We simulate our two main scenarios under alternative economic mechanisms. First, we take into account that trade might increase productivity through increased innovation, competition and other mechanisms, which are known as the dynamic gains from trade. Second, we consider alternative measures of the potential trade costs associated with Brexit.

2.3.1 Dynamic gains from trade

The HM Treasury (2016) report also includes a link between trade volumes and productivity, based on the recent work by Feyrer (2009) and Melitz and Trefler (2012). A similar trade-productivity link is used in the Kierzenkowski et al. (2016) report. It is important to mention that this dynamic relation between trade and income (through the productivity growth) is not a standard approach to CGE modelling of trade policy.[6] In Appendix A.3 we survey the recent literature on dynamic gains from trade. The

[5] In particular, we use the same assumptions that the WTO option will imply MFN tariffs and zero tariffs under the FTA option. The LSE/CEP study assumes a 6% increase in NTB costs in the WTO option, and only a 2% NTB cost increase in the FTA option. However, in contrast to this study, we do not assume that EU membership will imply additional NTB cost reductions in the future (see Appendix A.2 for details).

[6] One of the reasons that these reports use this dynamic link is that the model employed in both studies (NiGEM) is not an intrinsic trade model and as such, gains from trade are mainly achieved through exogenously imposed productivity increases that are associated with higher trade volumes.

main message from this survey is that there are compelling examples that trade has dynamic effects on income, through different channels. However, the precise empirical magnitude and mechanisms associated with these effects is less reliable. Therefore, as part of our sensitivity analysis we add an exogenously determined linked between trade volumes and productivity.[7]

2.3.2 Alternative trade cost estimations

The estimation of the trade costs associated with trade policy changes, as is the case for Brexit, can be done using different approaches (cf. Berden and Francois, 2015; Bekkers and Rojas-Romagosa, 2016). Therefore, to check the robustness of our main results, we use alternative trade cost estimations associated with Brexit.

For each scenario described above we can analyse the effects of tariffs and NTB cost changes separately. As an alternative, we use the estimation of total trade costs (i.e. tariffs plus NTB costs) from the HM Treasury (2016) report. Compiling several gravity estimations from the literature, they assume in their WTO scenario that total trade costs in goods are 16.6% and 4.4% in services; while the FTA scenario will have total trade costs of 4.5% and 1.4% for goods and services, respectively.

3 Brexit simulations using WorldScan

To simulate our Brexit scenarios we use WorldScan, the CPB in-house computational general equilibrium (CGE) model for the world economy (Lejour et al., 2006).[8] The CGE modelling framework allows for economy-wide analysis and is the standard tool for trade policy analysis.[9]

The key features of a CGE framework include the model that describes economic activity and behaviour, the underlying database that accounts for initial equilibrium of the global economy (e.g. the GTAP database), as well as a set of parameters that drive responses of agents to any given perturbation to the initial equilibrium. By employing a

[7] Technically, we create an exogenous link between trade volumes that are above the baseline values that is associated with above-baseline TFP increases. For this link we use a conservative value for the elasticity of trade to productivity of 0.1.

[8] Technically speaking, WorldScan belongs to the standard GTAP-class CGE models. The main characteristics and references to the standard GTAP model can be found at: www.gtap.agecon.purdue.edu/models/current.asp, while Hertel (2013) and Rutherford and Paltsev (2000) provide a detailed discussion of the GTAP-class models.

[9] More recently, a new type of quantitative trade models has also been used for trade policy analysis: structural gravity (SG) models. For instance, the LSE/CEP study (Dhingra et al., 2016a,b) employs a SG model for their Brexit analysis. See Bekkers and Rojas-Romagosa (2016) for a description of these SG models and a detailed comparison with standard CGE models.

balanced and internally consistent global database, in tandem with an economic model that describes economic activity for a variety of sectors and agents in the global economy, any change in exogenous variables can be assessed to understand the effects on endogenous variables in the model. For example, preferential trade agreements (PTAs) are usually assessed by imposing a trade policy shock (changing bilateral tariffs and NTBs) to a baseline scenario. The resulting counterfactual scenario is then compared with the baseline to obtain the potential economic effects of the PTA.[10]

The particular WorldSan model employed in this paper uses the latest version of the GTAP database (version 9 with base-year 2011) and distinguishes 21 goods and services sectors (see Table 9 in the Appendix), and 33 countries and regions. All EU countries are modelled separately, except for Belgium and Luxembourg, the three Baltic States, and Croatia, Cyprus and Malta (see Table 10 in the Appendix).

The Kierzenkowski et al. (2016) and HM Treasury (2016) simulations, on the other hand, are based on the NiGEM model, which is a global macroeconomic model. However, a very important limitation of NiGEM is that it is not a trade model and as such, it is not built to deal with trade policy shocks. The trade and productivity shocks associated with Brexit are thus taken from other sources and are not imbedded into the model. Choosing a non-trade model to simulate Brexit can be understood if short-term effects (consumer and investment volatility) and other non-trade effects are analysed (e.g. FDI, migration).

4 Trade and macroeconomic effects of Brexit

In this section we present the results of our scenarios simulated using the WorldScan model. We present first the results for our main scenarios and then the results for our scenarios using alternative economic mechanisms.

The UK is closely integrated with the EU. British exports to the EU27 (i.e. the EU without the UK) currently represent around 52% of total British exports, while EU27 exports to the UK are just around 7%. In this context, the increases in trade costs associated with Brexit are expected to affect the UK proportionally more than the EU27. For the Netherland, the UK is a more important export market than for the average EU country. Dutch exports to the UK represent 9% of the total and as such, the negative effects of Brexit are expected to be higher for the Netherlands than for the average EU.

[10] A more detailed and technical explanation of the WorldScan CGE model is provided in Appendix A.4.

4.1 Main scenario results

The overall macroeconomic results for our main scenarios are presented in Table 1. The WTO scenario represents the highest increase in trade costs –both in terms of tariffs and NTBs, and thus, has the highest total trade decreases for the UK, where total trade volume is collapsing by almost a quarter. This is a direct consequence of the costs of exporting and importing to EU27 countries increasing with Brexit, in conjunction with the the EU27 being the main trading partner for the UK. On the other hand, total trade for the EU27 and the Netherlands is decreasing only by around 3%, reflecting that the British market is not as important for EU trade.

Table 1: Brexit simulation results, main scenarios, overall macroeconomic effects, percentage changes with respect to the baseline in 2030

	WTO option			**FTA option**		
	NLD	EU27	UK	NLD	EU27	UK
GDP	-1.2	-0.8	-4.1	-0.9	-0.6	-3.4
export volume	-3.2	-3.0	-23.2	-1.9	-1.7	-13.2
import volume	-4.3	-3.4	-23.6	-2.2	-1.7	-12.3
real average wage	-1.0	-0.7	-4.2	-0.7	-0.4	-2.7

Source: Own WorldScan estimations using GTAP9 database.

These changes in trade flows have a direct effect on GDP levels. The higher costs of trading between the UK and the EU translate into a less efficient allocation of resources across industries –i.e. the static gains from trade are reversed in this case, as trade becomes more costly. Moreover, the GDP losses a directly proportional to the changes in trade flows, where the UK experiments the largest GDP decrease (4%) and the Netherlands has a 1% GDP reduction, which is higher than the EU27 lose because the Netherlands, on average, trades more with the UK than other EU members. GDP losses and the associated static productivity losses are also reflected in lower labour demand and lower average wages.[11]

The Brexit losses from the FTA scenario are less severe. The implementation of a new UK-EU FTA after 10 years of Brexit means that the initial tariff and NTB cost hikes from Brexit are reduced. As such, trade flows in 2030 are decreasing at a slower pace and GDP losses are smaller, although still significant.

It is important to note that all the simulation results we present refer to changes

[11] In the WTO scenario lower labour demand is also associated with a total employment decrease of around 0.5%, or around 40,000 currently employed workers.

with respect to the baseline scenario in 2030. In other words, the economic effects of Brexit are evaluated against the business-as-usual baseline scenario. In addition, we chose 2030 mainly for expositional purposes, but the results are quantitatively and qualitatively similar if we used 2040. In Table 11 in Appendix A.5 we present the Brexit simulation effects in 2040, where the GDP loses for the Netherlands and the EU27 are very similar to those using 2030 in Table 1, although slightly bigger for the UK.

The behaviour of trade flows after Brexit is further detailed in Table 2. Here we observe that the bilateral trade flows between the Netherlands and the UK are experiencing a very sharp decrease of more than 50 percentage points. While there are also some trade diversion effects: exports with other countries, in particular non-EU countries (RoW) is increasing by 1.5% while Dutch export to other EU countries has a small increase of 0.7% in our first scenarios. As similar trade pattern can be observed for the UK and the EU27. However, in all cases the extra trade with non-EU regions does not compensate for the lost UK-EU trade. Again, the WTO scenario trade shocks are almost double as large as those with the FTA scenario.

Table 2: Brexit simulation results, main scenarios, export values, percentage changes with respect to the baseline in 2030

		WTO option			
	Total	to EU27	to UK	to NLD	to RoW
NLD	-3.2	0.7	-51.5		1.5
EU27	-3.0	0.5	-56.6	0.2	0.7
UK	-21.8	-51.3		-44.5	1.7
		FTA option			
	Total	to EU27	to UK	to NLD	to RoW
NLD	-1.8	0.4	-28.7		0.7
EU27	-1.7	0.3	-31.0		0.3
UK	-12.5	-31.0		-24.9	1.2

Note: Percentage changes are for export *values*, while Table 1 shows changes in export *volumes*.

Source: Own WorldScan estimations using GTAP9 database.

Next, we define openness to the UK as exports to the UK plus imports from the UK, divided by the country's GDP. This concept of openness and that of "connection between countries" as used in Bollen et al. (2016) both refer to the degree of trade linkages between countries or groups of countries. This indicator shows how important British trade is with respect to total economic activity. Table 3 illustrates that EU member states that have a deeper trade integration with the UK also experience the largest GDP losses. The correlation between openness to the UK and the GDP losses in both scenarios is around 0.8. The starkest example is Ireland, which is highly integrated with the UK and which also has the biggest GDP losses. In particular, Irish losses from Brexit are just slightly lower than the losses experienced by the UK itself.

Table 3: Brexit simulation results, main scenarios, GDP changes and openness to UK, percentage changes with respect to the baseline in 2030

Code	Country/Region	Openness to UK	GDP changes WTO option	GDP changes FTA option
AUT	Austria	1.1%	-0.4	-0.3
BAL	Baltic countries	1.4%	-0.4	-0.3
BLU	Belgium and Luxembourg	5.9%	-2.1	-1.5
BGR	Bulgaria	1.6%	-0.6	-0.5
CCM	Croatia, Cyprus and Malta	3.0%	-0.8	-0.7
CZE	Czech Republic	1.9%	-0.6	-0.5
DNK	Denmark	2.9%	-0.8	-0.7
DEU	Germany	1.4%	-0.6	-0.5
FIN	Finland	2.0%	-0.4	-0.4
FRA	France	1.5%	-0.6	-0.5
GRC	Greece	1.1%	-0.6	-0.4
HUN	Hungary	2.4%	-0.8	-0.7
IRL	Ireland	12.0%	-3.7	-3.4
ITA	Italy	1.3%	-0.5	-0.4
NLD	Netherlands	3.3%	-1.2	-0.9
POL	Poland	1.5%	-0.6	-0.4
PRT	Portugal	1.8%	-0.9	-0.7
ROU	Romania	1.0%	-0.3	-0.3
SVK	Slovakia	1.6%	-0.6	-0.5
SVN	Slovenia	1.2%	-0.3	-0.3
ESP	Spain	1.9%	-0.9	-0.7
SWE	Sweden	2.2%	-0.7	-0.6
EU27	EU without UK	2.1%	-0.8	-0.6

Notes: Openness to UK is defined as exports to the UK plus imports to the UK divided by the country's GDP. Source: Own WorldScan estimations using GTAP9 database.

The previous overall macroeconomic effects, however, are masking sector-specific changes and the reallocation of production and exports between sectors. Table 4 presents the sectoral changes in output and exports in the Dutch economy as a consequence of Brexit.

As expected, there is a direct relation between sectoral export changes and sectoral production. Those sectors that experience the biggest export shocks –electronic

Table 4: Netherlands, main Brexit scenario, sectoral output and export percentage changes with respect to the baseline in 2030

		Output			Exports			
		2015 shares	% change		2015 shares	opennes	% change	
Sector	**Code**		WTO option	FTA option		**to UK**	WTO option	FTA option
Agriculture	AGR	2.1	-0.3	-0.1	4.6	6.0	-1.0	-0.2
Oil and other mining	OMI	0.2	0.0	0.0	0.2	51.0	-0.4	-0.3
Energy	ENG	6.7	-0.3	-0.1	12.0	23.0	-0.2	0.2
Processed foods	PFO	5.3	-5.5	-3.8	10.6	12.0	-9.6	-6.7
Low-tech manufacturing	LTM	3.6	0.1	0.1	4.6	6.0	-1.9	-0.4
Metals and minerals	MEM	3.9	-1.6	-1.1	7.7	7.0	-4.3	-3.2
Chemical, rubber and plastics	CRP	4.2	-4.8	-2.0	15.3	35.0	-5.5	-2.5
Motor vehicles and parts	MVH	1.0	-5.0	-1.9	2.7	27.0	-7.8	-3.0
Other transport equipment	OTN	1.0	-0.7	-0.5	1.2	3.0	-1.6	-1.2
Electronic equipment	ELE	1.4	-5.3	-3.6	2.6	16.0	-9.8	-6.4
Other machinery and equipment	OME	2.8	-0.5	0.0	8.4	13.0	-0.8	0.0
Other transport	OTP	3.3	-0.7	-0.5	1.9	2.0	-4.2	-2.5
Air transport	ATP	1.1	-0.6	-0.3	2.2	13.0	-2.1	-1.0
Water transport	WTP	1.4	0.0	0.0	0.8	4.0	0.2	0.1
Construction	CNS	9.9	-1.0	-0.7	0.8	0.0	-0.6	-0.5
Communication	CMN	2.3	-0.3	-0.3	1.3	3.0	-0.1	-0.2
Finance	OFI	2.7	0.1	-0.1	0.4	1.0	1.5	0.8
Insurance	ISR	1.4	-0.8	-0.6	0.4	1.0	0.5	0.1
Other commercial services	OCS	20.8	0.7	0.3	11.5	4.0	-3.2	-2.1
Recreational and other services	ROS	3.7	-0.8	-0.6	0.7	1.0	-2.9	-1.8
Government and public services	OSR	21.0	-0.8	-0.6	1.6	0.0	0.6	0.3

Notes: Export figures are in monetary values, and not in volumes like in Table 1. Openness to UK is defined as exports to the UK plus imports to the UK divided by the country's GDP.

Source: Own WorldScan estimations using GTAP9 database.

equipment, processed foods, motor vehicles and parts– are also the sectors with the largest output losses. These changes are a combination of the heterogenous sector-specific trade cost decreases, for instance when the tariff and NTB cost increases are above average for some sectors, and the level of trade of those sectors with the UK. In addition to these direct effects, there are indirect effects where some sectors, which are not directly affected by higher trade costs with the UK, will increase output as the initial shock reallocates resources between sectors.[12] The overall effect, however, is that total output is decreasing due to a less efficient allocation of resources in the economy, due to the higher distortionary trade costs.

[12] For example, in the WTO scenario the top five production-losing sectors will provide less employment: 20,000 jobs less or around 3% of current employment in these sectors. While, on the other hand, in a number of other sectors employment would increase. For example, with an additional 15,000 jobs in the "low-tech manufacturing" and "other financial services" sectors.

4.2 Alternative scenario results

Table 5 presents the results of our scenarios with alternative economic mechanisms. The inclusion of a direct link between trade volumes and productivity reflects the possibility to achieve dynamic gains from trade that expand the static effects present in our main scenarios. As we can observe at the top of Table5 the GDP effects are almost double in this scenario. The UK experiences a GDP reduction of almost 9%, which is comparable to the results in HM Treasury (2016) and Kierzenkowski et al. (2016), who also include dynamic gains in their simulations. In this scenario, the Netherlands experiences also the highest GDP losses (2%), with average wages also decreasing significantly by 1.6%.

Table 5: Brexit simulation results, alternative scenarios, overall macroeconomic effects, percentage changes with respect to the baseline in 2030

Trade-productivity link	**WTO option**			**FTA option**		
	NLD	EU27	UK	NLD	EU27	UK
GDP	-2.0	-1.5	-8.7	-1.5	-1.1	-5.9
export volume	-3.7	-3.6	-26.0	-2.2	-2.1	-14.7
import volume	-4.8	-3.9	-25.3	-2.6	-2.0	-13.2
real average wage	-1.6	-1.2	-7.8	-1.1	-0.8	-4.6
Alternative trade costs	**WTO option**			**FTA option**		
	NLD	EU27	UK	NLD	EU27	UK
GDP	-1.0	-0.6	-2.7	-0.6	-0.4	-2.0
export volume	-2.5	-2.1	-17.7	-0.9	-0.8	-5.9
import volume	-3.5	-2.5	-19.6	-1.0	-0.8	-5.9
real average wage	-0.9	-0.6	-3.0	-0.5	-0.3	-1.5

Source: Own WorldScan estimations using GTAP9 database.

The results with the alternative estimation of trade costs following the HM Treasury (2016) report are presented on the bottom of Table 5. Here we observe that the WTO option gives a GDP reduction in the UK and the Netherlands that are slightly lower than in our main scenarios, but of a comparable magnitude.

5 Summary

In this study we estimate the trade effects of Brexit when new alternative, but plausible, trade arrangements are considered. As with other studies that have analysed the trade implications of Brexit (HM Treasury, 2016; Dhingra et al., 2016b; Kierzenkowski et al., 2016), we also find that Brexit will reduce bilateral trade between the UK and the EU, and this translates into significant reductions in GDP and real income per capita. The extent of the losses is directly related to the kind of post-Brexit trade deal that is assumed. The effects are also asymmetrical. The EU imports around half of British exports, while the UK imports just around 7% of total EU27 exports. In this context, the associated increase in trade costs will disproportionally affect the UK with respect to the EU27.

The Netherlands has larger trade flows than the average EU27, and as such, will suffer trade and GDP losses that are also higher. In our main scenarios Dutch GDP is expected to decrease by around 1.2% when Brexit leads to a WTO-based trade relation between the UK and the EU. If a trade agreement is reached after Brexit, the losses will be mitigated (0.9%) but still significant. When we employ the more uncertain assumption that trade will also generate changes in innovation that positively affect productivity, then the Dutch losses with Brexit are significantly higher (2%). As such, our main scenario assessment should be taken as a lower-bound estimation of potential economic losses associated with Brexit. First, we only consider the trade-related effects of Brexit and do not evaluate other potential economic impacts (e.g. short term volatility and adjustment costs, FDI, migration, and financial effects). Secondly, because increased trade costs can bring about static effects but also more significant (but also more uncertain) dynamic shocks to income.

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A Appendix

A.1 MFN tariff estimation

The MFN tariff data is taken from the World Bank-UNCTAD WITS database. The original tariff data is present at the product level, which is a very disaggregated basis that cannot be used in our CGE model. Therefore, our source data is taken using the 57 GTAP sectoral classification from the WITS database, and as such, these sector-specific tariffs are trade-weighted. We then use GTAP trade weights to obtain the MFN tariffs for our eleven manufacturing sectors.

Table 6 presents the estimated MFN tariffs using our sectoral aggregation (see Table 9). The differences between the MFN tariffs facing the EU27 imports to the UK and the reciprocal tariffs facing the UK imports to the EU is provided by the different trade weights applied to the UK and the EU, respectively.

Table 6: Estimated MNF tariff levels by sectors, percentages

		MFN tariffs	
Sector	code	UK imports	EU27 imports
Agriculture	AGR	4.517	2.564
Primary energy and mining	OMI	0.003	0.001
Energy	ENG	1.568	0.988
Processed foods	PFO	7.848	7.075
Low-tech manufacturing	LTM	4.692	6.672
Metals and minerals	MEM	1.639	1.523
Chemical, rubber and plastics	CRP	2.800	2.890
Motor vehicles and parts	MVH	7.200	7.360
Other transport equipment	OTN	2.830	2.760
Electronic equipment	ELE	0.840	0.910
Other machinery and equipment	OME	1.970	1.980

Source: Own estimations using WITS data.

A.2 Applied NTB changes in simulations

Table 7: Estimated intra-EU NTB cost savings in manufacturing, ad valorem equivalents

Sector	code	WTO option	FTA option
Agriculture	AGR	25.2	12.6
Primary energy and mining	OMI	0.0	0.0
Energy	ENG	0.0	0.0
Processed foods	PFO	48.4	24.2
Low-tech manufacturing	LTM	5.7	2.8
Metals and minerals	MEM	38.5	19.2
Chemical, rubber and plastics	CRP	20.6	10.3
Motor vehicles and parts	MVH	19.5	9.8
Other transport equipment	OTN	19.5	9.8
Electronic equipment	ELE	19.4	9.7
Other machinery and equipment	OME	1.6	0.8
Average manufacturing		**12.9**	**6.4**

Source: Egger et al. (2015).

Table 8: Estimated intra-EU NTB cost savings in services, ad valorem equivalents

Sector	code	WTO option	FTA option
Construction	CNS	9.2	4.6
Air transport	ATP	25.0	12.5
Water transport	WTP	1.7	0.9
Other transport	OTP	29.7	14.9
Communication	CMN	1.1	0.6
Finance	OFI	1.5	0.7
Insurance	ISR	6.6	3.3
Other commercial services	OCS	35.4	17.7
Recreational and other services	ROS	8.8	4.4
Government and public services	OSR	n.a.	n.a.
Average services		**12.9**	**6.4**

Sources: Egger et al. (2015) and **?**.

As part of their scenarios Dhingra et al. (2016a,b) also include additional reductions in NTBs related to continued membership to the EU. Based on past studies (Méjean and Schwellnus, 2009), they argue that the rate of NTB reductions within the EU has been 40% larger than for other OECD countries. However, this additional trade cost decrease is based on the strong assumption that EU integration will continue as in the past. Given that most of the remaining trade barriers are concentrated in the services sectors, which are generally characterised by high political sensitivities and a much larger economic weight than in agriculture and manufacturing, we consider that further intra-EU liberalisation is far from granted. This is highlighted in the current eurosceptic political environment that was triggered by the financial and Eurozone crises, of which the Brexit referendum is one of the most clear examples.

Other alternatives have been proposed in the Brexit debate. The main position from the "Leave" campaign is that the UK will have the option to unilaterally eliminate all tariffs and trade barriers after Brexit (see for example the letter sent from Economists for Brexit to the Financial Times, 2016a) However, this is also a very unlikely outcome. WTO rules establish that if the UK sets its tariff levels to zero, it must do so for all WTO members. In this case, the UK will become effectively a free-trade zone as Singapore, with no negotiating tokens to lure trading partners to reciprocally reduce their tariffs. Moreover, NTB costs of importing to the UK will remain, unless the British government takes the unlikely decision to eliminate rules and regulations on imported goods –including sanitary and health regulation and protection. As we show below, NTBs are significantly higher than tariff levels, and as such, the trade and economic impact of unilateral tariff reductions is constrained.

A.3 Static and dynamic gains from trade

The impacts of increased trade flows on overall economic outcomes (production, income or welfare) are usually divided into two main effects.

First, static effects reflect a one-off impact that implies a change in the level of income. The most common static trade effect is associated with specialisation according to comparative advantage, which improves the allocation of productive factors and reduces consumer and intermediate input prices.[13] This is the main mechanism driving gains from trade in standard CGE models. Moreover, models that allow for imperfect competition and economies of scale have additional static effects: increased varieties of intermediate and final goods associated with intra-industry trade and lower average

[13] These are the classical comparative advantage gains of trade dating back to David Ricardo.

costs from economies of scale.[14] Finally, models with heterogeneous firms have the added effect of reallocation of production towards from smaller less productive firms, to larger more productive ones.[15] All these effects create a one-off shock to the economy that raises income levels. These effects are well established in the trade literature and are common to all quantitative trade models.

Second, dynamic gains from trade refer to changes in the economy associated with the increase in the growth of income over time. These dynamic effects are associated with changes in factor accumulation of human and physical capital (Baldwin, 1992; Wacziarg, 1998) due to larger market size, and more commonly, with productive efficiency gains linked to trade-induced innovation. This increased innovation and R&D investments lead to constant improvements over time in productivity and income (Keller, 2002; Bloom et al., 2015). In theory there are several links on how increased trade flows can affect innovation levels: increased competition may increase the incentives to innovate or increase the importance of more innovative firms, higher income prospects from bigger international markets can increase capital accumulation and innovation incentives. Finally, increased trade flows can also be associated with technological spillovers and learning effects that can indirectly increase innovation.[16]

However, these dynamic effects have been proved to be more elusive to understand and hence, more difficult to quantify than the static effects. Until recently, the consensus view was that the precise mechanism and magnitude of these effects was not well defined or empirically conclusive. This is the main reason standard CGE models do not usually include dynamic gains from trade in their estimations. This view was based on two priors. First, the use of particular mechanisms to link increased trade with growth has proven to be difficult, since the theoretical mechanisms are not straightforward. For instance, the relation between competition and innovation is complex, with some author's proposing an inverted-U relationship (Aghion et al., 2005, 2009), while others favour a more nuanced view (Boone, 2001). As such, these complex relationships cannot be easily implemented in trade models (cf. Hopman and Rojas-Romagosa, 2010). Secondly, when the overall relation between trade intensity and growth has been empirically researched, no broadly-accepted results were found. In an influential study, Rodríguez and Rodrik (2001) argue that the empirical evidence on the

[14] These gains were developed by the "New Trade Theory" that focused on intra-industry trade in differentiated goods produced subject to increasing returns to scale (Krugman, 1979, 1980; Helpman and Krugman, 1985).

[15] This new literature on heterogeneous firms is based on the empirical findings by Bernard and Jensen (1999, 2004) and the theoretical models by Melitz (2003) and Bernard et al. (2003).

[16] An important indirect effect of innovation is that there are considerable (national and international) spillovers from R&D investments (e.g. Coe and Helpman, 1995; Coe et al., 2009).

relation between trade policy and growth is inconclusive, while they are also skeptical on a more general relation between trade openness and growth. In general, there are serious econometric problems with identification (due to lack of exogenous variation in trade or trade policies) and omitted variables bias.

In more recent years, however, two sets of studies have brought new insights into the topic. First, Feyrer (2009, 2011) uses changes in transportation technology and the closing of the Suez Canal, respectively, to overcome the previous empirical difficulties in measuring the link between trade and income growth. In his first paper he concludes that the elasticity of income growth to trade can be as high as 0.5 –when all bilateral exchanges are accounted for, including FDI and technological spillovers. Thus, this first elasticity is mainly measuring a more general effect of globalisation over income. In his second paper, the trade elasticity is estimated to be between 0.15 and 0.25, reflecting the impact of trade in goods on income growth. Second, a group of studies based on the heterogeneous firms' framework has found significant links between increased export activity and productivity improvements. Melitz and Trefler (2012) summarise this new crop of papers and find a "within-plant" effect where trade raises productivity of individual plants by raising the returns to innovation. Several studies have confirmed this relationship, most notably Lileeva and Trefler (2010), who find that the Canada-US free trade agreement (CUSFTA) increased Canadian manufacturing productivity by 13.8 percent between 1989 and 1996. These results imply a trade-productivity elasticity of 0.6.[17]

These new papers clearly show positive dynamic gains from trade. Nevertheless, the implementation of this new set of results into quantitative trade models is not straightforward. The trade-productivity elasticity from Feyrer (2011) is based on a single event –the closing of the Suez Canal– that occurred five decades ago, while the implicit elasticity from the Lileeva and Trefler (2010) study is based on a single trade agreement –CUSFTA. These studies, therefore, shed some light on the complex relationship between trade intensity and productivity in general, but these single-point estimations need to be treated carefully and with reservations.

To sum up, there is compelling examples that increased trade can have beneficial dynamic effects. However, the precise value of the elasticity of productivity to trade is less robust and more studies are needed to estimate this link.

[17] We arrive at this value as follows. Using the World Bank's WDI database, the average value added share of manufacturing to Canadian GDP between 1988 and 1996 was 17.1%. Therefore, the 13.8% increase in manufacturing productivity from Lileeva and Trefler (2010) translates into a 2.4% productivity increase for the whole Canadian economy. We then use the estimates from Romalis (2007), who finds that CUSFTA increased bilateral trade by 4%, to obtain an elasticity of 0.6.

A.4 Technical specifications of the WorldScan CGE model

A computational general equilibrium (CGE) model consists of three main elements. The underlying general equilibrium economic model, the multi-regional input-output data and a set of exogenous parameters (being the most import the elasticities). The combination of these three elements yields a general equilibrium (calibrated) baseline in which all the accounting and market clearing conditions are met. Policy experiments consist of a shock to one or several exogenous variable (e.g. tariffs) that generate changes in the price and quantities of the endogenous variables such that a new general equilibrium is reached: the counterfactual scenario. The behavioural equations in the economic model determine how the endogenous variables react, while the underlying baseline data and the exogenous parameters (i.e. the various elasticities in the model) determine the size and scope of the adjustments.

It is important to note that CGE models are long-term supply-side driven models, where prices are (usually) assumed to be fully flexible to adjust to exogenous shocks and achieve a new long-term (structural) general equilibrium point. In this regard, aggregate demand is kept constant over time: i.e. there are no short-term fluctuations due to the business-cycle or other temporary adjustments in the economy.

Economic model

General equilibrium models describe supply and demand relations in markets. In these models, prices and quantities of goods and factor inputs (i.e. labour and capital) adjust, such that demand and supply become equal at an equilibrium price and quantity level. These models also describe the interactions between several markets. For instance, firms must determine the factor inputs necessary to produce a final good, given the price and demand of that good. Firms' supply decisions, therefore, depend on the equilibrium product price and in turn they determine the demand for the necessary intermediate and factor inputs required. Consumers preferences and budget constrains will determine the demand for final goods and the supply of factor inputs (mainly labor). The interaction of the optimisation decisions by firms and consumers will ultimately determine the equilibrium prices and quantities of goods and factor inputs.

Therefore, the core elements of all CGE models are the micro-economic founded neo-classical conditions: consumer and producer optimisation under budgetary constraints. Hence, economic behaviour drives the adjustment of quantities and prices given that consumers maximise utility given the price of goods and the consumers' budget constraints, while producers minimise costs, given input prices, the level of output and production technology.

These optimisation conditions are linked with market clearing conditions in the products markets (i.e. equating demand and supply for each production sector). The number of product markets is defined by the number of economic sectors in the database. For instance, the GTAP database identifies 57 sectors. Ina addition there are also market clearing conditions for the factor markets. Following the example above, the supply of low- and high-skill labour by households must equal the demand of these factor inputs by firms. There are five different factor types in GTAP: unskilled and skilled labour, capital, land and natural resources.[18] For instance, the demand of labour (determined from the profit maximisation conditions of firms) must equal the labour supply by households (which in turn is a function of economically active population and labour participation rates.)

Consumption is modelled as non-homothetic demand system using the linear expenditure system (LES). All partial elasticities of substitution for composite commodities as well as price and income elasticities drive demand responses to economic shocks. Production is modelled as a nested structure of constant elasticities of substitution (CES) functions. The values of the substitution parameters reflect the substitution possibilities between intermediate inputs and production factors.

We employ the WorldScan version with monopolistic competition and increasing returns to scale (de Bruijn, 2006). This version of the model is based on a Dixit-Stiglitz-Armington demand specification. In particular, it uses the love-of-variety –i.e. Dixit-Stiglitz (DS)– preferences for intermediate and final goods for non-agricultural sectors. Within a representative firm, individual varieties are symmetrical in terms of selling at the same price and quantity, but that increases in the number of varieties yield economic benefits because they are perceived to be different by intermediate and final demand agents. This DS approach is then nested within a basic CES demand system that includes both Armington- and DS-type demand systems for individual sectors using Ethier and Krugman-type monopolistic competition models –i.e. differentiated intermediate and differentiated consumer goods.[19]

This DS-Armington structure is combined with a monopolistic competition setting with economies of scale. While firms behave as monopolists, the existence of free entry drives economic profits to zero, so that pricing is at average cost, as is the case in the perfect competition specification. Economies of scale are then modelled using the concept of variety-scaled goods. We can define 'variety-scaled output', which refers to

[18] The most recent GTAP-9 version identifies five different labour types, but these can be aggregated to the common two labour types used in most CGE models.

[19] This can be done because one can reduce Ethier-Krugman-models algebraically to Armington-type demand systems with external scale economies linked to a variety of effects (Francois and Roland-Holst, 1997; Francois and Nelson, 2002).

physical quantities, with a 'scaling' or quality coefficient that reflects the varieties embodied on total physical output. This variety-scaled output can be substituted directly into an Armington-type demand system. The precise modelling in the CGE-GTAP code is done by means of a closure swap that yields output level and variety scaling effects at the sectoral level. This implies that sectoral productivity is now endogenous in the model and it adjusts to capture the output scale and variety effects.

Finally, the model provides an explicit and detailed treatment of international trade, international transport margins and other trade costs (e.g. tariffs, NTBs, export subsidies). Bilateral trade is handled via CES (constant elasticity of substitution) preferences for intermediate and final goods, using the so-called Armington assumption, where the substitution of domestics and imports –as well as product differentiation– is driven by the region of origin (i.e. by import source). This assumption is generic to most CGE models as it is a simple device to account for "cross-hauling" of trade (i.e. the empirical observation that countries often simultaneously import and export goods in the same product category).

A summary of the general equilibrium equations of WorldScan is provided in Appendix A in Lejour et al. (2006)

Underlying data and calibration

The primary data input is a global multi-regional input-output (GMRIO) database. In particular, we use the GTAP database, which provides balanced and harmonised input-output matrices, bilateral trade and protection data. For this particular WorldScan simulation we use GTAP-9 database with base-year 2011 (cf. Narayanan et al., 2015). The specific sectoral and regional aggregation is presented in Tables 9 and 10, respectively.

The economic model is then calibrated to the GTAP base year of 2011 using a set of exogenous parameters (mainly consumption and production elasticities). Our baseline scenario runs from 2011 to 2030. To construct this scenario we combine the GTAP9 data with the following additional data:

- GDP growth per capita projections taken from the OECD.
- Total labour supply ($LSup$) is built using a combination of demographic and labour data projections, as:

$$LSup_t = Pop_t * PR_t * (1 - \mu_t) \tag{1}$$

where Pop_t is total population in year t with projections taken from the Medium Variant of projections by the United Nations (UN, 2015) (for non-EU countries) and EuroStat population projections for EU countries. Labour participation rates (PR)

Table 9: Sectoral GTAP aggregation used in WorldScan simulations

number	code	WorldScan sector	Aggregated GTAP Sectors	GTAP codes
1	AGR	Agriculture	Paddy rice, Wheat, Other cereal grains, Vegetables & fruits,	PDR, WHT, GRO, V_F,
			Oil seeds, Sugar cane, Plant-based fibers, Other crops,	OSD, C_B, PFB, OCR,
			Bovine cattle, Other animal products, Raw milk, Wool,	CTL, OAP, RMK, WOL,
			Forestry, Fishing	FRS, FSH
2	OMI	Oil and other mining	Oil, Other minerals	OIL, OMN
3	ENG	Energy	Coal, Natural gas, Petroleum & coal products	COA, GAS, P_C
			Electricity, Gas manufacture & distribution	ELY, GDT
4	PFO	Processed foods	Bovine meat products, Other meat products, Vegetable oils	CMT, OMT, VOL,
			Dairy products, Processed rice, Sugar, Other food products	MIL, PCR, SGR, OFD,
			Beverages & tobacco	B_T
5	LTM	Low-tech manufacturing	Textiles, Wearing apparel, Leather products, Wood products	TEX, WAP, LEA, LUM,
			Paper products & publishing, Other manufactures	PPP, OMF
6	MEM	Metals and minerals	Other mineral products, Ferrous metals, Other metals	NMM, I_S, NFM,
			Metal products	FMP
7	CRP	Chemical, rubber and plastics	Chemical, rubber & plastic products	CRP
8	MVH	Motor vehicles and parts	Motor vehicles & parts	MVH
9	OTN	Other transport equipment	Other transport equipment	OTN
10	ELE	Electronic equipment	Electronic equipment	ELE
11	OME	Other machinery and equipment	Other machinery & equipment	OME
12	CNS	Construction	Construction	CNS
13	WTP	Water transport	Water transport	WTP
14	ATP	Air transport	Air transport	ATP
15	OTP	Other transport	Other Transport	OTP
16	CMN	Communication	Communication	CMN
17	OFI	Finance	Other financial services	OFI
18	ISR	Insurance	Insurance	ISR
19	OCS	Other commercial services	Trade, Other business services	TRD, OBS
20	ROS	Recreational and other services	Recreational & other services	ROS
21	OSR	Government and public services	Water, Public administration & public services, Dwellings	WTR, OSG, DWE

are taken from ILO projections.[20] Long-term unemployment rates (μ) are taken from from EuroStat and World Bank projections.

- Trade balances are projected to gradually decrease over time. As an initial benchmark we use the updated 2011 net foreign assets data from Lane and Milesi-Ferreti (2001).

The initial (calibrated) condition of the model is that supply and demand are in balance at some equilibrium set of prices and quantities; where workers are satisfied with their wages and employment, consumers are satisfied with their basket of goods, producers are satisfied with their input and output quantities and savings are fully expended on investments. Adjustment to a new equilibrium, governed by behavioural equations and parameters in the model, are largely driven by price linkage equations that determine economic activity in each product and factor market. For any

[20] From the Economically Active Population Estimates and Projections (EAPEP).

Table 10: Regional GTAP aggregation used in WorldScan simulations

Number	**Code**	**Country/Region description**
1	AUT	Austria
2	BAL	Baltic countries
3	BGR	Bulgaria
4	BLU	Belgium and Luxembourg
5	CCM	Croatia, Cyprus and Malta
6	CZE	Czech Republic
7	DNK	Denmark
8	FIN	Finland
9	FRA	France
10	DEU	Germany
11	GRC	Greece
12	HUN	Hungary
13	IRL	Ireland
14	ITA	Italy
15	NLD	Netherlands
16	POL	Poland
17	PRT	Portugal
18	ROU	Romania
19	SVK	Slovakia
20	SVN	Slovenia
21	ESP	Spain
22	SWE	Sweden
23	GBR	United Kingdom
24	USA	United States
25	ROE	Rest of OECD
26	EER	Rest of East Europe
27	CHH	China and Hong Kong
28	ASE	ASEAN
29	IND	India
30	MNA	Middle East and North Africa
31	SSA	Sub-Saharan Africa
32	LAC	Latin America and the Caribbean
33	ROW	Rest of the World

perturbation to the initial equilibrium, all endogenous variables (i.e. prices and quantities) adjust simultaneously until the economy reaches a new equilibrium. Constraints on the adjustment to a new equilibrium include a suit of accounting relationships that dictate that in aggregate, the supply of goods equals the demand for goods, total exports equals total imports, all (available) workers and capital stock is employed, and global savings equals global investment; unless adjustments to these assumptions are modified for a particular application.

A.5 Main scenario results in 2040

Table 11: Brexit simulation results, main scenarios, overall macroeconomic effects, percentage changes with respect to the baseline in 2040

	WTO option			**FTA option**		
	NLD	EU27	UK	NLD	EU27	UK
GDP	-1.2	-0.8	-4.8	-1.0	-0.6	-3.7
export volume	-3.1	-2.9	-20.8	-1.8	-1.6	-11.9
import volume	-4.1	-3.3	-21.9	-2.1	-1.7	-11.2
real average wage	-1.1	-0.8	-4.8	-0.7	-0.5	-3.0

Source: Own WorldScan estimations using GTAP9 database.

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