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The Trade Effects of the Brexit Announcement Shock

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Abstract

The unexpected vote for Leave in the Brexit referendum of June 2016 has introduced a classic case of a ‘renegotiation period’ for trade agreements, where no formal barriers have been imposed, but trade is affected by policy uncertainty. We analyse the effects upon bilateral trade between the UK and 14 EU and 14 non-EU trading partners, using a Synthetic Control Method (SCM), with the Brexit vote seen as a country-specific treatment effect upon the United Kingdom. Our main findings are that, after the exchange rate changes, UK exports have been lower than those of the ‘synthetic Britain’, with only a modest difference between exports to EU and to non-EU countries. Robustness checks suggest that this is not attributable to short-term sluggishness in responding to a fall in Sterling. Imports from the EU have declined a little, while those from non-EU countries have if anything declined more. However, there is some evidence that UK consumers may be turning towards Commonwealth countries.

JEL Codes: F02, F13, F15

Keywords: Anticipation, policy uncertainty, Brexit, synthetic control method.

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1 Introduction

Econometric analysis of the magnitudes and directions of trade flows traditionally applies a combination of economic, geographical, sociopolitical and observable policy variables to explain trade patterns.¹ However, a number of papers have indicated important roles for less directly observable factors relating to expectations, anticipation and uncertainty. For example, [Freund & McLaren \(1999\)](#) provide evidence of an anticipatory effect: that trade flows adjust in anticipation of trade agreements. This has been formalised theoretically by [Handley & Limão \(2017\)](#), who distinguish between the anticipation effect and the effect of policy uncertainty, which creates a strong real option value of delaying market entry decisions at times when policy changes are anticipated but not finalised. Regarding policy uncertainty, a recent WTO study found that average trade policy uncertainty is equivalent to an average tariff of between 1.7 and 8.7 per cent ([Osnago et al. 2015](#)). Some authors also claim that trade agreements play a major role in reducing trade policy uncertainty ([Limão & Maggi 2015](#) and [Carballo et al. 2018](#)).

While there is a strong literature on historical divorces, such as decolonisation events ([Head et al. 2010](#)) as well as the post-Soviet break-ups, this literature has not focused upon the announcement effects when an actual break-up is delayed. A very recent exception, [Crowley et al. \(2018\)](#), also uses the Brexit example, although its focus is on firm/product level entry and exit into export markets, and so is somewhat different methodologically to our study, and should perhaps be seen as complementary to it.

In this paper, we view the Brexit shock as a classic case in which to test the policy uncertainty and announcement effects of an anticipated breakup. This is partly because the result of the Brexit referendum result of 23rd June, 2016, was such a shock to most businesses and the markets. While the Conservatives had announced a proposed referendum in the general election a year previously, it was unclear that they would be able to enact it.² In any case it was widely expected that, with the support of Prime Minister Cameron, Remain would win. Betting on the eve of the poll had still strongly favoured the likelihood of a Remain victory.³ There was therefore a strong announcement shock when the results of the first constituency to report (Sunderland) were published, indicating a narrow but decisive victory for the Leave side. A clear indicator of this shock is the movement of exchange rates, shown in Appendix Figure A1.⁴ The vote represented an almost instantaneous move to a much lower value for sterling, which has largely been sustained since.

While no formal trade barriers have yet been imposed, at least some increase in trade barriers with the European Union is expected after the announced transition/implementation period ends (expected to be December 2020, assuming there is an agreement prior to the end of the Article 50 period in March 2019). This is a classic case of a ‘renegotiation period’, in [Handley & Limão’s \(2017\)](#) terminology, but one which we would expect to have a particularly marked effect, because of the estimated downside risk from a ‘no deal’ Brexit. [Born et al. \(2017\)](#) show a Brexit-related

¹This is primarily in the form of gravity models, following [Anderson & van Wincoop \(2003\)](#), [Head et al. \(2010\)](#), [Head & Mayer \(2014\)](#).

²Up to 2015 they had been in a coalition with the pro-European Liberal Democrats.

³Odds on a Remain win were cited at around 4:1.

⁴Within the space of seven hours of the shock Sunderland Leave vote, the pound fell by 8.6 percent against the euro and by 11.91 percent against the dollar.

spike in economic uncertainty after the referendum, which has not yet fully subsided. [Dhingra et al. \(2017\)](#), [Steinberg et al. \(2017\)](#), and [Ebell & Warren \(2016\)](#) are among a consensus of studies showing that the economic impact of a ‘hard’ Brexit for the UK economy is expected to be very negative.

In this article, we investigate the effects of this period upon the UK’s exports and imports of goods, both with the EU and with major non-EU partners. Hence, we are looking at the effects of the announcement on overall imports and exports (‘trade creation’) and on direction of imports and exports (‘trade diversion’ or ‘deflection’). We focus in particular on the following research questions:

- (i) Regarding the UK’s exports, is there any sign of an inward shift in Britain’s export demand curve?
- (ii) Is there a difference between changes in export demand from the European Union and from the rest of the World?
- (iii) Do any such shifts in (i) or (ii) appear to be short-lived or lasting?
- (iv) Are there any differential shifts in UK import demand between the EU and non-EU sources, and within those groups?

The rationale for these questions is as follows. In the first instance, UK suppliers now face considerable potential increases in trade costs in the near future, particularly if they are engaged in supply chains with the EU, and if a satisfactory customs and border deal is not forthcoming. Since trade requires investment in plant, products and relationships, the uncertainty might be expected to deter any UK exports - hence the relevance of (i). (ii) looks at whether the anticipation of (or uncertainty about) future tariff and non-tariff barriers on exports to the EU affect exports to those markets differentially, (iii) distinguishes between this effect and simply sluggish adjustment in the short-run to the fall in sterling following the vote. If the primary effect is anticipation of specific future trade costs on UK-EU trade following Brexit, then we would also expect this result to be more marked in exports to the EU than elsewhere (ii). (iv) is interesting, as it asks whether there is evidence of UK consumers – particularly Brexit voters – switching demand away from Europe towards other sources, and particularly to the Commonwealth, maybe as a result of negative campaigning against the EU.

In carrying out this analysis, we utilise a Synthetic Control Method (SCM) approach to compare the Brexit announcement as a treatment effect upon the United Kingdom’s bilateral trade with its various partners (as opposed to trade between other pairs). As such, we are the first to apply this popular approach to the issue of the effects of the Brexit announcement on the volume and direction of the UK’s trade, although previous studies ([Born et al. 2017](#), [Kren 2017](#)) have analysed the Brexit announcement effect upon UK GDP growth and exchange rate pass-through respectively. [Saia \(2017\)](#) applied a similar methodology to an earlier trade event: Britain’s decision not to enter the eurozone, showing a negative effect on UK trade compared to that between countries which joined.

The rest of the paper is as follows. In the rest of this section we briefly outline our main findings. Section 2 discusses our approach to modelling, and lays out in particular how we model the Brexit announcement as a treatment

effect upon bilateral trade flows involving the UK, and on how we carry out the SCM analysis, including testing for statistical significance. Section 3 briefly lays out our data sources, while in Section 4 we focus on the results for UK exports, including the implications in terms of our research questions, and carry out some robustness checks. The subsequent Section 5 carries out a similar discussion for UK imports. Section 6 concludes.

2 Our Modelling Approach

We are interested in the effects of the announcement shock upon the direction and volume of trade in the months following the Brexit referendum (in other words, during the ‘renegotiation period’ prior to any actual Brexit). As such, we would like to differentiate the announcement shock effect from the exchange rate effect (which is observable). Our modelling approach is based around aggregate bilateral trade flows, so that it is more disaggregated in terms of source/destination information compared to some recent work (Crowley et al. 2018), but aggregated in terms of products. We are also looking at effects on both exports and imports.

Our approach is an application of the Synthetic Control Method (SCM) for Comparative Case Studies (Card & Krueger 1993, Card 1990, Abadie & Gardeazabal 2003, Abadie et al. 2010). The key assumption underlying the choice of this method is that the Brexit shock is concentrated upon just one country (the UK) out of a panel of many countries. While this may be simplistic, there are strong a priori grounds to believe that Brexit will affect the UK far more than other countries, on the grounds that trade with the European Union is larger as a share of the UK’s overall trade than the UK’s share in the overall trade of any EU member.

Our application of the SCM then proceeds as follows. The sample (in our case, monthly bilateral trade data from Jan 1999 to Jan 2018) is divided into two periods: a control period, before the Brexit referendum result, and a treatment period, following the announcement.⁵ The UK is assumed to be the only country directly affected by the treatment.

Our sample contains the UK plus 14 European countries, namely Germany, France, the Netherlands, Italy, Spain, Belgium, Luxembourg, Portugal, Austria, Finland, Denmark, Sweden, Ireland and Greece. We then add a list of 14 non-EU countries - Australia, Canada, China, Hong Kong, India, New Zealand, USA, South Africa, Brazil, Israel, Japan, South Korea, Mexico and Russia.

To establish the direct announcement effect upon trade, we seek to control for a series of observable control variables: these include bilateral exchange rate movements, exchange rate volatility and GDP movements. In addition, we wish to control for unobservable shocks which are correlated across country pairs in our sample. UK trade patterns with individual trade partners, even after correcting for exchange rates and GDP, show clear correlation in terms of shock patterns with the behaviour of certain other country pairs: it is in this way that UK trade with each partner country is matched by the SCM algorithm with a weighted average of trade between other country pairs (i.e. pairs excluding the UK).

It is worth noting that SCM has been used successfully for a wide variety of case studies in the past. In the case of

⁵We have excluded the referendum month, June 2016, from the fitting period, even though the referendum was quite late in the month.

the EU, we can cite the modelling of EU membership effects, [Campos et al. \(2014\)](#). We are looking at this in reverse. [Saia \(2017\)](#) analysed the UK's missing trade gains from not joining the euro. In the case of Brexit announcement effects, we have already cited the study by [Born et al. \(2017\)](#), on GDP effects, and [Kren \(2017\)](#)'s work on exchange rate pass-through. Nevertheless, this is the first application of SCM to examining the trade announcement shock.

We observe a bilateral trade flow of country pairs i from a set X – i.e. $i \in X$. When we carry out the analysis on UK trade with a particular EU member (say Germany) we start by creating a counterfactual from the various flows between EU member states. Thus, given that the EU sample comprises 14 countries, and that we exclude one country's trade with itself from the analysis, we have 91 pairs (14 X 13/2, ignoring direction) excluding the UK and a further 14 including the UK. We denote the latter as the treatment group, X_T , and the former as the control group, X_{NT} .

We start by taking as an example one particular treated flow - that between the UK and Germany, which we denominate as $BTf_{t,GBR-DEU}(T)$. We can compare this treated flow with a counterfactual, had the treatment not occurred, which we designate as $BTf_{t,GBR-DEU}(NT)$. Hence in principle we can derive the percentage loss or gain in the Bilateral Trade Flow (BTF) over the the period of Jan 1999-March 2018 as follows:

$$\theta_{Jan1999-Mar2018,GBR-DEU} = \frac{\sum_{t=Jan1999}^{Mar2018} (BTf_{t,GBR-DEU}(T) - BTf_{t,GBR-DEU}(NT))}{\sum_{t=Jan1999}^{Mar2018} BTf_{t,GBR-DEU}(NT)} \quad (1)$$

The problem is that $BTf_{t,GBR-DEU}(NT)$ is not observable. Hence we need to construct a credible counterfactual that is able to replicate the bilateral trade flows between this treated pair. Thus, a selection of country pairs or a combination of those from the list X_{NT} as a counterfactual would lead to a measure of unobserved trade flows, i.e. Italy-France. However, manual selection of the pairs would inevitably lead to a selection bias. Therefore, we use the SCM, which constructs these counterfactuals as a weighted average from the list X_{NT} of country pairs, using a best fit algorithm to choose the weights. This therefore yields:

$$\hat{\theta}_{Jan1999-Mar2018,GBR-DEU} = \frac{\sum_{t=Jan1999}^{Mar2018} \left(BTf_{t,GBR-DEU}(T) - \sum_{i=1}^{X_{NT}} \alpha_i BTf_{t,i}(NT) \right)}{\sum_{t=Jan1999}^{Mar2018} \sum_{i=1}^{X_{NT}} \alpha_i BTf_{t,i}(NT)},$$

where $\sum_{i=1}^{X_{NT}} \alpha_i = 1$. (2)

In this case, $\sum_{i=1}^{X_{NT}} \alpha_i BTf_{t,i}(NT)$ is the synthetic counterfactual and α_i represents a positive weight for each pair in the X_{NT} list. Moreover, each combination of weights provides different counterfactual units, thus we need to select only those weights that minimise the distance between pre-treatment characteristics of the treated unit – i.e. GBR-DEU – and the characteristics of the pre-treatment of the counterfactual units.

To carry out this analysis, we correct for the effects of a series of observable confounding variables: namely GDP of the reporting country, GDP of the partner, bilateral exchange rates and the volatility of exchange rates, and bilateral distance.

To assess the statistical significance of our results we use the subsampling method of [Politis & Romano \(1994\)](#), which was also adopted by [Saia \(2017\)](#). If we simply chose the single best fitting set of weights, this would lead to only one estimate of our counterfactual $\hat{\theta}_{Jan1999-Mar2018,GBR-DEU}$, meaning that we would be unable to statistically test whether these results differ from zero. By contrast, the [Politis & Romano \(1994\)](#) subsampling method considers the statistical variability associated with different potential selections of countries and weights when constructing the synthetic variable. We do this as follows. First, we randomly construct C different counterfactual groups, of which every group ($X_{NT,c}$) has been randomly selected from the pool of possible counterfactual groups based on X_{NT} by drawing $z \times 91$, where z represents a sample size of 10 from the original sample size of 91.⁶ Thus, using this alternative subsampling procedure we can define:

$$\hat{\theta}_{Jan1999-Mar2018,GBR-DEU} = \frac{1}{C} \sum_{c=1}^C \left[\frac{\sum_{t=Jan1999}^{Mar2018} \left(BTF_{t,GBR-DEU}(T) - \sum_{i=1}^{X_{NT,c}} \alpha_{i,c} BTF_{t,c,i}(NT) \right)}{\sum_{t=Jan1999}^{Mar2018} \sum_{i=1}^{X_{NT,c}} \alpha_{i,c} BTF_{t,c,i}(NT)} \right] \quad (3)$$

and

$$\sigma_{Jan1999-Mar2018,GBR-DEU} = \sqrt{\frac{1}{C} \sum_{c=1}^C \left(\theta_{Jan1999-Mar2018,GBR-DEU,c} - \hat{\theta}_{Jan1999-Mar2018,GBR-DEU} \right)^2} \quad (4)$$

where $\theta_{Jan1999-Mar2018,GBR-DEU,c}$ is the percentage difference between observed BTF and the constructed counterfactual group ($X_{NT,c}$). We use a sample size equal to 500, e.g. $C = 500$, however we analysed our results by employing alternative sampling size for robustness checks – i.e. $C = 100, 200, 300, 750, 1000$ – and the results confirm the one reported here with little variation in the point estimates. This allows us to create a distribution of parameter estimates, which can be tested for statistical significance.

To evaluate the aggregate effects – i.e. by summing all UK treated country pairs – we can modify (3) to provide an estimate of the overall effect – i.e. gain or loss – of the UK Brexit referendum on BTF for both EU and non-EU

⁶We performed other sampling sizes, but the results remain quantitatively similar.

imports and exports, as follows:

$$\hat{A}_{Jan1999-Jan2018} = \frac{1}{500} \sum_{c=1}^{500} \left[\frac{\sum_{t=Jan1999}^{Jan2018} \left(\sum_{A=1}^{X_T} BTF_{t,A}(T) - \sum_{A=1}^{X_T} \sum_{i=1}^{X_{NT,c}} \alpha_{i,c} BTF_{t,c,i}(NT) \right)}{\sum_{t=Jan1999}^{Jan2018} \left(\sum_{A=1}^{X_T} \sum_{i=1}^{X_{NT,c}} \alpha_{i,c} BTF_{t,c,i}(NT) \right)} \right], \quad (5)$$

where $\sum_{A=1}^{X_T} BTF_{t,A}(T)$ is the sum of the twelve BTF of treated country pairs, whereas

$$\sum_{A=1}^{X_T} \sum_{i=1}^{X_{NT,c}} \alpha_{i,c} BTF_{t,c,i}(NT),$$

is the corresponding sum of counterfactual units.

3 Data

Our sample uses monthly data from IMF DOTS for bilateral trade in goods for the period Jan 1999 to March 2018, which is the latest month available. Sadly, data on services trade are not available on a monthly basis. We supplement the data set with GDP and exchange rate data from the IMF. GDP is expressed into current US dollars. We calculate a set of bilateral exchange rates, as well as a measure of bilateral exchange rate volatility over a 5 year period.

The synthetic control method requires a balanced panel, with no missing values. Consequently, we had to drop data from a number of significant non-EU countries, such as Turkey and Indonesia, due to too many holes in the data. This left us with Australia, Brazil, Canada, China, Hong Kong, India, Israel, South Korea, Mexico, New Zealand, Russia, South Africa, Japan and the USA as our sample of non-EU countries, plus 14 EU countries. Even with these countries, which reported for most months, some missing monthly data had to be filled in, albeit a relatively small number of observations. Fortunately, traded goods appear in the trade statistics twice: once as exports from the origin country, and the second time as imports for the destination country. While there is not a direct month-on-month comparison, partly because trade often takes time, we were able to fill in missing values using regressions on lagged (or leading) trade reported in the other direction.

Data has been seasonally adjusted, to reduce seasonal volatility before fitting for the synthetic doppelgangers. In addition, in few circumstances, since GDP is reported on a monthly basis, we used linear interpolation when data were missing.

4 Results for UK exports and discussion

In order to focus on our research questions about the effects of Brexit, we choose to review the results of our SCM for the UK's exports first, in this section, and then discuss them, before moving on to reviewing and discussing results for

imports in Section 5.

First we construct the doppelganger (or synthetic Britain) based on the pre-referendum period (1999:1-2016:5).⁷ This doppelganger serves as our counterfactual Britain which has not been subject to the ‘treatment’ of the vote to leave the European Union. We divide UK trade partners into a group of EU partners and a group of non-EU partners. We then analyse separately exports from the UK to our sample of EU countries and those from the UK to our sample of non-EU countries. In tables A1-A4, we provide a list of potential counterfactual trade flows as well as the weights obtained through our synthetic matching algorithm. Table A1 and Table A2 show our sample weights for our UK-EU exports and our UK-non-EU exports and Table A3 and Table A4 show our sample weights for imports from both our sample of EU and of our non-EU countries.

4.1 UK Exports to the European Union

In Figure 1, we plot aggregate UK exports to our sample of EU countries. The solid line maps actual UK exports over the entire period and the dashed line maps exports of our synthetic doppelganger. The Brexit shock vote is marked as the shaded area in the graph. The synthetic doppelganger follows actual trade values very closely in our pre-referendum sample period (1999:1-2016:5), but following the vote the two series diverge. Exports show an initial fall at the time of the referendum. By contrast, growth of the UK’s trading partners, combined with the effects of sterling devaluation, lead our SCM model to suggest that the UK’s exports should have been on an upward path. While exports do actually turn upwards from November 2016, they remain well below our synthetic doppelganger, and the gap even widens in certain months.

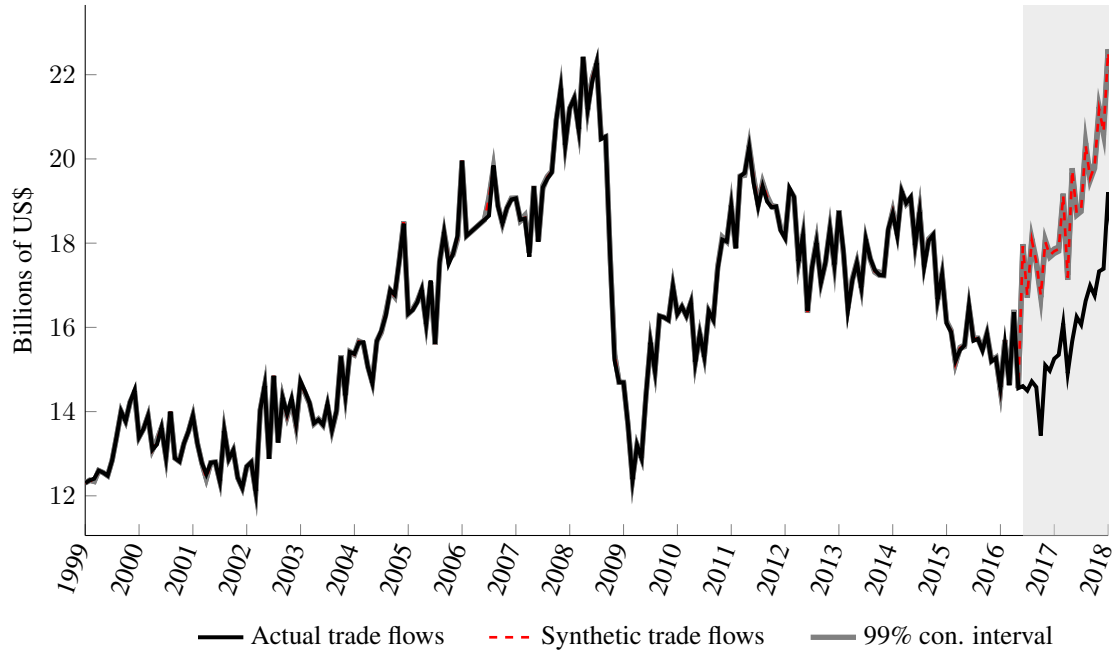
Table 1: Aggregate percentage exports difference between UK-EU partners vs counterfactual

	Pre-referendum	Post-referendum		
	1999:1-2016:5	2016:6-2018:3	2016:6-2016:12	2017:1-2018:3
% difference actual	-0.228	-15.807	-16.733	-15.558
vs synthetic	(0.033)	(0.321)	(0.306)	(0.336)

We summarise our results in Table 1. Trade in the pre-referendum period is insignificantly different from the synthetic, whereas in the post-referendum period the differences are highly significant. The post-referendum period (2016:6-2018:3) is divided into two: an initial six month period (the second half of 2016), and a second period comprising the year of 2017 and early 2018. This allows us to further examine the timing of any effects on trade. It is clear that, for both these periods, UK export performance is very poor. Initially, that is in the second half of 2016, exports are down by an average of 16.73% compared to the doppelganger, and export performance makes no significant recovery in 2017-18 where exports were 15.55% lower than Britain’s doppelganger. We discuss the implications of this result in more detail later in this section.

⁷We choose to finish our fitting period at the end of the last month before the referendum date, so that no post-referendum data are included in the fit.

Figure 1: UK – EU aggregate exports



In Table 2 we summarise our results by exports to individual EU countries. Notably, export performance to Finland (FIN), Greece (GRC) and Portugal (PRT) has been exceptionally poor, with differences between actual and synthetic trade at, respectively, -37.4%, -44.7% and -31.6%. Exports to Belgium (BEL), Denmark (DNK), Spain (ESP), France (FRA), Ireland (IRL), Italy (ITA) and the Netherlands (NLD) have fallen between approximately 14.7-24.8% whereas exports to Germany (DEU) and Austria (AUT) changed much less relative to our synthetic control. Notice that exports to all EU countries are lower relative to our doppelganger. In figure A3, we provide a visual presentation of our results by country in which the timing of the trade effects are made clearer.

Table 2: Percentage exports difference between the UK-EU single partner vs counterfactual

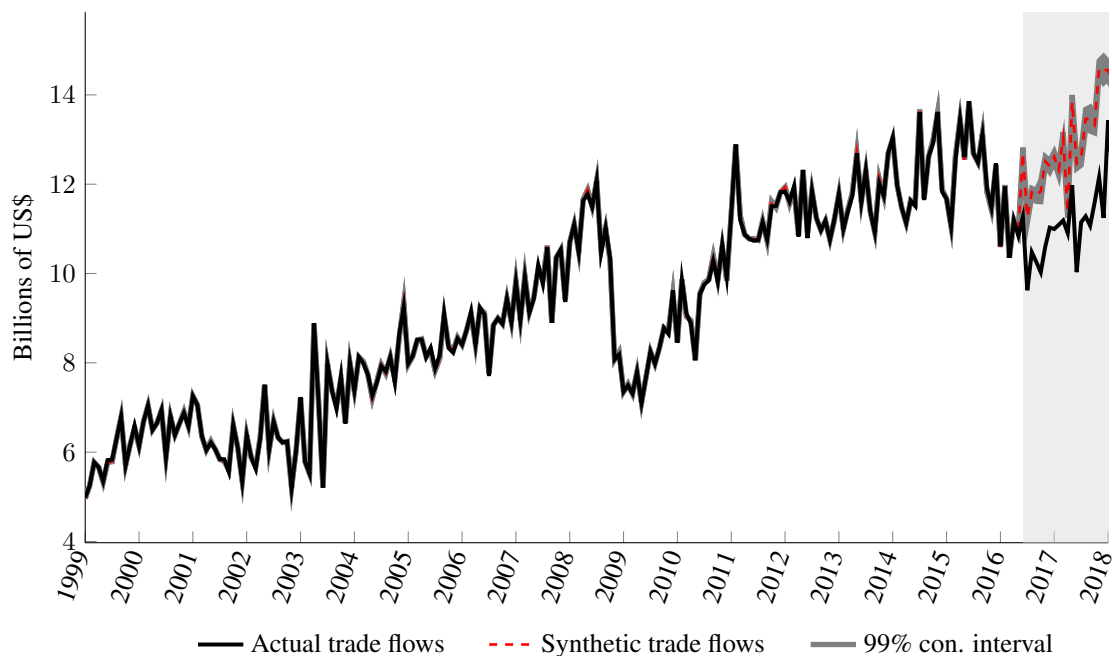
	AUT	BEL	DEU	DNK	ESP	FIN	FRA	GRC	IRL	ITA	LUX	NLD	PRT	SWE
% difference actual minus synth														
1999:1-2016:5.	-0.422 (0.036)	0.040 (0.014)	-0.099 (0.025)	-0.305 (0.025)	-0.156 (0.021)	-0.349 (0.036)	-0.155 (0.030)	-0.224 (0.050)	0.144 (0.022)	-0.243 (0.020)	0.160 (0.168)	0.071 (0.019)	-0.322 (0.043)	-0.112 (0.017)
% 2016:6-2018:3.	-3.604 (1.116)	-22.465 (0.366)	-4.276 (0.377)	-24.769 (0.677)	-22.783 (0.349)	-37.361 (0.705)	-15.950 (0.401)	-44.691 (0.726)	-18.582 (0.391)	-18.080 (0.366)	-50.553 (2.925)	-14.723 (0.357)	-31.564 (0.879)	-24.748 (0.387)

4.2 UK exports to non-EU countries

Turning now to UK exports to our sample of non-EU countries, we see a strikingly similar picture. We depict the time series in Figure 2. We see a clear divergence of the actual UK export values from their synthetic control following the Brexit vote (the shaded area shows the treatment period). As with exports to the EU, non-EU exports started the post-referendum period with a fall, later recovering. The doppelganger suggests that they should have increased. Even

though from late 2016 exports pick up, the gap with the doppelganger remains constant or increases slightly.

Figure 2: UK – non-EU aggregate exports



We summarise the results in Table 3. Over the whole post-Brexit period, actual exports are 13.3 % lower than their synthetic counterparts. Inspecting the last two columns of the table we note that the shortfall in actual exports relative to the doppelganger was slightly larger in our second post-Brexit period (2017-early 2018).

Table 3: Aggregate percentage exports difference between UK-Non EU partners vs counterfactual

	Pre-referendum	Post-referendum		
	1999:1-2016:5	2016:6-2018:3	2016:6-2016:12	2017:1-2018:3
% difference actual	-0.605	-13.326	-12.936	-13.337
vs synthetic	(0.099)	(1.171)	(0.895)	(1.306)

In Table 4 we summarise the differences between actual and synthetic exports by country. Despite the very weak performance overall, there is a wider variability in performance: exports to China (CHN), Korea (KOR) and New Zealand (NZL) seem to have performed very well since the referendum, while those to Mexico also grew. By contrast, exports to Israel (ISR), Russia (RUS) and Brazil (BRA) performed very badly compared to their synthetic counterparts. We have divided the countries in this sample into a Commonwealth grouping (including Hong Kong, which strictly left the Commonwealth in 1997) and a non-Commonwealth grouping, with the English-speaking USA as an intermediate case. It is worth noting that Brexit-supporting ministers have made a number of bullish statements about trade with former Commonwealth countries. However, there is little evidence of difference between these groups with respect to

British exports. See also Appendix Figure A4 for trade with individual countries.

Table 4: Percentage exports difference between the UK-non EU single partner vs counterfactual

	Commonwealth + HK						USA	Rest of World						
	AUS	CAN	HKG	IND	NZL	ZAF	USA	BRA	CHN	ISR	JPN	KOR	MEX	RUS
% diff. actual vs synth.														
1999:1-2016:5	0.002 (0.035)	-0.092 (0.029)	0.045 (0.029)	-0.047 (0.028)	-0.097 (0.080)	-0.103 (0.038)	-0.346 (0.087)	-0.147 (0.034)	0.020 (0.036)	-0.107 (0.049)	-0.138 (0.032)	-0.145 (0.035)	-0.327 (0.044)	-0.099 (0.031)
2016:6-2018:3	-19.753 (0.902)	-19.351 (0.834)	-4.269 (1.190)	-23.196 (0.756)	24.396 (3.177)	-42.431 (0.750)	-17.281 (0.188)	-28.804 (0.987)	43.615 (2.592)	-40.552 (1.025)	-18.663 (0.919)	30.762 (1.464)	0.236 (1.745)	-31.563 (0.851)

4.3 Discussion with respect to our research questions

In the Introduction, we posed a number of export-related questions. First of all, whether the post-Referendum period shows evidence of an inward shift in the UK's export demand curve. This is somewhat different to simply asking whether exports have increased or decreased, since we need to correct for flows in other trading partners whose patterns have traditionally tracked the UK well. We have also to correct for the effect of exchange rates, since in normal circumstances a fall in sterling would be expected to benefit exporters. The underlying hypothesis is that policy uncertainty (see [Osnago et al. 2015](#), [Limão & Maggi 2015](#) and [Carballo et al. 2018](#)), and particularly fears about the supply chains feeding UK exporters, would be expected to damage UK exports.

The results from our SCM analysis of UK exports are quite clear: compared to doppelgangers, there is an aggregate drop in exports of around 16 % to the EU across the post-referendum period, and around 13 % to non-EU countries, when measured in dollars. Moreover, in response to our second question, while the performance of exports to the EU is slightly worse than to non-EU countries (and the difference is statistically significant), both have fallen substantially behind their respective doppelgangers. This indicates that the primary driver is not simply expectations of the direct effect of future tariff movements exports to the EU after Brexit (assuming that markets might be discounting in future EU tariffs against the UK in the case of a hard Brexit, whereas tariffs in some other countries might even eventually fall, if the UK were successful in striking Free Trade Agreements of its own). Hence, the evidence suggests that worries about effects on the UK supply side post-Brexit are the main driver.

Our results are not directly comparable to [Crowley et al. \(2018\)](#), since their study is focused upon the extensive margin of exports (market entry/exit by firms/products), and makes some very significant inter-industry comparisons (linking uncertainty to the size of EU most favoured nation tariffs by product), which we cannot do. Nevertheless, both studies find evidence of disappointing performance by UK exporters, especially, but not exclusively to the EU, and should probably be considered to be consistent. Indeed, [Crowley et al. \(2018\)](#) argue that the collapse of entry in sectors most at threat of tariffs bears comparison with the effects on the French gross entry margin during the Great Trade Collapse of 2008-9 ([Bricongne et al. 2012](#)). However, our results are in some respects more striking, since exports are compared to other countries' bilateral trade flows in dollar terms, which emphasises the deterioration of the UK's terms of trade far more than either figures in sterling or export participation rates. [Crowley et al. \(2018\)](#) find

a Brexit announcement effect of about -5 % on the extensive margin (i.e. on the number of firms/products participating in trade). This is less than our Brexit effect, presumably because the intensive margin (sales per firm/product) has also fallen, which is entirely plausible.⁸

Exchange Rate considerations

We do, however, have to give a little more consideration to the possible role of exchange rates in this analysis, especially given the very large exchange rate movements directly following the referendum (see Appendix Figure A1). It is worth noting that our analysis has been carried out in dollars: this makes sense in any panel-type analysis based upon comparing bilateral trade between multiple pairs of countries, since it would not make sense to be comparing trade denominated in a variety of exchange rates. It is worth noting, of course, that, given the scale of the exchange rate depreciation seen in Figure A1, a flat export performance in dollar terms may appear as a sharp rise in exports in sterling terms.

Nevertheless, there is a potential issue of dynamics. While our SCM contains the bilateral exchange rate of each trading pair (i.e. sterling to euro, for UK-German trade, for example), and both countries' GDPs in dollars (which will change rapidly if the dollar exchange rate changes) as confounding variables, they are there in current levels, with the dynamics of the SCM provided by the weighted matching of the other bilateral trade flows in the synthetic doppelganger. We need to consider the possibility that traded volumes may take time to react to a large fall in the exchange rate, and hence that dollar values of UK exports may initially fall simply because UK export costs are falling.⁹

To test for this, we carry out a robustness check, by repeating our SCM exercise for UK exports to EU countries, this time including lagged, as well as current, export values and exporter's nominal GDP, which incorporates the dollar exchange rate. Results are reported in Table 5 below. We find that including these rather simple dynamics does not greatly change our conclusion that there has been a significant fall in UK export demand.

Table 5: Aggregate percentage exports difference between UK-EU partners vs counterfactual: lagged values included as confounding variables

	Pre-referendum	Post-referendum		
	1999:1-2016:5	2016:6-2018:3	2016:6-2016:12	2017:1-2018:3
% difference actual	-0.206	-12.733	-13.819	-13.390
vs synthetic	(0.131)	(1.145)	(1.086)	(1.096)

The evidence in Crowley et al. (2018) of a fall in entry by firms/products is consistent with our finding: if the fall in sterling was going to have a positive but delayed effect on exports, one of the first things we would expect to see is increased entry by firms, leading to larger sales in the long run as they expand. Hence, a fall in the extensive margin

⁸the percent change in overall trade will approximately equal the sum of the percentage changes on the extensive and intensive margins

⁹Against this, of course, many studies suggest that traded prices are sticky in terms of the importer currency, with limited exchange rate pass-through.

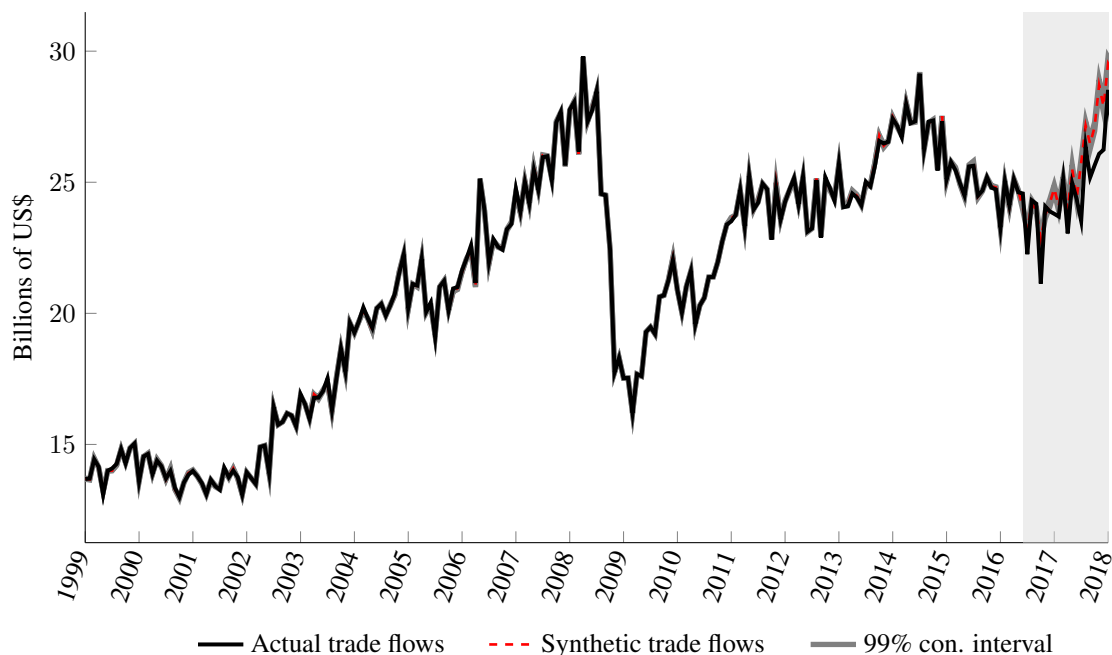
supports our finding that the Brexit announcement has produced a lasting negative shock to export demand, which has mainly been manifest as a deterioration in the UK’s terms of trade.

5 Results for UK imports and discussion

5.1 UK Imports from the EU

In the aggregate, we have found smaller effects upon imports than on exports. We plot imports as well as our synthetic doppelganger in Figure 3. We again depict the Brexit shock vote as the shaded area. We note that pre-referendum the synthetic doppelganger and actual data follow very closely, while after the referendum imports gradually fall behind the doppelganger. Nevertheless the effect is not great.

Figure 3: UK – EU aggregate imports



We summarise our results in Table 6. Actual imports fall below our synthetic doppelganger albeit by a small but significant amount for the full post-Brexit period, and there is a growing shortfall. In the first six months after the Brexit vote, imports are insignificantly lower than the doppelganger, while, in our second post-Brexit period (2017-early 2018) imports are 3.6 % below the doppelganger, and this is statistically significant.

Inspection of Table 7 reveals that there are significant effects of the Brexit vote on imports by country. For example, actual imports from Belgium (BEL), Germany (DEU), Spain (ESP), the Netherlands (NLD) and Portugal (PRT) exceed UK’s synthetic doppelganger by large and significant amounts (5%-14%). Strikingly, imports from Denmark (DNK), Finland (FIN), France (FRA), Ireland (IRL), Luxembourg (LUX) and Sweden (SWE) significantly underperformed.

Table 6: Aggregate percentage imports difference between UK-EU partners vs counterfactual

	Pre-referendum	Post-referendum		
	1999:1-2016:5	2016:6-2018:3	2016:6-2016:12	2017:1-2018:3
% difference actual	-0.339	-3.084	-0.605	-3.643
vs synthetic	(0.027)	(0.955)	(0.659)	(1.045)

See Appendix Figure A5 for graphical representations of the results by country.

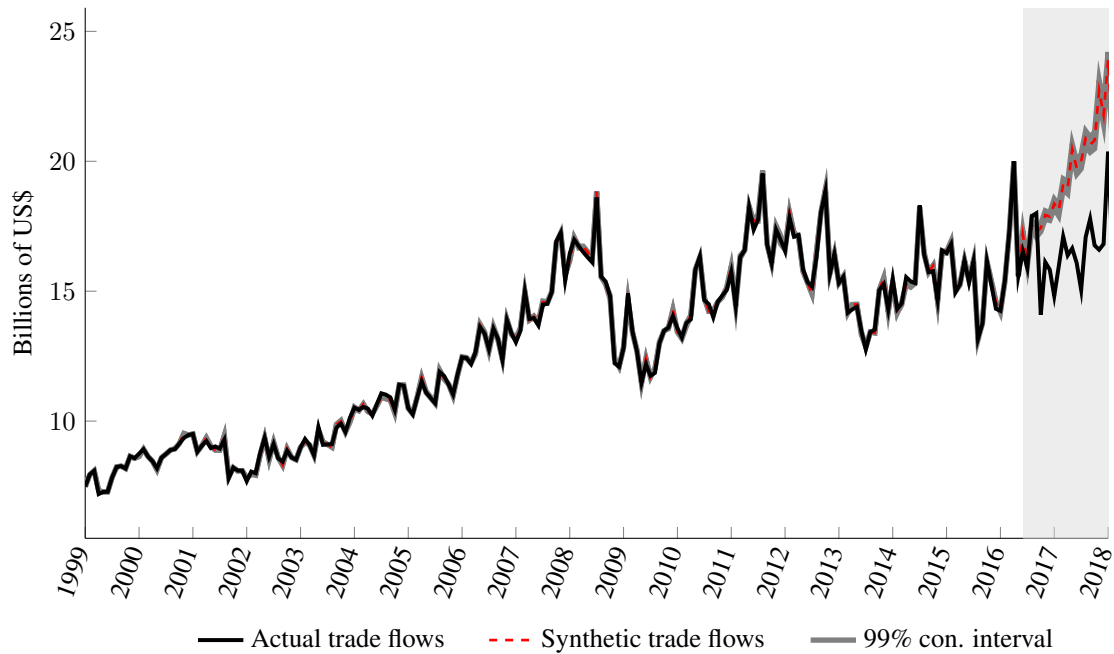
Table 7: Percentage imports difference between the UK-EU single partner vs counterfactual

	AUT	BEL	DEU	DNK	ESP	FIN	FRA	GRC	IRL	ITA	LUX	NLD	PRT	SWE
% diff. actual vs synth.														
1999:1-2016:5	-0.272 (0.022)	0.051 (0.016)	0.220 (0.030)	-0.165 (0.020)	-0.159 (0.016)	-0.085 (0.028)	-0.094 (0.024)	-0.145 (0.073)	0.047 (0.017)	-0.143 (0.016)	-0.161 (0.125)	0.129 (0.017)	-0.147 (0.031)	-0.034 (0.015)
2016:6-2018:3	-1.957 (0.448)	8.432 (0.563)	5.674 (1.190)	-16.179 (0.313)	5.500 (0.546)	-31.297 (0.349)	-15.064 (0.431)	3.934 (1.929)	-14.763 (0.448)	-3.608 (0.506)	-52.012 (1.859)	12.783 (0.635)	12.267 (0.731)	-24.619 (0.281)

5.2 UK imports from non-EU countries

In Figure 4, we plot actual and synthetic aggregate imports. Similar to the previous series which we have analysed, actual and synthetic imports follow each other closely before the Brexit vote, but there is a clear divergence afterwards, with aggregate imports from non-EU countries falling well behind the doppelganger.

Figure 4: UK – non-EU aggregate imports



We summarise our results for imports in Table 8. Inspection of this table reveals that imports from our sample

of non-EU countries initially did not change significantly (-0.8%). However, imports fall significantly short of their synthetic counterpart in the 2017-2018 period. The results for each individual country are summarised in Table 9 and in Figure A6 and we will discuss these results in more detail in the next section.

Table 8: Aggregate percentage imports difference between UK-non-EU partners vs counterfactual

	Pre-referendum	Post-referendum		
	1999:1-2016:5	2016:6-2018:3	2016:6-2016:12	2017:1-2018:3
% difference actual	0.268	-7.325	-0.807	-9.937
vs synthetic	(0.010)	(1.201)	(1.246)	(1.307)

5.3 Results and discussion: UK imports from EU and non-EU countries

As with exports, we now discuss the evidence with respect to our research questions. In particular, our fourth research question (iv) asked whether there were differential shifts in imports between EU and non-EU sources, and whether these were lasting.

As regards the differential shifts, the answer is clear, certainly at the aggregate level. Imports from both sets of countries slipped compared to the doppelganger, but the effects has been more marked in the case of the non-EU countries.

5.4 Discussion and Robustness Checks

An interesting question is whether there have been changes in these import patterns between different countries. As in the section on exports, Table 9 splits non-EU countries into Commonwealth/Hong Kong, the USA and the rest. All members of the former group, except New Zealand, have provided higher imports to the UK since the Referendum than the doppelganger, although this is only statistically significant for four of the six countries (Canada, Hong Kong, India and South Africa). By contrast, there have been sharp falls for most countries in the non-Commonwealth group, except for Mexico. This is consistent with the idea of a reorientation of imports specifically towards Commonwealth partners. note that imports from the USA did not perform particularly well compared to our doppelganger.

Table 9: Percentage imports difference between the UK-non EU single partner vs counterfactual

	Commonwealth + HK						USA	Rest of World						
	AUS	CAN	HKG	IND	NZL	ZAF	USA	BRA	CHN	ISR	JPN	KOR	MEX	RUS
% diff. actual vs synth.														
1999:1-2016:5	0.107	0.125	0.107	0.055	0.095	0.163	-0.060	0.020	0.112	-0.095	0.027	0.091	-0.220	0.063
	(0.036)	(0.031)	(0.032)	(0.026)	(0.045)	(0.030)	(0.110)	(0.023)	(0.044)	(0.038)	(0.042)	(0.028)	(0.032)	(0.033)
2016:6-2018:3	1.887	12.604	12.509	29.827	-5.608	4.423	-11.701	-18.361	-6.689	-27.059	-25.524	-1.591	23.314	-20.666
	(2.122)	(2.020)	(2.129)	(2.175)	(1.883)	(1.922)	(0.139)	(1.238)	(1.964)	(1.469)	(1.328)	(1.652)	(2.298)	(1.454)

One can certainly argue that this shift is in line with political trends among conservative-leaning UK correspondents

and politicians ¹⁰. However, it is not entirely clear whether such a trend will have influenced a wider public mood. One factor may well be a compositional effect in UK demand: while the economics community has overwhelmingly viewed Brexit in terms of its downsides (and financial markets – at least exchange markets – seem to share this view), this is not the view within the pro-Brexit press, or indeed in communities where ‘experts’ are viewed with suspicion. One should perhaps not expect consumers who supported Brexit to batten down the hatches in the ways that most economic models suggest they should. A Bank of England survey reveals how Leave voters’ consumer confidence rose after the vote, along with their household expenditure, while Remain voters’ confidence and spending declined.¹¹. It is quite conceivable that these voters have stronger identification with the old Commonwealth than with EU countries.

6 Conclusions

In this paper, we have examined the effects upon trade of the announcement of the ‘Leave’ vote in the United Kingdom on 23 June, 2016. This can be seen as a classic case of an announcement inducing uncertainty, since, two years on, no formal trade barriers have been announced, and there is considerable uncertainty still, both over future UK-EU relations, and upon potential future trade relations with other parts of the World – the latter depending upon a clear decision on what type of relationship the UK and EU settle upon.

Despite the lack of formal barriers, our work confirms very clearly that an announcement can have strong economic effects. Regarding the United Kingdom’s exports, the discussion in Section 4 provides some interesting insights into the effects of Brexit. UK export demand, measured in dollar terms, has fallen below what would be expected, from the trends of other countries’ trade and GDP, and from exchange rate movements to both EU and non-EU destinations. There is no sign of this gap closing over the 18 months of our study, which indicates a prolonged negative demand shock, rather than adjustment issues. There is a small but significant difference in the poor performance of UK exports to the EU and to non-EU countries, indicating that fear of barriers on exports to the EU plays some part, but that the main negative shock seems to be related to uncertainty and fears about the negative productivity/cost consequences of Brexit, which affects exports to all destinations. We discuss the relation of this to other recent firm/product level evidence (Crowley et al. 2018), which also indicate that policy uncertainty is deterring UK exporters. To summarise: we find clear evidence of an inward shift in the demand curve, mainly manifest as a deterioration in the UK’s terms of trade. Further robustness checks confirm that this does not seem to be simply a case of the response of exports to devaluation being delayed.

Regarding imports, Section 5 shows that those from the EU fall modestly below the doppelganger. Imports from many non-EU countries perform even worse, but there is a clear distinction between Commonwealth countries (except New Zealand), whose sales to the UK have risen, and non-Commonwealth countries. We argue that this may be consistent with the Brexit campaign reinforcing pro-Commonwealth sentiment among Leave voters, whose consumer

¹⁰<https://www.newstatesman.com/politics/2015/02/rise-anglosphere-how-right-dreamed-new-conservative-world-order>

¹¹<https://bankunderground.co.uk/2018/01/10/voting-with-their-wallets-consumer-expectations-after-the-eu-referendum/#more-3664>

confidence also rose following the result.

We need to make a few cautionary remarks at this stage. First, while monthly data on bilateral trade in goods are available for many countries, we lack comparable data on trade in services, which are an important component of overall UK exports. It would be interesting to see whether services trade has shown similar trends.

Secondly, the poor export performance picked out by our analysis is mostly in comparison with what one should have expected, given an upturn in many other economies, and the stimulus from a fall in sterling. This would be less evident in data published in sterling terms. Indeed, in sterling terms, UK exports have grown somewhat (although more or less in line with what we would have expected from the growth of export markets): the poor performance is that the UK is now having to sell its exports at a lower price, with little gain in volume terms.¹²

Overall, however, there seems to be an important message. Even before actual policy changes have been finalised, uncertainty and anticipation have sizeable and measurable effects upon trade.

As regards Brexit: substantial parts of the British electorate may have chosen ‘the wide open sea’¹³, but there is little evidence of the World outside Europe switching towards British exports – in fact, rather the reverse.

¹²In this regard, the Department of International Trade’s announcement in its export strategy briefing of 21 August 2018 that UK exports are ‘at record levels’ is both true and quite misleading in terms of the UK’s ability to purchase imported goods and services with what it exports.

¹³In Winston Churchill’s famous phrase

Appendix

Figure A1: Sterling vs dollar and euro – Jan 2016-June 2018

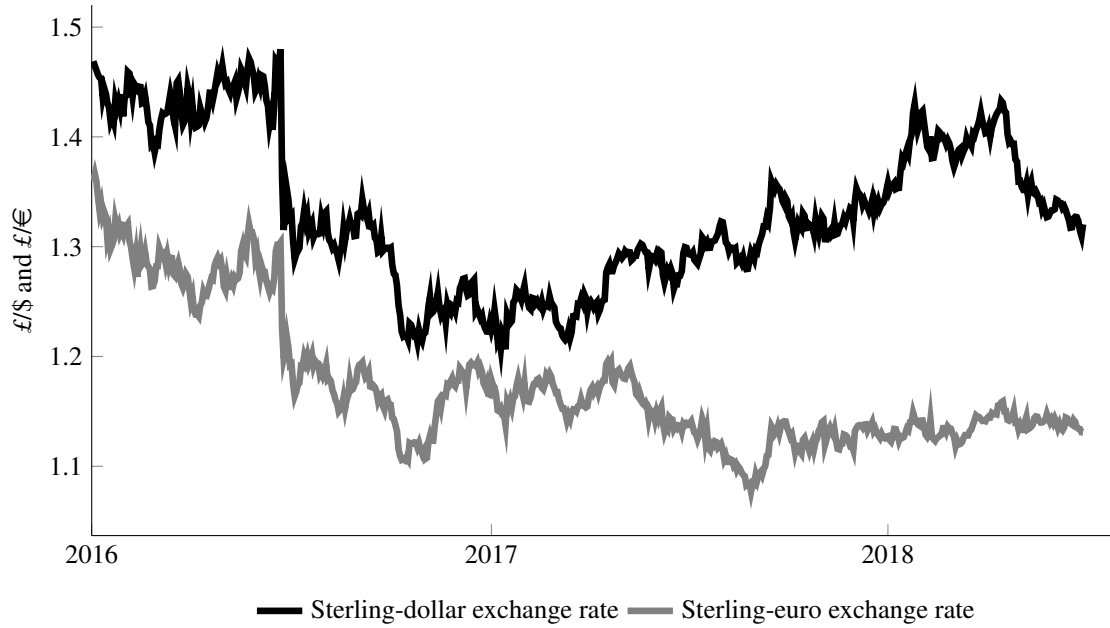
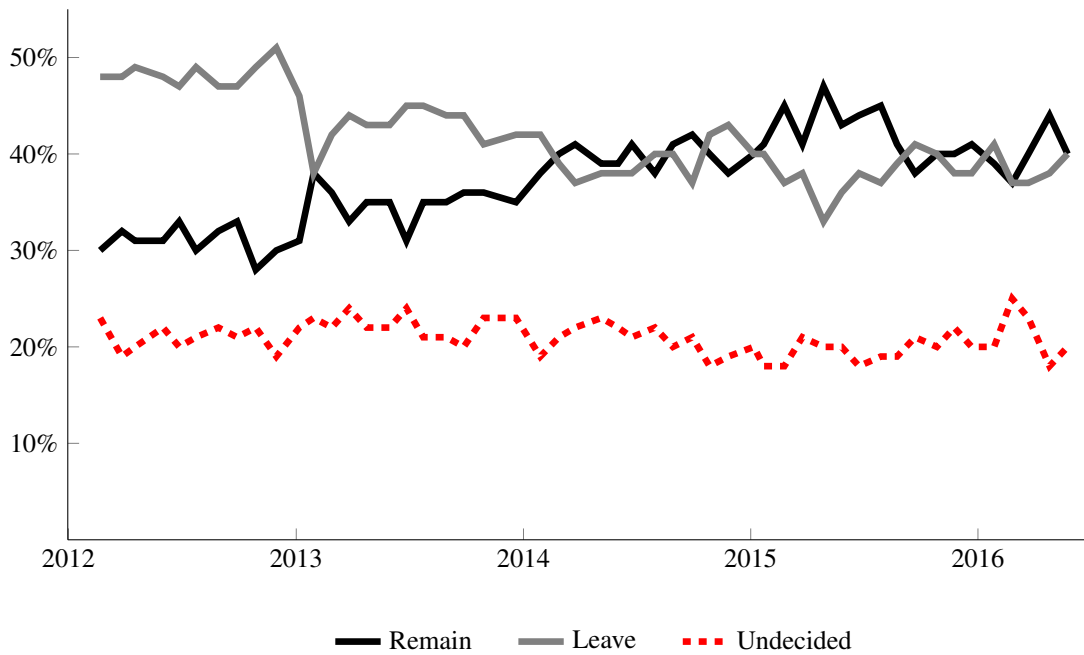


Figure A2: United Kingdom EU membership referendum opinion polling – Feb 2012-June 2016



IRL-ITA	0.006 (0.021)	0.003 (0.020)	0.031 (0.108)	0.008 (0.023)	0.084 (0.132)	0.006 (0.027)	0.041 (0.107)	0.006 (0.028)	0.000 (0.000)	0.188 (0.217)	0.000 (0.000)	0.002 (0.019)	0.002 (0.009)	0.018 (0.040)
IRL-LUX	0.166 (0.206)	0.020 (0.067)	0.004 (0.031)	0.085 (0.139)	0.000 (0.000)	0.075 (0.110)	0.004 (0.035)	0.044 (0.103)	0.019 (0.082)	0.000 (0.000)	0.525 (0.382)	0.006 (0.037)	0.122 (0.157)	0.005 (0.024)
IRL-NLD	0.040 (0.087)	0.049 (0.187)	0.077 (0.219)	0.045 (0.149)	0.097 (0.251)	0.018 (0.087)	0.088 (0.232)	0.012 (0.062)	0.034 (0.184)	0.120 (0.266)	0.000 (0.000)	0.062 (0.205)	0.018 (0.088)	0.068 (0.196)
IRL-PRT	0.143 (0.236)	0.000 (0.000)	0.000 (0.000)	0.066 (0.153)	0.011 (0.058)	0.094 (0.191)	0.000 (0.000)	0.058 (0.166)	0.000 (0.000)	0.011 (0.064)	0.281 (0.379)	0.000 (0.000)	0.113 (0.220)	0.022 (0.095)
IRL-SWE	0.203 (0.220)	0.002 (0.013)	0.007 (0.052)	0.117 (0.161)	0.058 (0.166)	0.10 (0.167)	0.018 (0.082)	0.10 (0.189)	0.000 (0.000)	0.057 (0.172)	0.064 (0.216)	0.010 (0.058)	0.096 (0.171)	0.126 (0.169)
ITA-LUX	0.399 (0.233)	0.087 (0.174)	0.008 (0.043)	0.278 (0.273)	0.083 (0.196)	0.309 (0.213)	0.032 (0.087)	0.274 (0.212)	0.069 (0.162)	0.069 (0.172)	0.853 (0.193)	0.054 (0.131)	0.361 (0.228)	0.113 (0.223)
ITA-NLD	0.040 (0.069)	0.132 (0.261)	0.094 (0.222)	0.096 (0.149)	0.174 (0.260)	0.042 (0.081)	0.125 (0.244)	0.029 (0.063)	0.104 (0.234)	0.195 (0.284)	0.011 (0.031)	0.122 (0.236)	0.047 (0.088)	0.158 (0.238)
ITA-PRT	0.171 (0.222)	0.115 (0.225)	0.004 (0.022)	0.303 (0.414)	0.201 (0.282)	0.361 (0.267)	0.054 (0.107)	0.30 (0.228)	0.072 (0.165)	0.157 (0.246)	0.034 (0.063)	0.062 (0.139)	0.335 (0.271)	0.297 (0.373)
ITA-SWE	0.122 (0.157)	0.055 (0.151)	0.026 (0.085)	0.197 (0.281)	0.119 (0.175)	0.154 (0.175)	0.060 (0.123)	0.150 (0.176)	0.041 (0.125)	0.155 (0.194)	0.030 (0.072)	0.042 (0.110)	0.132 (0.162)	0.220 (0.276)
LUX-NLD	0.052 (0.087)	0.032 (0.079)	0.017 (0.092)	0.048 (0.092)	0.006 (0.026)	0.005 (0.022)	0.014 (0.080)	0.004 (0.030)	0.013 (0.047)	0.023 (0.077)	0.085 (0.159)	0.034 (0.085)	0.008 (0.030)	0.022 (0.059)
LUX-PRT	0.139 (0.208)	0.000 (0.000)	0.000 (0.000)	0.039 (0.101)	0.005 (0.034)	0.142 (0.206)	0.000 (0.000)	0.123 (0.214)	0.001 (0.004)	0.001 (0.007)	0.218 (0.343)	0.000 (0.000)	0.129 (0.191)	0.012 (0.049)
LUX-SWE	0.180 (0.216)	0.002 (0.016)	0.007 (0.048)	0.094 (0.165)	0.044 (0.130)	0.038 (0.10)	0.018 (0.077)	0.038 (0.116)	0.000 (0.000)	0.042 (0.130)	0.117 (0.239)	0.002 (0.012)	0.046 (0.111)	0.040 (0.115)
NLD-PRT	0.061 (0.172)	0.038 (0.166)	0.020 (0.141)	0.10 (0.250)	0.049 (0.165)	0.129 (0.237)	0.025 (0.145)	0.116 (0.213)	0.035 (0.157)	0.028 (0.145)	0.022 (0.142)	0.035 (0.158)	0.111 (0.227)	0.077 (0.213)
NLD-SWE	0.017 (0.047)	0.132 (0.292)	0.087 (0.266)	0.077 (0.150)	0.117 (0.296)	0.018 (0.052)	0.105 (0.285)	0.016 (0.047)	0.124 (0.290)	0.096 (0.275)	0.001 (0.005)	0.119 (0.287)	0.014 (0.048)	0.194 (0.277)
PRT-SWE	0.062 (0.111)	0.000 (0.000)	0.022 (0.108)	0.023 (0.076)	0.053 (0.156)	0.086 (0.121)	0.031 (0.131)	0.184 (0.196)	0.001 (0.012)	0.042 (0.123)	0.063 (0.187)	0.001 (0.008)	0.055 (0.104)	0.026 (0.066)

SWE-RUS	0.006 (0.035)	0.037 (0.096)	0.049 (0.130)	0.015 (0.053)	0.023 (0.109)	0.038 (0.139)	0.108 (0.192)	0.019 (0.104)	0.037 (0.154)	0.001 (0.005)	0.000 (0.000)	0.192 (0.224)	0.000 (0.000)	0.026 (0.122)
SWE-USA	0.075 (0.111)	0.013 (0.030)	0.116 (0.134)	0.250 (0.270)	0.128 (0.171)	0.074 (0.113)	0.006 (0.020)	0.237 (0.170)	0.036 (0.070)	0.008 (0.018)	0.000 (0.001)	0.036 (0.074)	0.654 (0.470)	0.029 (0.060)
SWE-ZAF	0.063 (0.136)	0.085 (0.170)	0.002 (0.009)	0.027 (0.145)	0.046 (0.165)	0.009 (0.048)	0.051 (0.177)	0.000 (0.000)	0.019 (0.069)	0.032 (0.084)	0.173 (0.343)	0.010 (0.055)	0.000 (0.000)	0.060 (0.141)

IRL-ITA	0.034 (0.064)	0.002 (0.007)	0.019 (0.073)	0.011 (0.033)	0.087 (0.120)	0.020 (0.058)	0.081 (0.161)	0.031 (0.082)	0.000 (0.002)	0.138 (0.182)	0.005 (0.037)	0.005 (0.028)	0.022 (0.060)	0.023 (0.055)
IRL-LUX	0.089 (0.172)	0.007 (0.030)	0.000 (0.000)	0.072 (0.148)	0.002 (0.012)	0.037 (0.125)	0.000 (0.000)	0.065 (0.140)	0.031 (0.077)	0.000 (0.000)	0.513 (0.321)	0.003 (0.019)	0.087 (0.163)	0.016 (0.068)
IRL-NLD	0.038 (0.073)	0.024 (0.078)	0.000 (0.000)	0.040 (0.091)	0.035 (0.109)	0.005 (0.026)	0.011 (0.054)	0.000 (0.000)	0.015 (0.059)	0.044 (0.128)	0.014 (0.065)	0.019 (0.069)	0.003 (0.010)	0.009 (0.037)
IRL-PRT	0.076 (0.185)	0.005 (0.032)	0.000 (0.000)	0.032 (0.119)	0.000 (0.000)	0.050 (0.123)	0.000 (0.000)	0.159 (0.267)	0.013 (0.056)	0.000 (0.000)	0.196 (0.290)	0.003 (0.021)	0.083 (0.175)	0.017 (0.074)
IRL-SWE	0.093 (0.145)	0.000 (0.000)	0.006 (0.046)	0.062 (0.114)	0.026 (0.078)	0.032 (0.087)	0.008 (0.049)	0.097 (0.191)	0.001 (0.005)	0.028 (0.105)	0.067 (0.160)	0.002 (0.016)	0.034 (0.097)	0.051 (0.089)
ITA-LUX	0.257 (0.255)	0.120 (0.212)	0.000 (0.000)	0.248 (0.307)	0.066 (0.169)	0.245 (0.275)	0.011 (0.041)	0.250 (0.283)	0.165 (0.263)	0.027 (0.085)	0.715 (0.303)	0.060 (0.150)	0.299 (0.283)	0.120 (0.231)
ITA-NLD	0.004 (0.013)	0.378 (0.432)	0.256 (0.440)	0.019 (0.039)	0.174 (0.229)	0.013 (0.027)	0.326 (0.422)	0.001 (0.004)	0.295 (0.314)	0.295 (0.378)	0.000 (0.000)	0.341 (0.422)	0.005 (0.011)	0.057 (0.094)
ITA-PRT	0.415 (0.343)	0.095 (0.195)	0.000 (0.000)	0.249 (0.314)	0.187 (0.270)	0.520 (0.361)	0.037 (0.095)	0.497 (0.307)	0.134 (0.240)	0.098 (0.183)	0.302 (0.306)	0.043 (0.116)	0.537 (0.374)	0.258 (0.336)
ITA-SWE	0.142 (0.209)	0.066 (0.163)	0.000 (0.000)	0.127 (0.203)	0.142 (0.230)	0.286 (0.323)	0.052 (0.114)	0.102 (0.193)	0.079 (0.208)	0.141 (0.212)	0.031 (0.071)	0.042 (0.126)	0.183 (0.233)	0.151 (0.221)
LUX-NLD	0.035 (0.075)	0.015 (0.046)	0.000 (0.000)	0.025 (0.055)	0.021 (0.074)	0.002 (0.014)	0.015 (0.055)	0.003 (0.022)	0.014 (0.063)	0.031 (0.105)	0.050 (0.115)	0.010 (0.036)	0.005 (0.024)	0.011 (0.039)
LUX-PRT	0.023 (0.070)	0.005 (0.036)	0.000 (0.000)	0.010 (0.049)	0.000 (0.000)	0.057 (0.156)	0.000 (0.000)	0.190 (0.296)	0.007 (0.047)	0.000 (0.000)	0.135 (0.227)	0.001 (0.006)	0.049 (0.124)	0.010 (0.047)
LUX-SWE	0.060 (0.105)	0.005 (0.024)	0.001 (0.005)	0.059 (0.146)	0.011 (0.037)	0.019 (0.053)	0.006 (0.023)	0.067 (0.151)	0.001 (0.006)	0.004 (0.018)	0.173 (0.237)	0.002 (0.008)	0.025 (0.070)	0.041 (0.102)
NLD-PRT	0.265 (0.342)	0.046 (0.143)	0.000 (0.000)	0.178 (0.297)	0.070 (0.180)	0.311 (0.341)	0.006 (0.047)	0.321 (0.339)	0.054 (0.171)	0.038 (0.136)	0.206 (0.311)	0.018 (0.080)	0.342 (0.362)	0.151 (0.257)
NLD-SWE	0.071 (0.145)	0.061 (0.181)	0.002 (0.012)	0.180 (0.248)	0.035 (0.104)	0.035 (0.110)	0.013 (0.065)	0.006 (0.023)	0.075 (0.193)	0.015 (0.068)	0.003 (0.017)	0.048 (0.157)	0.030 (0.085)	0.169 (0.245)
PRT-SWE	0.029 (0.058)	0.000 (0.000)	0.000 (0.000)	0.023 (0.054)	0.023 (0.094)	0.042 (0.086)	0.003 (0.024)	0.165 (0.213)	0.000 (0.000)	0.018 (0.074)	0.015 (0.070)	0.000 (0.000)	0.038 (0.079)	0.033 (0.065)

SWE-RUS	0.067 (0.210)	0.122 (0.209)	0.185 (0.303)	0.088 (0.278)	0.114 (0.248)	0.259 (0.334)	0.148 (0.121)	0.111 (0.288)	0.116 (0.248)	0.015 (0.048)	0.003 (0.012)	0.337 (0.321)	0.080 (0.277)	0.171 (0.326)
SWE-USA	0.010 (0.034)	0.003 (0.006)	0.045 (0.195)	0.038 (0.196)	0.007 (0.027)	0.029 (0.131)	0.000 (0.000)	0.080 (0.193)	0.010 (0.049)	0.003 (0.009)	0.000 (0.000)	0.029 (0.138)	0.053 (0.199)	0.023 (0.092)
SWE-ZAF	0.047 (0.150)	0.071 (0.190)	0.003 (0.018)	0.003 (0.015)	0.016 (0.062)	0.031 (0.111)	0.020 (0.074)	0.000 (0.000)	0.014 (0.060)	0.096 (0.171)	0.133 (0.252)	0.000 (0.000)	0.000 (0.000)	0.010 (0.036)

Table A5: Aggregate percentage exports difference between UK-EU partners vs counterfactual with different M samples

	Pre-referendum	Post-referendum		
	1999:1-2016:5	2016:6-2018:1	2016:6-2016:12	2017:1-2018:1
M==250				
% difference actual	-0.2310	-14.5554	-15.4780	-14.4989
vs synthetic	(.0407)	(.3875)	(.3799)	(.3963)
M==500				
% difference actual	-0.169	-14.359	-15.103	-14.440
vs synthetic	(0.029)	(0.294)	(0.293)	(0.295)
M==750				
% difference actual	-0.1760	-14.1340	-14.8609	-14.2430
vs synthetic	(.0241)	(.2429)	(.2433)	(.2461)
M==1000				
% difference actual	0.1873	-14.0440	-14.7719	-14.1409
vs synthetic	(.0210)	(.2115)	(.2103)	(.2125)

Table A6: Aggregate percentage imports difference between UK-EU partners vs counterfactual with different M samples

	Pre-referendum	Post-referendum		
	1999:1-2016:5	2016:6-2018:1	2016:6-2016:12	2017:1-2018:1
M==250				
% difference actual	-0.2834	0.1837	2.5079	-0.8631
vs synthetic	(.0424)	(1.1773)	(.9212)	(1.2636)
M==500				
% difference actual	-0.316	0.392	2.564	-0.696
vs synthetic	(0.029)	(0.835)	(0.647)	(0.906)
M==750				
% difference actual	-0.3108	0.9538	3.0909	0.0094
vs synthetic	(.0243)	(.6839)	(.5201)	(.7448)
M==1000				
% difference actual	-0.3048	1.6959	3.7101	0.8630
vs synthetic	(.0207)	(.5976)	(.4539)	(.6467)

Table A7: Aggregate percentage exports difference between UK-non EU partners vs counterfactual with different M samples

	Pre-referendum	Post-referendum		
	1999:1-2016:5	2016:6-2018:1	2016:6-2016:12	2017:1-2018:1
M==250				
% difference actual	-0.4942	-16.3865	15.0513	-16.7997
vs synthetic	(.1484)	(1.0607)	(.9795)	(1.1088)
M==500				
% difference actual	0.476	-16.518	-15.090	-16.955
vs synthetic	(0.096)	(0.649)	(0.635)	(0.644)
M==750				
% difference actual	-0.4930	-16.2062	-15.0634	-16.5655
vs synthetic	(.0714)	(.7636)	(.7423)	(.7562)
M==1000				
% difference actual	-0.4820	-16.0659	-14.8597	16.4785
vs synthetic	(.0639)	(.6667)	(.6464)	(.6667)

Table A8: Aggregate percentage imports difference between UK-non EU partners vs counterfactual with different M samples

	Pre-referendum	Post-referendum		
	1999:1-2016:5	2016:6-2018:1	2016:6-2016:12	2017:1-2018:1
M==250				
% difference actual	0.1391	5.8324	20.2381	-0.0670
vs synthetic	(.0591)	(1.7967)	(2.2446)	(1.6135)
M==500				
% difference actual	0.141	7.635	25.628	4.435
vs synthetic	(0.042)	(1.304)	(1.424)	(0.977)
M==750				
% difference actual	0.1072	7.8340	22.3069	1.7740
vs synthetic	(.0361)	(1.1339)	(1.4049)	(1.0281)
M==1000				
% difference actual	0.1380	7.7948	22.9111	1.7140
vs synthetic	(.0321)	(1.0278)	(1.2658)	(.9407)

Figure A3: UK – EU exports by country

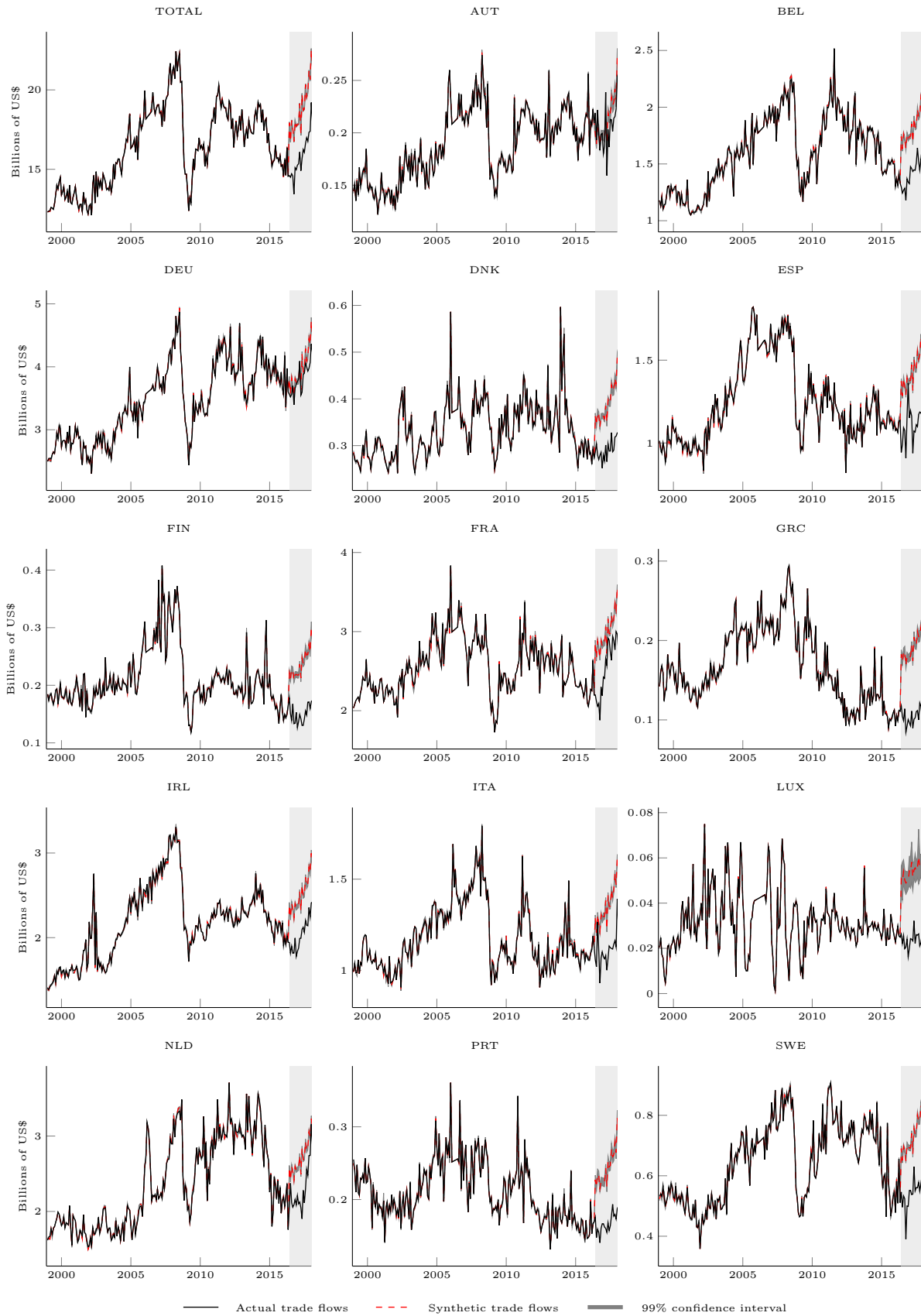


Figure A4: UK – non-EU exports by country

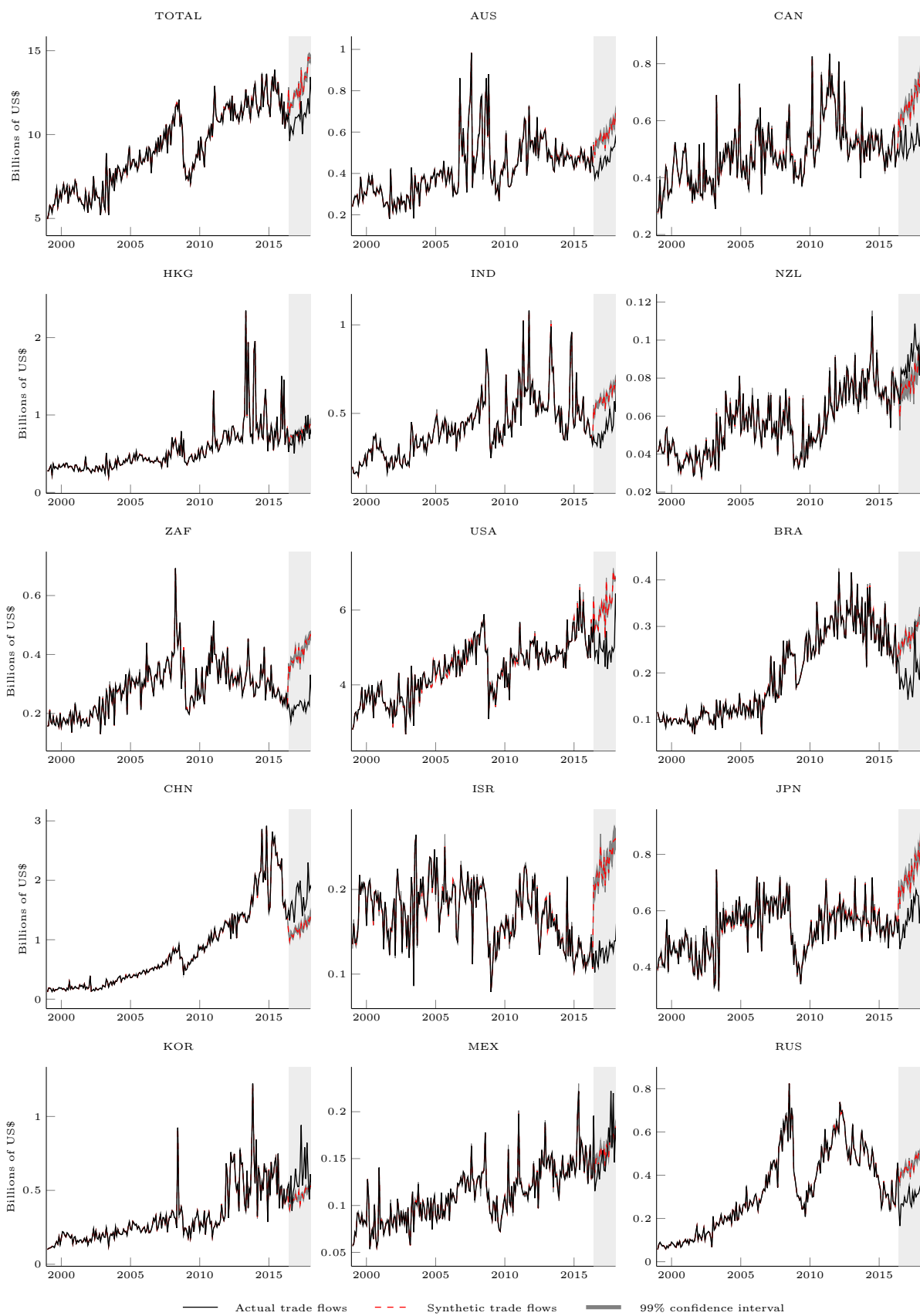


Figure A5: UK – EU imports by country

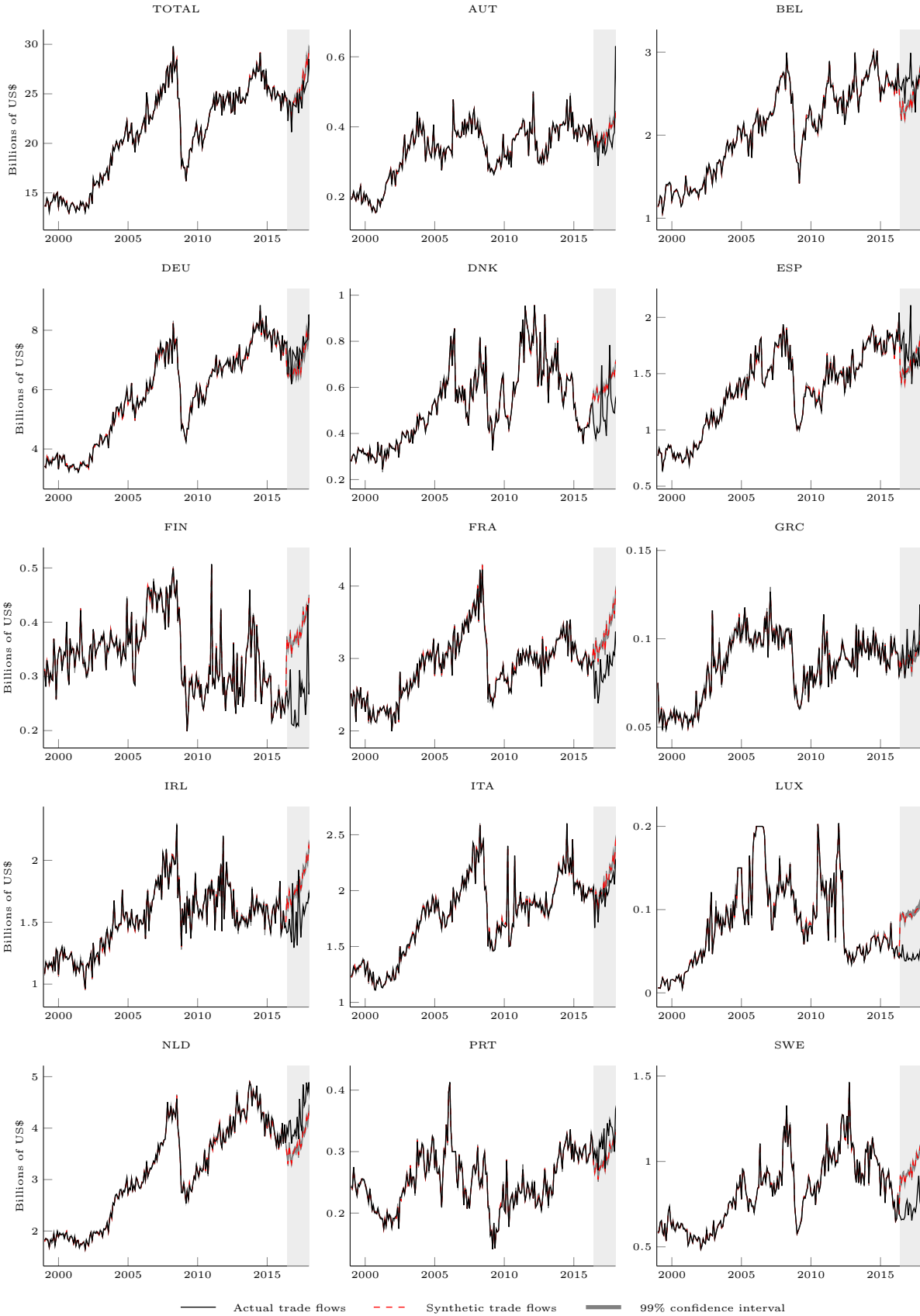
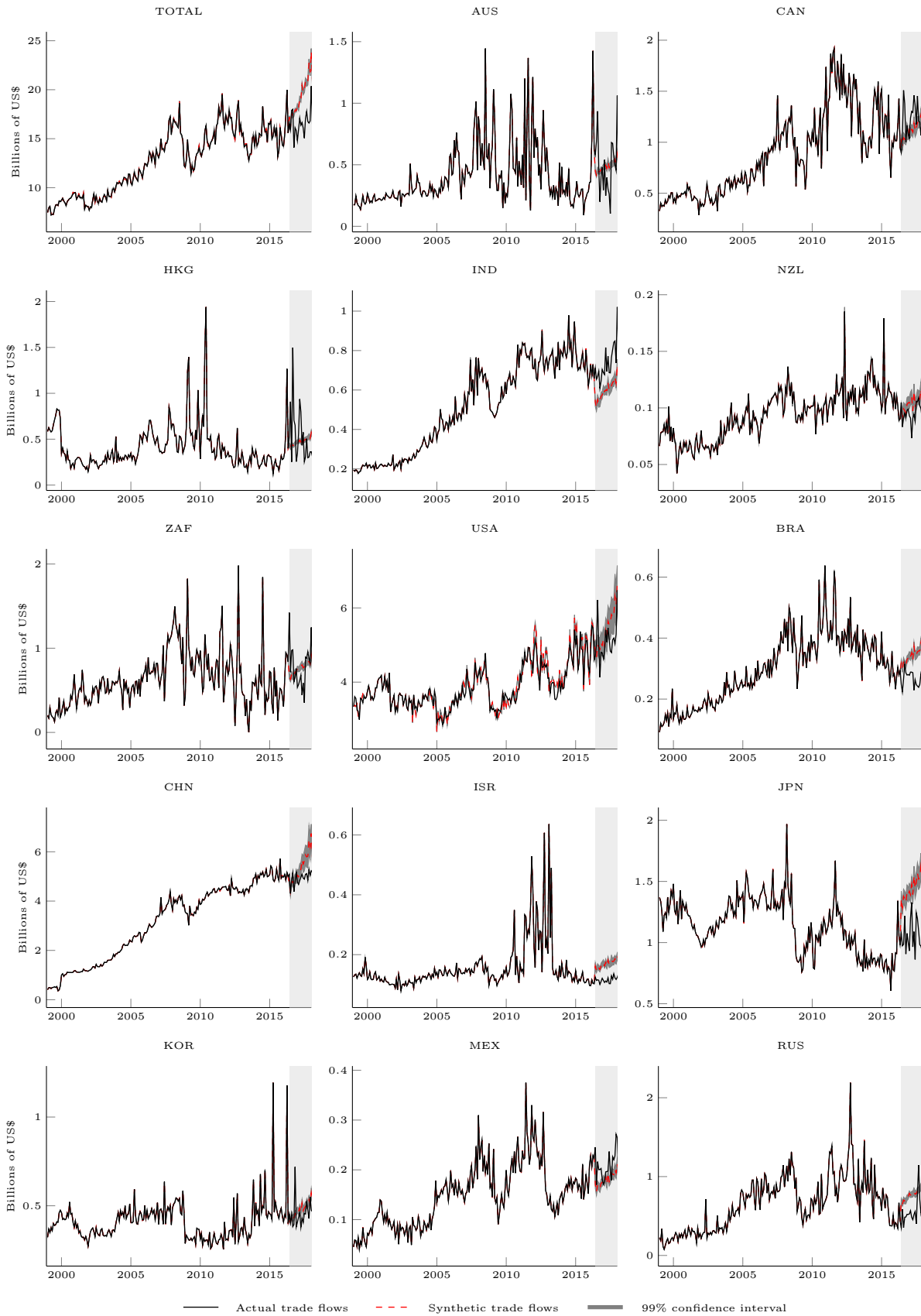


Figure A6: UK – non-EU imports by country



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