AN ESTIMATION OF THE EFFECTS OF BREXIT ON TRADE AND MIGRATION

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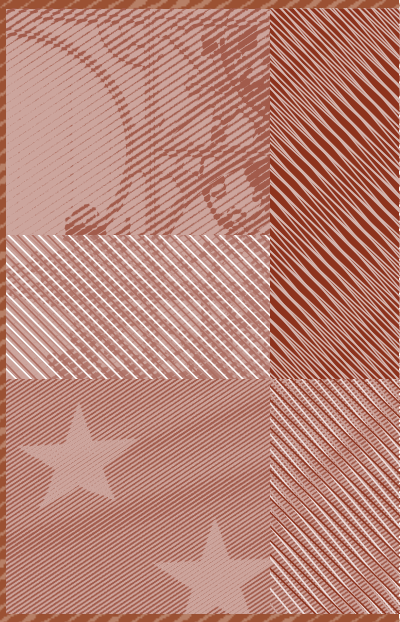
Rodolfo Campos and Jacopo Timini



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Abstract

This paper uses a gravity model approach to estimate the effects of Brexit in two dimensions: trade in goods and migration. We simulate two scenarios: 1) no agreement with reversion to WTO rules and no special treatment for migrants; 2) signature of a bilateral free trade agreement (FTA). According to our results, Brexit may have large negative effects on trade and migration flows between the EU and the UK. In the WTO scenario, trade flows are predicted to drop by 30% and migration by close to 25%. If the UK and the EU sign an FTA-like agreement (which does not include free mobility of labour), the negative effects on trade are lessened although there is no significant difference in terms of migration with respect to the WTO scenario.

Keywords: international trade, migration, Brexit, gravity models, United Kingdom, European Union.

JEL classification: F13, F14, F17, F22.

Resumen

Este documento utiliza un modelo de gravedad para estimar los efectos del *brexit* en dos dimensiones: el comercio de bienes y la migración. Simulamos dos escenarios: 1) no acuerdo, con reversión a las reglas de la OMC y sin trato especial para los migrantes; 2) firma de un acuerdo bilateral de libre comercio (TLC). Según nuestros resultados, el *brexit* puede tener efectos negativos importantes sobre el comercio y los flujos migratorios entre la UE y el Reino Unido. En el escenario de la OMC, se prevé que los flujos comerciales disminuyan en un 30 % y la migración en cerca de un 25 %. Si el Reino Unido y la UE firman un acuerdo similar a un TLC (que no incluye la libre movilidad de la mano de obra), los efectos negativos sobre el comercio se reducen, aunque no hay una diferencia significativa en términos de migraciones con respecto al escenario de la OMC.

Palabras clave: comercio internacional, migración, *brexit,* modelos de gravedad, Reino Unido, Unión Europea.

Códigos JEL: F13, F14, F17, F22.

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1 Introduction

"Should the United Kingdom remain a member of the European Union or leave the European Union?" This was the question printed on the ballots of the referendum held in the United Kingdom (UK) on 23 June 2016. With a 72% turnout, almost 52% of the voters declared their intention to leave the European Union (EU). Consequently, the British government triggered Article 50 of the Treaty on the European Union – that regulating the withdrawal from the Union – on 29 March 2017, opening the two-year window[1] for reaching an agreement between the EU and the UK.

The process of European economic integration has been extremely complex and very comprehensive in scope. This is shown by the depth of the *acquis communautaire*, i.e. the legal order of the EU,[2] and, in particular, by the Single Market[3] and its potential for shaping the EU economy. The UK's exit from the EU, namely "Brexit", is set to revert and (at least partially) undo this course. This is likely to have profound implications for a variety of economic dimensions, in Europe and beyond, as the extensive nature of UK-EU relations multiplies the potential transmission channels of such an event. However, there are four channels of transmission of economic fragmentation that can be singled out: trade of goods and services (including financial services), migration, foreign direct investment (FDI) and, ultimately, productivity.[4]

This paper uses a gravity model approach to estimate the effects of Brexit for two of these dimensions: trade in goods and migration. Following Pisani and Vergara Caffarelli (2018),[5] we initially consider two alternative post-Brexit scenarios, assuming different degrees of disintegration. In the first, the UK and the EU do not reach any substantial agreement; therefore bilateral trade flows revert to WTO rules and migrants from both areas change to a situation of no special treatment. In the second scenario, the UK and the EU sign a bilateral free trade agreement (an FTA), which may entail effects for both trade and migration (see i.a. Glick, 2017; Orefice, 2015). In a gravity framework for trade and migration, the scenario where the UK becomes a member of the European Economic Area (EEA),[6]

1 The European Council "in agreement with the Member State concerned" (art.50, TEU) extended the window until 31 October 2019 (the window may end before that date if an agreement is reached).

2 As an indicator of its comprehensiveness, the European Commission, enumerating the "conditions for membership", summarises the *acquis* in 35 chapters: free movement of goods; freedom of movement for workers; right of establishment and freedom to provide services; free movement of capital; public procurement; company law; intellectual property law, competition policy, financial services; information society and media; agriculture and rural development; food safety, veterinary and phytosanitary policy; fisheries; transport policy; energy; taxation; economic and monetary policy; statistics; social policy and employment; trans-European networks; regional policy and coordination of structural instruments; judiciary and fundamental rights; justice, freedom and security; science and research; education and culture; environment; consumer and health protection; customs union; external relations; foreign, security and defence policy; financial control; financial and budgetary provisions; institutions; other issues.

3 The expression "Single Market" is used to refer to the internal market of the EU, which in the EU legislation is defined as "a single market in which the free movement of goods, services, capital and persons is assured, and in which citizens are free to live, work, study and do business" (EUR-Lex, 2018).

4 The productivity channel includes a variety of possible drivers, among them changes in trade (Alvarez and Lopez, 2008; Cortinovis and Timini, 2018); FDI (Cortinovis and van Oort, 2018), competition, R&D, managerial skills (Mion *et al.*, 2016).

5 They start from the pre-Brexit British Foreign and Commonwealth Office *alternatives to the EU membership*.

6 The EEA created an internal market for the EU member states and three (out of four) members of the European Free Trade Association (Iceland, Liechtenstein and Norway). The EEA internal market is driven by the same pillars of the EU Single Market (see note 3). The European Free Trade Association (EFTA) is a regional trade agreement whose current members are Iceland, Liechtenstein, Norway and Switzerland.

maintaining full access to the Single Market and its "four freedoms" (free movement of goods, services, capital and persons) boils down to a "no-policy change" in relation to EU membership, i.e. a continuation of the *status quo*. This scenario will be our baseline. Therefore our analysis focuses on the first two alternative scenarios: the WTO scenario and the FTA scenario.

According to our results, Brexit may have large negative effects on trade and migration flows between the EU and the UK. In the WTO scenario, trade flows are predicted to drop by 30% and migration by close to 25%. If the UK and the EU sign an FTA-like agreement (which does not include free mobility of labour), the negative effects on trade are lessened although there is no significant difference in terms of migration with respect to the WTO scenario.

The rest of the paper is organised as follows. Section 2 summarises the related literature, devoting particular attention to the application of gravity models for estimating trade and migration effects of any kind of trade (or currency) agreements, and their potential use to simulate trade disintegration (and Brexit in particular). Section 3 defines the main features of the models used in this paper. Section 4 briefly describes the data used. Section 5 discusses the results obtained and Section 6 concludes.

2 Literature review

Gravity models have a long-established tradition in social sciences, at least since the 19th century (Anderson, 2011). They became the "workhorse" model used in research on trade and migration with Tinbergen's contribution (1962). As far as trade is concerned, gravity models have been used to respond to a variety of questions, from the nexus between trade and democracy (Yu, 2010) to the effects of trade on the environment (Frankel and Rose, 2005). The strand of the literature devoted to analysing the effects of trade agreements (TAs) and currency unions (CUs) on trade flows is the most relevant one for the purpose of this paper. The pioneering studies by Frankel (1997) and Rose (2000) provided early estimations of the significance of TAs and CUs for bilateral trade flows. The magnitude of the effects triggered a long debate, summarised by Carrère (2006) and Baldwin and Taglioni (2006), and stimulated the development of new estimation techniques to control for issues related to omitted variables bias, model mis-specification and endogeneity (Anderson and van Wincoop, 2003; Baier and Bergstrand, 2007; Head and Mayer, 2014; UNCTAD and WTO, 2016), mainly relying on different blends between country and time fixed effects.

Since the work by Baier and Bergstrand (2007) supporting the idea that TAs increase members' openness to international trade, there have been different studies focusing on the consequences of specific TAs: the NAFTA (Romalis, 2007; Caliendo and Parro, 2015); the Eastern Partnership Countries (Gylfason and Martinez-Zarzoso, 2015); the MENA region (Parra *et al.*, 2016); MERCOSUR (Cuenca Garcia *et al.*, 2013; Nowak-Lehmann and Martinez-Zarzoso, 2005); the ASEAN-China FTA (Yang and Martinez-Zarzoso, 2014; Yu *et al.*, 2014); and the South Asian Free Trade Agreement (Islam *et al.*, 2014). Cipollina and Salvatici (2010) summarise a major part of this literature with meta-analysis techniques.[7]

On the determinants of international migration, recent research employing gravity estimations on bilateral country data includes Grogger and Hanson (2011), Beine, Docquier, and Özden (2011), and Bertoli and Fernández-Huertas Moraga (2013). Ortega and Peri (2013) show that migration is highly responsive to income per-capita differentials across countries and that this elasticity is particularly high within the EU. Orefice (2015) and Figueiredo, Lima, and Orefice (2016), apply the gravitational framework to study the impact of TAs on migration.

Turning to Brexit, the potential of this event to revert the secular trend of integration among EU countries acted as a catalyst for many researchers, producing a proliferation of studies trying to assess the "costs-of-non-Europe" (Mayer *et al.*, 2019). Most of the studies report considerable economic costs from Brexit, measured in terms of output or income, ranging between –1% and –10%, approximately. The wide range of estimates is due to the diversity of scenarios assumed and of the channels considered (trade, migration, FDI, productivity, etc.)

7 The relative abundance of studies focussing on economic integration – rather than disintegration – episodes is dictated by the favourable historical trend since the second half of the 20th century. To analyse economic fragmentation episodes, researchers often use data from the inter-war (e.g. de Bromehead *et al.*, 2017) or the first globalisation (e.g. Timini, 2018) periods.

(Bisciari, 2019). Dhingra *et al.* (2017) implement a general equilibrium trade model, following Ottaviano (2014), highlighting that the losses deriving from trade will affect both the EU and the UK, and will be significantly linked to the productivity channel. Along these same lines, Pisani and Vergara Caffarelli (2018) simulate different scenarios within a dynamic general equilibrium framework, finding that whereas in most cases the impact on the UK economy is non-negligible, the effects on the euro area economies are "negative, but quite limited". Kierzenkowski *et al.* (2016) consider both short and long-term channels of transmission to calibrate and simulate the size of the different Brexit scenarios using the National Institute Global Econometric Model (NiGEM). The HM Treasury (2016), the House of Commons Treasury Committee (2018) and the Bank of England (2018) also published their assessments on the Brexit effects. These three studies are very heterogeneous, both in terms of scenarios and methodology, but they coincide in indicating strong negative effects for the UK economy. Finally, the IMF (2018) used a standard computable general equilibrium model and a range of assumptions on the relative magnitude of the different Brexit transmission channels to find that the level of output is expected to decline by between 2 and 8%.

Mayer *et al.* (2019) calculate the Brexit effects on trade, through the use of gravity equations, in a similar fashion to what we implement in this paper, but they do not include migration in their empirical analysis. Additionally, Mulabdic *et al.* (2017) use a partial equilibrium gravity model to estimate the Brexit effects on trade, finding a reduction in trade flows between –6% and –28%, depending on the scenario considered. These numbers are largely in line with our estimations. Coupling two different strands of research (trade and migration) that previously remained separate in the literature analysing Brexit, we aim to provide a (more) comprehensive assessment and estimates of the Brexit effects on the international economy, with a particular focus on trade and migration.

3 Methodology and scenarios

In the spirit of Head and Mayer (2014) and UNCTAD-WTO (2016), we implement a structural gravity model to assess the effects of Brexit on trade and migration. It is important to note that the existing data only allow us to estimate the effects of the UK entering the EU. So we have to assume that these effects are perfectly symmetric, i.e. that the effects derived from the EU accession are equal in size and opposite in sign to the effects of leaving the EU. Glick and Rose (2016) tested this hypothesis for trade in the case of entry and exit in monetary unions and found this assumption to be reasonable. However, the debate among economists is still open in the case of trade: some argue that the estimates for entry may be interpreted as a lower bound of the estimates for exit, as European value chains created since the UK accession would depend on strong comparative advantages and would have implied long-term investments, which are more difficult to destroy than to create; others argue that the estimates for entry may be interpreted as an upper bound for exit, as the interruption of the relevant international relations may occur abruptly with respect to how these relationships were forged. For example, the UK may not be able to replace all the TAs it is part of, due to its status as an EU member, or it might replace them with agreements with less favourable conditions, as its bargaining power (often related to market size) might decrease. In addition, these estimates do not incorporate dynamic effects through other channels, e.g., productivity, which may be significant (Dhingra *et al.*, 2017).

Our estimation strategy develops in three steps. The first step consists in calculating an augmented gravity model (Anderson and van Wincoop, 2003). In the case of trade, our main equation is specified as follows:

$$X_{ijt} = \exp(\beta_0 + \beta_1 EU_{ijt} + \beta_2 EUUK_{ijt} + \beta_3 Euro_{ijt} + \beta_4 FTA_{ijt} + \gamma_{it} + \delta_{jt} + \eta_{ij}) + \epsilon_{ijt} \quad (1)$$

where X_{ijt} denotes export flows between the country of origin "i" (i.e. exporter) and the country of destination "j" (i.e. importer) at time t;[8] EU_{ijt} is a dummy which takes value 1 when both countries are EU members at time t, but neither of them is the UK; $EUUK_{ijt}$ is a dummy, which is equal to 1 when both countries are EU members and one of them is the UK; $Euro_{ijt}$ is a dummy which takes value 1 when both countries are Euro-area members; FTA is a dummy that identifies country pairs which have a trade agreement in place; γ_{it} and δ_{jt} are exporter-time and importer-time fixed effects and are included to account for multilateral resistances (Anderson and van Wincoop, 2003; Feenstra, 2016); η_{ij} are country-pair fixed effects, and are included to control for potential endogeneity of the dummy variables included in the regression (Baier and Bergstrand, 2007). We include not only international but also internal trade flows, to minimise possible biases in estimating the "globalisation effects" (see Yotov, 2012). Finally, following Anderson and Yotov (2016), we assume that trade policy-related adjustment does not happen instantaneously and we use 4-year intervals.[9]

8 Technically, with Poisson Pseudo-Maximum Likelihood (PPML), flows of any of our variables of interest are inserted in levels. However, the interpretation is equivalent to the logarithm of flows in an OLS model.

9 Estimates are robust to the use of the usual 1-year time interval.

In the case of migration, the main differences consist in the separation between migration inflows and outflows, and in the introduction of additional details on trade agreements.

$$M_{ijt} = \exp(\beta_0 + \beta_1 EUmov_{ijt} + \beta_2 EUmovUKin_{ijt} + \beta_3 EUmovUKout_{ijt} + \beta_4 CU_{ijt} + \beta_5 EIA_{ijt} + \beta_6 FTA_{ijt} + \gamma_{it} + \delta_{jt} + \eta_{ij}) + \epsilon_{ijt} \quad (2)$$

The variable M_{ijt} stands for bilateral migration flows from country i to j. The variable $EUmov_{ijt}$, takes the value 1 if there is free mobility between EU country i and EU country j in the year t; this variable takes into account that free mobility does not coincide in time with EU accession in some cases. To take into account any potential specific characteristics that are particular to the UK, this variable is interacted with a UK dummy, both for migration into and out of the UK. The variable CU stands for a currency union, the variable EIA for an economic integration agreement and the variable FTA for a free trade agreement, as codified in Mario Larch's Regional Trade Agreements Database (Egger and Larch, 2008). As usual, these variables are lagged 5 years to allow for a delayed response of migration.[10] In this database, the EU is codified jointly as a currency union and an economic integration agreement.

In the second step, following Anderson *et al.* (2018) and UNCTAD-WTO (2016) for trade, and Sirries (2017) for migration, we solve the system of equations that describe the conditional general equilibrium for trade and migration flows, taking into account the consequences of a change in bilateral trade or migration costs not only on the countries directly affected by the change, but also on third countries. Within this framework, the effects of a trade or migration policy change influence third countries through the general equilibrium multilateral resistance terms, while output and expenditure are assumed to remain unchanged. In the case of trade, we solve equation (1) to obtain the "complete matrix of bilateral trade costs",[11] limiting our analysis to partial and conditional general equilibrium effects (see UNCTAD and WTO, 2016, for details), not estimating full general equilibrium effects in the case of trade because changes in population induced by changes in migration may render the methodology invalid. In the case of migration, we use the model of Anderson (2011) to obtain the bilateral migration frictions in the way described by Sirries (2017). We specify a relationship between bilateral migration frictions and various distance variables used in the literature, imposing the coefficients obtained for the variables of interest from the estimation in (2). We then use the predicted estimates of these bilateral migration frictions together with the equations characterising an equilibrium in the model of Anderson (2011) to solve for the complete matrix of bilateral migration flows, which are a function of the variables describing mobility within the EU and the various dummy variables that codify the type of trade agreement between countries.

In the third step, we define two alternative scenarios, with respect to our baseline of "no policy change" and solve the model. The first one is a "WTO scenario", in which the UK exits the EU without any formal agreement on trade or migration, therefore relying on nothing other than WTO rules. In the case of trade, we implement this hypothesis by forcing the EUUK dummy

10 Estimates are also robust to using four-year lags, akin to the case of trade.

11 We follow the Anderson and Yotov (2016) two-stage procedure, to avoid biases in estimating the alternative scenarios.

equal to zero. In the case of migration, we compute the WTO scenario by setting the mobility variables EUmovUKin and EUmovUKout to zero and setting the variables representing the EU (CU and EIA) to zero. The second scenario is one in which the UK and the EU sign a FTA. Both for trade and migration, the FTA scenario is constructed by starting out from the WTO scenario and then switching the dummy variable FTA_{ijt} from zero to one for all pairs of countries that involve the UK and other EU members to simulate the effects of the UK belonging to an FTA. We then solve for equilibrium trade and migration based on the resulting bilateral friction parameters in the same way as described in the WTO scenario.

4 Data

In the case of trade, the data (bilateral exports) are from the UN Comtrade database. We include both international and intra-national trade flows, the latter being calculated as the difference between total manufacturing production and total manufacturing exports. Due to restrictions in intra-national data, we focus on the 1986-2006 time interval. As already said, we follow Anderson and Yotov (2016) in assuming that trade policy-related adjustment does not happen instantaneously, therefore using 4-year time intervals. Data are consistently available for 69 countries, among those 19 current EU members,[12] other than the UK. EU and Euro membership has been coded following European Commission data.[13] FTA data have been retrieved from Mario Larch's Regional Trade Agreements Database (Egger and Larch, 2008), which includes "all multilateral and bilateral trade agreements as notified to the World Trade Organization".

In the case of migration, migration flows are taken from the OECD International Migration database. The database covers the years 1997-2014. It contains bilateral migration flows between 206 origin countries and 35 destination countries. Data are reported in terms of gross flows.

12 Austria, Belgium, Bulgaria (which joined the EU in 2007, after the time interval of our trade database), Cyprus, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Malta, the Netherlands, Poland, Portugal, Romania (joined in 2007), Spain, Sweden.

13 Available at https://europa.eu/european-union/about-eu/countries_en#tab-0-1

5 Results

Results shown in this section have to be interpreted as medium to long-run effects, in a comparative static fashion, i.e. when all the factors that are presumed to affect trade and migration have materialised.[14]

The estimates for the Brexit effect on trade are presented in Figure 1.[15] In the WTO scenario, bilateral trade flows between UK and the rest of the world are set to drop about 30% in volume, an effect driven by setting to zero the EU-UK dummy, and slightly reinforced (–0.2%) by the multilateral trade resistances taken into account in the model. The EU will also see a reduction in its bilateral trade flows driven by the same forces, but very moderate in relative size, with a decline of 2% approximately. Results for the Euro area are not appreciably different from those of the EU as a whole. The US and the rest of the world (RoW) are expected to see small increases in bilateral trade flows, well below 0.5%. Brexit will also affect total world trade, which is set to drop close to 2%.

In the FTA scenario, the Brexit effect on trade is small. In our trade regression, the FTA dummy has a positive and significant effect on trade flows, in line with the rest of the related literature (see i.a. Baier and Bergstrand, 2007). The presence of a trade agreement between the EU and the UK – assuming that the effect of this FTA is equal to the average effect of the FTAs included in the sample – lessens the reduction in bilateral trade flows to –10% in volume, and to –0,8% for the EU. Trade flows involving the US and the RoW would increase only very marginally (between +0.1 and +0.2%).

The estimates for the effect of Brexit on migration are presented in Figure 2.[16] In this case, estimates for the WTO scenario and the FTA scenario are similar. Indeed, in the migration regression, the FTA dummy is not statistically different from zero (see Appendix). This implies that when, in addition to the changes described for the WTO scenario, we switch the dummy variable FTA_{ijt} from zero to one for all pairs of countries that involve the UK and other EU members, this does not produce any change in migration. The result that signing an FTA does not have a noticeable impact on migration differs from some previous results in the literature, such as Orefice (2015). However, Orefice (2015) does not consider the universe of free trade agreements, but preferential trade agreements only (i.e. non-reciprocal preferential schemes).

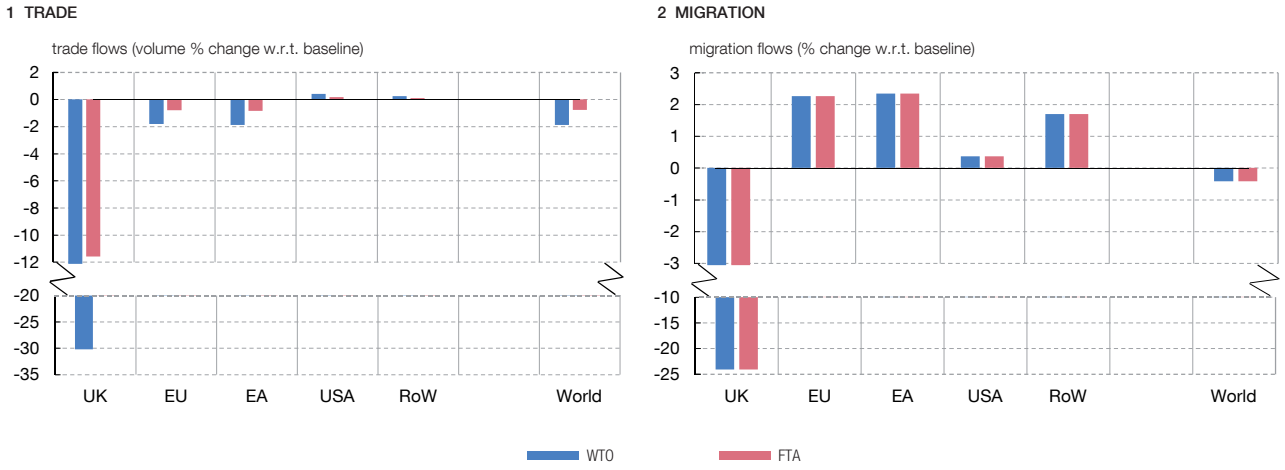
Therefore, in both the scenarios considered, Brexit is expected to have a strong impact on migration flows to the UK, which could fall by up to 25%. Effects on migration are however opposite for the EU member states as recipients: they are expected to receive more inflows per year, mostly coming from other EU member states (+2% approximately).

14 Unlike trade, yearly population growth forecasts are available from a range of international organisations (e.g. United Nations, OECD and European Commission) and short-run estimates are available upon request.

15 Results of the underlying estimations are presented in the Appendix (Table A.1).

16 Results of the underlying equation are presented in the Appendix (Table A.2).

THE EFFECT OF BREXIT ON TRADE AND MIGRATION FIGURE 1



SOURCE: Prepared by authors.
NOTE: When aggregated at the supranational level, results are the weighted average of trade and population flows.

On the other hand, immigrants from EU countries, while going abroad, will prefer to choose alternative locations with respect to the UK.[17]

6 Conclusions

In this paper we estimate the effects of Brexit on trade and migration. To do so, we implement a structural gravity model. The quantitative analysis shows robust negative effects both on trade and migration flows for the UK owing to Brexit. Our results are in line with the literature both in terms of sign and size. When we consider the EU-27, the negative effects on aggregate trade flows are much more limited in size. An FTA agreement (which does not include free labour mobility) between the UK and the EU has the potential to reduce the negative effects on trade by a substantial amount but is not expected to have a significant effect on migration. As this analysis is conducted using aggregate data, we cannot rule out the possibility that trade for single products may be particularly hit due to a particular increase in tariffs or divergence in non-tariff measures.

17 In our analysis we have quantified the possibility that the large stock of EU citizens currently living in the UK or that of UK citizens living in EU countries may wish to relocate after Brexit. If that were to happen, then migration flows of these currently stationary populations may add to the migration flows calculated in this section.

APPENDIX

TRADE PPML PANEL STRUCTURAL GRAVITY ESTIMATIONS

TABLE A.1

	Trade regression results
EU	0.3765***
	(0.0518)
EU_GB	0.4599***
	(0.1354)
EURO	0.1794***
	(0.0402)
FTA	0.307***
	(0.0909)
Observations	28,236
R-squared	0.9989

NOTE: Dependent variable: bilateral export flows (including intra-national flows, see UNCTAD-WTO, 2016). Exporter-year, importer-year and pair fixed effect are included in the regression but not reported. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

MIGRATION PPML PANEL STRUCTURAL GRAVITY ESTIMATIONS

TABLE A.2

	Migration regression results
EU	0.0168
	(0.0909)
EUmovUKin	1.266***
	(0.292)
EUmovUKout	-0.0975
	(0.132)
FTA	-0.132
	(0.0922)
Economic Integration Agreement	0.268***
	(0.0740)
Currency Union	0.144
	(0.123)
Observations	66,041
R-squared	0.966

NOTE: Dependent variable: bilateral migration flows. Origin-time, destination-time and pair fixed effects are included in the regression but not reported. The regression also includes partial scope agreements (not reported) as an additional control. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

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