Research Article

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The Impact of Hard Brexit on Polish Exports

https://doi.org/10.2478/ijme-2018-0010
Received September 19, 2017; accepted April 25, 2018

Abstract: The decision of the United Kingdom (UK) to leave the European Union (EU) is unprecedented, especially considering the recent trend in the global economy toward economic integration. There is a multitude of research concerning the implications of economic integration; however, research in the field of disintegration is scarce. Brexit serves as an interesting case study to investigate the effects of economic disintegration. The implications for trade are especially fascinating as trade liberalization is one of the most important benefits of economic integration. Existing studies focus mainly on Brexit's impact on the UK's exports and imports, while less attention has been paid to Brexit's effects on the trade of other countries. The main objective of our research is to estimate Brexit's influence on Polish exports. We present several possible scenarios of future trade relations between the UK and the EU and assume that, at least in the nearest-future post-Brexit scenario, trade under the World Trade Organization rules is most likely. This will result in the imposition of tariffs on trade between the UK and the EU members, including Poland. In our research, we used the real exchange rate of the Polish zloty against the British pound as a proxy for the changes in price competitiveness of Polish exports due to the imposition of tariffs. We find that in the first year after Brexit, the dynamics of Polish exports to the UK will decrease due to the imposition of customs duties by 1.3 percentage points (pp) and by 0.1 pp when it comes to total Polish exports. This paper contributes to the discussion on the effects of disintegration on trade. We propose a new method for assessing changes in trade volume due to increase of trade barriers.

Keywords: Brexit, international trade, European integration
JEL codes: F13, F14, F15, F17

1 Introduction

The trend toward the deepening of international economic integration by reducing trade barriers has been observed in the global economy over the past few decades. According to the World Trade Organization (WTO), the number of regional trade agreements increased from ~40 in 1990 up to almost 280 in 2016 [WTO, 2016]. Considering the growing global economic integration, the decision of the United Kingdom (UK) to leave the European Union (EU) was unexpected and extraordinary. On 23 June 2016, the Brexit referendum took place, and a majority of British voters opted for the UK to leave the EU. The proponents of Brexit raised arguments concerning the protection of the British labor market and the autonomous economic policy[1]. Following the provisions of Article 50 of the Treaty on European Union[2], the EU was officially notified by the

1 Lord Ashcroft Polls, *How the United Kingdom voted on Thursday... and why*, 24 June 2016, available at: http://lordashcroftpolls.com/2016/06/how-the-united-kingdom-voted-and-why/, accessed: August 21, 2017

2 European Union, *Consolidated version of the Treaty on European Union, art. 50*, 2012 OJ C 326, available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:12012M/TXT, accessed August 21, 2017

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UK about its intention to leave. This triggered negotiations, which should result in a withdrawal agreement within 2 years of the notification. If no agreement is reached within this time frame, the UK will leave the EU without any additional provisions, unless the European Council, in agreement with the UK, unanimously decides to extend this period. The official notification was presented on 29 March 2017; therefore, by the end of March 2019, the UK will cease to be an EU member, unless an extension of the negotiation period is applied.

Since economic integration has been observed for many years, there exists a wealth of research concerning its impact on the economies of participating counterparties. Brexit, on the other hand, is a movement in the opposite direction – toward disintegration. As a part of the EU, the UK has reached a degree of integration with other EU members that will not be achievable in any other possible outcomes following Brexit. First and foremost, leaving the EU means that the UK will lose its unconstrained access to the EU Single Market, which is available only for EU members. Therefore, Brexit serves as an incentive to conduct studies on the effects of economic disintegration.

We assume that trade relations between the EU members and the UK after Brexit will be defined by the WTO rules (henceforth referred to as Hard Brexit scenario). Other less likely options are as follows: the UK's accession to the European Free Trade Area (EFTA); a customs union between the EU and the UK; and a free trade agreement (FTA) between the UK and the EU.

In our study, we focus on Brexit's impact on Polish exports. There are already publications covering the effects of Brexit on international trade; however, these studies focus mainly on the impact to the UK, while trade effects for other countries have not been investigated fully.

The analysis of Brexit effects is relevant from Poland's point of view, since according to the international trade data obtained from Eurostat, the UK was the second biggest importer of Polish goods in 2016, receiving ~7.3% of total Polish exports. Hence, the UK is an important economic partner for Poland. In order to estimate the change in Polish export dynamics due to Brexit, we created a model in which fluctuations of the real exchange rate of the Polish zloty against the British pound (PLNGBP) serve as a proxy for the change in price competitiveness of Polish exports. Assuming the Hard Brexit scenario, we can assess the deterioration of price competitiveness of Polish exports to the UK due to imposition of tariffs in mutual trade. The presented approach is complementary to the existing literature. Our understanding is that approximation of customs duties' impact on the price competitiveness caused by fluctuations of the exchange rate has not yet been applied by other authors. Our paper is, to the best of our knowledge, the first research providing a methodology that is truly country specific.

Our results indicate that in the first year after Brexit, the dynamics of Polish exports to the UK will decrease by ~1.3 percentage points (pp) and, therefore, the total exports dynamics will be lower by ~0.1 pp. Hence, the results indicate that the impact of Brexit on the gross domestic product (GDP) growth rate of Poland will be negligible.

This paper is organized as follows. In Section 2, we present a literature review concerning the effects of economic integration and the latest research on Brexit effects. In Section 3, we discuss the possible scenarios of the UK's trade relations with the EU after Brexit. Section 4 includes a presentation of the applied methodology and data used in our research, followed by our results in Section 5, and concluding remarks in Section 6.

2 Literature Review

The consequences of economic integration agreements (EIAs) have been a topic of extensive research for >5 decades. Considering our analysis, the impact on trade flows is especially interesting. The gravity model is one of the most popular methods used to examine the impact of integration on trade. In short, this model describes bilateral trade flows as a function of the size of the countries' economies (measured in GDP) and the geographical distance between them. There is a positive correlation between trade flows and countries' GDP, while the dependence between trade and distance is negative. The gravity model is usually augmented either by additional exogenous variables, such as exchange rate or by dummy variables (e.g.,

for the existence of an FTA between trading partners). The effects of EIA can be derived by estimating the trade flows in two counterfactual scenarios: in the presence of such agreement and without it [Busch and Matthes, 2016].

The first application of the gravity model can be found in the study by Tinbergen [1962], where the author evaluated the effects of a membership between the British Commonwealth (BC) and participation in the Benelux Free Trade Agreement (BFTA) on trade flows using data from 1959. The results of his calculations indicate that BC membership was associated with an ~5% increase in a country's exports to other BC members, while in the case of BFTA, the exports between partners were higher by ~4%.

The results of the research that emerged in the following years do not give a clear answer about the significance of the EIA impact on trade [Baier and Bergstrand, 2007]. However, as Baier and Bergstrand pointed out in their research, these results were often biased downward and underestimated the effects of preferential trade agreements (PTAs) because of an assumption that PTA dummies are exogenous random variables, while, in reality, they are not. Baier and Bergstrand addressed this issue by using panel data about PTAs between 96 potential trade partners in the years 1960–2000 and found that the existence of a trade agreement approximately doubles bilateral trade flows after 10 years.

In the study by Bergstrand et al. [2011], six trade agreements in which the EU participates are analyzed. The results show that in four cases, there was a statistically significant increase of trade flows between partners. The FTAs were associated with an increase of EU exports to Chile, Tunisia, and Morocco, while in the case of an FTA with Mexico, the increase was observed in EU's imports.

Another comprehensive study was conducted by Saucier and Rana [2017]. The authors point out that up to the year 1990, trade agreements usually did not include following provisions that are not regulated by the WTO rules: financial capital mobility, competition policy, labor mobility, and environmental standards. In their research, the authors analyzed the impact of including these provisions within the framework of a trade agreement. Using data on the existing trade agreements and trade flows for 188 countries in the period between 1960 and 2010, the authors applied the gravity model. Their results show that, in general, inclusion of these provisions has a positive effect on bilateral trade flows, increasing their volume by 35% in the case of environmental standards and up to 43% in the case of capital mobility.

Trade effects of Brexit are a relatively recent subject of research, yet even before the UK decided to leave EU, Springford and Tilford [2014] had conducted a study based on the gravity model and used data on the trade flows and trade agreements between the UK and 181 countries between 1992 and 2010. They found that due to EU membership, trade in goods between UK and other EU members is, in general, 55% higher than the results from the size of the countries' economies and other controls.

The dominant method applied to forecast future effects of Brexit is known as the computable general equilibrium (CGE) model. This form of analysis simulates the impact of trade policy measures on endogenous variables, such as GDP or exports. The general idea behind the CGE model is to present a simplified version of the economy by capturing the number of interdependencies between countries and sectors. The results are measured by the difference between two simulated future equilibria – one assuming the implementation of a given policy; and the other without it [Busch and Matthes, 2016].

Dhingra et al. [2016] applied the CGE model to estimate the economic impact of Brexit. Their results vary. However, they all point to a decline in the UK's foreign trade due to Brexit. In the short term, i.e., in the first year after Brexit, the total British export is expected to decrease by 4% in the optimistic scenario and up to 12% in the pessimistic one, while the decrease in total imports can range from 5% to 12%.

In another study, Kierzenkowski et al. [2016] applied the Organisation for Economic Co-operation and Development (OECD)'s trade model, termed the ModElling Trade at the OECD (METRO), which is a new form of the CGE approach. Their research of the Brexit effects indicates a possible drop in British exports amounting to anywhere from 6.4% to 8.1%, depending on the assumed scenario.

Her Majesty's Treasury [2016] estimated the long-term impact of Brexit (within a 15-year horizon) on the UK trade volume using the gravity model. The results show that in comparison to remaining an EU member, the trade volume for the UK will drop by 9% in the optimistic scenario and up to 24% in the most pessimistic one.

According to our best knowledge, there is only one study directly presenting Brexit's impact on Polish

exports. Lawless and Morgenroth [2016] calculated the effect on each of the EU members by combining trade elasticities on the sector levels obtained from Imbs and Mejean [2017], the rise in trade costs due to imposition of tariffs under the Hard Brexit scenario, and the trade structure between the UK and a given country. Their results indicate that the UK's exports to the EU would fall by 22.25%, implicating a decrease in total UK exports by 9.83%. The effects for Poland show that Brexit will cause 30.58% reduction in the country's exports to the UK, which means a drop of 2.08% in total Polish exports.

We find shortcomings in the approach of Lawless and Morgenroth, due to issues resulting from the application of trade elasticities. Imbs and Mejean calculated elasticities on the sector level for 28 developed and emerging markets from all over the world. Lawless and Morgenroth applied a cross- country median for each sector, meaning that they did not use the UK's import price elasticity for a particular sector, but a median that could be derived from another country. It should be noted that, as shown by Imbs and Mejean, there is a significant difference between countries' elasticities, e.g., in the case of the petroleum sector, the median elasticity is equal to –4.6, while the minimum value of –26.3 occurs for Spain and the maximum of –2.5 occurs for the UK.

Further, Imbs and Mejean calculate an aggregate elasticity, which means that they do not present the price elasticity of UK's imports against a particular trading partner but as a whole. These authors even point out that Poland is one of the countries excluded in their computations. It is to be expected that UK's import price elasticity varies across trading partners. An exemplary explanation of these differences could be the country-specific preferences among immigrants in the UK. Polish was the most common non-British nationality in the UK in 2015, accounting for 916,000 residents, while the second most common nationality (India) accounted for 362,000 residents[3]. Therefore, preferences of Poles can influence the price elasticity of imports from Poland, and it can be expected that this indicator is different from the aggregate value.

Finally, Imbs and Mejean calculated trade elasticities based on data from the years 1995–2004. However, the EU has grown since 2004, which has caused changes in the relative price competitiveness of imports from new member states. As Poland entered the EU in 2004, it is to be expected that its current price elasticity varies compared to the period before accession. In addition, globalization causes imports to be more price elastic, as the substitutes are available to a wider extent due to lower customs duties and freer international trade. Thus, the more appropriate approach would be to calculate elasticities based on more recent data, in order to capture changes that occur in global economy.

For these reasons, we find the method applied by Lawless and Morgenroth to be too general and inadequate to calculate the impact on a single country, Poland in particular. Therefore, we would like to contribute to the existing studies by proposing a different approach to the estimation of the changes in imports dynamics due to the imposition of customs duties, which is specifically designed for trade between Poland and the UK. In our study, we apply the ordinary least squares (OLS) model in which imposition of tariffs is captured by changes in dynamics of the real exchange rate of the Polish zloty against the British pound. According to our best knowledge, our study is the first application of such an approach. Furthermore, in the method applied by Lawless and Morgenroth, it is assumed that the elasticity of imports from Poland is the same as that of imports from any other country. We address this issue by estimating the parameters of our model using specific data on the trade between Poland and the UK. This gives us the model, which is free from the generalizations present in the study by Lawless and Morgenroth.

3 Scenarios

Negotiations concerning the terms of Brexit are in progress, and their outcome is unknown. Given the existing forms of international cooperation, we can identify four possible scenarios. As each one of them would result in different limitations to trade between the UK and the EU, we present possible outcomes in

3 Office of National Statistics, *Population of the UK by Country of Birth and Nationality: 2015,* available at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/internationalmigration/bulletins/ukpopulationbycountryofbirthandnationality/august2016, accessed August 21, 2017

more detail with an assessment of the probability of their occurrence in the short term.

In the first scenario, trade between the EU and the UK will be carried out within the framework of the WTO, of which both the UK and other EU States are members. WTO covers trading in goods (under the General Agreement on Tariffs and Trade [GATT]) and services (under the General Agreement on Trade in Services [GATS]). One of the most important rules of WTO is the most favored nation (MFN) rule. It means that a member state must not use preferential rates of customs duties with regard to only one WTO member state, thus discriminating other WTO members. Once customs duties have been reduced for one member state, the remaining ones should be offered the same terms. Exceptions from the MFN rule are allowed, e.g., in the case of FTAs (e.g., the EU agreement with Switzerland) or customs unions (e.g., the EU). In these cases, trade may be liberalized under a trade agreement, providing its scope of goods is wide enough and it does not directly deteriorate the situation of other WTO members. Individual rates of customs duties, limits on imports and exports at lower customs duties, and other terms of foreign trade applied by the respective WTO members are agreed on a country's negotiations with the remaining WTO members and are included in the so-called schedules of concessions. The EU members apply a common schedule of concessions, although each of them is individually a WTO member. This means that on exiting from the EU, the UK will have to establish its own schedule of concessions. The UK will most likely adopt the schedule of concessions currently applied by the EU. The adoption of the same customs duties as those used by the EU vis-à-vis the remaining WTO members should not be met with their objections, as it will not deteriorate the terms on which they are currently carrying out trade with the UK.

The second scenario is the conclusion of an FTA between the UK and the EU. In addition to trade in goods, they may include other provisions, which may for instance apply to services or movement of people and capital. However, the scope of the mutual economic cooperation would largely depend on the compatibility of the future UK legislation with the EU law. At the same time, an FTA must have a wide scope (it cannot apply to single sectors) in order to comply with the WTO rules. An FTA is not a customs union and does not imply membership in the Single Market. Consequently, the UK would maintain independence from the EU in shaping its customs policy vis-à-vis third countries. We believe that, compared to other scenarios, an FTA provides the UK with the most freedom in shaping the terms of future relationship with the EU and, in our view, this is the most preferred option. However, signing an FTA is a lengthy process, judging by the negotiation of the agreement between the EU and Canada (Comprehensive Economic and Trade Agreement or CETA).

The third scenario is a customs union between the UK and the EU. A customs union assumes the lifting of tariff and nontariff barriers in trade in goods between its members, as well as a common trade policy vis-à-vis third countries. This would mean the necessity of subordinating a significant portion of British law to the EU law and no independence in conducting trade policy with the countries that are not EU members. In addition, a customs union would need to have a wide scope and could not apply to single sectors. At the same time, a customs union would not govern issues relating to movement of services, where most restraints are of a nontariff nature. In our view, due to the reasons for which the UK decided to exit the EU (Brexit proponents were most often raising arguments concerning the freedom of conducting economic policy), the probability of this scenario is low.

The fourth scenario is the UK's accession to the EFTA, currently affiliating Norway, Iceland, Liechtenstein, and Switzerland. Membership in the EFTA would allow the UK to join the European Economic Area (EEA), which currently affiliates the EU, Norway, Iceland, and Liechtenstein. The EEA is based on the principle of free movement of goods, people, services, and capital. Consequently, this solution would be the closest to the current status. Countries belonging to the EEA are members of the single market of services. However, the EEA does not mean full participation in the EU Single Market of goods, because the EU and the EFTA members belonging to the EEA do not form a customs union and, consequently, they are not obliged to apply the same tariff rates to third countries. This allows the EEA members to shape independent trade policy vis-à-vis third countries but also creates limitations in the mutual trade in goods, which remains based on the rule of origin. In short, the rule of origin consists in determining the main country of the origin of goods based on the origin of their components. It allows the UK to determine the rate of customs duty to be applied on products made from components originating from different countries. In addition, the

free movement of goods does not apply to all the markets and does not cover agriculture or fisheries. Due to the high level of economic integration and liberalization of movement of goods, services, capital, and people, the EFTA members affiliated in the EEA are required to implement into national law the EU single market legislation, including legislation on consumer protection, company law, environmental protection, and social policy. At the same time, they have no formal influence on the decisions of the EU institutions responsible for those regulations. The EFTA countries affiliated with the EEA are required to contribute to the EU budget. Considering that membership in the EEA would mean the need of significant harmonization of British law with the EU law without a possibility of influencing the EU legislative process and the need to maintain free movement of people, we consider that the probability of the implementation of this scenario is low.

Considering the political and social background of Brexit and the will to minimize the impact of its costs on British consumers and producers, the most beneficial option for the UK would be signing an FTA with the EU. According to the EU law [Munro, 2016], no deal can be struck before UK officially ceases to be an EU member. This was confirmed by the President of the European Council, Donald Tusk, according to whom, unless sufficient progress has been made in negotiations concerning the terms of withdrawal of the UK from the EU, no parallel talks on the possible signing of the FTA can take place [Bloomberg, 2017]. The negotiations on the terms of Brexit will be a lengthy process. Thus, our base scenario assumes that the UK will not manage to negotiate an FTA with the EU before leaving it. Taking into consideration the main reasons for Brexit, both EFTA/EEA and customs union with the EU are options that the British government is unlikely to accept. This means that once the UK has left the EU, until a possible FTA is signed, their trade relations are likely to be defined by the rules resulting from the membership of the UK and of the remaining EU states in the WTO. The main risk to our scenario is that the UK will negotiate a temporary solution, the form of which is impossible to predict at the current stage of the negotiations.

4 Methodology and Data

We deviated in our study from traditionally applied methods, i.e., gravity and CGE models, and developed our own approach. It can be presented by the following OLS linear regression:

$$trade_t = \alpha + \beta_1 exrate_t + \beta_2 pmi_t + \beta_3 AR(1)_t + \varepsilon_t \tag{1}$$

The dependent variable *trade* denotes an annual dynamics of Polish exports to the UK, adjusted with the Polish exports deflator. In the group of independent variables, we have included the annual dynamics of real exchange rate of the Polish zloty against the British pound (PLNGBP) lagged by two quarters (*exrate*), change in the UK's manufacturing Purchasing Managers Index (PMI)[4] in annual terms (*pmi)*, and the first-order autoregressive process *AR(1)*. The parameters α and ε stand for an intercept parameter and a random error term, respectively.

Our method is based on the assumption that changes in the annual dynamics of real PLNGBP exchange rate serve as a proxy for changes in the price competitiveness of Polish exports to the UK due to the imposition of customs duties. Hence, we can implement changes in ad valorem customs duties as the changes in exchange rate, as both values directly affect the price competitiveness. In our model, we assume that an increase in duties will be completely reflected in the final prices of exported goods. It means that the consumers will bear the customs duties costs, as the exporters will not reduce their margins. This assumption is a common approach in existing literature [Dhingra et al., 2016; Lawless and Morgenroth, 2016]. The use of a lag of two quarters is motivated by the fact that the price-adjusting process to the changes

4 Manufacturing Purchasing Managers Index (manufacturing PMI) is a survey-based indicator of an economic activity in the manufacturing sector. The questionnaire covers aspects such as output, new orders, suppliers' delivery times, purchases, employment, and others. Each month, executives in manufacturing companies are asked to describe each aspect as better, worse, or the same, compared to the previous month. The net balance of the survey responses is taken into account. PMI values >50 mean an improvement of economic activity, while values <50 mean deterioration [IHS Markit, 2017].

in foreign exchange (FX) rates is gradual.

Adding FX rates as an explanatory variable in trade equations may pose a risk of endogeneity. Weakening/strengthening of currency is negative/positive for the value of exports, while lower/higher level of exports is conducive to the depreciation/appreciation of currency. Nevertheless, we have avoided the problem of endogeneity. Firstly, Polish exports to the UK account for only 7.3% of total Polish exports. Therefore, even marked fluctuations in Poland–UK trade do not significantly affect the equilibrium rate of the Polish zloty. Secondly, the PLNGBP rate, which was used in our equation, is a cross rate of PLNEUR and GBPEUR. In other words, PLNGBP is determined by the GBPEUR rate, which fundamentally remains unrelated to the Polish economy.

The next independent variable, change in the UK's manufacturing PMI in annual terms, reflects economic fluctuations in the UK's manufacturing sector. It allows us to capture changes in demand on imports from Poland and the stage of a business cycle in the UK. An improvement of the economic situation in the sector results in an increased demand for the intermediate goods that are used in final production. As shown in Figure 1, this type of goods accounts for 38% of Polish exports to the UK. Therefore, it is to be expected that changes in the UK's manufacturing PMI have significant impact on the imports from Poland. The change in the manufacturing PMI is calculated as the difference in the index level in a given quarter compared to the same quarter from a previous year. Instead of PMI, we also tried to apply the annual dynamics of: private consumption, GDP, investments, and domestic demand. Nevertheless, none of these had sufficient explanatory power in describing changes in the Polish exports dynamics. Similarly, as in the case of FX rates, adding business survey indicators to the trade equations may lead to endogeneity. Trade activity may affect business sentiment in the same way as business sentiment may influence trade. In the case of our research, there is no risk of such causality. While business sentiment in British manufacturing may affect Polish exports, it is not likely that Polish exports to the UK, which amounts merely to 1.96% of total British imports, would have any significant impact on the situation in British manufacturing.

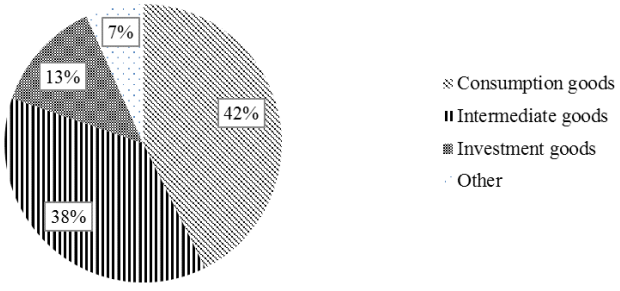

Figure 1. Distribution of Polish exports to the UK by Broad Economic Categories (BEC) groups in 2016 (euros). Source: Główny Urząd Statystyczny (GUS).

The final variable, which is a first-order autoregressive process, reflects the time series memory occurring when using trade data.

Our model was calculated using quarterly data from the period 2006–2016, which were obtained from the following sources:

- Eurostat: data on Polish exports to the UK, Polish exports deflator
- Datastream: data on PLNGBP real exchange rate
- Markit: data on PMI values

Estimation of the coefficient for the variable *exrate* in the regression (Equation 1) allows us to capture the reaction of Polish exports to the UK on the imposition of customs duties. These new costs of trade vary across different product categories that are represented by two-digit Harmonized System (HS) codes, as shown in Table 1. In order to capture an uneven increase in tariff rates, we have calculated the weighted average ad valorem customs duties increase. The average of MFN applied rates imposed on each of the

Table 1. Exports structure and ad valorem customs duties

HS code	Average ad valorem duties in the EU (%)	Share of exports of given category in total exports to the United Kingdom (%)	HS code	Average ad valorem duties in the EU (%)	Share of exports of given category in total exports to the United Kingdom (%)
01	1.2	0.0	49	0	0.8
02	5.1	3.8	50	3.1	0.0
03	11.1	0.4	51	3.5	0.0
04	5.3	0.9	52	6.1	0.0
05	0.1	0.1	53	2.8	0.0
06	6.9	0.1	54	6	0.0
07	8.5	1.1	55	6.2	0.0
08	5.9	0.5	56	6	0.1
09	2.3	0.3	57	7.3	0.1
10	2.2	0.1	58	7.3	0.0
11	12.2	0.1	59	6.1	0.0
12	1.2	0.0	60	7.9	0.0
13	2.3	0.0	61	11.7	0.3
14	0	0.0	62	11.3	0.6
15	5.4	0.2	63	10.1	0.1
16	18.2	2.4	64	11.1	0.3
17	6.8	0.3	65	2.3	0.0
18	6.1	2.3	66	4.3	0.0
19	10.7	1.6	67	2.8	0.0
20	17.5	0.7	68	1.4	0.3
21	9.2	1.0	69	4.6	1.0
22	3.9	0.6	70	5	1.5
23	0.8	0.3	71	0.6	3.3
24	44.7	1.0	72	0.3	0.1
25	0.2	0.0	73	1.7	2.0
26	0	0.0	74	3.3	0.1
27	0.8	0.9	75	0.7	0.0
28	4.5	0.2	76	6.4	0.9
29	4.3	0.1	78	2.3	0.0
30	0	0.9	79	3.1	0.0
31	4.8	0.5	80	0	0.0
32	5.5	0.3	81	3	0.0
33	2.4	3.0	82	3.1	0.6
34	2	1.2	83	2.5	0.8
35	4.6	0.0	84	1.8	14.5
36	6.3	0.0	85	2.8	12.7
37	5.5	0.0	86	1.7	0.1
38	5.4	0.3	87	5.8	14.4
39	6	3.1	88	3.3	0.3
40	2.6	2.1	89	1.1	0.1
41	2	0.0	90	2.2	1.3
42	4.6	0.1	91	4.2	0.1
43	1.2	0.0	92	3.2	0.0
44	2.2	3.0	93	2.2	0.0
45	2.7	0.0	94	2.3	6.7
46	3	0.0	95	2.3	1.2
47	0	0.1	96	3.3	0.4
48	0	1.4			

Source: WTO, Eurostat.

product categories has been weighted by the share of a given product category of exports from Poland to the UK in the total Polish exports to the UK in 2016. For example, in the category HS 31, which stands for fertilizers, the average ad valorem duty is 4.8% and it has been weighted by 0.5%, which is the share of fertilizer exports to the UK in the total Polish exports to the UK in 2016. The MFN rates and shares of each category are presented in Table 1. The ad valorem customs duties values were derived from the rates currently applied by the EU on imports from third countries, obtained from the WTO database[5]. Our results show that in the assumed Hard Brexit scenario, we can expect an average increase of ad valorem customs duties imposed on Polish exports to the UK by 4.55%.

Figure 2 presents the geographical structure of Polish exports, showing that the UK was the second biggest trade partner for Poland in 2016.

An important assumption in our research is that we consider only the effect of customs duties imposition on Polish exports and omit other potential effects resulting from Brexit, such as depreciation of the British currency, increase of transactional costs, a return migration of Poles, the reorientation of Polish exports to other markets, or reallocation of some British export-oriented companies to Poland. The negotiations concerning Brexit are not advanced enough to realistically predict the final arrangements. If we assume the Hard Brexit scenario, for the reasons given in Section 3, it provides us only with information about future ad valorem customs duties because most of the other provisions are outside the scope of the WTO framework. Thus, any assumptions concerning factors other than tariffs would be burdened with a too high level of uncertainty to make our estimates reliable. For this reason, we have decided to focus solely on costs resulting from imposition of customs duties, which is an approach taken by Lawless and Morgenroth [2016] as well.

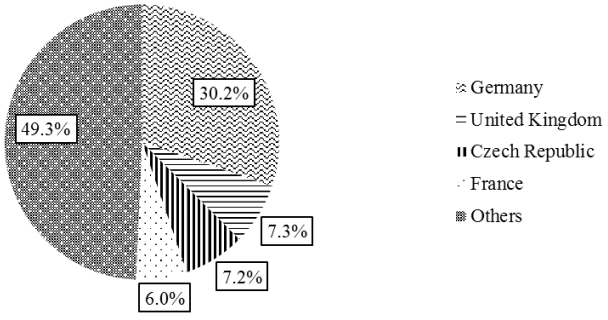

Figure 2. Geographical structure of Polish exports in 2016 (euros). Source: Eurostat database.

5 Results

We estimated our model with the autoregressive moving-average (ARMA) maximum likelihood method. The results are presented in Table 2.

Table 2. Estimation results

Variable	Coefficient	p-value
a	9.2907	0.0000
exrate	−0.2947	0.0685
pmi	0.4140	0.0800
AR(1)	0.4909	0.0043

Source: own elaboration.

5 Available at: http://tariffdata.wto.org/; accessed: April 20, 2017.

According to the results of our estimates, a 1 pp decrease in PLNGBP exchange rate dynamics leads to a decrease in the dynamics of Polish exports to the UK by ~0.29 pp. In the case of PMI, its increase by 1 point on an annual basis results in, ceteris paribus, exports dynamics being higher by ~0.41 pp. All of the exogenous variables are statistically significant at 10% level of confidence.

According to the results of our model, in the assumed Hard Brexit scenario, the imposition of ad valorem duties by an average amount of 4.55% leads to, ceteris paribus, a decrease in the annual dynamics of Polish exports to the UK by ~1.3 pp in the first year after Brexit. Taking into account that in 2016, ~7% of Polish exports was directed to the UK, the impact on the dynamics of total Polish exports would be equal to a decrease by 0.1 pp. Hence, the imposition of duties would have a negligible effect on the growth rate of GDP of Poland.

As our results show an impact on trade dynamics, they are not directly comparable with the existing research of other authors [Lawless and Morgenroth, 2016]. What can be said, however, is that all results are consistent in terms of the direction of Brexit impact, indicating that its outcome for Poland will be negative.

6 Concluding Remarks

The most common view in existing research is that the UK's membership in the EU is economically beneficial for the UK as well as for other EU members. Empirical papers suggest that Brexit will have a negative impact on trade flows between the UK and other countries associated within the EU. The results of our research are in line with that view, indicating that in the year following Brexit, the annual dynamics of Polish exports to the UK will decrease by 1.3 pp compared to the situation when the UK remained an EU member, while the total Polish exports dynamics will decrease by 0.1 pp. Our analysis is based on the assumption that future UK–EU trade relations are defined by the WTO rules, at least in the short period following Brexit. We find this scenario most possible because other arrangements would not be preferred by the UK or they would not be achievable within the time frame designed for Brexit negotiations. Under this scenario, we can estimate a direct impact on trade due to the deterioration of Polish exports' price competitiveness, caused by imposition of customs duties.

It is noteworthy that we omit Brexit effects other than those that are tariff-related, since any assumptions about arrangements concerning those factors would be burdened with a very high degree of uncertainty. However, it is likely that adding those effects would deepen the negative impact of Brexit on trade. In fact, nontariff costs (NTCs) could potentially have a significant impact on overall trade costs. Dhingra et al. [2016] mentioned that in an optimistic scenario, NTC could amount to 2.01% in tariff equivalent, while in a pessimistic one, it could equal 6.04%. These numbers are based on the assumption that after Brexit, the UK would face a fraction of the NTCs calculated for the EU and the USA by Berden et al. [2009], who used business surveys and econometric methods for estimations. Such values may indicate that our assumptions are conservative, as we focus solely on tariff costs, which amount to 4.55%. Nevertheless, in order to avoid the necessity of making arbitrary assumptions about NTCs, similar to Dhingra et al. [2016], we decided to dedicate our research to the Brexit effects that we can reliably estimate.

On the other hand, the relatively low labor costs in Poland and the low geographic rent due to its attractive location in the center of Europe may encourage some of the British companies to reallocate their activity to Poland. It would allow them to lower production costs and maintain their free access to the EU Single Market, which would have a positive impact on Polish exports, including exports to the UK. This creates room for further research in the field of Brexit implications for Polish exports.

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