The impact of Brexit uncertainties on
international trade : Evidence from Belgium

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by Emerson Erik Schmitz

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Abstract

This paper investigates the short-run effects of the uncertainties brought along with the Brexit referendum on the bilateral trade between Belgium and its main trading partners. I find that import and export markets have specific dynamics and react differently to changes in political uncertainty and economic variables. While import flows are more rigid and do not react to the uncertainties related to the Brexit referendum, export flows are more sensitive to this event. Consequently, I find that the instable environment created by the Brexit referendum leads to lower intensive margin of Belgian exports to the UK in comparison to Belgium's' main neighboring countries. The impact of uncertainties is more pronounced in larger Belgian exporting firms in the period preceding the Brexit referendum, since these firms are better able to absorb the associated costs of postponing or diverting exports. The results for Belgian manufacturing firms, which are more responsive to changes in competitiveness, also suggest more intense reaction to the Brexit uncertainties than commodities' producers but are not conclusive.

Authors:

Emerson Erik Schmitz, Tilburg University and Central Bank of Brazil.
     e-mail: emerson.schmitz@bcb.gov.br

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1. Introduction

The surprising outcome of the United Kingdom (UK)'s European Union (EU) referendum, the so-called "Brexit", leads to several doubts about the future relationship between the UK and the EU. The most noticeable, direct economic effect registered before and in the aftermath of the Brexit referendum is the sharp devaluation of the sterling pound (GBP). However, the Brexit win is also associated with major political uncertainties on the implementation of the UK departure from the EU. This unexpected outcome thus represents an interesting opportunity to analyze the consequences of an unusual decision to renounce a free trade agreement, one of EU's founding principles.

I exploit this exceptional instable environment to address the effects of the Brexit referendum on the bilateral trade between Belgium and its main trading partners – United Kingdom, Germany, France, and the Netherlands. Belgium is undoubtedly among the most affected European countries by this decision[4], and represents an interesting setting to study the impact of the Brexit referendum on international trade. I focus my analysis on whether the uncertainties governing the future Brexit arrangements could be affecting Belgian and British trading firms' decisions in the short-run, i.e., prior to the actual Brexit. Then, I investigate the impact of uncertainty on trade over and above the effect of the currency depreciation on bilateral trade. Specifically, I hypothesize that Belgian and British trading firms could be reacting in advance to the potential introduction of tariffs and non-tariffs barriers in the wake of the Brexit agreements completion.

To empirically test my hypothesis, I examine both Belgian firms' import and export trade flows to the UK and to other Belgium's main trading partners from January 2012 to June 2017. I focus on the intensive margin of trade by Belgian firms, since most of the Belgian trade flows are driven by incumbent companies. I do not use firm-product level information because the aggregation by firms already enables me to identify the effects of the uncertainties related to the Brexit referendum on the Belgian international trade.

My identification strategy relies on Belgian firms with trade relationships with at least two Belgium neighboring countries at a given time. These firms with multiple country connections are not only more prone to quickly divert their trade flows to other markets (since they do not incur in

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[4] Belgium and the UK have deep financial and trade ties, and the still unknown consequences of the Brexit will change and reshape this relationship. For instance, The UK is the Belgian's 4th trade partner and the 1st considering non-Euro partners.

sunk costs to create new relationships), they also allow for a within-firm comparison. Doing so, I can abstract from firm-specific characteristics, such as productivity and management, that may be driven by aggregate uncertainty, and focus exclusively on the impact of uncertainty on trade decisions.

I start by searching for possible trends in Belgian firms' imports and exports to each of Belgium's main trading partners in comparison with the UK. I look at the relative changes in the trade between Belgium and the UK in each of the semesters in the aftermath of the surprising referendum outcome, as well as variations in the semesters preceding the voting procedure. These preliminary specifications allow me to identify similar movements of Belgian firms' trade flows from/to Germany, France, and the Netherlands.

Based on the outcomes of these introductory investigation, I develop a difference-in-differences strategy to disentangle the effects of political uncertainty and economic fundamentals. The treatment group are the flows to and from the UK, whereas the control group are the flows to and from France, Germany and the Netherlands. I use three time periods to account for possible effects of Brexit uncertainties. The pre-period starts in 2012 and runs until David Cameron's announcement that there will be a referendum. The "intermediate period", is a dummy which takes the value of one during the period in between the announcement of the referendum but before the results' announcement (from July 2015 to June 2016). The "post-referendum period" relates to the period in the aftermath of referendum outcome (from July 2016 to June 2017). In my main specification, I use firm-time fixed-effects to capture firms' unobserved characteristics and introduce macroeconomic variables (exchange rates, GDP growth, inflation rates, and interest rates) to isolate the effect of uncertainties from macro-economic conditions.

Concerning export flows' growth rates, the outcomes without macroeconomic controls show that Belgian firms reduce their outward trade to the UK market in 7.2 percentage points in the year before the referendum, and in 9.3 afterward, relative to the pre-period and in comparison with the evolution to Belgium's other main trading partners. These results comprise Belgian firms' capacity to prevent a high pass-through of exchange rate changes to export prices, preservation of their markups, and adeptness to differentiate prices across markets. The introduction of economic fundamentals influences the magnitude of these coefficients but does not eliminate their relevance and statistical significance. Hence, I find that, after controlling for macroeconomic variables (in particular the exchange rate), Belgian firms' export flows' growth rates to the UK are 5.8 and 4.4

percentage points lower one year before and one year after the Brexit referendum, respectively, in comparison to Belgium's other neighboring countries.

Consequently, the instable environment created by the Brexit referendum boosts the negative price effects of the GBP devaluation on Belgian export flows' growth rates. Particularly, this effect might be explained by the impact of Brexit uncertainties on both trading partners. From one side, Belgian exporting firms possibly postpone their exports to the UK to a more stable and predictable period or divert part of their production to other trading partners, while British firms and households may adopt a more precautionary behavior in the wake of the doubts motivated by the referendum and its unexpected outcome.

Regarding inward trade flow, I find in the specifications without macro-economic controls that the average growth rate of Belgian trading firms' import flows from the UK does not present any statistically difference from Belgium's other main neighboring countries immediately before the Brexit referendum, but are 4.3 percentage points relatively lower in the subsequent year. However, after controlling for economic fundamentals, this last result disappears, implying that macroeconomic controls capture all the variation and that Brexit uncertainties do not have an impact on Belgian import flows. These results suggest that import and export markets have specific dynamics and react differently to changes in economic variables and political uncertainties, which might be explained by the rigidity of import flows, both in prices and in quantities, and more sensitivity of export flows to economic and political turmoil.

Further, I provide additional discussion concerning the impact of the Brexit referendum on the bilateral trade between Belgium and its main trading partners. I examine the heterogeneity of these effects by distinguishing Belgian firms' by size (large and small firms) and sector (commodities and manufacturing firms). In regard to export flows, my results imply that larger firms, more able to absorb the associated costs, either postpone exports to the UK or divert them to other markets in the period preceding the Brexit referendum. The results for manufacturing firms, which are more responsive to changes in competitiveness, also suggest more reaction to the Brexit uncertainties, but are not statistically different from those of the commodities' sector. When it comes to import flows, I find variations between subsamples towards relatively more imports from the UK in smaller and manufacturing firms' subsamples. However, these results cannot be associates to the political uncertainties caused by the Brexit referendum.

This paper is related to two different streams of literature. First, this research concerns the impact of political uncertainty on economic activity. The literature on this subject addresses these effects on firms' investment (Julio and Yook, 2012; Gulen and Ion, 2015), employment (Baker et al., 2016), output and productivity (Bloom, 2009). Specifically regarding the impact of Brexit referendum, Campello et al. (2018) use this novel event to measure the spillover of political uncertainties on American corporations' decisions regarding investment, employment, R&D, and savings. I take a different avenue and follow an incipient literature on the effects of political distress on trade activity (Pierce and Schott, 2016; Handley and Limão, 2017; Steinberg, 2019). Second, this study is close to the literature on the impact of exchange rate shocks on importing and exporting firms, which is usually concerned with firms' markup, pricing-to-market and exchange rate pass-through in the wake of an unexpected event (Gopinath and Rigobon, 2008; Neiman, 2010; Amiti et al., 2014; Li at al., 2015).

Regarding the specific impact of the unstable environment created by the Brexit referendum on trade activity, my paper is closely related to Winters and Fernandes (2018), who use the referendum as a quasi-natural experiment to analyze the effect of GBP devaluation on Portuguese exports. My analysis differs from their paper in at least three important ways: first, I go beyond the estimation of the consequences of an exchange rate shock *per se* by seeking to isolate the effect of political uncertainties on firms' short run decisions from pure economic circumstances; second, I take into account the period preceding the Brexit referendum, in which uncertainties related to the Brexit future agreements are already driving both exchange rates movements and trading firms' decisions; and, third, I use both firms' exports and imports information, which allow me to differentiate the impact of an exchange rate shock and political uncertainty in both segments.

Although I focus on a specific country and on the short-run consequences of an uncertainty-trigger event, my findings may be useful to other economies with significant financial and trade relationship with the UK, especially those which are part of the EU. This research is also important to understand the collateral effects of the decision-making to renounce a free trade agreement and how the underlying uncertainties affect exchange rate markets and firms' short-run decisions.

The remainder of the paper is organized as follows. In Section 2, I provide a review of the literature concerning the effects of political uncertainty on firms' decision and, specifically, on trade. Section 3 presents a brief overview of the effects of Brexit uncertainties on the GBP exchange market. Section 4 discusses the potential impact of the GBP devaluation on Belgian

firms' import and export flows and delineates the testable hypothesis of this study. Section 5 describes data sources, variables' construction, and presents descriptive statistics and a preview of the data. Section 6 presents the methodology and empirical results, including the additional discussion concerning the heterogeneity of Belgian exporting firms by firm size and sector. Finally, Section 7 concludes.

2. Literature review: the effects of political uncertainty on trade

The theory concerning the effects of political uncertainties on economy has been addressed in the literature by several lens, such as the impact on firms' investment decisions, households' consumption, and asset prices (IMF, 2016). In regard specifically to firms, assuming the irreversibility of investment decisions, firms' managers facing events of political distress may postpone new projects to periods of more stable and predictable economic environment (Bernanke, 1983; Dixit, 1989; Bloom et al., 2007). Empirically, there is evidence that this slowdown in investment caused by political uncertainties spreads over to the economy, resulting not only in less investments (Julio and Yook, 2012; Gulen and Ion, 2015), but also in reduced employment (Leduc and Liu, 2015; Baker et al. 2016) and lower productivity and output ((Bloom, 2009).

Regarding the impact of political uncertainty on trade, the most noticeable way that this effects can be experienced is through the higher volatility in the exchange rate market. However, although in theory exchange rate volatility could harm trade flows because of higher costs of hedge (Clark, 1973; Hooper and Kohlhagen, 1978), the empirical findings are conflicting, with negative (Arize et al., 2000; Sauer and Bohara, 2001), indeterminate (Gagnon, 1993; Baum et al., 2006) and positive (Baum and Caglayan, 2010) outcomes.

Likewise the overall impact on economy, political turmoil affects trade by the delay of firms' decision to enter foreign markets, by the decision to postpone new investments, in case of incumbent trading firms, and by motivating a more cautious behavior in households' consumption, affecting the demand for tradable products. In this regard, there is an increasing theoretical literature on trade political uncertainty. For instance, Das, Roberts, and Tybout (2007) develop a dynamic structural model that links exporter firms' decisions to enter or to increase volumes depending on future market conditions, such as exchange rate and policy changes. Arkolakis (2010) relates foreign market penetration to marketing costs, which leads to increasing costs to reach a broader set of costumers. Handley and Limão (2017) models the effects of changes in trade

policy on firms and consumers, adding that political uncertainty influences not only the entrance of new firms in the export market, usually with small volumes, but also incumbent exporting firms' investments in technology upgrading, affecting the more representative intensive margin of exports. Finally, Steinberg (2019) constructs a dynamic general equilibrium model to measure the effect of uncertainty related to the Brexit agreement on the UK economy. His model takes into account two scenarios – soft and hard Brexit -, which predicts limited impact of uncertainty triggered by the Brexit results on the UK economy.

3. The Brexit Referendum and the GBP/Euro devaluation

To have a more comprehensive understanding of the uncertainties surrounding the Brexit referendum, I provide a brief analysis of the GBP/euro exchange rates' progress from January 2013 to June 2017, illustrated in Figure 1. The GBP/euro exchange rates present two approximately symmetric movements throughout this period: a GBP appreciation, from January 2013 to its peak in November 2015; and a GBP devaluation, from November 15 on. Understanding the motivations for these upward and downward movements is essential to figure out which part might be related to actual economic fundamentals[5] and which part is derived from expectations regarding the Brexit referendum.

While the stronger British domestic demand in comparison with EU countries reasonably explains the appreciation of the GBP/euro between 2013 and 2015, UK economic performance does not seem to be responsible for the following weakening of the GBP. To support this argument, I present in Figure 2 the differences in economic growth between the UK and Belgium's other main trade partners (Germany, France, and the Netherlands). The UK economy grows at a rate considerably higher than its neighboring countries' economies until the end of 2015 but does not underperform significantly in comparison to its EU peers as from 2016.

Another plausible explanation for the GBP devaluation could come from monetary policy issues, such as differences in inflation and interest rates between both sides in the short-run. Figures 3A and 3B compare the inflation and benchmark interest rates in the UK and in the EU,

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[5] There is an extensive literature on the unpredictability of exchange rates by macroeconomic fundamentals, starting with Meese and Rogoff (1983a, 1983b). Several papers have addressed this puzzle since them, with limited success (MacDonald and Taylor, 1994; Chinn and Meese, 1995; Mark and Sul, 2001; Kilian and Taylor, 2003). Even though exchange rates may follow a random walk in the short run (Engels and West, 2005), I use macroeconomic fundamentals to mark out my reasoning and rule out these explanations for the GBP devaluation starting at the end of 2015.

respectively. Concerning inflation rates, there are also no substantial differences between both economies' indices that could justify exchange rate corrections.

When it comes to interest rates, the reduction in European Central Bank (ECB)'s benchmark interest rates from 2013 to 2015 could have had an impact on GBP appreciation, due to less attractive Euro Zone's fixed-income bonds. However, as from 2016, besides a slightly drop in ECB's rate, the Bank of England reduces the British benchmark interest rate with 250 basis points as an attempt to overcome the potential adverse economic effects of the surprising Brexit referendum outcome on UK's economic prospects. However, although this decision could lead to less short-run investment flows in the UK, its magnitude does not seem sufficient to reasonably explain the concurrent GBP devaluation.

Setting aside the relevance of short-run economic fundamentals to explain the GBP devaluation that started at the end of 2015, this movement could still be explained, from a long term perspective, by a natural mean reversion of the GPB/euro exchange rate (Kilian and Taylor, 2003). However, the most plausible explanation seems to come from market expectations. Taking into consideration the economic policy uncertainty (EPU) index for the UK[6] (Baker et al., 2016), Figure 4 shows the evolution of the EPU index in combination with the euro/GBP spot rate and its respective volatility index[7].

In the time preceding the Brexit referendum, it can be noted that, as of the approval of the referendum, the GBP starts to depreciate in accordance with the rise in uncertainties, captured both by the EPU and by the exchange volatility indices. In the aftermath of the announcement of referendum results, the GBP experiences a new round of depreciation to adjust for the unexpected outcome, while the EPU increases as a natural consequence of the debate about the consequences of the UK departure from the EU. Oppositely, the GBP/euro volatility drops, as long as the event triggering the financial market stability realizes and its underlying cause is still distant to materialize.

Specifically, Broadbent (2017) provides an insightful reasoning for the GBP devaluation, which, in his consideration, is a result of two expected effects of the Brexit on the real equilibrium

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[6] Available on www.policyuncertainty.com. The methodology takes into consideration the number of new articles that include the terms "uncertainty" and other policy terms ("economy", "policy", "regulation", etc) in 11 UK relevant newspapers.
[7] BPVIX, retrieved from Thomson Reuters Datastream.

exchange rate (REER)[8]: first, the possibility of the introduction of new tariffs and non-tariffs barriers, changing the relative prices of tradable goods (external component); and, second, the relatively higher costs of UK-produced tradable goods after the Brexit completion, affecting the productivity of non-tradable goods in the UK (internal component). As a result, exchange rate market agents anticipate and price the potential deterioration of trade relationship between the UK and the EU.

4. Testable hypotheses

In order to derive testable hypotheses concerning the impact of Brexit uncertainties on Belgian firms' trade flows, I start with the main assumption of this paper. Belgian firms exposed to the UK market and British trading firms may have reacted not only to the exchange rate market behavior (GBP devaluation and increasing volatility) triggered by the Brexit referendum, but also to the potential introduction of tariffs and non-tariffs barriers in the wake of the Brexit agreements completion. Then, Belgian and British trading firms may have postponed investments and trade decisions to a period of more predictability of the future impact of the Brexit agreement, for instance. Belgian firms, in especial, could have also could have also been affected by a more cautious British households' consumption behavior and temporarily diverted part of exports/imports to other markets, especially those in which they have already a relationship and do not incur in sunk costs.

To illustrate the possible effects of the Brexit referendum on Belgian firms' import and export flows, I rely initially on the extensive literature concerning the impact of exchange rate shocks on trade. Following, I differentiate the potential impact of uncertainties from the effects of exchange rates changes.

4.1 Exchange rate shocks

At first, it is important to discuss the currency pricing in which the trade between the EU and the UK is carried out. The literature on local currency pricing (LCP) has made important

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[8] The REER is measured by the nominal exchange rate (e) deflated by the ratio between foreign (P^*) and overall domestic (P) price indexes and can be decomposed into an external component (q_T), which takes into account the domestic (P_T) and foreign (P_T^*) prices of tradable goods; and an internal component (q_{NT}), denoted by the relationship between tradable and non-tradable goods.

contributions to the incompleteness of the exchange rate pass-through (ERPT). For instance, Gopinath and Rigobon (2008) study price stickiness and find local currency pricing in US imports and producer currency pricing in US exports. In the wake of this study, Gopinath et al. (2010) show that local currency pricing in US dollars contributes to import price rigidity and a lower ERPT into US import prices. Using Swiss data, Bonadio et al. (2018) find no price adjustments for goods invoiced in euros following the Swiss franc appreciation in 2015.

Concerning the limited literature on the use of euro in international trade flows, Amiti et al. (2018) shed some lights on the currency invoicing of European firms with Belgian data. Using extra-EU transactions, they document that approximately 40% of Belgian exports and imports to destinations outside EU are denominated in euros, and find that this pattern is more pronounced in smaller and non-import-intensive firms. Oppositely, larger firms and especially those who import goods from the US invoiced in dollars are more prone to negotiate exports in this same currency.

Within the EU, it is reasonable to expect that most of transactions of tradable goods are invoiced in euros. Particularly in relation to the EU trade with the UK, I also expected that euro plays the role of a regional dominant currency, given the considerably larger economy of the set of euro denominated countries in comparison to the UK. Consequently, I assume hereafter local currency pricing in EU imports and producer currency pricing in EU exports.

4.1.1 Import flows

Starting with import flows, Table 1A demonstrates a simple example of the possible dynamics regarding Belgian import flows afterwards the GBP devaluation. I assume, for simplicity, that the import prices for a given product in the period before the GBP devaluation is equal to the spot exchange rate (1 GBP = 1.40 euros). Then, for a hypothetical traded quantity of 1,000, Belgian firms import 1,400 euros from the UK. After a hypothetical GBP devaluation to 1.20 euros, for instance, prices of imported products will adjust to this new scenario, in which a complete ERPT means importing prices of 1.20 euros and an incomplete ERPT leads to prices at some level between 1.20 and 1.40 euros.

Under the assumption of local currency pricing in euros, the price of tradable goods imported from the UK to the EU could have presented some rigidity after the GBP devaluation. Besides this, the GBP devaluation means an opportunity to British exporters to increase their markup, not passing all the exchange rate through export prices after a currency devaluation (Berman et al., 2012). Then, we can expect that the GBP devaluation leads to a low ERPT to imported prices

denominated in euros. As a result, after the GBP devaluation, import prices in euros necessarily drop but not as much as the exchange rate variation, which results in higher prices in GBP.

Concerning imported quantities, it is reasonable to expect a higher demand for cheaper British products in euros, from Belgium's perspective. However, the final effect on import flows in euros is indeterminate. Although we can expect that Belgian firms import more volumes from the UK because of more competitive prices, this variation in quantities can be sufficient, higher or not enough to compensate for the lower prices of products in euros, leading to constant, larger and lower import flows in euros, respectively.

4.1.2 Export flows

When it comes to export flows, assuming the price of exported Belgian goods invoiced in euros, the GBP devaluation turns Belgian goods more expensive to UK costumers. Consequently, Belgian exporting firms may adjust their markups to this currency appreciation. The magnitude of these effects, however, depends on several firm characteristics, as already widely addressed in the literature on exchange rate shocks.

For instance, Amiti et al. (2014) use Belgian data to show that high import intensive exporting firms and firms with higher market shares have lower ERPT. Li et al. (2015) analyze Chinese exporters and find moderate but significant volume changes with almost complete ERPT, which differs slightly according to firms' productivity, import intensity, distribution costs, income level of importers and foreign ownership. Winters and Fernandes (2018) find a combination of lower markups, pricing-to-market (PTM) and lower sales from Portugal to the UK in the aftermath of the Brexit referendum outcome announcement and consequent GBP devaluation, whose effect is higher for larger firms and for consumer goods.

Table 1B shows the expected effects of the incomplete ERPT to export prices on export flows after the GBP devaluation. First, Belgian firms reduce export prices of goods, in euros, traded with the UK, since prices are higher in sterling pounds. As a result, the quantities exported from Belgium to the UK are expected to decrease, given the higher costs for British costumers. Lastly, the combined effects of lower ERPT, to contain the rise of prices in GBP to the UK market, with the negative quantity prospects, leads to lower Belgian export flows to the UK.

4.2 Uncertainties

Now, I turn to the hypotheses concerning the impact of uncertainties on the trade flows between Belgium and the UK in the time surrounding the Brexit referendum. These propositions take into account Belgian and British trading firms' decisions and households' reaction to the political uncertainties, which could have reduced the positive and triggered the negative price effects of the GBP devaluation on the Belgian firms' import and export flows. In this regard, to give support to the buildup of hypotheses on the effects of uncertainties on firms' decisions, and as I do not have similar information for Belgium firms, I rely on the Agents' Summary of Business conditions, produced by the Bank of England[9], a quarterly report comprising 12 regional agents with views and expectations of more than 700 senior business executives across the UK.

Specifically, I use two measures obtained from these reports: the agents' score for investment decisions, which takes into account possible firms' expenditure over 12 months in tangible non-financial assets, and the agents' score for employment intention, which refers to changes in firms' workforce within 6 months. Figures 5A and 5B show the progress of the agents' scores for investment decisions and employment intention in the UK from 2015:Q1 to 2017:Q4. In both scores, firms' investment and employment forecasts decline at the time preceding the Brexit referendum, as a potential consequence of the uncertainties involving this voting process and its outcome. Although both indices recover quickly in the aftermath of the announcement of the referendum results, they come back to lower levels than experienced before the presence of political uncertainties concerning the Brexit, such as the first semester of 2015.

These British agents' scores for investment decisions and employment intention give an indication of the impact of Brexit uncertainties on British firms' short run decisions. For the sake of the construction of hypotheses, I suppose that Belgian firms with trade relationship with the UK respond similarly in terms of investment and employment decisions, whose level of impact depends on firms' exposure to the UK market and, consequently, to the Brexit uncertainties. Moreover, both British and Belgian trading firms are affected also by the exchange rate volatility, which could also be a reason to firms postpone exports or imports transactions, or divert part of them to other markets.

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[9] Available at https://www.bankofengland.co.uk.

4.2.1 Import flows

The impact of the GBP devaluation on Belgian import flows from the UK is unclear, since the potentially higher imported quantities can be been sufficient, higher or not enough to compensate the price effects, as discussed in section 4.1.1. The players involved in Belgian import flows from the UK are British exporting firms and Belgian importing firms and households. Since I do not expect any short run impact of the Brexit referendum on Belgian households' consumption, my inference focus on firms' trade decisions. Then, I hypothesize that both British exporting and Belgian importing firms could have reacted to uncertainties triggered by the Brexit referendum, reducing traded volumes. Belgian importing firms, for instance, could have additionally activated other suppliers to prevent from future shortage or from higher costs of British production inputs.

This conjecture leads to the first testable hypothesis:

Hypothesis 1. *Taking into account the effects of the GBP devaluation, the average growth rate of Belgian firms' import flows from the UK is lower than from other Belgium's main trading partners due to uncertainties brought along with the Brexit referendum.*

4.2.2 Export flows

Concerning exports, the expectations are clear towards lower export flows from Belgium to the UK as a consequence of the GBP devaluation, as addressed in section 4.1.2. Now, the players are Belgian exporting firms, British importing firms and British households. While Belgian exporting firms' could have reduced investments in marketing and also diverted exports to other partners, the instable environment of political uncertainty may also have motivated a more cautious behavior in British importing firms and British households' consumption. Then, I expect that uncertainties related to the Brexit referendum result in even lower quantities exported from Belgium to the UK, triggering the effects of the GBP devaluation.

Therefore, we come to the following second hypothesis:

Hypothesis 2. *Taking into account the effects of the GBP devaluation, the average growth rate of Belgian firms' export flows to the UK is lower than to other Belgium's main trading partners due to uncertainties brought along with the Brexit referendum.*

5. Data

5.1 Data sources

This paper uses two datasets administrated and provided by the National Bank of Belgium (NBB). To evaluate the evolution of Belgian firms' import and export flows from/to the UK market and other neighboring countries, I obtain information from the International Trade in Goods Database. This data is available monthly, from which I select a dataset from January 2012, four and a half years before the referendum, to one year later, until June 2017.

I limit the sample to firms with trade relationship with the UK, focus of this analysis, and with Belgium's other main neighboring countries: Germany, France, and the Netherlands. These countries are the most important Belgium trading partners and are relatively similar to the UK in importance to Belgium's international trade[10]. I do not consider Belgium imports and exports to Luxembourg in this study, which are significant, but less representative than the trade with other neighboring countries.

I merge this dataset with balance sheet information that is obtained from the Belgian Business Registry. Firms' balance sheet data is provided on an annual basis. I use this information mainly to divide the sample by relevant firms' characteristics in order to account for the heterogeneity of the impact of the Brexit referendum outcome on Belgian exporting firms.

Additionally, I obtain macroeconomic variables concerning Belgium and its main trading partners from the statistical office of the European Union (Eurostat). This information is used to test the adherence of Belgian firms' trade flows to economic fundamentals.

5.2 Construction of variables

To measure the impact of the Brexit referendum on the trade relationship between Belgium and its main trading partners, I rely on the intensive margins of Belgian firms' import and export flows. To accurately calculate these variables, I take into account some specific characteristics of the trade data. First, firms may concentrate their trade on particular periods of the year, leading to a non-negligible degree of seasonality. Second, many firms may have bulky but infrequent

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[10] In 2016, according to the Belgian Foreign Trade Agency, these countries figured within the top 5 Belgium suppliers, representing 67.7% of the countries' imports from the EU, and 39.9% worldwide. These countries were also the main destination of Belgian exports, accounting for 68.4% of intra EU exports and 41.1% of the total exports.

volumes of imports and exports, which need to be distinguished from an eventual lumpiness in their trade activity.

Although I have monthly trade data available, I aggregate the data into more comprehensive periods, given its granularity. Ideally, I would rather work with annual data, which would completely capture the seasonality issue. However, because of the short period of the analysis, and as I am interested in observing the immediate impact of the Brexit referendum outcome and the tendency of Belgian imports and exports from/to neighboring countries before that event, my analysis requires a shorter level of aggregation. I choose to work on a semiannual basis[11], as long as using quarterly data would still be too granular, potentially leading to misleading classifications.

To avoid seasonality, instead of calculating the intensive margin by taking into account two consecutive semesters, I measure this variable by computing the annual growth, comparing one semester of a given year with the same semester one year before, as given by the following equation:

$$\text{int\_mg}_{i,j,t} = \ln(\text{trade}_{i,j,t}) - \ln(\text{trade}_{i,j,t-2}), \tag{1}$$

where time index t reflects semiannual periods, $\text{int\_mg}_{i,j,t}$ is the intensive margin of trade (imports or exports) of firm i to destination j in time t, $\text{trade}_{i,j,t}$ is the amount imported or exported by firm i from/to destination j in time t, and $\text{trade}_{i,j,t-2}$ is the amount imported or exported by firm i from/to destination j in time t-2.

5.3 Descriptive statistics

I provide the summary statistics for the intensive margins of import and export flows for the whole sample of Belgian firms in Table 2A. The 28 members of the European Union ("EU28") account for 41.4% and for 50.9% of the total number of Belgian firms ("All") that have imported and exported goods from/to a given country in two semesters, respectively. Within the EU28, Belgium's neighboring countries are the majority of Belgian firms with import (97.2%) and export (96.9%) intensive margin information.

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[11] I aggregate the dataset on a semiannual basis because of its granularity, avoiding a misclassification of trade flows produced by incumbent firms (intensive margin) and by entering or exiting firms (extensive margin). The choice for the ideal level of aggregation takes into account not disregarding information and, at the same time, having enough time variation to observe the impact of the referendum on firms' short run decisions. Then, using monthly or quarterly information could lead to disproportional number of entering/exiting firms, while reducing the number of available data for the intensive margin. On the other extreme, using annual information would not allow me to observe the immediate effects of the GBP devaluation and potential uncertainties at the time surrounding the Brexit referendum.

In Table 2B, I present the summary statistics for the sample of Belgian firms that have intensive margin information for at least two of Belgium's neighboring countries and that have available information for the sector they belong to[12]. Importantly, this sample selection excludes approximately only 8.8% and 7.2% of Belgian firms' intensive margins of import and export flows' observations. It is interesting to observe that the average of intensive margins is considerably higher for the subsample of firms with continuous trade relationship with more than one of Belgium's neighboring countries. It implies that the group of firms with a single trade partner experienced more intense shortfalls in their average intensive margins and firms with more than one continuous trade partner seem more able to access different markets and possibly reorient imports and exports.

5.4 Data preview

In this section, I compare the average of imports' and exports' intensive margins from/to Belgium main neighboring countries in Figures 6A and 6B. Belgian firms reported average negative intensive margins of import flows to the four considered countries over almost all the sample period. However, we cannot visually identify any particular difference in this measure across Belgium suppliers. Concerning Belgian firms' intensive margins of exports, there is a consistent upward trend of Belgian firms' export flows' growth rates to the UK until 2015S1, and then an inflection of this tendency as from 2015S2. The export flows' growth rates to Belgium's other neighboring countries were considerably lower, or even negative, during the period of extensive growth of exports to the UK. Nevertheless, these export markets were not hit by the same magnitude as the exports to the UK as from 2015S2.

Overall, the data suggest that Belgian firms' export flows are more synchronized with economic circumstances, as long as the periods of growth in exports to the UK coincide with a better British economic performance and a more appreciated sterling pound. On the other hand, Belgian firms' import flows seem less responsive to macroeconomic variables.

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[12] Since I cluster the errors by sectors, I lose observations in which this information is not available. Then, the descriptive statistics replicate the samples used in the empirical tests.

6. Methodology and empirical results

6.1 Impact of the Brexit referendum on Belgian firms' short-run decisions

I start this empirical section by analyzing the behavior of Belgian imports and exports from/to the UK in comparison to other neighboring countries in the time surrounding the Brexit referendum. In this first step, my focus is on observing whether the Brexit referendum has an impact on the trade relationship between Belgium and the UK, and, if so, on the timing and the intensity. I am therefore not particularly interested in just one single intermediate or post coefficient, but rather look at the bi-annual differences. In particular, I look at the relative changes in the trade between Belgium and the UK in each of the semesters in the aftermath of the surprising referendum outcome, as well as variations in the semester preceding the voting procedure. I am also concerned with the Belgian exports' and imports' trends to Belgium's neighboring countries before any influence of the uncertainties regarding the Brexit referendum.

I evaluate the effect of the Brexit uncertainties on trade by calculating the intensive margins of Belgian firms' exports and imports to/from the UK in comparison to Belgium's other neighboring countries and important trade partners (Germany, France, and the Netherlands). I select all Belgian firms that have imports' or exports' intensive margin information, respectively, for at least two Belgium neighboring countries at a given time.

Initially, I run the following regression model for both Belgian firms' exports and imports:

$$\text{Int\_mg}_{i,j,t} = \sum_{j=1}^{3} \beta_j \text{neigh}_j + \sum_{j=1}^{3} \sum_{t=1}^{8} \beta_{j,t} \text{neigh}_j * \text{time}_t + \lambda_{i,t} + \varepsilon_{i,j,t}. \tag{2}$$

where $\text{Int\_mg}_{i,j,t}$ takes the values of the intensive margins of imports and exports, respectively. The remaining variables of the model are described as follows: time_t is a dummy variable that takes the value 1 for a given semester, and 0 otherwise. neigh_j is a set of dummy variables that take the value 1 for the intensive margins of Belgian firms' imports and exports, respectively, from/to Germany, France, and the Netherlands, and 0 otherwise; $\lambda_{i,t}$ controls for firm-time fixed effects, and takes into consideration the unobserved differences in Belgian firms' total factor productivity (TFP) over time; and $\varepsilon_{i,j,t}$ is the error term. I am interested in all the coefficients of the interaction between time_t and neigh_j, especially those in the surrounding of the Brexit referendum [13]. I cluster

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[13] Statistically significant and positive coefficients should be interpreted as an evidence of higher growth rate of imports of exports to a given Belgium's neighboring country in comparison to the UK in time *t* relatively to the same

the errors by sectors, as long as the error terms for firms within the same sector are very likely to be correlated.

Imports

I present the outcomes for the intensive margin of imports in Table 3A, whose coefficients for the country-time interactions (point estimates) are also illustrated in Figure 7A. We notice a statistically significant increment of Belgian firms' import flows from France in the two semesters that followed the surprising results (2016S2 and 2017S1) and from Germany (2017S1). It is also interesting to realize that the country-time coefficients follow similar trends up to 2016S1, which change in the same direction afterwards.

These coefficients indicate that a potential increase in the quantities imported from the UK following the GBP devaluation did not offset the respective price effects[14]. However, these relatively lower growth rates to the UK in comparison to Germany and France may also be explained by differences in their respective business cycles, for instance. Additionally, these results also suggest that Belgian firms may have decided to import relatively more from permanent EU trade partners, who also share the same currency, responding in the short-run to the uncertainties related to the future Brexit agreements.

Exports

Next, I turn to the investigation of the effect of Brexit uncertainties on the intensive margin of Belgian firms' export flows. The outcomes are presented in Table 3B and the coefficients for the country-time interactions (point estimates) are replicated in Figure 7B. The results are in line with the expectation of lower export flows' growth rates from Belgian to British firms comparing to firms in Belgium's other main trading partners. Belgian firms experience relatively higher exports' growth rates to the Netherlands from 2015S2 until 2017S1, to France from 2016S1 until 2017S1, and to Germany in 2016S2.

As before, these results may have been caused solely by the reaction of Belgian exporting firms to economic fundamentals but also amplified by the instable environment created by the Brexit referendum. Importantly, we realize once more a strong and simultaneous upward

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difference in 2013S1. The choice of this period as base is arbitrary but has no practical effect, as the intuition underlying this preliminary study is to capture intensive margins' trends and their respective deviations.

[14] As explained in section 4, even assuming low ERPT, British tradable goods became cheaper to Belgian firms, in euros, in comparison to euro denominated counterparts, following the GBP devaluation.

movement in country-time coefficients, but now as from 2015S2, which suggests that the impact the GBP devaluation and potentially the Brexit uncertainties were affecting Belgian export flows already one year prior to the referendum.

6.2. Difference-in-differences approach

Now I turn to my main specification, which is motivated by the outcomes of previous model. As the country-time coefficients for both imports' and exports' intensive margins' regressions follow similar trends before any effect of the Brexit uncertainties, I employ a difference-in-differences strategy to disentangle the effects of political uncertainty and economic fundamentals. The treatment group are the flows to and from the UK, whereas the control group are the flows to and from France, Germany and the Netherlands. In addition, I use two time dummies to account for sources of exogenous variation: an "intermediate period", which accounts for the period in which the Brexit uncertainties could already be present, but before the results' announcement; and a "post-referendum period", related to the period in the aftermath of referendum outcome. I then compare the intensive margin of Belgian imports and export to the UK and to Belgium's other neighboring countries, using the following regression model:

$$Y_{i,j,t} = \beta_1 UK_j + \beta_2 Inter_t * UK_j + \beta_3 Post_t * UK_j + X_{j,t} + \lambda_{i,t} + \varepsilon_{i,j,t}. \tag{3}$$

where $Y_{i,j,t}$ takes the values of $int\_mg_{i,j,t}$; $Inter_t$ is a dummy variable that takes the value 1 for 2015S2 and 2016S1, and 0 otherwise; $Post_t$ is a dummy variable that takes the value 1 for 2016S2 and 2017S1, and 0 otherwise; and UK_j is a dummy variable that takes the value 1 for the intensive margins of imports or exports from/to the UK, $X_{j,t}$ is a set of changes in macroeconomic variables (exchange rates, GDP growth, inflation rates, and interest rates), $\lambda_{i,t}$ are firm-time fixed effects, and $\varepsilon_{i,j,t}$ is the error term. Compared with the coefficients of the preliminary specification, the results now give two different perspectives: *i*. the UK as treatment group, and *ii*. two new time dummies condensing the effects into more comprehensive periods.

Table 4A shows the outcomes for the intensive margin of import flows. Starting with the results without macroeconomic controls, we observe that Belgian firms do not show a relative increment of imports' growth rates from the UK in the semesters preceding the referendum, but experience, on average, 4.3 lower percentage points in imports' growth rates from the UK after

the voting process[15], compared to other Belgium neighboring countries. These results suggest that even if Belgian importing firms increase the imported quantity of goods from the UK, offsetting the effects of cheaper prices in euros in import flows, this potential growth is not enough to compensate the price effects in the aftermath of the voting process.

However, after the inclusion of exchange rate changes and especially controlling for Belgium's neighboring countries GDP growth, the coefficient for the interaction of UK with the dummy for the period in the aftermath of the Brexit referendum becomes statistically indistinguishable from zero. It implies that the economic fundamentals totally capture the lower growth of import flows from the UK in comparison to Belgium's other neighboring countries. Therefore, uncertainties related to the Brexit referendum do not seem to have played a role in Belgian firms' import flows.

Concerning the intensive margin of export flows, the respective outcomes are illustrated in Table 4B. First, the regression without macroeconomic controls shows that Belgian firms relatively reduce their expansion to the UK market with 7.2 percentage points in the year before the referendum, and with 9.3 afterwards, comparing to Belgium's other main trading partners and relative to the pre-period. Belgian exporting firms adjust their prices and exported quantities in the wake of the GBP devaluation given their susceptibilities, such as capacity to prevent a high pass-through of exchange rate changes to export prices, preservation of their markups, and adeptness to differentiate prices across markets.

In columns 2-5, I introduce economic fundamentals to disentangle the effects of (political) uncertainty from economic fundamentals. These controls, which account for Belgian firms' responsiveness to the GBP devaluation and Belgium's neighboring countries economic performance, influence the magnitude of the previous coefficients but preserve their relevance and statistical significance. Consequently, macroeconomic variables do have an effect on export flows, but do not capture all the variation in their intensive margin to the UK in relation to the treatment group.

Then, I find that, after controlling for macroeconomic variables, export flows' growth rates to the UK 5.8 and 4.4 percentage points lower one year before and one year after the Brexit referendum, respectively, in comparison to Belgium's other neighboring countries[16]. I associate

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[15] Statistically significant only at the 10% level.

[16] Comparing the relative economic relevance these findings, I estimate from the coefficients of Table 4B that 80.6% and 47.3% of the variation in the intensive margin of exports in the periods before and after the referendum,

these remaining results to the instable environment created by the Brexit referendum[17], which boosts the negative price effects of the GBP devaluation on Belgian export flows' growth rates. Belgian exporting firms possibly reduce their volumes exported to the UK and/or divert part of their production to other trading partners, a pattern that supports the hypothesis that the uncertainties brought along with the Brexit referendum influence Belgian trading firms' decisions in the short-run.

Overall, these findings suggest that import and export markets have different dynamics and react differently to changes in economic variables and political uncertainties. This distinction might be explained by the characteristics of each segment, such as stickiness of imported prices and quantities, and a fast adjustment of exporting prices (Bonadio et al., 2018). In accordance, my results imply more rigidity of import flows, and more sensitivity of export flows to economic and political turmoil.

6.3. Belgian firms' heterogeneity

In this section, I provide additional discussion of the impact of the Brexit referendum on the bilateral trade between Belgium and its main trading partners. I examine the heterogeneity of these effects in terms of Belgian firms' sizes and sectors. The relative decline in the export and import flows' growth rate to the UK could have been experienced in a different way by Belgian firms depending on their susceptibility to exchange rate movements, disparities in business cycles, political uncertainties and on their capacity to absorb the costs of diverting production or switching suppliers to different markets. To investigate it, I rerun the specification (3) without and with macroeconomic controls but now splitting the sample into the two different approaches mentioned above. I also test the statistic difference between the coefficients of the respective subsamples.

6.3.1. Firm size

I start by differentiating firms by their sizes, taking into consideration the average of total assets over the three years before the Brexit referendum for each firm and then dividing the sample by the respective median.

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respectively, may be related to Brexit uncertainties. These results are sizable and illustrate the extent to which firms are exposed to this unforeseen event of renouncing a trade agreement.

[17] Including the GBP/euro exchange rate volatility.

<u>Export flows</u>

I expect that larger exporting firms have a higher capacity to absorb exchange rate movements on their markups and present lower ERPT (Winters and Fernandes, 2018), to hedge their currency exposures in financial markets, and to stablish different prices for different export markets in the wake of exchange rate shocks[18] (Gopinath and Itskhoki, 2011; Fitzgerald and Haller, 2014). Moreover, concerning the effects of Brexit uncertainties, larger firms may also be able to postpone export to more stable and predictable periods and to promptly divert part of the production to different export markets.

Table 5A illustrates the results to firms' sizes. Starting with the regressions without macroeconomic controls, we observe that larger firms present relatively lower intensive margin of export flows to the UK. This outcome is especially relevant during the "intermediate period", in which I find that larger firms experience 5.9 percentage points[19] lower export flows' growth rates to the UK than smaller firms. This result is in line with findings of lower ERPT for larger exporters (Amiti et al., 2014; Winters and Fernandes, 2018).

Then, I introduce macroeconomic variables to account for price and quantity effects caused by economic fundamentals. Interestingly, we observe a higher impact of exchange rate variations on smaller firms, as long as larger firms are better able to shield themselves from currency shocks. With these controls, I find that larger firms experience 7.7 and 5.9 lower percentage points[20] in the intensive margins of export flows to the UK, on average, in comparison to other Belgium's main trading partners in the intermediate and post-period, respectively, while smaller firms presented 3.1 lower percentage points[21] before the Brexit referendum but statistically insignificant coefficient afterwards. The difference between larger and smaller firms' coefficients is statistically significant only in the intermediate period, when larger firms' coefficient is 4.6 percentage points lower than the coefficient for smaller firms.

The outcomes of this subsample analysis suggest that larger firms take additional actions in response to the uncertainties related to Brexit referendum in the time preceding the Brexit referendum. A possible explanation for this finding is that larger firms have more capacity to

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[18] Pricing-to-market (PTM).
[19] Significant at the 1% level of significance.
[20] Significant at the 1% and 5% levels of significance, respectively.
[21] Significant at the 5% level of significance.

postpone exports to the UK and reorient their exports to other markets and absorb the associated costs.

Import flows

I repeat the same exercise for import flows, whose results are reported in Table 5B. Without macroeconomic controls, I do not find any substantial difference between large and small firms' subsamples. Interestingly, after controlling for economic variables, I find that Belgian smaller firms present higher import flows' growth rates to the UK in comparison to other Belgium's main trading partners in the post-period. In addition, this coefficient is statistically different from the coefficient for larger firms. Although these results imply some degree of intertemporal choices[22], they do not give evidence that the political uncertainties caused by the Brexit referendum could be influencing larger Belgian importing firms' decisions.

6.3.2. Sector

I now take into account the two main Belgian exporting sectors, which concentrate the majority of exports and have intrinsic different characteristics: manufactured goods and "commodities" (agricultural products, raw materials, energy products or services). Since commodities are considered more homogeneous goods and manufactured goods are deemed more responsive to changes in countries' competitiveness (Schmitz et. al., 2012), I test whether both segments could have reacted differently to the Brexit referendum.

Export flows

Table 6A presents the results for the export flows across different sectors. Concerning the regressions without macroeconomic controls, I find a slightly higher decrease in the intensive margin of export flows to the UK for manufactured goods in both analyzed periods, comparing to Belgium's other trading partners. This result is in accordance with an expected larger effect of the GBP devaluation on manufactured or consumer goods (Campa and Goldberg, 2010), in spite of the difference between the respective coefficients is not statistically significant.

After including controls to account for economic fundamentals, the results for the intensive margin of export flows to the UK for commodities become barely significant in the intermediate

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[22] For instance, smaller importing firms could have decided to postpone imports to the period in the aftermath of the Brexit referendum.

period, and not significant anymore in the year after the Brexit referendum. Conversely, I find statistically significant results for the sample of manufacturing goods before and after the Brexit referendum [23], indicating consistently lower growth rates to the UK after controlling for macroeconomic changes. It suggests that manufacturing firms may be more reactive to changes in competitiveness caused by political distress, as long as these coefficients imply lower exported volumes to the UK, or a potential diversion of production to other markets in the wake of the uncertainties triggered by the Brexit referendum. However, the differences between manufacturing and commodity coefficients in both periods are not statistically significant.

Import flows

The outcomes for import flows among firms in the manufacturing and commodities' sectors are reported in Table 6B. Without macroeconomic controls, it is striking to observe that manufacturing firms experienced 7.5 percentage points lower growth rates in imports from the UK in comparison to Belgium's other neighboring countries in the wake of the Brexit referendum. However, after adding economic fundamentals, while this last effect vanishes, we find that firms in the manufacturing sector relatively increase import flows from the UK in 6.5 percentage points in the period before the voting process.

Although apparently atypical, these results might be explained by the higher responsiveness of manufacturing goods to changes in competitiveness. Once more, the outcomes for import flows imply some degree of intertemporal choices, as manufacturing firms may have decreased imported quantities from the UK before the referendum and increased afterwards. However, there is no evidence in this regard. On the other hand, firms in the commodities' sector do not experience any significant variation, which is in accordance with the expectation.

7. Conclusion

This paper analyzes the effects the Brexit uncertainties on the bilateral trade between an important EU economy – Belgium – and its main trading partners (United Kingdom, Germany, France and the Netherlands). I find that import and export markets have different dynamics and react differently to changes in economic variables and political uncertainties. While import flows are more rigid and do not react to the uncertainties related to the Brexit referendum, the instable

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[23] -5.9, at the 1% level, and -5.8 percentage points, at the 5% level of significance, respectively.

environment created by the Brexit referendum boosts the negative price effects of the GBP devaluation on Belgian export flows' growth rates.

Consequently, Belgian exporting firms possibly postpone their volumes exported to the UK to more stable periods or divert part of their production to other trading partners. This inference supports the hypothesis that the uncertainties brought along with the Brexit referendum influence Belgian and British trading firms' decisions in the short-run.

Following, I examine the heterogeneity of these effects by Belgian exporting firms' size and sector. Concerning export flows, my results suggest that larger firms, more able to absorb the associated costs, postpone exported volumes to the UK or are more prone to divert exports to other markets. Regarding manufacturing firms, more responsive to changes in competitiveness, results suggest more intense reaction to uncertainties than commodities' producers but are not conclusive. In regard to import flows, outcomes give no evidence that the political uncertainties caused by the Brexit referendum could be influencing Belgian importing firms' decisions.

These findings may be useful to other economies with significant financial and trade relationship with the UK, especially those which are part of the EU. In addition, understanding the collateral effects of the decision-making to renounce a free trade agreement and how the underlying uncertainties affect exchange rate markets and firms' short-run decisions is also important to policymakers worldwide.

I suggest two possible avenues for future research. First, one could extend the findings in these paper to other relevant EU economies. Second, and in addition to the first suggestion, forthcoming papers could use firm-product level data to explore the elasticity of substitution between EU-produced and non-EU-produced traded products in the wake of Brexit uncertainties.

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Figure 1 – GBP/Euro exchange rates (2013-2017)

Notes: Figure 1 shows the daily GBP/Euro exchange rates from 2013 to June 2017.

Source: Eurostat

Figure 2 – GDP growth of UK and Belgium' main neighboring countries (2015/4 = 1)

Notes: Figure 2 compares the economic growth between the UK and Belgium's main neighboring countries (Germany, France, and the Netherlands). All indices are equal to 1 in 2015/4 (4th trimester of 2015) to facilitate the comparison. We show that the UK economy grew at a rate considerably higher than its neighboring countries' economies until the end of 2015, but did not underperform significantly to its EU peers as from 2016.
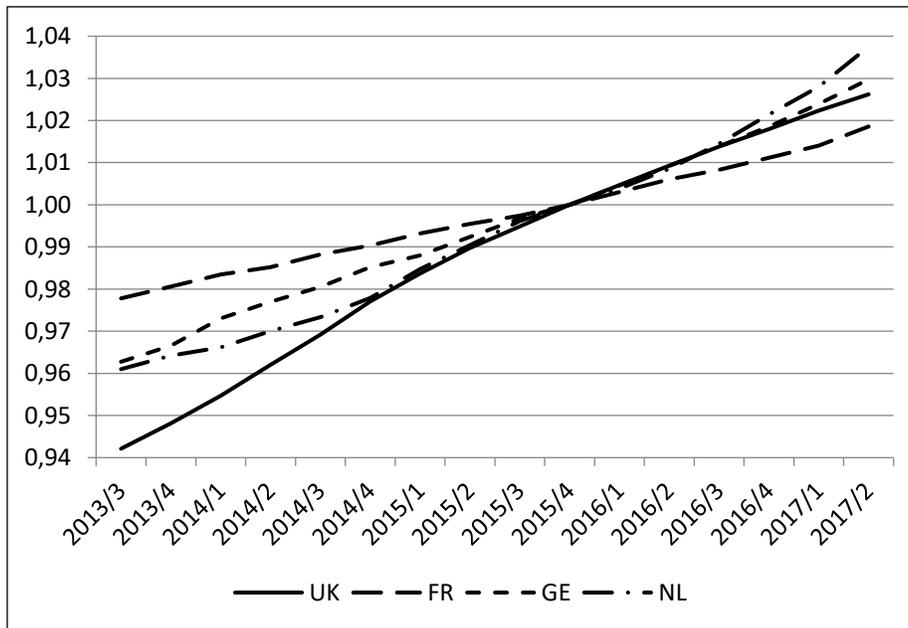
Source: Eurostat

Figure 3A – Euro Area and UK inflation rates (2013-2017)

Notes: Figure 3A shows the inflation rates of the Euro Area and the UK from 2013 to June 2017.
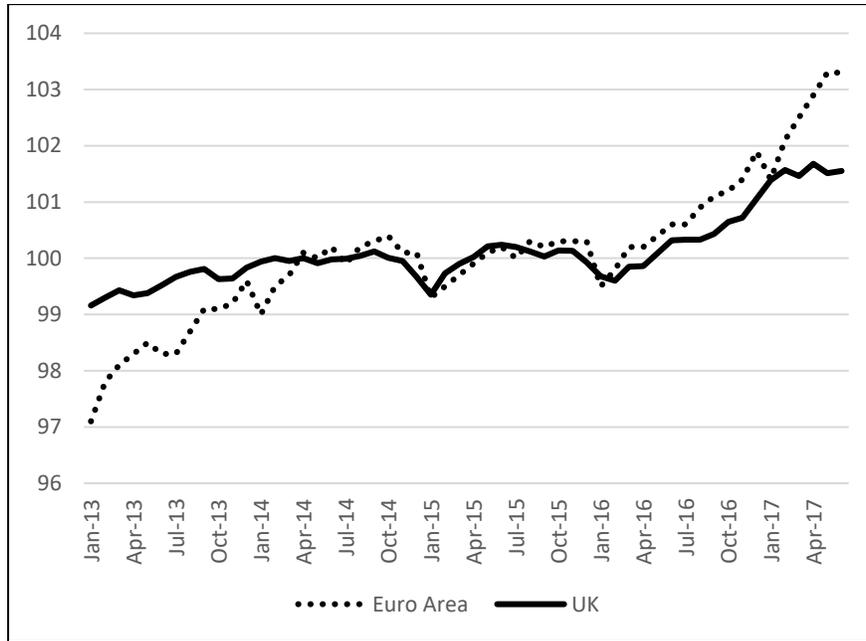
Source: Eurostat

Figure 3B – Euro Area and UK interest rates (2013-2017)

Notes: Figure 3B shows the interest rates of the Euro Area and the UK from 2013 to June 2017.
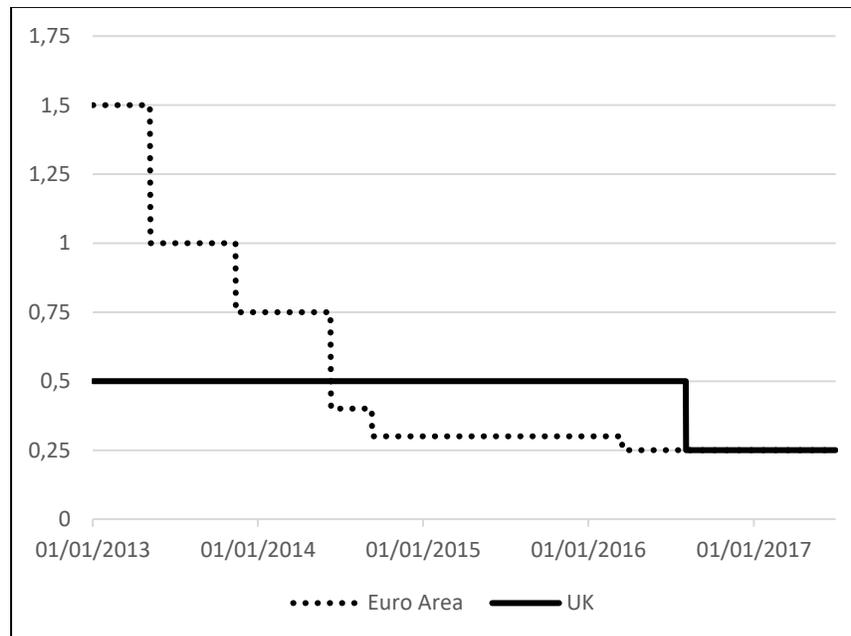
Source: Eurostat

Figure 4 – Euro/GBP (exchange rate and volatility index) and political uncertainty

Notes: Figure 4 shows the evolution of the economic policy uncertainty (EPU) index (Baker et al., 2016) in combination with the euro/GBP spot rate and its respective volatility index (secondary axis). The methodology for the EPU takes into consideration the number of new articles that include the terms "uncertainty" and other policy terms ("economy", "policy", "regulation", etc) in 11 UK relevant newspapers. Exchange rate volatility (BPVIX) is retrieved from the Thomson Reuters Datastream database.
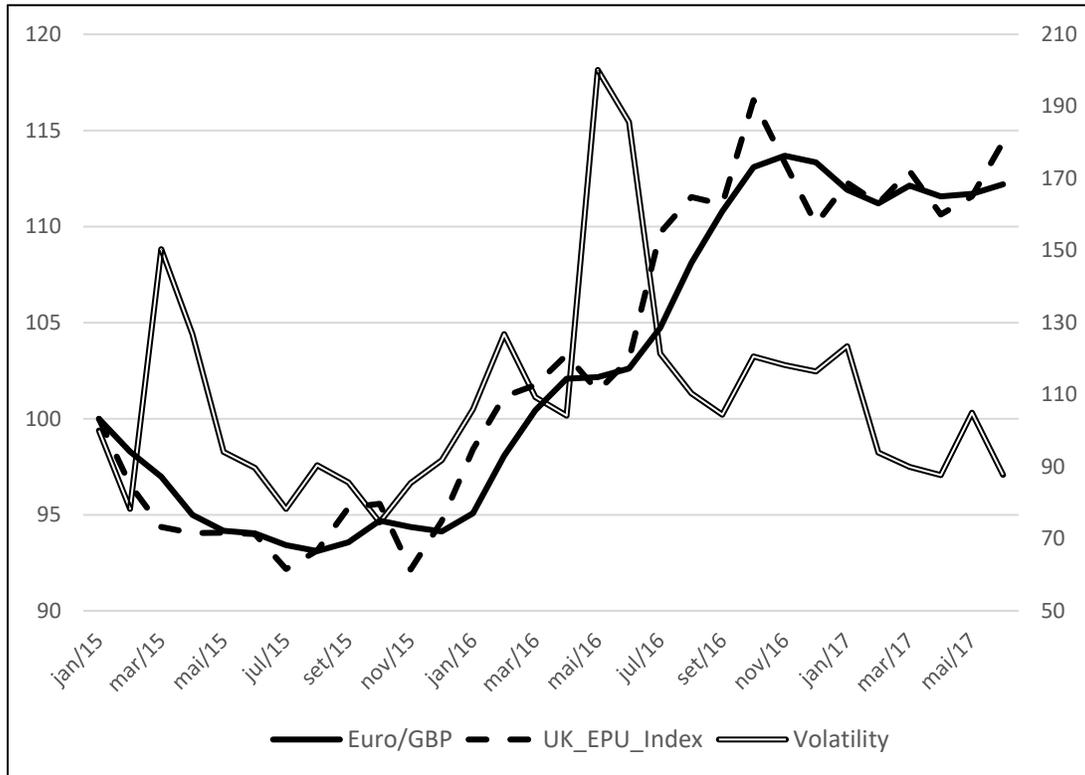
Figure 5A – Agents' Summary of Business Conditions (Bank of England) - Agents' score for investment decisions

Notes: Figure 5A shows the progress of the agents' score for investment decision from 2015:Q1 to 2017:Q4, published on Agents' Summary of Business Conditions, a quarterly reported produced by the Bank of England. The score for investment decisions takes into consideration possible firms' expenditure in tangible non-financial assets over a horizon of 12 months.
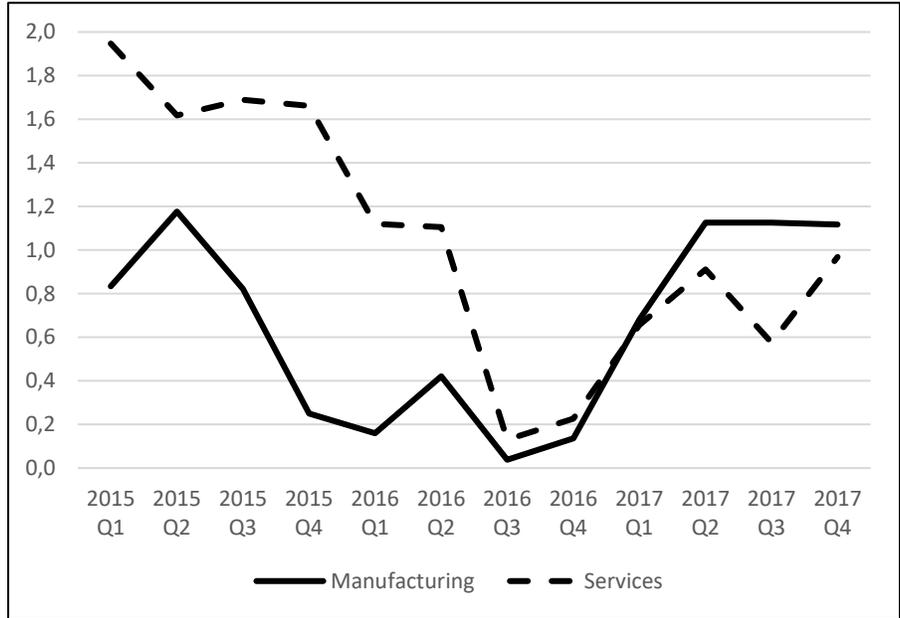
Figure 5B – Agents' Summary of Business conditions (Bank of England) - Agents' score for Employment intention

Notes: Figure 5B shows the progress of the agents' score for investment decision from 2015:Q1 to 2017:Q4, published on Agents' Summary of Business Conditions, a quarterly reported produced by the Bank of England. The score for employment intention takes into consideration possible changes in firms' workforce within 6 months.

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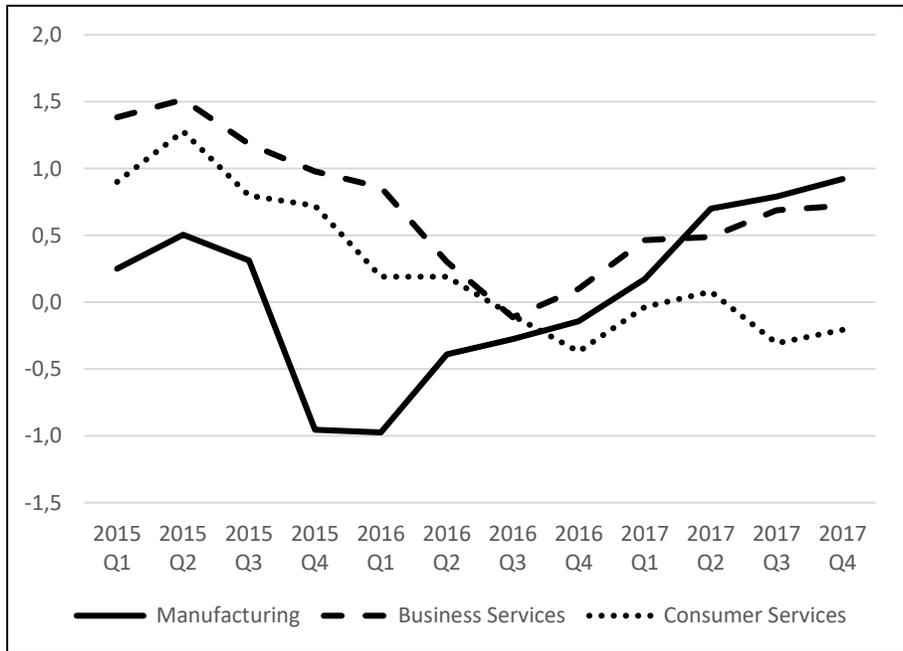
Figure 6A – Average intensive margin of imports to Belgium' main neighboring countries

Notes: Figure 6A shows the average Belgium firms' imports' growth rate to its main neighboring countries from 2013 to the first semester of 2017.
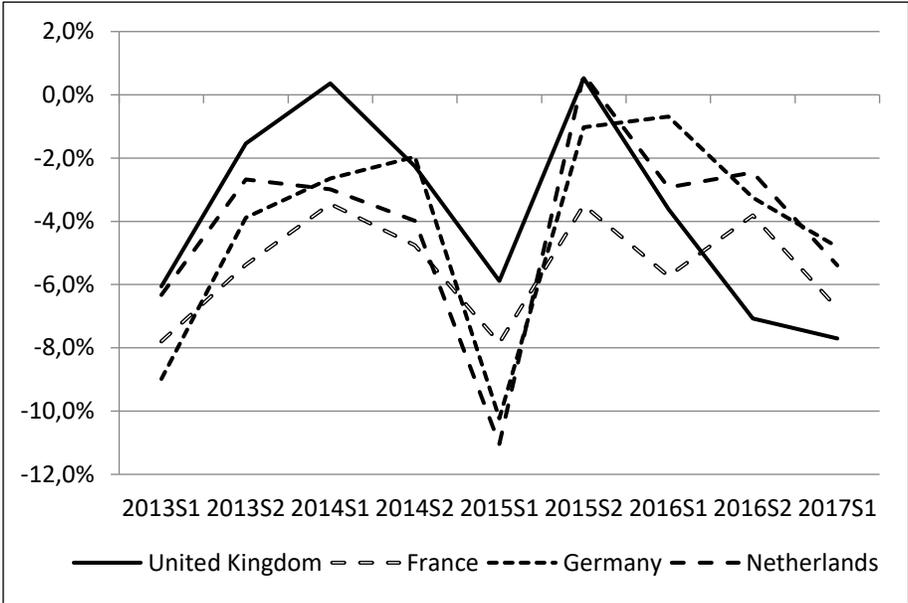
Figure 6B – Average intensive margin of exports to Belgium' main neighboring countries

Notes: Figure 6B shows the average Belgium firms' exports' growth rate to its main neighboring countries from 2013 to the first semester of 2017.

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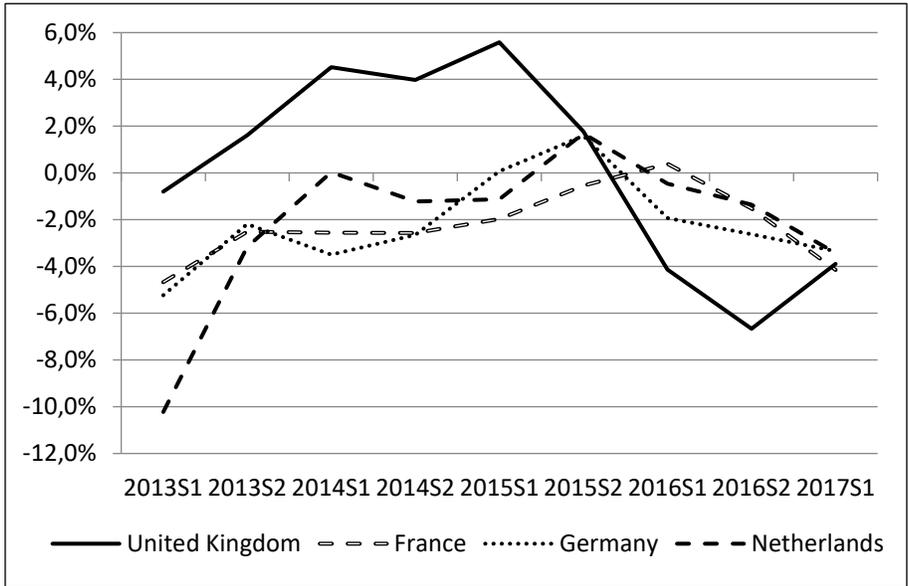
Figure 7A – Intensive margin of imports to Belgium' main neighboring countries – Point estimates

Notes: Figure 7A provides the point estimates (coefficients of the interaction terms $\sum_{j=1}^{3}\sum_{t=1}^{8}\beta_{j,t}\text{neigh}_j * \text{time}_t$) of specification (1) when $Y_{i,j,t}$ takes the values of $int\_mg_{i,j,t}$ (imports' growth rates of Belgian firm i from supplier j at time t). The base group are the Belgian firms' imports' growth rates from the UK in 2013S1 (1st semester of 2013).

Time*Countries' Coefficients - Intensive margin of imports

.... Germany   – – – France   —— Netherlands
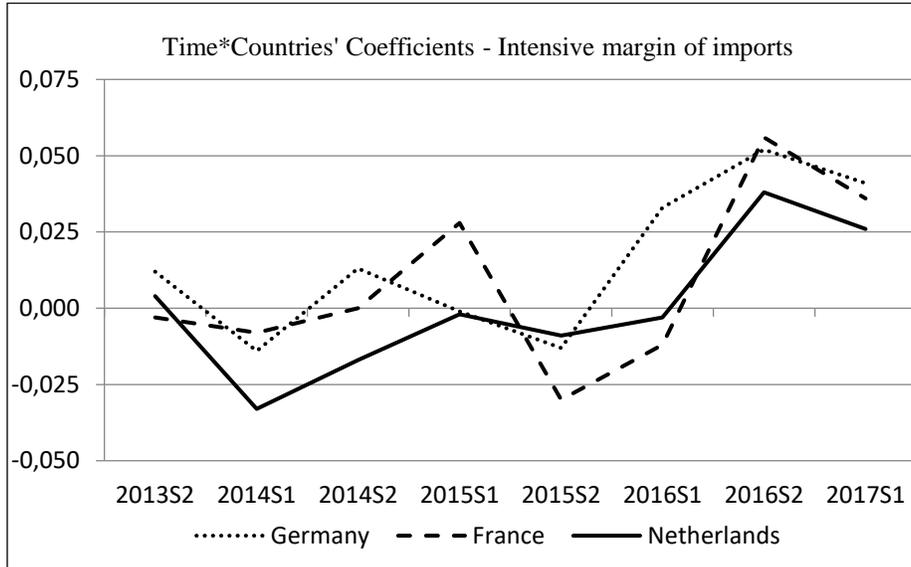
Figure 7B – Intensive margin of exports to Belgium' main neighboring countries - Point estimates

Notes: Figure 7B provides the point estimates (coefficients of the interaction terms $\sum_{j=1}^{3}\sum_{t=1}^{8}\beta_{j,t}\text{neigh}_j * \text{time}_t$) of specification (1) when $Y_{i,j,t}$ takes the values of $int\_mg_{i,j,t}$ (exports' growth rates of Belgian firm i to destination j at time t). The base group are the Belgian firms' exports' growth rates to the UK in 2013S1 (1st semester of 2013).

Time*Countries' Coefficients - Intensive margin of exports

.... Germany   – – – France   —— Netherlands
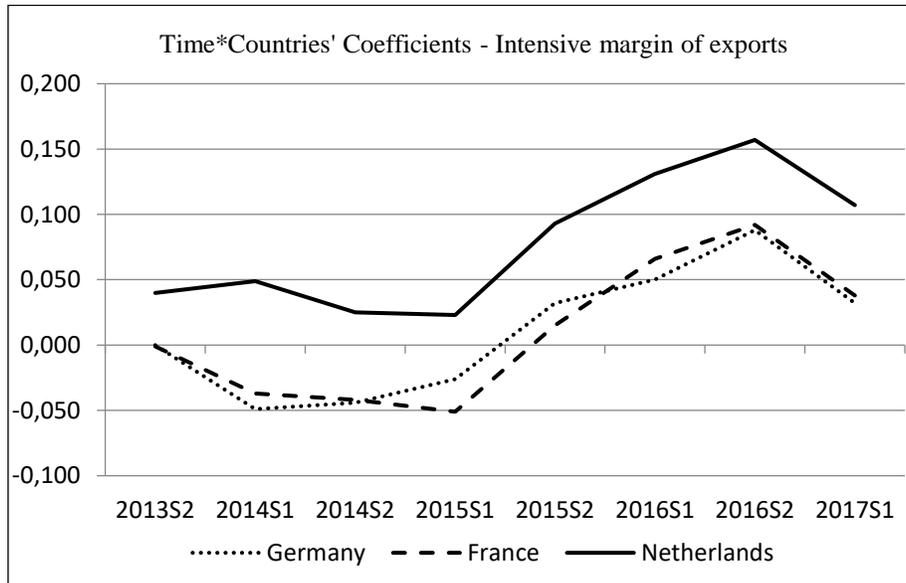
Table 1A – Possible dynamics of Belgian import flows from the UK as a consequence of Brexit uncertainties

Notes: Table 1A demonstrates a simple example of the possible dynamics regarding Belgian import flows afterwards the GBP devaluation. I assume, for simplicity, that the traded price for a given product in the period before any impact of uncertainties associated with the Brexit referendum is equal to the exchange rate (1 GBP = 1.40 euros). After the impact of Brexit uncertainties, I hypothesize that the exchange rate GBP/euro moves to 1.20. The columns "Price", "Quantity", and "Imp. /Exp. flows" report the expected effects on the prices in euros and sterling pounds (GBP), the quantities traded and the trade flows in both currencies.

Trade partners / Scenarios	Belgian firms importing from British firms			
	Exchange rate $e = (GBP/euro)$	Price $(P_E$ and $P_{GBP})$	Quantity (q)	Imp./Exp. flows $(Imp_E$ and $Exp_{GBP})$
Before Brexit uncertainties	$e = 1.40$	$P_E = 1.40;$ $P_{GBP} = 1.00$	$q = 1,000$	$Imp_E = 1,400;$ $Exp_{GBP} = 1,000$
After Brexit uncertainties	$e = 1.20$	$1.20 < P_E < 1.40;$ $P_{GBP} > 1.00$	$q > 1,000$	$Imp_E >, <, = 1,400;$ $Exp_{GBP} > 1,000$

Table 1B – Possible dynamics of Belgian export flows to the UK as a consequence of Brexit uncertainties

Notes: Table 1B demonstrates a simple example of the possible dynamics regarding Belgian export flows afterwards the GBP devaluation. I assume, for simplicity, that the traded price for a given product in the period before any impact of uncertainties associated with the Brexit referendum is equal to the exchange rate (1 GBP = 1.40 euros). After the impact of Brexit uncertainties, I hypothesize that the exchange rate GBP/euro moves to 1.20. The columns "Price", "Quantity", and "Imp. /Exp. flows" report the expected effects on the prices in euros and sterling pounds (GBP), the quantities traded and the trade flows in both currencies.

Trade partners / Scenarios	Belgian firms exporting to British firms			
	Exchange rate $e = (GBP/euro)$	Price $(P_E$ and $P_{GBP})$	Quantity (q)	Imp./Exp. flows $(Exp_E$ and $Imp_{GBP})$
Before Brexit uncertainties	$e = 1.40$	$P_E = 1.40;$ $P_{GBP} = 1.00$	$q = 1,000$	$Exp_E = 1,400;$ $Imp_{GBP} = 1,000$
After Brexit uncertainties	$e = 1.20$	$1.20 < P_E < 1.40;$ $P_{GBP} > 1.00$	$q < 1,000$	$Exp_E < 1,400;$ $Imp_{GBP} >, <, = 1,000$

Table 2A – Summary statistics of the intensive margins of Belgian firms' import and export flows – whole sample

Notes: in Table 2A, I provide the summary statistics for the intensive margins of import and export flows for the whole sample of Belgian firms.

Suppliers	Imports			
	N	Mean	Median	sd
All	182195	-0.0827	-0.0070	1.0258
EU28	75367	-0.0558	-0.0022	0.4093
Neighbors	73223	-0.0628	-0.0079	0.4676
United Kingdom	31069	-0.0362	-0.0095	1.0133
France	53244	-0.0551	-0.0180	0.7848
Germany	56863	-0.0441	-0.0035	0.7156
Netherlands	61904	-0.0418	-0.0025	0.7020
Destinations	Exports			
	N	Mean	Median	sd
All	106509	-0.0301	0.0058	0.9049
EU28	54216	-0.0364	0.0082	0.4049
Neighbors	52539	-0.0418	0.0025	0.8699
United Kingdom	26385	0.0023	0.0196	0.6344
France	43679	-0.0246	-0.0036	0.7996
Germany	36838	-0.0217	0.0037	0.6505
Netherlands	43714	-0.0233	0.0081	0.4546

Table 2B – Summary statistics - Belgian firms with continuous trade relationship with at least two Belgium's neighboring countries

Notes: in Table 2B, I present the summary statistics for the sample of Belgian firms that have intensive margin information for at least two Belgium's neighboring countries, and that have available information of the sector they belong to.

Suppliers	Imports			
	N	Mean	Median	Sd
United Kingdom	29442	-0.0342	-0.0083	1.0148
France	48078	-0.0507	-0.0165	0.7916
Germany	52286	-0.0370	-0.0013	0.7138
Netherlands	54227	-0.0309	0.0015	0.7026
Total	184033	-0.0384	-0.0050	0.7866
Destinations	Exports			
	N	Mean	Median	Sd
United Kingdom	25647	0.0035	0.0196	0.8695
France	38815	-0.0163	0.0005	0.6228
Germany	35204	-0.0173	0.0052	0.7960
Netherlands	39216	-0.0121	0.0131	0.6424
Total	138882	-0.0117	0.0085	0.7247

Table 3A – Intensive margin of imports to Belgium' main neighboring countries – Point estimates

Notes: in Table 3A, I analyze the behavior of Belgian imports' growth rates from the UK (base group) in the time surrounding the Brexit referendum outcome, comparing it with the imports' growth rates from Belgium other main neighboring countries. I use firm-time fixed-effects to takes into consideration the unobserved differences in Belgian firms' total factor productivity (TFP) over time. For this first specification, I select all Belgian firms that have imports' intensive margin information for at least two Belgium neighboring countries at a given time. I report results for the country-time interactions (point estimates) and for the country dummies. I cluster the errors by firms' sectors.

Countries		Germany	France	Netherlands
Interactions (time*country)	2013S2	0.012	-0.003	0.004
		(0.015)	(0.032)	(0.012)
	2014S1	-0.014	-0.008	-0.033**
		(0.012)	(0.029)	(0.013)
	2014S2	0.013	-0.000	-0.017
		(0.011)	(0.011)	(0.020)
	2015S1	-0.001	0.028	-0.002
		(0.014)	(0.021)	(0.018)
	2015S2	-0.013	-0.030	-0.009
		(0.032)	(0.038)	(0.026)
	2016S1	0.033	-0.012	-0.003
		(0.031)	(0.053)	(0.018)
	2016S2	0.052	0.056***	0.038
		(0.038)	(0.019)	(0.044)
	2017S1	0.041***	0.036***	0.026
		(0.012)	(0.013)	(0.016)
Country dummies		0.003	-0.011	0.021**
		(0.011)	(0.021)	(0.009)

Observations	184033
Adjusted R-squared	0.114
Fixed Effects	firm-time
Cluster	Sector
Robust standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table 3B – Intensive margin of exports to Belgium's main neighboring countries – Point estimates

Notes: in Table 3B, I analyze the behavior of Belgian exports' growth rates to the UK (base group) in the time surrounding the Brexit referendum outcome, comparing it with the exports' growth rates to Belgium other main neighboring countries. I use firm-time fixed-effects to takes into consideration the unobserved differences in Belgian firms' total factor productivity (TFP) over time. For this first specification, I select all Belgian firms that have imports' intensive margin information for at least two Belgium neighboring countries at a given time. I report results for the country-time interactions (point estimates) and for the country dummies. I cluster the errors by firms' sectors.

	Countries	Germany	France	Netherlands
Interactions (time*country)	2013S2	0.000	-0.001	0.040***
		(0.010)	(0.012)	(0.010)
	2014S1	-0.049	-0.037	0.049
		(0.047)	(0.024)	(0.033)
	2014S2	-0.044	-0.042*	0.025
		(0.041)	(0.020)	(0.040)
	2015S1	-0.026	-0.051*	0.023
		(0.037)	(0.029)	(0.031)
	2015S2	0.032	0.015	0.093***
		(0.034)	(0.034)	(0.031)
	2016S1	0.050	0.066***	0.131***
		(0.043)	(0.018)	(0.031)
	2016S2	0.088***	0.092***	0.157***
		(0.023)	(0.016)	(0.042)
	2017S1	0.032	0.038*	0.107***
		(0.026)	(0.019)	(0.036)
Country dummies		-0.020	-0.018	-0.077**
		(0.033)	(0.022)	(0.035)

Observations	138882
Adjusted R-squared	0.116
Fixed Effects	firm-time
Cluster	Sector
Robust standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table 4A – Intensive margin of imports to Belgium's main neighboring countries – diff-in-diff strategy with the UK as the treated group

Notes: in Table 4A, I report the results of specification (7) for the intensive margin of imports using a difference-in-differences strategy. The treatment group is the UK and the control group are Belgium's other neighboring countries. The regression model relies on similar trends before any effect of the Brexit uncertainties. I divide the potential impact of Brexit uncertainties into two time-dummies: the first one, "intermediate period", accounts for the period in which the Brexit uncertainties were already present, but before the results' announcement; and the second one, "post-period", related to the period in the aftermath of referendum outcome. Macroeconomic control variables are added one at a time. $\Delta e_{j,t}$ is the variation of the average of exchange rates between Belgium and its neighboring countries; $\Delta GDP_{j,t}$ is the variation of the gross domestic product (GDP); $\Delta i_{j,t}$ is the percentage points' difference of money market 12-months interest rates for the Euro zone countries and the UK; and $\Delta HICP_{j,t}$ is the variation of the harmonized index of consumer prices (HICP). All variations are measured considering the variation of period t to period t-2, likewise the calculation of intensive margins of trade. I cluster the errors by firms' sectors.

Variables	(1)	(2)	(3)	(4)	(5)
UK	-0.003	-0.004	-0.015	-0.013	-0.045***
	(0.005)	(0.005)	(0.009)	(0.008)	(0.010)
Inter*UK	0.004	0.005	0.012	0.019	0.029
	(0.025)	(0.025)	(0.029)	(0.036)	(0.033)
Post*UK	-0.043*	-0.034	-0.019	-0.016	-0.005
	(0.021)	(0.020)	(0.013)	(0.011)	(0.014)
Δe		0.058	0.064	0.146	0.071
		(0.046)	(0.046)	(0.135)	(0.156)
ΔGDP			0.737	0.687*	1.478***
			(0.426)	(0.382)	(0.297)
Δi				-0.039	0.032
				(0.050)	(0.071)
ΔHICP					2.308***
					(0.724)
Observations	184033	184033	184033	184033	184033
Adjusted R-squared	0.114	0.114	0.114	0.114	0.114
Fixed Effects	firm-time	firm-time	firm-time	firm-time	firm-time
Cluster	Sector	Sector	Sector	Sector	Sector

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4B – Intensive margin of exports to Belgium's main neighboring countries – diff-in-diff strategy with the UK as the treated group

Notes: in Table 4B, I report the results of specification (7) for the intensive margin of exports using a difference-in-differences strategy. The treatment group is the UK and the control group are Belgium's other neighboring countries. The regression model relies on similar trends before any effect of the Brexit uncertainties. I divide the potential impact of Brexit uncertainties into two time-dummies: the first one, "intermediate period", accounts for the period in which the Brexit uncertainties were already present, but before the results' announcement; and the second one, "post-period", related to the period in the aftermath of referendum outcome. Macroeconomic control variables are added one at a time. $\Delta e_{j,t}$ is the variation of the average of exchange rates between Belgium and its neighboring countries; $\Delta GDP_{j,t}$ is the variation of the gross domestic product (GDP); $\Delta i_{j,t}$ is the percentage points' difference of money market 12-months interest rates for the Euro zone countries and the UK; and $\Delta HICP_{j,t}$ is the variation of the harmonized index of consumer prices (HICP). All variations are measured considering the variation of period t to period t-2, likewise the calculation of intensive margins of trade. I cluster the errors by firms' sectors.

Variables	(1)	(2)	(3)	(4)	(5)
UK	0.046***	0.039**	0.023***	0.024***	0.049***
	(0.010)	(0.014)	(0.007)	(0.008)	(0.015)
Inter*UK	-0.072***	-0.066***	-0.055***	-0.051***	-0.058***
	(0.011)	(0.014)	(0.010)	(0.007)	(0.008)
Post*UK	-0.093***	-0.059**	-0.036**	-0.035**	-0.044**
	(0.008)	(0.024)	(0.015)	(0.014)	(0.016)
Δe		0.219	0.225*	0.276***	0.332***
		(0.125)	(0.123)	(0.072)	(0.061)
ΔGDP			1.124*	1.084**	0.517
			(0.543)	(0.498)	(0.338)
Δi				-0.026	-0.085*
				(0.030)	(0.048)
ΔHICP					-1.881***
					(0.617)
Observations	138882	138882	138882	138882	138882
Adjusted R-squared	0.116	0.116	0.116	0.116	0.116
Fixed Effects	firm-time	firm-time	firm-time	firm-time	firm-time
Cluster	Sector	Sector	Sector	Sector	Sector

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5A – Intensive margin of exports to Belgium' main neighboring countries – Firms' Heterogeneity (firm size)

Notes: in Table 5A, I report the results for the heterogeneity of the Brexit uncertainties among Belgian exporting firms considering their respective sizes. I take into consideration the average of total assets over the three years before the Brexit referendum for each firm, and then dividing the sample by the respective median. I also report the coefficients for the differences between "larger" and "smaller" firms (2-1). I present the results first without considering any macroeconomic variable and them including these controls. I cluster the errors by firms' sectors.

Variables	(1)	(2)	(2-1)
Without macroeconomic controls			
Inter*UK	-0.039***	-0.098***	-0.059***
	(0.011)	(0.011)	(0.018)
Post*UK	-0.080***	-0.103***	-0.023
	(0.013)	(0.017)	(0.026)
With macroeconomic controls			
Inter*UK	-0.031**	-0.077***	-0.046**
	(0.011)	(0.010)	(0.017)
Post*UK	-0.022	-0.059**	-0.038
	(0.013)	(0.020)	(0.023)
Δe	0.413***	0.266***	-0.148*
	(0.080)	(0.056)	(0.080)
ΔGDP	0.161	0.840**	0.679*
	(0.319)	(0.360)	(0.349)
Δi	-0.093	-0.072*	0.020
	(0.065)	(0.040)	(0.041)
$\Delta HICP$	-3.095***	-0.776	2.319***
	(0.812)	(0.860)	(0.564)
Observations	66463	72419	138882
Adjusted R-squared	0.114	0.114	0.116
Fixed Effects	firm-time	firm-time	firm-time
Cluster	Sector	Sector	Sector
Sample	smaller	larger	Both

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5B – Intensive margin of imports to Belgium' main neighboring countries – Firms' Heterogeneity (firm size)

Notes: in Table 5B, I report the results for the heterogeneity of the Brexit uncertainties among Belgian importing firms considering their respective sizes. I take into consideration the average of total assets over the three years before the Brexit referendum for each firm, and then dividing the sample by the respective median. I also report the coefficients for the differences between "larger" and "smaller" firms (2-1). I present the results first without considering any macroeconomic variable and them including these controls. I cluster the errors by firms' sectors.

Variables	(1)	(2)	(2-1)
Without macroeconomic controls			
Inter*UK	-0.014	0.015	0.029
	(0.016)	(0.034)	(0.039)
Post*UK	-0.037	-0.044	-0.008
	(0.027)	(0.038)	(0.062)
With macroeconomic controls			
Inter*UK	0.009	0.041	0.032
	(0.022)	(0.052)	(0.068)
Post*UK	0.020**	-0.018	-0.037*
	(0.009)	(0.016)	(0.021)
Δe	0.130	0.042	-0.088
	(0.290)	(0.355)	(0.606)
ΔGDP	1.605***	1.355**	-0.250
	(0.304)	(0.498)	(0.579)
Δi	0.058	0.012	-0.046
	(0.061)	(0.128)	(0.178)
ΔHICP	2.291***	2.296*	0.005
	(0.256)	(1.281)	(1.241)
Observations	86165	97868	184033
Adjusted R-squared	0.125	0.105	0.114
Fixed Effects	firm-time	firm-time	firm-time
Cluster	Sector	Sector	Sector
Sample	smaller	larger	Both

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6A – Intensive margin of exports to Belgium' main neighboring countries – Firms' Heterogeneity (firm sector)

Notes: in Table 6A, I report the results for the heterogeneity of the Brexit uncertainties among Belgian exporting firms considering their respective sectors. I divide the sample into the two main exporting sectors, which concentrate the majority of exports and have intrinsic different characteristics: manufactured goods and "commodities" (agricultural products, raw materials, energy products or services). I also report the coefficients for the statistical difference between the coefficients for both sectors in (2-1). I present the results first without considering any macroeconomic variable and them including these controls.

Variables	(1)	(2)	(2-1)
Without macroeconomic controls			
Inter*UK	-0.056**	-0.080***	-0.024
	(0.023)	(0.018)	(0.029)
Post*UK	-0.092***	-0.103***	-0.011
	(0.023)	(0.018)	(0.029)
With macroeconomic controls			
Inter*UK	-0.045*	-0.059***	-0.014
	(0.027)	(0.021)	(0.034)
Post*UK	-0.023	-0.058**	-0.035
	(0.033)	(0.027)	(0.043)
Δe	0.425**	0.318**	-0.107
	(0.189)	(0.149)	(0.241)
ΔGDP	0.225	0.939*	0.714
	(0.625)	(0.549)	(0.830)
Δi	-0.033	-0.141**	-0.108
	(0.073)	(0.059)	(0.094)
$\Delta HICP$	-1.273	-2.702***	-1.430
	(0.862)	(0.746)	(1.139)
Observations	62043	64361	126404
Adjusted R-squared	0.122	0.111	0.118
Fixed Effects	firm-time	firm-time	firm-time
Cluster	No	No	No
Sample	Commodities	Manufacturing	All

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6B – Intensive margin of imports to Belgium' main neighboring countries – Firms' Heterogeneity (firm sector)

Notes: in Table 6B, I report the results for the heterogeneity of the Brexit uncertainties among Belgian importing firms considering their respective sectors. I divide the sample into the two main exporting sectors, which concentrate the majority of exports and have intrinsic different characteristics: manufactured goods and "commodities" (agricultural products, raw materials, energy products or services). I also report the coefficients for the statistical difference between the coefficients for both sectors in (2-1). I present the results first without considering any macroeconomic variable and them including these controls.

Variables	(1)	(2)	(2-1)
Without macroeconomic controls			
Inter*UK	-0.030	0.025	0.055*
	(0.021)	(0.025)	(0.033)
Post*UK	-0.025	-0.075***	-0.050
	(0.021)	(0.025)	(0.033)
With macroeconomic controls			
Inter*UK	-0.013	0.065**	0.078**
	(0.025)	(0.029)	(0.039)
Post*UK	0.006	-0.024	-0.031
	(0.030)	(0.036)	(0.047)
Δe	-0.018	0.315	0.333
	(0.179)	(0.213)	(0.279)
ΔGDP	1.287**	1.405**	0.118
	(0.521)	(0.647)	(0.834)
Δi	0.080	-0.094	-0.175*
	(0.065)	(0.079)	(0.103)
$\Delta HICP$	2.722***	0.845	-1.878*
	(0.680)	(0.860)	(1.100)
Observations	100378	65242	165620
Adjusted R-squared	0.112	0.110	0.111
Fixed Effects	firm-time	firm-time	firm-time
Cluster	No	No	No
Sample	Commodities	Manufacturing	All

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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