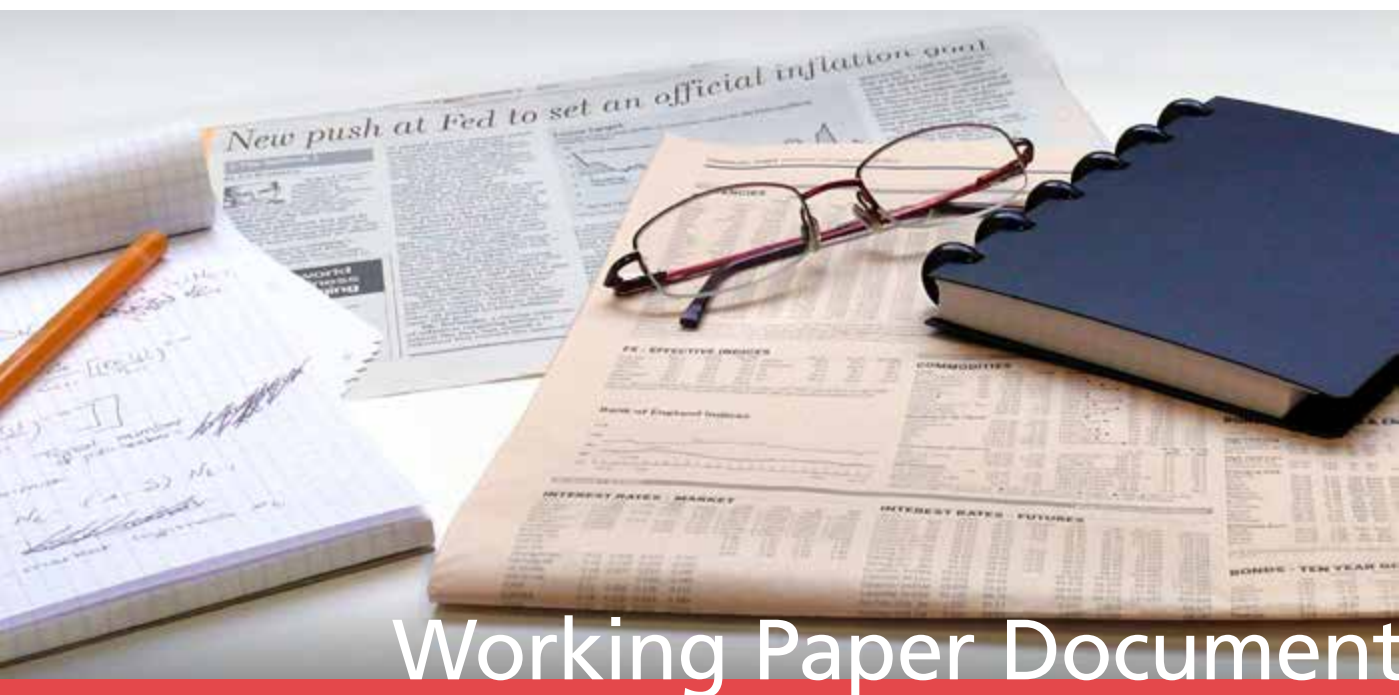


A survey of the long-term impact of Brexit on the UK and the EU27 economies



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by Patrick Bisciari

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Abstract

This paper reviews a sample of studies on the long-term impact of Brexit on GDP and welfare for both the UK and EU economies. It considers only official and academic studies published before the end of November 2018. The paper highlights the very wide range of results, especially for the UK, reflecting great uncertainty. The negative economic impact is more limited for the EU27 and for most Member States. Small open economies closely related to the UK are more hit than others. This is the case for Ireland due to geographical proximity, for Luxembourg with its economy specialising in financial services and for Cyprus and Malta as they are Commonwealth countries. When only the trade channel of Brexit is estimated, GDP (or welfare) losses are around 1 percentage point of GDP in the Netherlands and in Belgium while these average 0.6 percentage point of GDP in the EU27. For a same Brexit scenario, the results depend on the model specifications, on the channels considered and on some key assumptions. For the UK higher GDP/welfare losses are found for reduced-form approaches, when a productivity shock is added and, also for the EU, for global value chain approaches. Higher GDP/welfare losses are also associated with higher non-tariff trade barriers. Results are sensitive to some parameters such as the reaction of trade volumes to changes in tariffs and non-tariff trade barriers (trade elasticities). Reaching a Free Trade Agreement could limit the GDP/welfare losses both for the UK and the EU Member States compared to an orderly no deal (WTO scenario). If the UK remains in the Single Market or the Customs Union, the GDP/welfare losses induced by Brexit could be even more contained. This justifies the economic interest for both the UK and the EU Member States to reach an agreement on their future relationship.

JEL classification: F13, F14, F15, F17, F60.

Keywords: Brexit, trade, integration, EU.

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1. Introduction

On 23 June 2016, UK citizens voted in a referendum to leave the EU. Before and after the referendum, many studies have tried to quantify the economic impact of Brexit, at first for the UK and then for the remaining EU27 countries.

In November 2018, a deal was concluded between the UK Government and the European Commission (EC) on both a Withdrawal Agreement and a Political Declaration on the future relationship between the EU and the UK. This has led to new analysis estimating the economic impact of the agreement. In order to become legally binding, the agreement endorsed by the EU Council on 25 November needs to be ratified by the House of Commons (and the European Parliament). The non-binding nature of the Political Declaration and its wording in general terms still leave many options open for the future relationship. Against this background, an overview should still encompass various Brexit scenarios.

The aim of this paper is to inform on the potential long-term economic consequences of different Brexit scenarios on both the UK and the EU27. How big could the losses be in the event of a hard Brexit? To what extent can the losses be contained according to the type of agreement reached? To provide meaningful answers to these questions, the paper gives an overview of the main findings from empirical research published before 30 November 2018, including those that have been made public in London in the week following the endorsement of the deal by the EU Council.

The main Brexit transmission channel in the long term is trade in goods and services. After it leaves the EU, trade between the UK and the EU27 will again face barriers that had been dismantled thanks to the EU's Single Market and Customs Union. Therefore, this survey will cover empirical research which considers at least trade as a transmission channel. But trade is not the only channel towards unwinding of some of the gains of past economic integration. Our survey includes other transmission channels such as foreign direct investment (FDI) and migration, among others. Financial services are in general considered as a service that can be traded and financial institutions are companies that can be relocated but both the specific situation of the City of London and the financial stability issues are generally not covered. As our focus is on the long term, potential short-term disruptive effects from a disorderly Brexit have not been taken into account¹.

A sample of findings under various institutional scenarios for the future relationship between the EU and the UK post-Brexit will be compared. The loosest relationship between the two would result from an orderly no deal. Under such a hard Brexit scenario, trade relations would follow the rules of the World Trade Organisation (WTO). At the other extreme, the closest relationship would be for the UK to remain a Member State of the EU. Intermediate scenarios include free trade agreements (FTA) like that implemented recently between the EU and the Canada (CETA), a customs union similar to that between the EU and Turkey or UK membership of the European Economic Area (EEA) like Norway. The EEA

¹ In late November, the Bank of England (2018) examined the short- to medium-term impact of a disorderly Brexit.

scenario is an example of a soft Brexit offering a closer relationship between the UK and the EU27. Such a closer relationship comes at the cost for the UK of more limited autonomy.

Our survey focuses on published studies reporting results for most EU Member States while some Brexit studies covering only the UK economy are also discussed. We have also chosen to restrict our analysis to estimates from academics and from national or international institutions. Our survey will cover both large macroeconomic models that are wide in scope but often limited in their modelling of trade flows as well as more sophisticated trade models developed with narrower scope. Our focus will be on the results for the whole economy, in particular on GDP or welfare².

The paper is organised as follows. In section 2, we discuss the main channels through which Brexit can impact the UK and the EU27 economies. In section 3, we recall the main options (institutional scenarios for Brexit) from remaining in the EU to an orderly exit without a deal (WTO scenario). Section 4 is devoted to the impact of a WTO scenario for the UK and for the EU27 treated as a bloc. For the same scenario, section 5 considers the estimated impact of the trade channel on Belgium as an example of a small economy having strong trade relations with the UK, while section 6 ranks the EU countries according to the size of estimated Brexit losses. Section 7 illustrates to what extent various agreements (including first estimates of the deal reached in November) may mitigate these Brexit losses both for the UK and the EU countries. Section 8 concludes.

2. What impact could a hard Brexit have on the UK and the EU27 economies?

Economically speaking, a hard Brexit (such as in a WTO scenario) is a shock that affects both the UK and the EU27 economies through various channels³: trade in goods and services (including financial services), foreign direct investment, migration, the exchange rate, uncertainty and the EU budget. Brexit is expected to induce losses to both the UK and the EU 27. The losses for the UK may even be amplified if the above-mentioned channels also affect productivity, i.e. if they are accompanied by negative productivity shocks. On the contrary, the UK Government (or subnational authorities) may consider different kinds of (macro and micro) policies to try to mitigate the GDP losses induced by Brexit.

² Welfare is often defined as consumption (or income) per capita.

³ For a presentation on how Brexit might affect the UK economy, see Tetlow and Stojanovic (2018). Most of these channels also play a role in soft Brexit scenarios.

Table 1 - Channels for the transmission of a hard Brexit to the UK and EU27 economies

		For the EU 27 countries	
		Positive or neutral	Negative
For the UK	Positive or neutral		EU budget UK deregulation
	Negative	FDI Migration Productivity shock	Trade <i>Uncertainty</i>

In a hard Brexit, some channels will have a negative impact on both the UK and the EU27 compared to the current EU membership option. Both areas will lose out from **reduced trade** as their bilateral trade will face the WTO's most favoured nation (MFN⁴) tariffs on goods and non-tariff barriers on both goods and services. Non-tariff barriers (NTBs) can take many forms, including rules of origin⁵, customs handling costs, differences in regulation, restrictions on foreign entry, requirements on qualifications, standards, licences, nationality requirements or barriers on ownership of companies, barriers on movement of professionals, etc. Bilateral trade between the UK and the EU27 is particularly important for the UK as the EU27 is a partner covering around half its trade while the UK barely takes in one-tenth of EU exports⁶. Higher trade costs may result in higher prices and/or lower exchanged volumes (trade

⁴ "For WTO member countries such as the UK, the maximum tariff that can be imposed on the import of a particular good from any other WTO member country is what is (slightly misleadingly) known as the MFN tariff. This is the tariff that applies to any country with which the member state does not have a preferential trade agreement. It is set out in a schedule approved by the other WTO members" (Tetlow and Stojanovic, 2018).

⁵ "Rules of origin require firms exporting to the EU from outside it to prove which country the product originated from in order to certify the domestic content of exports" (Office for Budget Responsibility, 2018). These are administrative compliance costs, in addition to the tariffs, that UK goods would face when these are delivered to EU markets if the UK leaves the EU Customs Union. "After Brexit, if the UK sets up a FTA with the EU27, UK firms may be required to prove the origin of exports into the EU – generally where over 50 per cent of the value of the product was added – to determine whether it can receive potential preferential tariff treatment" (possibly duty-free treatment) (OBR, 2018, *idem*). "For products that have components produced or compiled in different countries, proving origin can be a costly process, to the extent that some firms choose to pay tariffs rather than meet the rules of origin requirement" (OBR, 2018, *ibidem*).

⁶ In 2017, about 44 % of goods and services exports went to other countries in the EU, while 53 % of UK imports came from other countries in the EU, according to data from the Office for National Statistics (Fullfact, 2018b). Only 8 % of the EU's goods and services exports went to the UK in 2016 when intra-EU exports are also considered (EU data).

destruction). As a result of higher bilateral trade costs, businesses in the UK and the EU27 might also divert their activities to new suppliers and customers (trade diversion).

In a hard Brexit scenario, the UK will no longer benefit from existing EU FTAs with third parties like Canada (CETA, etc.). On the other hand, if the UK leaves the Customs Union with the EU, it is entirely free to define its own trade policy, concluding for example FTAs with the same or other countries. However, outside the EU, the UK may become a less attractive FTA partner for third countries, like the United States, since its market is smaller.

Another channel by which Brexit may entail losses for both the UK and the EU27 is **uncertainty**. Since the Brexit referendum, uncertainties have already led to delays or cuts in business investment in the UK. Businesses still don't know what Brexit will look like (a hard or a soft Brexit, the existence and the length of a transition period, etc.) and what it will imply for them exactly. These uncertainties are expected to dissipate when clarity is made on future trade relations between the UK and the EU27. Being short-term in nature, the uncertainty channel will only receive scarce⁷ consideration in this paper focusing on the long-term impact of Brexit.

Uncertainty may also be reflected in financial markets (risk premiums on UK financial instruments such as equities or bonds) and in the **exchange rate**. The most immediate reaction after the Brexit referendum was a significant depreciation of the pound sterling (GBP). This is expected to help UK exports by making them less expensive and thus more competitive, but at the same time, sterling depreciation pushes up the cost of imports for British customers. This has been passed on to a higher consumer price index, weighing on the purchasing power of households and their consumption and investment expenditure. Therefore, any depreciation of the pound may lead to an ambiguous net impact on GDP, both for the UK and the EU27. In the Brexit literature, exchange rate movements have rarely been considered and when they have, it has mostly been in macroeconomic models where sterling's depreciation may be added as a shock or it may be an endogenous change resulting from shocks applied to other variables (trade tariffs, etc.).

Other shocks may benefit one area at the expense of another. In general, empirical studies⁸ tend to show that EU membership has boosted **FDI** inflows and that Brexit may affect FDI flows to the UK economy negatively but to the EU27 economy positively. Indeed, the negative impact of firms relocating their plants from the UK to any EU27 country is found to exceed the positive impact of firms prompted to establish new units in the UK to circumvent trade barriers and continue to serve the UK market.

⁷ Some long-term impact estimates, notably from the UK Treasury (2016), assume that the persistence of Brexit-related uncertainties may induce a loss of around 1 percentage point of GDP.

⁸ See notably Dhingra *et al.* (2016b) and de Almeida *et al.* (2019).

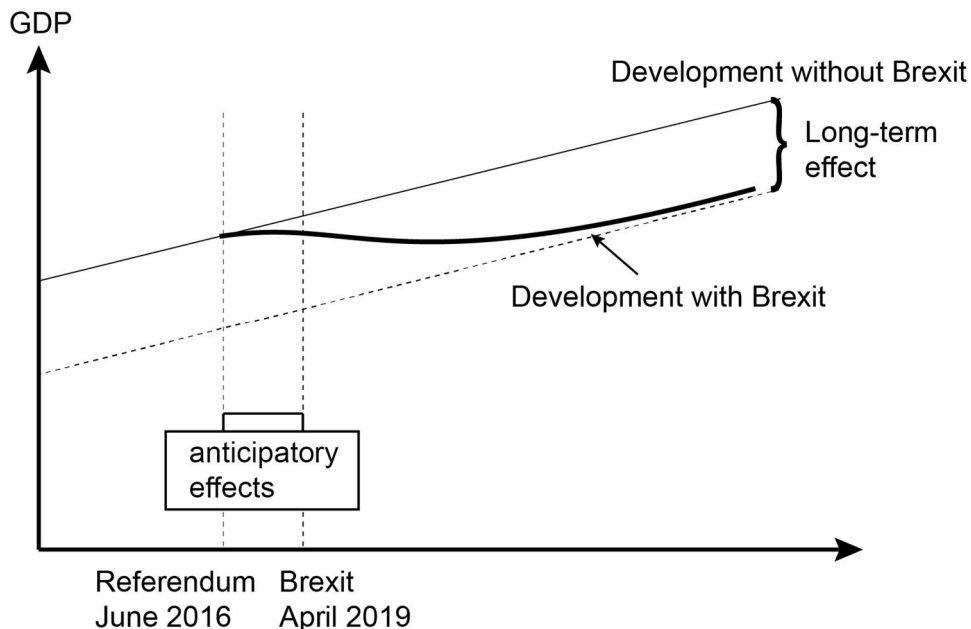
Since the EU referendum, net **migration** of EU citizens into the UK has risen much less rapidly than in the period before the referendum. We may therefore expect this trend to continue in a hard Brexit scenario.

By leaving the EU, besides the divorce bill issue⁹, the UK Government will save part or all its net contribution to the **EU budget**, the savings being all the more important the shallower relationship negotiated with the EU.

By further **deregulating**, the UK may boost its corporate competitiveness with a positive impact on its economy at the expense of the EU. However, the UK will no longer be able to influence EU regulation that prevails in its main export market and, furthermore, if the EU authorities move towards more integration, deepening the Single Market for instance, the UK will likely not benefit from these future integration gains if it leaves.

Due to the working of all the channels described above, Brexit is expected to lead to GDP losses. This does not necessarily mean that real GDP will decline at any moment in time. It does mean that real GDP will reach a lower level under Brexit than if the UK remains in the EU.

Figure 1 - Illustration of long-term static loss from Brexit on the level of GDP



Source: Felbermayr *et al.* (2017a).

⁹ The UK will have to pay to the EU for commitments made during its membership. These payments will take place at the same time as if it were still a Member State.

Most channels are reported to have a temporary impact on the growth rate of GDP and thus a permanent long-term impact only on the level of GDP, while others may eventually also modify the growth rate of GDP permanently through effects on productivity growth. The first case refers to static gains/losses from trade, while the second refers to dynamic gains/losses from trade. Since the latter effects are difficult to quantify, most studies in the empirical literature are static in the sense that at the time of the shock, economic variables such as GDP start to deviate from their level under a baseline scenario, then, this deviation from the baseline further increases over time and finally stabilises when the economy has reached a new equilibrium (figure 1).

3. What are the options for the future relationship between the UK and the EU27?

The (long-term) impact of Brexit on the GDP will differ according to the type of Brexit scenario that will emerge. With a hard Brexit whereby future EU-UK trade will be more constrained by new barriers, trade will be more negatively affected than with a soft Brexit scenario where this future relationship involves less trade barriers. But on the other hand, after a transition period, the UK will no longer pay contribution to the EU budget in a hard Brexit scenario, while it is expected to still pay some contribution to the EU budget in a soft Brexit scenario.

There are thus significant trade-offs between conflicting objectives in the discussions on the future economic relationship. Another crucial trade-off in the negotiations between the EU and the UK has involved the degree of policy autonomy (for the UK) and the extent of access to the EU's Single Market. This has been clearly illustrated by Michel Barnier, EU Commissioner and Chief Negotiator, when he commented in December 2017 on the type of alternatives¹⁰ to EU membership that could be reached for the UK depending on the UK Government's red lines at that time¹¹. Starting out from the UK being part of the EU, he shows how the UK Government's red lines in the negotiations may lead to a CETA-like FTA offering very restricted access to the EU Market¹².

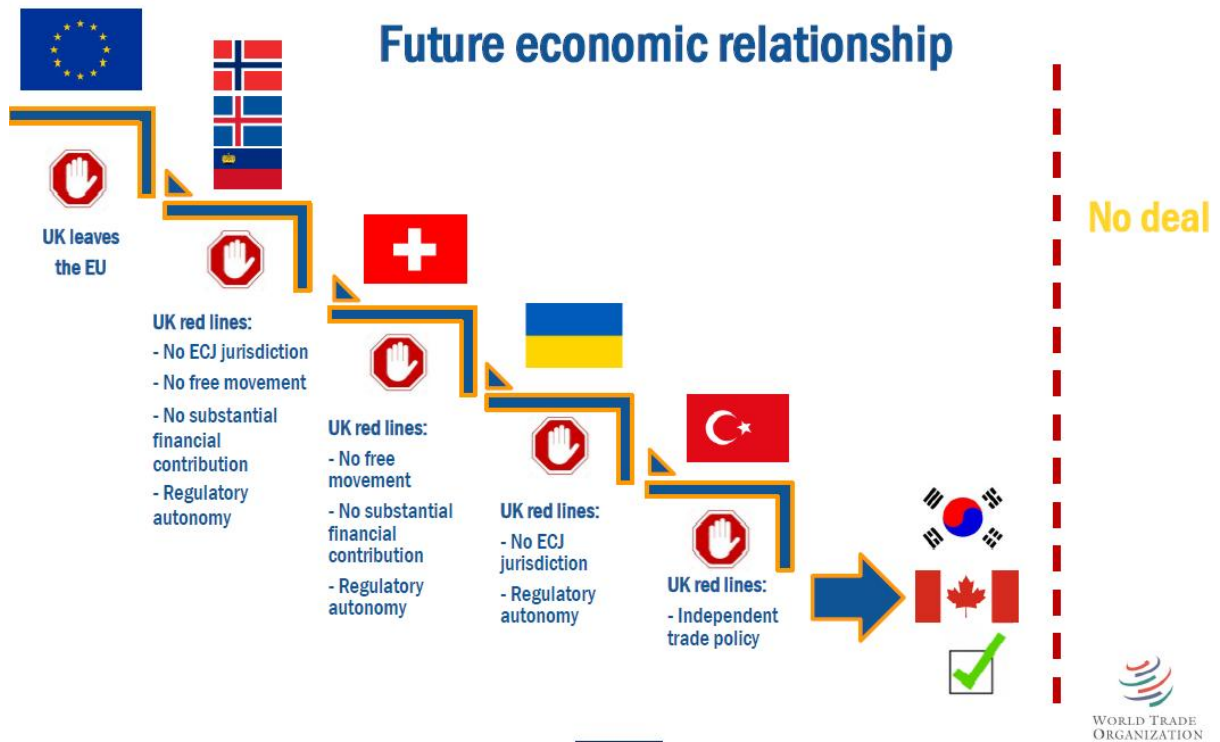
These kinds of FTA would however still represent less barriers to trade than a hard Brexit based merely on World Trade Organisation rules or than a disorderly no deal. In a WTO scenario, tariffs are raised to the MFN terms and NTBs can be substantial. Both drastically limit the access to the EU market, but the UK would enjoy a free trade policy and a maximal freedom to set other policies, including migration policy.

¹⁰ A full description of these alternatives can be found notably in Fossum and Graver (2017), Geeroms and Minnaert (2018), Hantzsche *et al.* (2018a), Morphet (2017), Szyszczak (2017), UK Treasury (2016) and NBB (2016).

¹¹ Defined notably by UK Prime Minister Theresa May (2017) in a speech in January 2017. Since then, red lines have moved from both the UK and the EU sides which has allowed the November 2018 agreement.

¹² This review of the existing alternative relationships to full membership of the EU should not be seen as bargaining tactics. The aim of the exercise is purely pedagogical.

Figure 2 - Possible institutional scenarios according to the original UK Government red lines



Source: Barnier (2017).

In line with the results of the referendum, the UK Government has opted to leave the EU and its institutions. The existing¹³ model offering the closest relationship between the EU and another country is the **European Economic Area (EEA)**, to which Norway, Iceland and Liechtenstein belong. In exchange for full and dynamic access to the Single Market including the EU passport for financial services, Norway accepts free movement of people with the EU. It hardly enjoys regulatory autonomy; it has no influence on the EU legislation process and it is submitted to the EU Court of Justice. By being out of the Customs Union, it faces some customs costs and no access to the trade agreements concluded by the EU with third countries. Norway benefits from zero tariffs for its trade with the EU except for agriculture and fisheries. Its Government also pays a very substantial annual contribution to the EU budget.

If the UK rejects the Norway model, the model offering the next widest access to the EU market is the current situation of **Switzerland**, which has concluded a set of bilateral agreements in various sectors (mostly industrial goods and certain services such as non-life insurance). For these sectors, Swiss firms enjoy access to the EU market (and vice versa) but the Swiss authorities are required to adopt EU legislation and pay into the EU budget, albeit at a lower rate than Norway. In return, Switzerland must accept free movement of EU citizens. Access to the EU market is much more restricted than under the

¹³ Membership of the EEA plus a customs union with the EU27 (“Norway Plus” option) would be even closer to EU membership but such a model has not yet existed so far.

Norway model, especially for services. The financial sector, in particular, has no EU passport (as is the case for the next alternative models) and relies on less comprehensive and less stable equivalence regimes.

If the UK does not want to pay a substantial contribution to the EU budget, another alternative model would be a Deep and Comprehensive Free Trade Agreement (**DCFTA**), like the one that entered into force between the EU and **Ukraine** in September 2017 as part of a broader Association Agreement. It aims to integrate Ukraine as far as possible into the EU market. It opens the markets via the gradual removal of almost all tariffs (in trade value) for both agricultural and industrial products and “extensive harmonisation of laws, norms, regulations in various trade-related sectors, creating the conditions for aligning key sectors of the Ukrainian economy to EU standards” (EC, 2013). Most aspects of the Single Market are covered¹⁴, but the free movement of people takes the form of a visa-free regime for short-stay travel.

If the UK wants even more (regulatory) autonomy, it may aim for a customs union, like **Turkey** has had with the EU since 31 December 1995 (with a view to Turkey joining the EU in the future). This has removed tariffs, most customs costs and other NTBs for most manufacturing goods (including related processed agricultural goods) but all frictions (checks at the border, etc.) have not been removed and Turkish firms must adopt EU product standards and respect EU competition rules, etc. Services, agricultural products, investment and public procurement fall outside the scope of the customs union. There is no free movement of people. Turkey does not enjoy independent trade policies¹⁵.

The models considered so far (Norway, Switzerland, Ukraine and Turkey) were established to define economic relationships between the EU and neighbour countries. This relates to “**near**” trade (Szyszczak, 2017). In all these cases, the trade benefits for non-EU member countries are substantial but one of the main interests for the EU lies in extending EU regulatory norms (standards for products, etc.) to a wider geographical area. If the UK wants to have wide autonomy both in regulatory and trade policies, then the solution is a FTA. It is used with countries further afield (“**far**” trade as in Szyszczak, 2017). In these FTAs, the EU is less able to dominate the agenda and regulatory cooperative arrangements tend to refer to international technical standards.

¹⁴ “The DCFTA is complemented by a process of legislative approximation in financial services, telecommunications services, postal and courier services, and international maritime services. The Ukraine is committed to take over the existing and future EU-acquis in those sectors and, when it has done so, Ukrainian firms will be granted access to the EU internal market for the sectors concerned. The approximation process will also mean that EU investors in those sectors will find the same regulatory environment in Ukraine as in the EU.” (EC, 2013, *idem*)

¹⁵ Turkey is subject to the EU's trade policy and common external tariffs on imports of goods covered by the Customs Union. It is also bound to apply to third countries the same preferential treatment the EU has negotiated with many third countries by means of FTAs. However, Turkish exporters do not automatically benefit of the same tariff as EU exporters when they trade with these countries with which the EU has concluded a FTA. Turkey is only free to sign FTAs with third countries in sectors not covered by EU FTAs, provided these sectors are themselves also not covered by the Customs Union with the EU (Barnard and Leinarte, 2018).

The FTAs that the EU has reached with **Canada** (CETA), **South Korea** and, more recently, with Japan (JEFTA), are modern as they offer wider market access and cover more items than old-generation FTAs. But their depth is limited. For example, CETA has removed most tariffs, but there are still some on agricultural goods and, even on manufactured goods, some tariffs remain for a transitional period; customs costs apply. As for the other alternatives, CETA does not offer advantages in terms of market access to countries with which the EU has already concluded FTAs. Services are liberalised but only partially and with many restrictions. As market entry is limited, Canada is free to set its own rules on migration and it has more regulatory autonomy. As for financial services, CETA includes a prudential carve-out, confirming each party's ability to impose prudential measures if deemed necessary.

Other considerations have also played a major role in the Brexit negotiations. The most significant one has been the need to avoid a hard border between the Republic of Ireland and **Northern Ireland**, not least to ensure that the island remains an open and peaceful territory, in keeping with the 1998 Good Friday Agreement, and to maintain the Common Travel Area. Avoiding a hard border requires at least a customs union and some regulatory alignment. In other words, an EEA scenario, an FTA or a WTO/no-deal scenario cannot meet the EU and Irish demands and the UK Government's commitment to ensuring no hard border between Northern Ireland and Ireland (UK Government, 2018b).

The November 2018 Withdrawal Agreement, intended to be legally binding, first of all, provides for a **transition** period until the end of 2020 that may be extended by two years to the end of 2022. During this time, the UK would continue to be part of the EU's Single Market and Customs Union. Then, unless and until a trade agreement is reached, a **backstop**, described in the Protocol on Northern Ireland as part of the Withdrawal Agreement, would come into effect. In practice, this means that there would be a single customs territory¹⁶ between the UK and the EU27 avoiding the need for tariffs, quotas or checks on rules of origin, while Northern Ireland would keep full access to the EU Single Market under conditions of regulatory alignment. Level-playing-field measures have also been agreed on taxation, environment and labour and social protection standards and EU state aid rules will continue to be enforced directly as part of the backstop solution.

For the **future economic relationship** between the EU and the UK, the non-binding Political Declaration (page 1) "establishes the parameters of an ambitious, broad, deep and flexible partnership across trade and economic cooperation". For future trade in goods, the plan is to establish a "free trade area, combining deep regulatory and customs cooperation" (Political Declaration, p. 6). On financial services, "The Parties are committed to preserving financial stability, market integrity, investor and consumer protection and fair competition, while respecting the Parties' regulatory and decision-making autonomy, and their ability to take equivalence decisions in their own interests" (Political Declaration, p. 8). As far as other services are concerned, trade liberalisation well beyond WTO commitments is

¹⁶ The scope of this customs union is wider than that between the EU and Turkey as it covers all goods (except fishery and aquaculture products).

envisaged, with substantial sectoral coverage. In order to maintain fair competition, the Declaration also contains level-playing-field measures.

Negotiations on the future relationship will only start after Brexit. The nature of this relationship might evolve over time both during these negotiations and once the new regime is in place. For an assessment of the long-term impact of Brexit, it is therefore still useful to investigate the economic consequences of various Brexit institutional scenarios.

4. How big is the economic impact of a WTO scenario for the UK and the EU27/euro area as a whole?

Conventions

Throughout this paper, we will use negative signs for losses in the tables and figures but positive signs for losses and contributions to losses in the text. When factors help reduce losses, they will be mentioned in the text with a negative sign. Moreover, we will quote the Brexit impact studies by the name of the institution rather than by the author. The table of correspondence is as follows (in the order of table1):

LSE (2017) = Dhingra *et al.* (2017) where LSE = London School of Economics (UK)

LSE (2018) = Levell *et al.* (2018). This study is a collaboration between experts at the Centre for Economic Performance at the LSE, King's College London and the Institute for Fiscal Studies. The report is published by the academic think tank The UK in a Changing Europe.

IMF (2018b) is a Selected Issue of the Article IV Consultation Report on the euro area in July

CAE (2018) = Vicard (2018) where Conseil d'analyse économique (France). The estimation has been realised at the Centre d'études prospectives et d'informations internationales (CEPII). This research follows that from Mayer *et al.* (2018), published notably by the Banque de France.

IFO (2017) = Felbermayr *et al.* (2017a) where IFO = IFO institute (Germany)

IFO (2018) = Felbermayr *et al.* (2018b)

CPB (2016) = Rojas-Romagosa (2016) where CPB = Central Planning Bureau (the Netherlands)

KUL (2017) = Vandenbussche *et al.* (2017) where KUL = Katholieke Universiteit Leuven (Belgium)

Bank of Italy (2018) = Pisani and Vergara Caffarelli (2018)

NIESR (2016) = Ebell and Warren (2016) where NIESR = National Institute for Economic and Social Research (UK)

NIESR (2018) = Hantzsche *et al.* (2018b)

Most Brexit studies have examined a WTO scenario, which is closest to an (orderly) no deal from a long-term perspective, relative to a baseline where the UK remains in the EU. For such a scenario:

- the impact of Brexit is always found to be negative in terms of GDP (or welfare) for both the UK and the EU27 (or the euro area) considered as a whole;
- the GDP/welfare loss is always much higher for the UK than for the whole EU27. This is mainly because the EU27 represents a much more significant export market and supplier for the UK than the UK is for the EU27;

- reflecting the huge uncertainty¹⁷ around the estimates, the impact of Brexit, especially on the UK economy, varies substantially depending on the channels and the models considered.

Table 1 - **Long-term impact on GDP/welfare of Brexit in a WTO scenario**
(percentage point of GDP/welfare deviation from EU-like scenario)

Institution	Losses		Channels	Kind of methods
	UK	EU27		
LSE (2017)	-2.7		Trade, EU budget	Comparative static, trade models
LSE (2018)	-3.3		Trade	
IMF (2018b)	-4.0	-0.5		
CAE (2018)	-2.7	-0.8		
IFO (2017)	-1.7	-0.3	Trade	
IFO (2018)	-3.2	-0.6		
CPB (2016)	-4.1	-0.8	Trade	
KUL (2017)	-4.5	-1.5	Trade, global value chains	Comparative static, trade model with sector-level input-output linkages
Bank of Italy (2018)	-2.0 -10.6	-0.3 (EA) -0.5 (EA)	Trade Trade, TFP	DSGE macro model
IMF (2018b)		-1.5	Integration	Various methods
NIESR (2016)	-3.2		Trade, tariffs, FDI, EU budget	Macroeconomic model (NiGEM)
	-7.8		Idem + labour productivity shock	
NIESR (2018)	-5.5		Goods and services trade volumes, FDI, net migration, EU budget + limited labour productivity shock	
UK Gov (2018b)	-7.7		Trade, new trade deals, deregulation	CGE macro model (+ gravity)
	-9.3		Idem + migration (zero net inflows of EEA workers)	
	-9.9		Trade, business investment-productivity	Idem (with capital accumulation)
UK Treasury (2016)	-7.5		Trade, FDI, uncertainty persistence	Back-of-the-envelope calculations for trade based on estimates of trade destruction and trade-income elasticity
LSE (2018)	-8.1		Trade	
	-8.7		Trade and migration	

Sources: Dhingra *et al.* (2017), Ebell and Warren (2016), Felbermayr *et al.* (2017a and 2018b), Hantzsche *et al.* (2018b), IMF (2018b), Levell *et al.* (2018), Pisani and Vergara Caffarelli (2018), Rojas-Romagosa (2016), UK Government (2018b), UK Treasury (2016), Vandenbussche *et al.* (2017), Vicard (2018).

For the UK, the highest GDP losses induced by Brexit (over 5 percentage points and, in some cases, even over 10 percentage points) are found in:

¹⁷ This uncertainty is also reflected in the original studies in the fact that the results are often presented in ranges. For the sake of simplicity, we have kept to central estimates throughout this paper.

- reduced-form approaches based on estimates of trade-income elasticity: notably the UK Treasury (2016) and LSE (2018);
- models where a significant total factor productivity (TFP) shock¹⁸ has been added (Bank of Italy¹⁹, 2018);
- models where a significant labour productivity shock has been added (NIESR, 2016);
- macroeconomic models of international trade, such as the UK Government's computable general equilibrium (CGE) model²⁰ (2018b) or NiGEM²¹ (NIESR, 2016 and 2018), where several channels have been combined.

In its post-November-2018 deal report, the UK Government (2018b) did actually publish several results depending on the channels considered:

- when only trade effects are considered, the combined GDP loss for the UK due to Brexit amounts to 7.6 %: 1.4 percentage points of GDP for the extra tariffs and 6.5 percentage points for non-tariff barriers (NTBs) in EU-UK trade, and then discounting for the gains from concluding new FTAs with a large number of countries²² (-0.2 of a percentage point);
- adding migration (0.2 of a percentage point under the no-change-to-migration arrangements²³) and integrating small gains from further deregulation (-0.1 percentage point) leads to a combined loss of 7.7 % of GDP;
- If there is a change in migration policy, in particular if migration flows are curbed to a zero net inflow of EEA workers, then the UK's GDP loss due to Brexit is further increased by 1.6 percentage point of GDP and is estimated at 9.3 % of GDP.

¹⁸ Such a shock has also been implemented by CPB (2016) with the same effect of increasing significantly the GDP losses due to Brexit.

¹⁹ In this WP, the Bank of Italy uses a dynamic stochastic general equilibrium (DSGE) model. As their name indicates, DSGE models are general equilibrium models (see next footnote). They are "dynamic" and "stochastic" in the sense that they aim at replicating the models' macro variables' dynamics following unexpected shocks.

²⁰ As a general equilibrium model, it is composed by a system of equations (structural representations of agents' behaviour, based on microeconomic theory) that has been calibrated to match the data set as tight as possible and that can be solved for a ultimate equilibrium ("steady-state") solution through satisfying necessary market clearing conditions for all markets (goods, services, factors of production). As it models all markets together, it takes full account of second-round and knock-on effects. A CGE model is often built around a large input-output data structure and is augmented with trade matrices, representing the intensity of trade flows between countries and sectors. When a CGE model includes time dynamics, the wording CGE macro model is used throughout the paper.

²¹ NiGEM stands for the National Institute Global Econometric Model. Produced and developed by the NIESR, it is a widely-used macroeconomic model, also in Brexit studies (e.g. Kierzenkowski *et al.* (2016) at the OECD).

²² The United States of America, Australia, New Zealand, Malaysia, Brunei, China, India, Mercosur (Brazil, Argentina, Paraguay and Uruguay) and the Gulf Cooperation Council (UAE, Saudi Arabia, Oman, Qatar, Kuwait and Bahrain).

²³ In this case, the lower economic output in the UK due to the trade channel reduces the incentives for EEA workers to emigrate to the UK.

- Starting out from just the trade effects of Brexit (loss of 7.6 % of GDP), the UK Government has also performed several sensitivity analyses, one of which consisting in allowing for capital accumulation²⁴. The activation of this channel leads to a further increase in the UK output loss by 2.3 percentage points. So, the GDP loss from trade and investment channels comes to 9.9 %. If we add a policy aiming at ending net inflows of EEA migration, the GDP loss may well exceed 10 % of GDP.

Results are also found to be rather sensitive to the market structure. To illustrate this point, the IMF (2018c) has compiled results²⁵ for three versions of its trade model corresponding to different degrees of competition. It has been shown that the estimated UK GDP losses from higher barriers, when the UK trades with the EU on WTO terms, ranges from 3.8 % in the version with perfect competition among production firms to 4.2 % in the version of monopolistic competition like Krugman (1980) and to 6.4 % in the version of monopolistic competition with firm-level heterogeneity as in Melitz (2003).

If we limit ourselves to models considering the effects of trade, then the maximum GDP loss for the UK remains below 5 %, varying from 1.7 % in IFO (2017) to 4.5 % in KUL (2017). These studies in the upper part of the table are the only ones that feature results for most of the individual EU countries and will be discussed more into depth in the next section.

For the EU as a bloc, the maximum loss is limited to 1.5 % of GDP. This level is found in both the KUL model where global value chains (GVC) are fully included and in the IMF's (2018b) assessment based on an integration index intended to capture various channels of economic integration²⁶. Adding a TFP shock on the UK has barely any impact on the euro area as shown by the Bank of Italy (2018).

5. How large is the expected impact of Brexit for a small country highly exposed to the UK like Belgium?

In this section, we will examine the impact of a hard Brexit (WTO scenario) for Belgium, as an example of a small economy open to trade with the UK. As mentioned in the previous section, the only studies

²⁴ The rationale behind this channel is that changes in productivity resulting from the changes in trade affect returns on capital, the levels of investment and capital in the economy and the capital to labour ratio.

²⁵ These results from the November 2018 Article IV Report for the UK vary slightly from those presented in the Table 1 that are based on the July 2018 Article IV Report for the euro area due notably to a revision in the NTB increases by sectors considered as these trade shocks have been harmonised together with trade elasticities. However, results of November 2018 are published only for the UK while those from July cover most of EU countries.

²⁶ The IMF (2018b) has estimated the long-term effect of a partial reversal of EU integration with the UK on the EU27 GDP (and employment) following a three-step method. First, it has built a multi-dimensional index that captures the depth and trend of integration between the UK and the rest of the EU, combining trade in domestic value added, participation in supply chains, openness in services trade, cross-border banking positions and migration. Second, it has determined the relationship between EU27 countries' output and their integration with the UK by regressing output on several control variables and the integration index. Third, it has calibrated the change in the integration index from post-Brexit scenarios.

reporting findings for a wide range of EU countries are those focusing on the Brexit trade channel and that do not try to estimate dynamic gains from trade through productivity. All these studies rely on the same two-step methodology to estimate trade losses from Brexit.

1. Tariffs and NTBs are gathered along with other key parameters, in particular trade elasticity showing the extent trade to which volume flows decline when trade costs rise. While tariffs are observed for all products and can be aggregated across goods categories²⁷, NTBs need to be estimated²⁸ either bottom-up by calculating directly and summing up the various costs or top-down by econometric estimates of past trade relationships (ideally by estimating gravity equations/models or by taking figures from the literature). Typically, these gravity models aim at isolating the total impact of trading on EU terms relative to other trade terms (WTO, etc.). In practice, they estimate the increase in trade volumes due to EU integration separately from other trade agreements such as being part of the EEA or another FTA or other EU integration steps like the euro area or the Schengen area and from other characteristics that are usually found to boost trade between countries. More trade is expected with a heavy populated and richer country or area than with a sparsely populated one or poorer one and between countries that are close to each other rather than between distant ones. Other characteristics than market size (GDP, population) or geographical distance may comprise a shared language, past historical links, etc. The estimated coefficient for trade volume changes can be transformed into any estimate of declining NTBs.
2. Tariffs and NTB changes²⁹ are injected into a trade model which can be the same gravity model or a multi-country trade model, most often a CGE model. Except for the CPB (2016), CGE models are used in comparative static, pointing up the effect of changing from one Brexit scenario (Remain in the baseline) to another (WTO in this section).

As expected, all models predict GDP/welfare losses for Belgium in the WTO scenario (table 2) since any gains from trade diversion do not fully offset direct trade losses with the UK and indirect trade losses via third EU countries. GDP/welfare losses for Belgium are always (much) lower than those for the UK and in most cases higher than those for the EU27 (average), since Belgian exposure to the UK is lower than the UK's exposure to the EU but is larger than the EU average exposure to the UK³⁰.

²⁷ They therefore differ very little from one study to another as all economists have assumed that UK-EU trade in goods would be subject to the EU's current MFN tariffs with countries in the rest of the world not having preferential tariffs because of a FTA with the EU. Cappariello (2017) has calculated tariffs for all EU countries.

²⁸ "Quantifying NTBs is a challenge because of their heterogeneous nature and because of the difficulty of constructing comprehensive measures. Research on international trade has developed techniques to estimate an ad-valorem tariff equivalent of NTBs. These can be interpreted as the tariff rate that would have an equally restrictive effect as the NTBs in question" (Bank of England, 2018).

²⁹ It is then assumed that the rise in trade costs due to Brexit is the same or a portion of the decline in trade costs due to EU integration.

³⁰ This point has already been made in NBB (2016) on the basis of the OECD's trade in value added (Tiva) data for the year 2011. It is confirmed on the basis of the Tiva data for 2015 released recently.

The scale of GDP losses estimated for Belgium differs widely across the studies covered³¹. For the WTO scenario, the range of expected GDP losses for Belgium varies from 0.5 % in IFO (2017) and 0.6 % in LSE (2017 and 2018) to 2.1 % in CPB (2016) and 2.3 % in KUL (2017). These figures may be compared with the share of the value added produced in Belgium that is generated by final demand of UK origin (around 3 % in 2011³²). This could mean that, in the latter study, most of the Belgian value added exported one way or another to the UK would disappear with Brexit, not just because of trade breaking off as in the case of an embargo but simply due to some added barriers.

The **KUL** model takes global value chains and input-output linkages in production fully into account. In this study, the main result may to some extent be due to:

- the method implying the inclusion of indirect effects of trade and the full use of sectoral data and parameters (trade elasticity, NTB per sector, input-output linkages, etc.);
- the assumptions of no trade diversion (hence, Belgium cannot divert any loss in trade with the UK by trading more with other countries);
- the assumption of a complete pass-through of trade costs to domestic prices.

The **CPB** study is the only study covered in table 2 to consider a time dimension and to allow for two factors of production, including capital stock on top of labour. We have identified some factors driving their Brexit GDP losses up, notably for Belgium:

- in their model, capital accumulation through investment plays an amplifying role;
- the CPB study has looked at the “effects of trade tariff changes on the shift of inputs, such as labour and capital, caused by sector-specific production changes and has accounted for shifts in production between sectors (including employment)”;
- the CGE macroeconomic model also features increasing returns to scale à la Krugman (1980);
- while not the highest, the NTBs (12.9 % on average for goods and for services), are not the lowest either (see insert);
- the CPB study reports results for Belgium and Luxembourg together and not for Belgium alone.

The five **other studies** are similar in their modelling approach in the sense that the results are reported as comparative static (also for the KUL). The model of reference is that of Costinot and Rodriguez-Clare

³¹ Felbermayr *et al.* (2018c) figures have not been included since I have discovered this study too late.

³² The data used in the Brexit impact studies covered in this paper are based on the 2011 input-output tables (some being extrapolated up to 2014). According to recent Tiva data for 2015, the share of the value added produced in Belgium that is generated by final demand of UK origin has increased to 3.8 % of GDP (Monitoring Brexit, January 2019).

(2014) for the LSE, IMF and CAE. The IFO studies refer to a similar model, that of Caliendo and Parro (2015), but they consider only Ricardian comparative advantages as sources of static gains from trade³³.

The use of a Ricardian model is one explanation for the rather low economic impact of Brexit found in **IFO** (2017). Another factor is the inclusion of the EU budget as a transmission channel³⁴ of Brexit, which has also been the case in **LSE** studies. In a WTO scenario, the UK will no longer contribute to the EU budget. This reduces the negative impact of Brexit on UK GDP/welfare by, respectively, 0.15 to 0.3 of a percentage point in LSE (2017) and IFO (2018). The latter also reports the negative impact of this fiscal transfer for EU countries, but it is marginal (0.06 of a percentage point on average). For the LSE, another explanation for the low economic impact of Brexit is the small size of the NTB increase (see insert). The moderate Brexit trade impact on GDP in the IFO simulations may stem from the fact that it has isolated membership of the EU from other regional trade agreement and that they are the only studies to look at the asymmetric effects of EU membership for the UK and the other EU27 countries and because their estimate relies on a very short period (2000-2014)³⁵.

In general, differences³⁶ across studies may stem from the data, the size of the trade shocks applied (in particular, NTB changes) or some specifications of the model (especially key parameters such as trade elasticity).

Looking at the **data**, most studies investigating the impact of Brexit on EU countries have used the publicly available World Input-Output Database (WIOD). The LSE and the IMF have used the 2013 edition³⁷ with data until 2011, corresponding until recently to the latest official input-output tables available in a harmonised way, while the IFO institute, the CAE and the KUL have used the 2016 edition with data until 2014. Some have argued that the 2011 results were less stable in the sense that 2011

³³ This implies trade in different products (wine versus cars, for example) and not trade in varieties of a same product (different models of cars). The latter kind of trade involves love-of-variety effects.

³⁴ Conversely, the LSE also includes the fact that, by leaving the EU, the UK will not benefit from further EU27 integration. This factor mainly affects the UK and has little negative impact on the EU countries.

³⁵ Identification of the UK's EU membership during 2000-2014 is more difficult as the UK had joined the EU in 1973 (absorbed by fixed effects) and trade with Eastern European countries (that joined the EU during in that period) is less important for the UK whose main EU trade partners are Germany, France, the Netherlands, Ireland and Belgium" (Felbermayr *et al.*, 2018b).

³⁶ Another difference that we have not explored as it mainly affects the UK (and not the EU27 economies) is the extent to which the UK also loses access to the markets of the countries with which it currently trades under FTAs that have been concluded with the EU. Trade with these other countries accounted for 12% of UK imports and 13 % of exports in 2016 (Fullfact, 2018a). Tetlow and Stojanovic (2018) mention that both the LSE and the CPB assume that the UK retains its access to these markets while this is not the case for IFO.

³⁷ See Timmer *et al.* (2015) for a description.

was an atypical year. The CPB used the GTAP9 database³⁸, which is a more common choice in the UK³⁹.

Both databases cover all EU countries. GTAP can map supply chains more precisely with wider coverage in terms of countries (140). This wider coverage has also justified preference for GTAP as it favours estimation of trade creation, trade diversion and third-country effects (Aichele *et al.*, 2016). However, in the context of Brexit, most researchers prefer WIOD⁴⁰ “because GTAP is less up to date and burdened with higher measurement errors and because the absence of continuous annual data complicates econometric estimates” (Felbermayr, 2017a).

NTBs are more difficult to assess. In general, bottom-up estimates are found to be lower than top-down ones (UK Government, 2018a). In bottom-up approaches, some costs may be ignored or underestimated (Tetlow and Stojanovic, 2018). In top-down approaches, the NTBs may be over-estimated especially if tariffs are not treated separately in the gravity equations⁴¹.

- The lowest reported NTB increases for the WTO scenario are those – bottom-up – in the LSE study (also used by the KUL). Assuming three-quarters of the reducible⁴² NTBs found by Berden *et al.* (2009)⁴³ in EU-US relations, they amount to 8.3 %⁴⁴.
- The CPB also used results from econometric estimates of US-EU NTBs, such as those from Egger *et al.* (2015) for goods and Jafari and Tarr (2015) for services, but these estimates are obtained via a top-down approach. The NTBs average 12.9 % for both goods and services sectors in a WTO scenario.
- IFO researchers have carried out their own econometric estimates on data referring to the 2000-2014 period. They took the asymmetry in the UK’s trade relations with the EU27 into account. An EU (and euro area) exporter would face 12.1 % NTBs when trading with the UK, while a UK exporter would face 18.7 % NTBs when trading with EU counterparts (Kadow *et al.*, 2018). These NTBs vary across sectors.

³⁸ See Narayanan *et al.* (2015) for more details on GTAP9.

³⁹ For example, the UK Government (2018a, b) studies rely on GTAP9.

⁴⁰ WIOD data have their own weaknesses too, especially for countries where financial services play a significant role like Malta and Luxembourg.

⁴¹ This is the case of CAE that implies very high NTB increases (tariffs included) in the WTO scenario for the goods sector alone.

⁴² Berden *et al.* (2009) have found a weighted average across all sectors of NTBs on trade flows from the United States to the EU of 20.4 %. They have also considered that, on average, 54 % of these NTBs is the share of costs that are potentially reducible thanks to a FTA (the TTIP).

⁴³ In Berden *et al.* (2009) “the size of NTBs is estimated using a combination of literature reviews, business surveys among about 5 500 firms, econometric analyses (gravity regressions) and consultations with regulators and sector experts” (Bekkers and Rojas-Romagosa, 2016).

⁴⁴ It is this average effect found for goods and services sectors that is applied as a shock in the trade model afterwards but evenly for all sectors.

- The IMF (2018b)⁴⁵ selected sectoral NTB increases among different sources: Berden *et al.* (2009) for some sectors and the UK Government's top-down gravity approach (2018a) for other sectors. They have also assumed higher NTB increases in several cases, notably in the transport equipment sector to reflect the supply chain linkage. Together with the use of the increasing returns version of their model, this contributes to slightly higher Brexit losses in IMF (2018b) than in the LSE studies.

Turning to parameters, a significant one in the Brexit impact studies is **trade elasticity**. With the exception of the IMF (2018b), which kept the same value as the LSE for most⁴⁶ sectors, the trade elasticity values differ for each study. In most cases, trade elasticity is constant across all services sectors but differs widely from one study to another. For goods, trade elasticity differs across sectors within all studies except the CAE's. In most other studies, trade elasticity for the goods sectors has been found in the literature. IFO (2018b and c) has managed to estimate trade elasticity for goods using the same data on which the model is calibrated.

Amending the values for trade elasticity (and even the relative values for the goods and services sectors) may substantially change the magnitude of Brexit losses⁴⁷.

⁴⁵ In IMF (2018c), the staff used the NTBs and trade elasticities found in Febelmayr *et al.* (2018b).

⁴⁶ The IMF (2018b) specifically left the trade elasticity for the transport equipment sector pointing upwards. This also contributes to somewhat higher Brexit losses than in LSE studies.

⁴⁷ See sensitivity analysis in Febelmayr *et al.* (2018c).

Table 2. Long-term impact of a WTO scenario in studies including Belgium
(percentage point of GDP/welfare deviation from an EU-like scenario)

	GDP/welfare losses for			Return to scale	Data	Trade elasticities	NTB changes	NTB changes in a WTO scenario
	UK	EU27	BE					
LSE (2017)	-2.7	n.a.	-0.6	Constant	WIOD (2013)	Goods: Calliendo and Parro (2015) Services: -5	Bottom-up Estimates of NTBs between the US and the EU Based on Berden <i>et al.</i> (2009)	8.3 % for all sectors
LSE (2018)	-3.3	-0.6	-0.6	Increasing (Krugman)	WIOD (2013)	Goods ³ : Calliendo and Parro (2015) Services: -5	Various sources according to the sector ⁴	Varying across sectors
IMF (2018b)	-4.0	-0.5	-0.9	Constant	WIOD (2013)	Goods: Felbermayr <i>et al.</i> (2018a) Services: -6	Top-down Own gravity estimates for 2000-2014	Varying across sectors Differ for EU vs UK and for UK vs EU Differ between the two studies
IFO (2017)	-1.7	-0.3	-0.5	Constant	WIOD (2016)	Goods: own gravity estimates Services: -1.5	Top-down Own gravity estimates for goods for 1948-2016	Differ only in goods versus tradable services
IFO (2018)	-3.2	-0.6	-1.4	Increasing (Krugman)	WIOD (2016)	Not published	Top-down Estimates of NTBs between the US and the EU Goods: Egger <i>et al.</i> (2015) Services: Jafari and Tarr (2015)	Varying across sectors 12.9 % on average for goods and for services
CAE (2018)	-2.7	-0.8	-0.7	Constant	WIOD (2016)	-5 for all sectors	Top-down Own gravity estimates for goods for 1948-2016	Differ only in goods versus tradable services
CPB (2016)	-4.1	-0.8	-2.1 ⁵	Constant	GTAP9	Not published	Top-down Estimates of NTBs between the US and the EU Goods: Egger <i>et al.</i> (2015) Services: Jafari and Tarr (2015)	Varying across sectors 12.9 % on average for goods and for services
KUL (2017)	-4.5	-1.5	-2.3	Constant	WIOD (2016)	Goods: Imbs and Méjean (2017) for 16 manufacturing sectors Services (and agriculture): -4	As in LSE	8.3 % for all sectors

Sources : Dhingra *et al.* (2017), Felbermayr *et al.* (2017a and 2018b), IMF (2018b), Levell *et al.* (2018), OBR (2018), Rojas-Romogosa (2016), Vandenbussche *et al.* (2017) and Vicard (2018).

¹ Including the loss of benefits from further EU27 integration.

² Only included for the UK in LSE (2017).

³ The IMF has set the trade elasticity on the 'coke, refined petroleum and nuclear fuel sector' close to zero and calibrated that of the 'transport equipment sector' to be in line with Egger and Kaynak (2017).

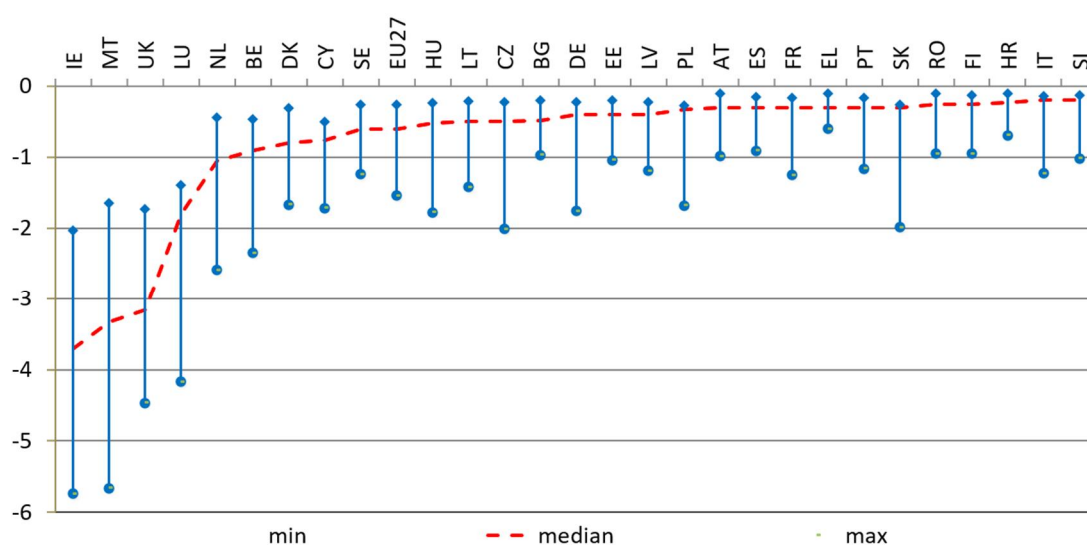
⁴ The primary source for NTB (changes) between the UK and the EU trade is from the UK Government (2018a) complemented by Berden *et al.* (2009, 2013). A higher increase in NTBs than in other studies has been retained for the 'transport equipment sector' to reflect the supply chain linkage. For the financial sector, the extent of NTBs has been calibrated such that net exports of financial services from the UK to the EU would fall by about 40 %. NTB changes from the UK Government (2018a) were at that stage mainly derived from a top-down approach (gravity models at a sector level) while NTBs from Berden *et al.* (2009) include more features of a bottom-up approach.

⁵ Belgium and Luxembourg.

6. How large are the expected losses for the EU countries in case of a WTO scenario ?

For most EU countries, GDP/welfare losses induced by a hard Brexit alongside a WTO scenario have been published in the studies covered in the previous section. With a view to comparing the impact of Brexit on the EU economy and to establishing rankings for the most badly affected countries, we have computed the minimum⁴⁸, maximum⁴⁹ and median across the studies for which results were available⁵⁰.

Figure 4 - **WTO scenario losses may differ across the studies but the ranking of countries is fairly the same**
(percentage points of GDP/welfare deviation from an EU-like scenario, results from seven studies)



Countries are ranked by decreasing median GDP/welfare losses.

In the CPB's study, results are combined for BE and LU. The losses have been applied to BE and LU separately.

Sources: Dhingra *et al.* (2017), Felbermayr *et al.* (2017a and 2018b), IMF (2018b), Rojas-Romagosa (2016), Vandenbussche *et al.* (2017a), Vicard (2018), own calculations.

⁴⁸ As for Belgium and the UK, most of the minimum losses are found in IFO (2017) and, in some cases (Croatia, Cyprus, Estonia, Greece and Romania), in CAE (2018) as both studies distinguish several steps in the EU integration process. In four cases (Finland, France, Italy and Slovakia), lower losses are found in IMF (2018b).

⁴⁹ As for Belgium and the UK, most of the maximum GDP/welfare losses are found from the KUL (2017) study, reflecting the full sectoral approach with the focus on GVC. The only exceptions are Cyprus, Luxembourg and Malta where the maximum losses are found in IFO (2018) and Greece where the maximum loss is found in CPB (2016). For the first three countries, this may reflect high NTBs to financial services for trade with the UK.

⁵⁰ The eight studies covered in the previous section have been examined apart from LSE (2018) since the results of this research are very close to those found in LSE (2017).

Several lessons can be drawn from this comparison:

- The substantial distance for most countries between the minimum and maximum reflects the uncertainty around the results even for the static losses of the Brexit trade channel;
- The ranking⁵¹ of the losses is determined by the degree of openness with respect to the UK. This openness may be in terms of geographical distance or more cultural and based on historical connections. This degree of openness reflects the initial⁵² strength of trade ties, taking input-output (involving third countries) into account. Based on the medians, the biggest GDP/welfare losses are expected for Ireland⁵³, Malta⁵⁴ and the UK (more than 3 percentage points). The three Benelux countries follow in descending order of Brexit-induced GDP losses, Luxembourg showing median losses of more than twice the EU27 average. The Netherlands faces median losses slightly above 1 percentage point, while Belgium's GDP/welfare may contract by close to 1 percentage point. Denmark, Cyprus and Sweden are also found to face expected losses equal or above the EU27 average (0.6 %). Losses are limited to less than half of the EU27 average in all the other countries including the four main euro area countries (Germany⁵⁵, France, Italy and Spain). Relative to smaller economies, the latter countries can absorb a trade shock like Brexit more easily due to the larger size of their domestic markets and their more diversified trade ties (Felbermayr *et al.*, 2018c).

⁵¹ The ranking of the countries, especially the distinction between the most affected countries and the others, does not vary much from one study to another. It is also robust to higher values for trade elasticity in both services and goods sectors as illustrated by Felbermayr *et al.* (2018c).

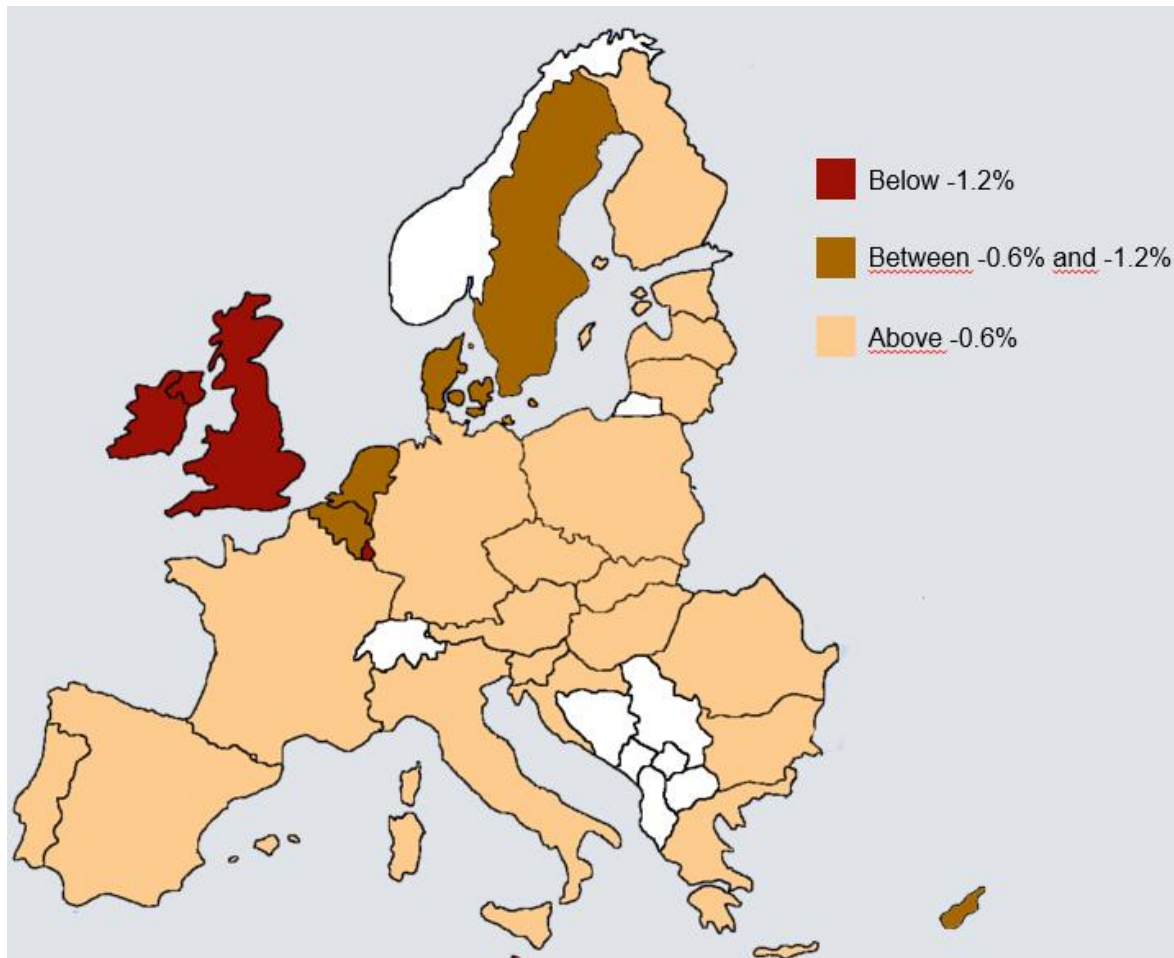
⁵² With data from 2011 or 2014 according to the input-output database.

⁵³ The losses appear to be higher in Ireland than in the UK in four out of seven studies, including the minimum (IFO, 2017) and the maximum (KUL, 2017). All these studies use the WIOD (2016) database. The rationale behind higher losses for Ireland than for the UK is that Ireland is a much smaller and more open economy than the UK and it thus relies more on trade. Ireland is also less reliant on trade with the EU but more on trade with the United States, its first export market and second import market. Macroeconomic estimates have also found that both Ireland and the UK are expected to face supply shocks due to Brexit as inflation is found to be higher and growth to be lower, while in most other EU countries, the Brexit shock acts as a demand shock lowering both inflation and growth.

⁵⁴ The wide variation for Malta (and Luxembourg) may reflect the difficulties in the treatment of highly services-oriented economies and errors included in WIOD data.

⁵⁵ Only KUL (2017) reports a Brexit-induced GDP loss higher in Germany and in France than in the EU27 as a whole.

Figure 5 - Only certain countries are expected to endure severe Brexit losses in a WTO scenario
(percentage point of GDP/welfare deviation from an EU-like scenario, classification in terms of median losses)



Sources: Dhingra *et al.* (2017), Felbermayr *et al.* (2017a and 2018b), IMF (2018b), Rojas-Romagosa (2016), Vandenbussche *et al.* (2017a), Vicard (2018), own calculations.

7. To what extent can a trade agreement mitigate the expected Brexit losses ?

All studies reporting results for individual EU countries have considered at least one other scenario where the EU and the UK concludes a trade agreement. In some cases, it is a FTA as for the IMF (2018b) and IFO (2018) or a deferred FTA (CPB, 2016). In other cases, it even is plain membership of the EEA, as in LSE (2017) and KUL (2017). In LSE (2018), it is a customs union with a view to proxying an estimate of the backstop contained in the Protocol on Northern Ireland. In all these scenarios, tariffs are cut to zero for all goods while NTB increases are set arbitrarily at a lower value than under the WTO scenario.

Two studies have considered several alternative Brexit scenarios. The four scenarios in CAE (2018) are a Norway model (EEA), a model like Switzerland, an average FTA and the WTO. IFO (2017) has

presented no less than eight scenarios, four of which are particularly useful in an analysis of the possible impact of Brexit :

1) '**WTO**': for trade between the EU and the UK, including MFN tariffs and NTB increases as estimated from the gravity equations.

2) '**ambitious FTA**': the UK still leaves the Single Market and EU Customs Union but concludes an ambitious modern FTA with the EU featuring zero tariffs and, in terms of NTBs, full reversal of the estimated trade-cost-reducing effects from the EU-**South Korea FTA**⁵⁶.

3) '**EEA-like**': compared to scenario 2, NTBs are reduced by an additional 50 %⁵⁷ since the UK is assumed not to leave the Single Market anymore in this case (but it still leaves the Customs Union).

4) '**FTA and a customs union (CU)**': compared to scenario 2; it is assumed that trade between the EU and the UK will not require proof of origin where the administrative cost is found to average 5 %. NTBs for goods are therefore reduced by a further 5 percentage points.

⁵⁶ See EC (2017) for an assessment of the impact of the FTA between the EU and South Korea. The EU-Korea agreement that has been into force since 2011 is one of the EU's most ambitious FTAs (Lakatos and Nilsson, 2017). It is the closest to the CETA for which no data are yet available as it has only recently been implemented (on a temporary basis).

⁵⁷ The distance between the trade-cost-reducing effects of an ambitious FTA (scenario 2) and full membership of the EU is reduced by 50 %.

Table 4 - Long-term impact of various Brexit scenarios
(percentage points of GDP/welfare deviation from an EU-like scenario)

Institution	Scenario	GDP / welfare losses for			Tariffs	NTBs
		the UK	the EU27	BE		
LSE (2017)	WTO	-2.7	-0.3	-0.6	MFN	8.3 %
	EEA	-1.3	-0.1	-0.3	Zero	2.8 %
LSE (2018)	WTO	-3.3	n.a.	-0.6	MFN	8.3 %
	Backstop	-1.7	n.a.	-0.3	Zero	Goods: 2.8 % Services: 7.3 %
IMF (2018b)	WTO	-4.0	-0.5	-0.9	MFN	Varying across sectors
	FTA	-2.5	-0.2	-0.5	Zero	Half of WTO
CAE (2018)	WTO	-2.7	-0.8	-0.7	Included in NTBs	Derived from the coefficients of the gravity equation
	FTA	-2.2	-0.6	-0.6		
	Switzerland	-1.8	-0.5	-0.5		
	EEA	-0.8	-0.2	-0.2		
IFO (2017)	WTO	-1.7	-0.3	-0.5	MFN	Gravity EU/UK coefficient
	FTA	-0.6	-0.1	-0.2	Zero	South Korea coefficient
	FTA and a CU	-0.4	-0.1	-0.1	Zero	Idem minus 5 % NTB goods
	EEA	-0.4	-0.1	-0.1	Zero	As FTA minus 50 %
IFO (2018)	WTO	-3.2	-0.6	-1.4	MFN	Gravity EU/UK coefficient
	FTA	-1.8	-0.3	-0.5	Zero	South Korea coefficient
CPB (2016)	WTO	-4.1	-0.8	-2.1 ¹	MFN	Average : 12.9 %
	FTA (2029)	-3.4	-0.6	-1.5 ¹	Zero	Average : 6.4 %
KUL (2017)	WTO	-4.5	-1.5	-2.3	MFN	8.3 %
	EEA	-1.2	-0.4	-0.6	Zero	2.8 %

Sources: Dhingra *et al.* (2017), Felbermayr *et al.* (2017a and 2018b), IMF (2018b), Levell *et al.* (2018), Rojas-Romagosa (2016), Vandenbussche *et al.* (2017), Vicard (2018).

¹ Belgium and Luxembourg.

LSE studies (2017 and 2018) also feature the loss of benefits from further EU27 integration.

The main conclusions from the studies focused on trade effects are as follows:

- There is no scenario of a soft Brexit that is expected to lead to GDP/welfare gains relative to Remain. In other words, GDP losses are expected in all Brexit scenarios – even soft Brexit ones – for the UK, the EU27 (as a whole) and Belgium⁵⁸.
- With respect to a WTO scenario, all countries win if an agreement is reached favouring trade between the UK and the EU, whatever form this trade agreement takes. If the UK benefits more from a trade agreement than Belgium and the EU27 in absolute terms, in relative terms, the main beneficiary is not always the same. Even after a trade agreement, the GDP losses induced by a softer Brexit remain higher for the UK than for Belgium and for the EU27 as a bloc.

⁵⁸ This does not prevent that some sectors may win in some Brexit scenarios or that some EU countries may win under some soft Brexit scenarios.

- Remaining in the Single Market as with EEA membership is the best strategy for the UK to minimise output/welfare losses under a hard Brexit (WTO scenario). In that case, the Brexit loss is always found to be divided by two or more in the UK, in the EU27 (as a whole) and in Belgium. Indeed, trade in goods is tariff-free and NTB increases tend to be halved or more.
- The welfare gain associated with a move from the WTO to a FTA is always (much) lower than that from WTO to EEA. Depending on how the FTA is defined in terms of trade cost shock, the gain can either cover more than half of the GDP loss stemming from a WTO scenario or not.
- A Switzerland scenario is found to lead to smaller Brexit losses than those under a FTA but higher than those under an EEA membership.
- The proxy for the Irish backstop estimated by the LSE (2018) halves the Brexit GDP losses reported for the WTO scenario for both the UK and Belgium⁵⁹.
- The IFO (2017) study shows that creating a new customs union between the UK and the EU27 on top of a new generation FTA (as with South Korea) may also mitigate the NTBs for goods (due to rules-of-origin effects) and thus the Brexit losses in value added to an extent similar to the EEA scenario.

In this IFO (2017) study, even moving from a WTO scenario to a South Korea/CETA-like FTA may lead to a very significant reduction in the GDP losses for all countries. For most Member States⁶⁰, this move would cut the losses occurred in a WTO scenario by more than half. Adding a customs union or a full Single Market yields further benefits. For most countries⁶¹, more losses are recovered under a Norway scenario (EEA) than under an improved FTA cancelling out rules-of-origin costs. Even under a FTA or an EEA scenario, the ranking of the most negatively impacted countries due to Brexit is very similar.

⁵⁹ Relative to the WTO scenario, the other countries are reported to mitigate between one-quarter (small EU countries) and two-thirds (Greece) of their income losses ten years after Brexit. Ireland is expected to contain only around 39 % of its WTO income loss.

⁶⁰ The exceptions are Bulgaria, Croatia, Denmark, Greece, Lithuania, Poland, Romania, Slovenia and Slovakia.

⁶¹ The exceptions are countries where services represent a high share of exports, in particular, the UK, Malta, Luxembourg and Cyprus.

Table 3 - GDP losses in various Brexit scenarios
(deviation from an EU-like scenario, in percentage points)

	WTO	(South Korea like) FTA	FTA and a Customs union	EEA
Ireland	-2,03	-0,88	-0,77	-0,52
UK	-1,73	-0,57	-0,36	-0,4
Malta	-1,65	-0,71	-0,23	-0,46
Luxembourg	-1,4	-0,46	0,02	-0,37
Cyprus	-0,51	-0,23	-0,13	-0,15
Belgium	-0,46	-0,2	-0,14	-0,13
Netherlands	-0,44	-0,21	-0,15	-0,14
Slovakia	-0,35	-0,23	-0,19	-0,15
Denmark	-0,31	-0,16	-0,12	-0,1
Poland	-0,27	-0,14	-0,12	-0,08
EU27	-0,26	-0,11	-0,09	-0,07
Sweden	-0,26	-0,12	-0,09	-0,08
Hungary	-0,24	-0,09	-0,08	-0,06
Germany	-0,23	-0,1	-0,09	-0,06
Czech Republic	-0,23	-0,09	-0,09	-0,06
Estonia	-0,23	-0,11	-0,1	-0,07
Latvia	-0,22	-0,1	-0,08	-0,06
Lithuania	-0,21	-0,11	-0,1	-0,06
Bulgaria	-0,2	-0,11	-0,1	-0,08
France	-0,19	-0,09	-0,07	-0,06
Finland	-0,17	-0,07	-0,06	-0,05
Portugal	-0,17	-0,08	-0,07	-0,05
Spain	-0,15	-0,07	-0,06	-0,04
Italy	-0,15	-0,07	-0,06	-0,04
Greece	-0,13	-0,07	-0,05	-0,05
Romania	-0,13	-0,07	-0,05	-0,04
Slovenia	-0,13	-0,07	-0,05	-0,04
Austria	-0,11	-0,05	-0,04	-0,03
Croatia	-0,11	-0,06	-0,05	-0,04

Source: Felbermayr *et al.* (2017a).
Countries have been ranked by decreasing WTO GDP losses.

In late November 2018, two studies on the long-term impact of Brexit used macroeconomic models to estimate the extent to which the November 2018 deal may temper the economic losses that the UK would endure under a no-deal scenario: Hantzsche *et al.* (2018b) at the NIESR on the basis of NiGEM

and UK Government (2018b and c) on the basis of a CGE macro model. In both cases⁶², multiple channels of Brexit - though not necessarily the same from one study to another - have been tested. The NIESR researchers considered two alternatives to an orderly no deal (WTO scenario):

- a transition period until 2020 followed by a FTA along the lines of the Political Declaration. Their interpretation of the Declaration is that of a FTA largely related to goods trade while trade in services is heavily restricted;
- the same transition period followed by implementation of the Irish backstop. The backstop is seen as a comprehensive trading relationship for goods with the UK in a single customs territory and alongside that an agreement in services trade with some major restrictions.

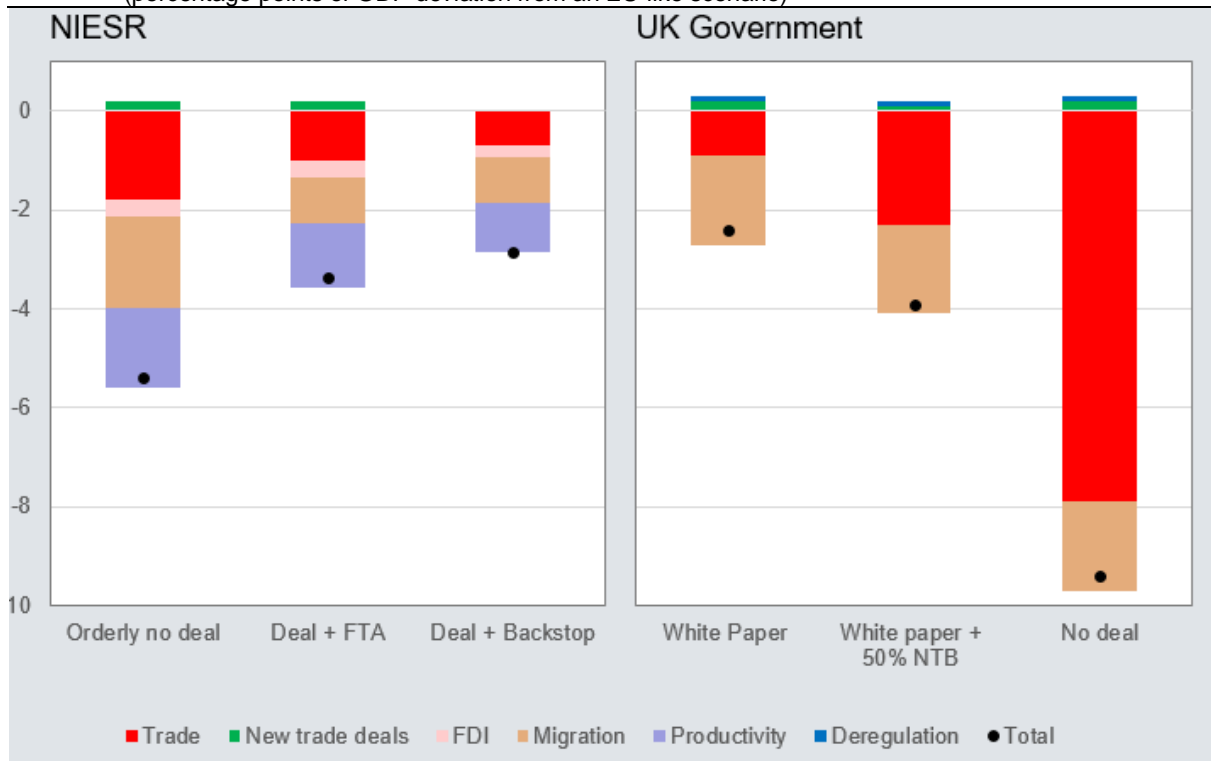
Both scenarios assume that migration flows will be curtailed relative to a Remain scenario, but restrictions would only be half the size of those assumed under a WTO scenario. The difference between the backstop and the FTA scenarios primarily relates to access to the EU market, in particular for services. For trade in goods, the NIESR thinks that the frictions under the backstop are on balance similar to those under bilateral agreements between the EU and Switzerland.

The UK Government has considered several scenarios. One of these is the so-called White Paper (or “Chequers”) scenario, based on the UK Cabinet’s July 2018 proposal. To include evidence that the deal reached with the EU in November 2018 is narrower in terms of trade than the Chequers proposal, the UK Government uses a sensitivity analysis scenario with 50 % more NTBs than estimated for the White Paper.

⁶² To facilitate the comparison, we have opted for a sensitivity analysis scenario along the lines of NIESR where the UK may conclude FTAs with third countries as UK Government simulations do. It is quite an optimistic assumption as in both studies the UK is also assumed to keep the FTAs concluded between the EU and third countries that it has enjoyed from being part of the EU.

Figure 6 –The November 2018 deal should mitigate the Brexit losses expected for the UK in a no-deal scenario

(percentage points of GDP deviation from an EU-like scenario)



Sources: Hantzsche *et al.* (2018b), UK Government (2018b).

NIESR: simulation until 2030.

According to the UK Government (2018b), the White Paper scenario would compensate nearly three-quarters of the Brexit GDP losses that would be incurred under a(n orderly) no-deal scenario (WTO). Even with the sensitivity scenario, concluding a trade agreement would mitigate nearly 60 % of the economic costs of a WTO Brexit⁶³. As the net migration assumption is the same in the three reported scenarios, all the benefits from reaching a deal come from trade.

According to the NIESR, a backstop would mitigate 47 % of Brexit losses under an orderly no-deal scenario, while a FTA would cover only 37 % of this loss. The lower mitigation effect of the deal in the NIESR study may be explained by several factors:

- the benefits of the deal stemming from trade are smaller (than in the UK Government study);
- the NIESR assumes that there remains a productivity decline in both deals' scenarios (productivity is not considered as such by the UK Government⁶⁴);

⁶³ By comparison, an FTA would only compensate 29 % of the GDP loss under a WTO scenario, while an EEA scenario - allowing for free movement of people and thereby no possibility of restricting migration of EEA workers - would cut 85 % of the GDP loss incurred in a WTO scenario.

⁶⁴ The UK Government has modelled a sensitivity analysis extending the model for business investment (see above).

- the NIESR assumes that the fall in FDI is only slightly reduced in both deals scenarios;
- in the backstop scenario, the UK has no independent trade policy and is thus not allowed to conclude FTAs with third countries.

8. Conclusion

At the end of this survey of official and academic studies on the long-term economic impact of Brexit on the UK and EU economies, several conclusions can be drawn.

Under all scenarios, Brexit is a lose-lose situation for both the UK and the EU economies, meaning that GDP or welfare will increase by less under Brexit scenarios than if the UK remains in the EU. The UK is found to be much more affected by Brexit than the EU27 since the UK represents a relatively small share of EU27 trade, while the EU27 still accounts for close to a half of UK imports and exports.

Brexit losses vary widely from one study to another, and especially for the UK, reflecting great uncertainty. For a given Brexit scenario – the most estimated one in the empirical literature being an orderly no deal whereby future trade between the EU and the UK relies on World Trade Organisation (WTO) terms (with Most Favoured Nation tariffs and non-tariff trade barriers) – the magnitude of the results depends on the model specifications and on the channels considered. For the UK, adding other channels than trade (FDI, migration, etc.) tends to increase the negative long-term impact on economic activity. Higher GDP losses are also found in reduced-form approaches based on econometric estimates of trade-income elasticity or when a productivity shock is added. Under extreme assumptions, the losses may well exceed 10 % of GDP. If just the trade channel is considered, the losses are in general found to remain below 5 % of GDP.

The range of results for the EU27 as a whole (and for most of the individual EU countries) is more limited than that for the UK. Small open economies closely related to the UK are more hit than others due to geographical proximity as is the case for Ireland, because of specialisation of its economy in financial services (Luxembourg) or because they are Commonwealth countries (Cyprus and Malta). When only the trade channel of Brexit is estimated, GDP (or welfare) losses amount to around 1 percentage point of GDP in the Netherlands and in Belgium. In the four main euro area countries, they are lower than the EU27 average (0.6 of a percentage point of GDP) due to less openness to trade with the UK and to their larger home market. Significantly higher GDP losses are reported in global value chain approaches than in purely trade models. Higher GDP losses are also associated with higher estimated values for the shock variables (in particular, non-tariff trade barriers). The results are sensitive to the values set for parameters, especially trade elasticities which indicate to what extent trade volumes decline with higher tariffs and non-tariff barriers.

In the long-term studies surveyed, worst-case scenarios such as a disorderly Brexit are not considered. The financial channels are also not fully reflected.

Under all scenarios, the economic losses due to Brexit are estimated *ceteris paribus* and in most cases at unchanged policies. However, one of the main aims of Brexit for the UK is to take back control of its borders and policies. The UK could thus mitigate the economic losses by activating its monetary, fiscal, trade and/or regulatory policies. The UK would be more able to do so in hard Brexit scenarios (such as the WTO) where it will regain more autonomy than in soft Brexit scenarios since a closer relationship with the EU would impose less independent policies. Other considerations than economic ones have also played a significant role in negotiating the Withdrawal Agreement reached in November 2018, in particular, the need to prevent a hard border between Northern Ireland and the Republic of Ireland.

Reaching a trade agreement for the future relationship between the UK and the EU could limit GDP losses both for the UK and the EU Member States compared to a no-deal scenario. If the relationship goes no further than a Free Trade Agreement like that between the EU and Canada, the losses are in general expected to be less than halved. If the UK remains in the Single Market or the Customs Union, the GDP losses induced by a WTO scenario could be even more contained and most often more than halved for both the UK and the EU countries. First estimates of the deal reached at the November 2018 EU summit tend to show that a significant share of the economic loss under a WTO scenario may disappear for the UK both in the backstop provided by the Protocol on Northern Ireland and in the free trade area for goods and the FTA for services intended in the Political Declaration agreed in November.

After 46 years of EU membership, the UK economy is deeply integrated into the EU Single Market and Customs Union and European value chains. Leaving the EU may allow the UK to recover some autonomy in the design of its policies, but this will be at an economic cost. The more autonomy it retrieves the more damaging it will be for the UK economy. An extreme case would be a no-deal scenario. If not managed properly, huge costs may be felt immediately after leaving, possible as early as 30 March 2019. On the contrary, leaving the EU with a deal would avoid these cliff-edge-related costs and already substantially reduce uncertainty, even knowing that the future relationship between the EU and the UK still has to be defined.

References

- Aichele R., G. Felbermayr and I. Heiland (2016), *Going deep: the trade and welfare effects of TTIP revised*, Ifo, Working Paper 219.
- Arkolakis C., A. Costinot and A. Rodriguez-Clare (2012), "New Trade models, same old gains?", *American Economic Review*, 102, 94-130.
- Armington P.S. (1969), "A theory of demand for products distinguished by place of production", IMF, *Staff Papers*, 16, 159-178.
- Bank of England (2018), *EU withdrawal scenarios and monetary and financial stability*, A response to the House of Commons Treasury Committee, November.
- Banque nationale de Belgique, SPF Économie et Bureau fédéral du Plan (2019), *Monitoring Brexit*, note de synthèse, Janvier 2019.
- Barnard C. and E. Leinarte (2018), *EU-Turkey Customs Union*, The UK in a changing Europe, 8 June.
- Barnier M. (2017), document TF50 (2017)21 – Commission to EU 27
https://ec.europa.eu/commission/sites/beta-political/files/slide_presented_by_barnier_at_euco_15-12-2017.pdf, 19 December.
- Bekkers E. (2017), *Comparing CGE and NQT models: a formal overview of the model structures*, World Trade Organization, Paper, December.
- Bekkers E. and H. Rojas-Romagosa (2016), *Literature survey on the economic impact of TTIP*, CPB Background Document, CPB Netherlands Bureau for Economic Policy Analysis, May.
- Belgian Prime News (2016), "Brexit: how exposed and how resilient is the Belgian economy?", special topic, n°72, June.
- Berden K.G., J.F. Francois, S. Tamminen, M. Thelle and P. Wymenga (2009), *Non-tariff measures in EU-US trade and investment: an economic analysis*, Final Report prepared by for the EC, Reference OJ 2007/S180-219493, Ecorys Nederland BV, Rotterdam.
- Berden K.G., J. François, S. Tamminen, M. Thelle and P. Wymenga (2013), *Non-tariff measures in EU-US trade and investment: an economic analysis*, IIDE Discussion Papers 20090806, Institute for International and Development Economics.
- Bollen J.C., G.W. Meijerink and H.A. Rojas-Romagosa (2016), *Brexit costs for the Netherlands arise from reduced trade*, CPB Policy Brief 2016/07, The Hague.
- Busch B. and J. Matthes (2016), *Brexit – The Economic Impact: A Meta-Analysis*, IW Report 10/2016, Institut der Deutschen Wirtschaft Köln, April.
- Caliendo L. and F. Parro (2015), "Estimates of the trade and welfare effects of NAFTA", *Review of Economic Studies*, 82(1), 1-44.
- Cappariello R. (2017), *Brexit: estimating tariff costs for EU countries in a new trade regime with the UK*, Questioni di Economia e Finanza (Occasional papers) 31, Banca d'Italia, June.
- Costinot A. and A. Rodriguez-Clare (2014), "Trade theory with numbers: quantifying the consequences of globalization" in Helpman E., K. Rogoff and G. Gopinath (eds), *Handbook of International Economics*, vol.4, 197-261, Elsevier.
- de Almeida A., M. Hoeberechts, T. Sastre and D. Van Lindenbergh (2019), *The Brexit effect on FDI flows vis-à-vis the UK*, Banco de España Occasional Paper (forthcoming).

Dhingra S., G. Ottaviano, Th. Sampson and J. van Reenen (2016a), *The consequences of Brexit for UK trade and living standards*, CEP, <http://cep.lse.ac.uk/pubs/download/brexit02.pdf> [2016-3-22], London School of Economics.

Dhingra S., G. Ottaviano, Th. Sampson and J. van Reenen (2016b), *The Impact of Brexit on Foreign Investment in the UK*, CEP Brexit Analysis 3, London School of Economics.

Dhingra S., H. Huang, G. Ottaviano, J.P. Pessoa, Th. Sampson and J. van Reenen (2017), "The Costs and Benefits of Leaving the EU: Trade effects", *Economic Policy*, 32(92), 651–705, <https://doi.org/10.1093/epolic/eix015>,

Ebell M. (2016), "Assessing the impact of trade agreements on trade", *National institute economic review*, 238, November, 31-42.

Ebell M. and J. Warren (2016), The long-term economic impact of leaving the EU, *National Institute Economic Review*, 236, May, 121-138.

Ebell M., I. Hurst and J. Warren (2016), *Modelling the long-run economic impact of leaving the European Union*, NIESR Discussion Paper 462, 20 June.

EC (2013), *Overview of the key elements of the EU-Ukraine Deep and Comprehensive Free Trade Area*, http://trade.ec.europa.eu/doclib/cfm/doclib_results.cfm?key=Overview%20of%20the%20key%20elements%20of%20the%20%20EU%2DUkraine%20Deep&opt=2&dis=20&lan=all&ty=&sta=1&en=20&page=1&year1=&year2=§or=all&country=all&langld=EN

EC (2017), Report to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the *implementation of Free Trade Agreements*, 1 January 2016-31 December 2016, COM (2017) 654 final.

Egger P., J. François, M. Manchin and D. Nelson (2015), "Non-tariff barriers, integration and the Transatlantic economy", *Economic Policy*, 30(83), 539-584.

Egger P. and P. Kaynak (2017), *Estimating trade elasticities for manufacturing industry in the OECD Countries: A dynamic gravity applicatio*", European Trade Study Group (ESTG), 27 July.

European Parliament (2017), *An assessment of the economic impact of Brexit on the EU27*, Study for the IMCO Committee, March.

Felbermayr G., J. Gröschl, I. Heiland, M. Braml and M. Steininger (2017a), *Brexit's Economic Effects on the German and European Economy*, study commissioned by the German Federal Ministry for Economic Affairs and Energy (BMWi), CESifo, Munich, June, <http://www.cesifo-group.de/ifoHome/infoservice/News/2017/06/news-20170602-brexit.html>.

Felbermayr G., J. Gröschl and I. Heiland (2017b), *Undoing Europe in a New Quantitative Model*, <https://www.ethz.ch/content/dam/ethz/special-interest/mtec/cer-eth/cer-eth-dam/documents/research/seminar/2017/FelbermayrGroeschlHeiland2017.pdf>, 22 November (published in 2018 as Ifo Working Paper 250).

Felbermayr G., C. Fuest, J. Gröschl and D. Stöhlker (2017c), *Economic effects of Brexit on the European economy*, EconPol Report, November, http://www.econpol.eu/sites/default/files/2017-11/2017_PR04-NEU%20%282%29.pdf.

Felbermayr G., J. Gröschl and T. Steinwachs (2018a), "The trade effects of border controls: evidence from the European Schengen agreement", *Journal of Common Market Studies*, 56(2), 335-351. February.

Felbermayr G., J. Gröschl and M. Steininger (2018b), *Brexit through the lens of new quantitative trade theory*, IFO institute Paper, March.

Felbermayr G., J. Gröschl and M. Steininger (2018c), *Quantifying Brexit: from ex post to ex ante using structural gravity*, Cesifo Working Papers 7357, November.

Fossum J.E. and H.P. Graver (2018), *Squaring the circle on Brexit: could the Norway model work ?*, Bristol University Press.

Francois J., M. Manchin, H. Norberg, O Pindyuk and P. Tomberger (2013), *Reducing transatlantic barriers to trade and investment: an economic assessment*, Final project report, prepared under implementing Framework Contract TRADE10/A2/A16, CEPR, London.

Fullfact (2018a), 'Does most UK trade happen outside of the EU and trade agreements?', 13 July, <https://fullfact.org/europe/does-most-uk-trade-happen-outside-eu-and-trade-agreements/>

Fullfact (2018b), 'Everything you might want to know about the UK's trade with the EU', <https://fullfact.org/europe/uk-eu-trade/>

Geeroms H. and W. Minnaert (2018), "History does not always move forward – Brexit and the possible future relationship between the European Union and the UK", Belgian Financial Forum, Revue Bancaire et financière, November.

Hantsche A., A. Kara, C. Lenoel and R. Piggott (2018a), How much would a 'White Paper Brexit' cost the UK economy?, <https://www.niesr.ac.uk/blog/how-much-would-%E2%80%99white-paper-brexit%E2%80%99-cost-uk-economy#.XBDfdOTm7cs>, NIESR Blog, 1 August.

Hantsche A., A. Kara and G. Young (2018b), *The Economic effects of the Government's proposed Brexit Deal*, <https://www.niesr.ac.uk/sites/default/files/publications/NIESR%20Report%20Brexit%20-%202018-11-26.pdf>, NIESR, London, 26 November.

Head K. and Th. Mayer (2014), "Gravity Equations: Workhorse, Toolkit, and Cookbook", in Helpman E., K. Rogoff and G. Gospinath (eds), *Handbook of International Economics*, vol. 4, Elsevier.

Imbs J. and I. Méjean (2017), "Trade elasticities", *Review of International Economics* 25(2), 383-402.

IMF (2016), *United Kingdom, Selected issues*, IMF Country Report 16/169, June.

IMF (2018a), *United Kingdom*, Article IV Consultation Staff paper, February.

IMF (2018b), "Long-term impact of Brexit on the EU", *Selected Issue*, Euro area, Article IV Consultation Staff paper, July.

IMF (2018c), *United Kingdom, Selected issues*, IMF Country Report 18/250, November.

Jafari Y. and D.G. Tarr (2015), "Estimates of ad valorem equivalents of barriers against foreign suppliers of services in eleven services sectors and 103 countries", *World Economy*, 40(3), 544-573.

Kadow A. (2018), Non-tariff barriers in Brexit scenarios: quantification and modelling issues, mimeo, Deutsche Bundesbank, Frankfurt, December.

Kierzenkowski R., N. Pain, E. Rusticelli and S. Zwart (2016), *The economic consequences of Brexit: a taxing decision*, OECD Economic Policy Paper 16.

Krugman, P. (1980), "Scale Economies, Product Differentiation, and the Pattern of Trade", *American Economic Review*, 70, 950–9.

- Lakatos C. and L. Nilsson (2017), "The EU-Korea FTA: anticipation, trade policy uncertainty and impact, *Review of World Economics*, 153 (1), 179-198.
- Levell P., A. Menon, J. Portes and Th. Sampson (2018). *The Economic Consequences of the Brexit Deal*, Centre for Economic Performance (London School of Economics and Political Science) and The UK in a Changing Europe, <http://ukandeu.ac.uk/new-research-shows-economic-and-fiscal-consequences-of-the-brexit-deal/>, London, November.
- Lippoldt D. (2018), *Brexit & trade: a Jersey model ?*, Economics Global, HSBC Global Research, 15 August.
- May Th. (2017), *The government's negotiating objectives for exiting the EU*, <https://www.gov.uk/government/speeches/the-governments-negotiating-objectives-for-exiting-the-eu-pm-speech>, Lancaster House, London, 17 January.
- Mayer Th., V. Vicard and S. Zignano (2018), *The Cost of Non-Europe, revisited*, CEPII Working Paper 2018-06, April (also published as *CEPR Discussion Paper* 12844 and by the Banque de France).
- Melitz M.J. (2003), "The impact of trade on intra-industry reallocations and aggregate industry productivity", *Econometrica*, 71(6), 1695-1725.
- Morphet J. (2017), *Beyond Brexit? How to assess the UK's future*, Policy Press, University of Bristol.
- Mulabdic A., A. Osnago and M. Ruta (2017), *Deep integration and UK-EU trade relations*, World Bank, Policy Research Working Paper 7947, January.
- Narayanan B.G., A. Aguiar and R. McDougal (2015), *Global Trade Analysis Production: the GTAP9 Data base*, Center for Global Trade Analysis, Purdue University.
- NBB (2016), *De relaties tussen het VK en de EU in het licht van de Brexit*, <https://www.nbb.be/doc/ts/publications/other/brexit-nota.pdf>, 24 juni.
- Noguera G. (2012), *Trade costs and gravity for gross and value-added trade*, Job Market Paper, Columbia University.
- Office for Budget Responsibility (2018), *Brexit and the OBR's forecasts*, Discussion paper 3, October.
- OECD (2018e), *Estimating ad-valorem equivalent of non-tariff measures: combining price-based and quantity-based approaches*, TAD/TC/WP(2017)12/FINAL.
- Pisani M. and F. Vergara Caffarelli (2018), *What will Brexit mean for the UK and euro area economies? A model-based assessment of trade regimes*, Temi di Discussione/Working Papers 1163, Bank of Italy, January.
- Portes J. and G. Forte (2017), "The economic impact of Brexit-induced reduction in migration", *Oxford Review of Economic Policy*, 33 (supplement 1), S31-S44.
- Rojas-Romagosa H. (2016), *Trade effects of Brexit for the Netherlands*, CPB Background Document, The Hague, June.
- Sampson Th. (2017), "Brexit: the Economics of International Disintegration", *Journal of Economic Perspectives*, 31(4), Fall, 163-184.
- Szyszczak E. (2017), *A UK Brexit transition to the Ukraine model ?*, UK Trade Policy Observatory, Briefing Paper 11, November.
- Tetlow G. and A. Stojanovic (2018), *Understanding the economic impact of Brexit*, Institute for Government, October.

Timmer M.P., E. Dietzenbacher, B. Los, R; Stehrer and G.J. de Vries (2015), "An illustrated user guide to the World input-output database: the case of global automotive production", *Review of International Economics*, 23, 575-605.

UK Government (2018a), *EU Exit Analysis: Cross Whitehall briefing*, Presentation before the House of Commons Exiting the European Union Committee, January.

UK Government (2018b), *EU Exit: Long-Term Economic Analysis*,

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/759762/28_November_EU_Exit_-_Long-term_economic_analysis.pdf, November

UK Government (2018c), *EU Exit: Long-Term Economic Analysis*, Technical Reference Paper,

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/759763/28_November_EU_Exit_Long-Term_Economic_Analysis_Technical_Reference_Paper.PDF, November

UK Government (2018d), *The future relationship between the United Kingdom and the European Union*, <https://www.gov.uk/government/publications/the-future-relationship-between-the-united-kingdom-and-the-european-union>, 12 July.

UK Government and European Commission (2018), *Political Declaration setting out the framework for the future relationship between the European Union and the United Kingdom*, draft agreed at negotiators' level and agreed in principle at political level, subject to endorsement by Leaders, 22 November.

UK Treasury (2016), *HM Treasury analysis: the long-term economic impact of EU membership and the alternatives*, 19 April.

Vandenbussche H., W. Connell and W. Simons (2017), *Global value chains, trade shocks and jobs: an application to Brexit*, CEPR Discussion Paper 12303.

Vicard V. (2018), *Une estimation de l'impact des politiques commerciales sur le PIB par les nouveaux modèles quantitatifs de commerce*, Focus du Conseil d'Analyse économique, n°22, juillet.

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