

Online Appendix

The Costs of Economic Nationalism: Evidence from the Brexit Experiment*

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A Data

The donor group contains all OECD countries for which we were able to obtain contiguous real GDP data starting in 1995Q1 and pre-Brexit-vote averages of the additional covariates – allowing for missing values (see Table 2 for a list). If not otherwise noted, the data comes from OECD Economic Outlook database (November 2018 edition). For the baseline, we use real GDP (gross domestic product, volume, market prices), consumption (private final consumption expenditure, volume), investment (gross fixed capital formation, total, volume), real export (exports of goods and services, volume) and import (imports of goods and services, volume), employment (total employment, labour force survey basis), and annual population (working-age population, age 15-74). The latter is linearly interpolated to the quarterly frequency. For the decomposition exercise, we additionally use government consumption (government final consumption expenditure, volume). For the VAR exercises, we also use inflation (change in consumer price index, harmonized, index 2015) and the nominal exchange rate (nominal effective exchange rate, chain-linked, overall weights).

For the uncertainty analysis, we use the Baker *et al.* (2016) Economic Policy Uncertainty index available at www.policyuncertainty.com. The index is based on a (standardized) count of newspaper articles containing the terms uncertain or uncertainty, economic or economy, and one or more policy-relevant terms. The macroeconomic uncertainty index, based on Jurado *et al.* (2015), has been computed for the UK in Redl (2017) and has been made available to us by Chris Redl. Stock market returns are based on the Datastream total

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market total returns index for the UK (TOTMKUK). The policy rate is the Bank of England bank rate.

The proprietary real output growth forecasts come from Oxford Economics (<https://www.oxfordeconomics.com>). We aggregate the monthly growth forecasts to quarterly frequency by taking the average over the three months pertaining to a quarter.

B SMC: details and robustness

B.1 End-of-sample instability test

Andrews’ (2003) end-of-sample instability test has recently been suggested in the context of synthetic control approaches by Hahn and Shi (2017) and shown to have good size properties. While the test is technically based on stationary data, Andrews (2003) notes (p. 1681, comment 4), that his test can be shown to be asymptotically valid under stationary errors. To conduct the test, we run the SCM over the *whole* (pre- and post-Brexit vote) sample and then base the test statistic on the sum-of-squares of the post-Brexit vote errors. Following Andrews (2003), the distribution of the test statistic is computed using a subsampling scheme. Specifically, we conduct the matching on the sample $1, \dots, T_0$, where observations $j, \dots, j + \lceil m/2 \rceil - 1$ are excluded. Here, m is the number of post-Brexit vote observations, T_0 is the time of the treatment, and we resample for $j = 1, \dots, T_0 - m + 1$. For each iteration, the resampled test statistic is based on the matching errors from j to $j + m - 1$.

B.2 Additional country placebo tests

The main text conducted placebo tests on the relevant subset of the donor pool, i.e. the countries which received a non-zero weight in the baseline UK doppelganger. First, we report the standard deviations of the differences between the respective doppelgangers and actual time paths of GDP in each of these countries. This is done in Table 1 below.

Table 1: Country placebos: fit

Germany	0.02	Hungary	0.03	Iceland	0.03	Ireland	0.08
Italy	0.03	New Zealand	0.02	United States	0.03	United Kingdom	0.01

Standard deviation of the difference between the doppelganger and actual real GDP paths in the respective donor pool countries prior to the Brexit vote. The UK (our baseline estimate) is shown for comparability.

Next, this appendix shows that similar results are obtained for the rest of the donor

pool countries. Figure 1 shows the country placebo time paths and Figure 2 depicts the two statistics of relative pre- and post-treatment fit. Again, the UK economy stands out as the one with the largest post-treatment deviation.

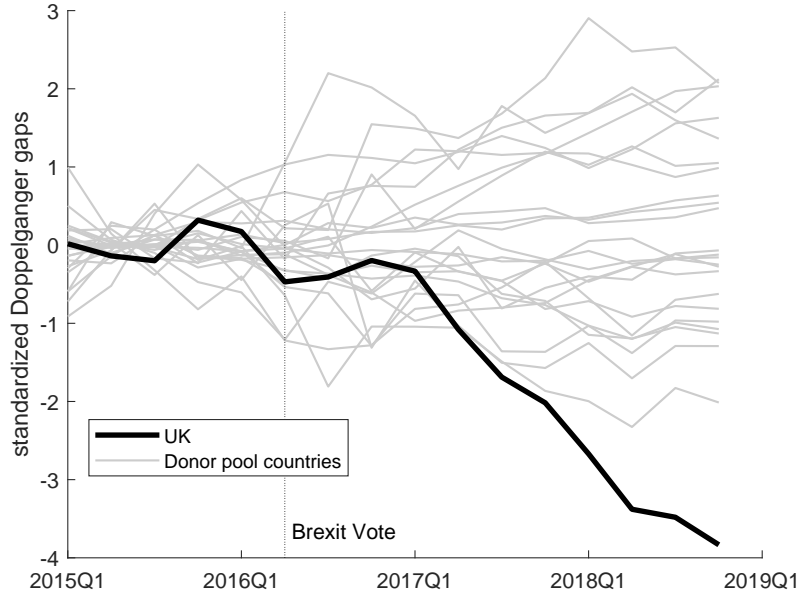


Figure 1: Country placebo tests *Note:* UK doppelgänger *gap* (thick black line), with gray lines representing country placebo doppelgänger gaps estimated by considering fictitious Brexit votes in all donor pool economies. For comparability, all doppelgänger gaps are normalized by their respective pre-Brexit standard deviations and centred around their 2015 means.

B.3 Western donor pool robustness

This section provides an additional robustness check with respect to the donor pool. In particular, we restrict the donor pool to include countries that are likely most similar to the UK and exclude all east and south European economies (Hungary, Italy, Portugal, Slovak Republic, Spain) as well as Luxembourg. Nevertheless, using this *a priori* restricted donor pool gives similar results as suggested by our donor pool exercises in the main text. The cost of the Brexit vote at the end of 2018 is 1.7 percent of GDP. While this is lower than the 2.4 percent in our baseline specification, it is nevertheless still sizeable.

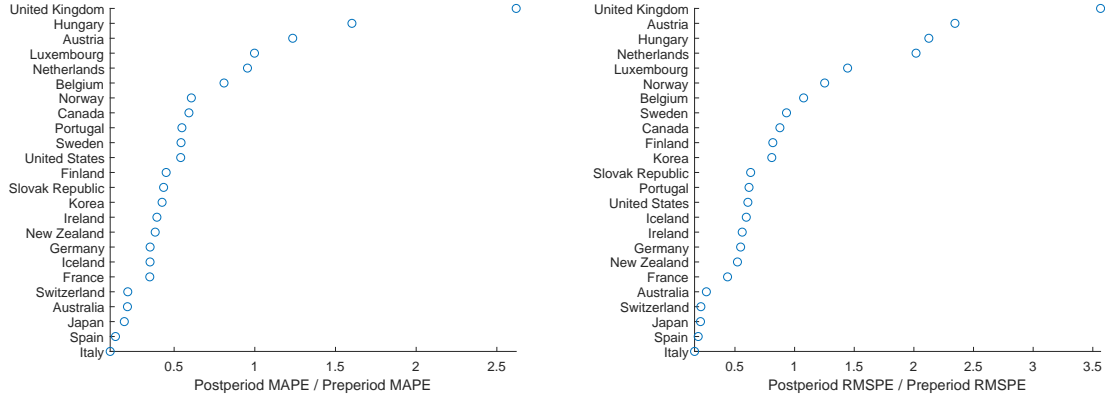


Figure 2: Relative measures of the pre- and post-treatment doppelganger gaps. *Note:* left panel shows the relative maximum absolute prediction error ρ_2 , the right panel shows the relative root means squared prediction error ρ_1 .

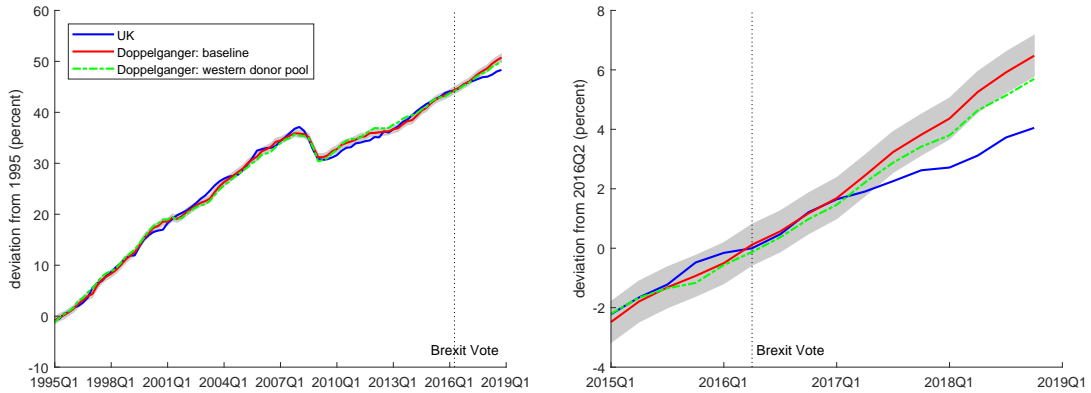


Figure 3: Real GDP of the UK. Actual data (blue line), baseline doppelganger (red line), doppelganger based on restricted donor pool (green line). *Note:* shaded area is one standard deviation of difference prior to Brexit vote. Data source: OECD Economic Outlook.

B.4 Alternative covariate specification

In the baseline, we match on a number of covariates where we average over the sample 1995Q1 to 2016Q2. In this robustness check, we average the covariates instead over the year prior to the Brexit vote (2015Q2 to 2016Q2). The results shown below indicate that while this affects the country weights (the US become even more important), the results remain unchanged with regard to the output effect of the Brexit vote.

Table 2: Matching of covariates

	UK	Doppelganger
Consumption / GDP	65.09	63.68
Investment / GDP	16.73	20.99
Exports / GDP	28.42	28.45
Imports / GDP	29.34	25.67
Labor productivity growth	-0.08	-0.07
Employment share	65.16	61.90

Note: All numbers are in percent. Labor productivity growth is the log difference between quarterly real GDP and quarterly total employment; employment share is the ratio between total employment and the working age population.

Table 3: Composition of the doppelganger: country weights

Australia	<0.01	Austria	<0.01	Belgium	<0.01	Canada	<0.01
Finland	<0.01	France	<0.01	Germany	<0.01	Hungary	0.13
Iceland	0.02	Ireland	<0.01	Italy	0.07	Japan	0.11
Korea	<0.01	Luxembourg	<0.01	Netherlands	<0.01	New Zealand	0.04
Norway	<0.01	Portugal	<0.01	Slovak Republic	<0.01	Spain	<0.01
Sweden	<0.01	Switzerland	<0.01	United States	0.63		

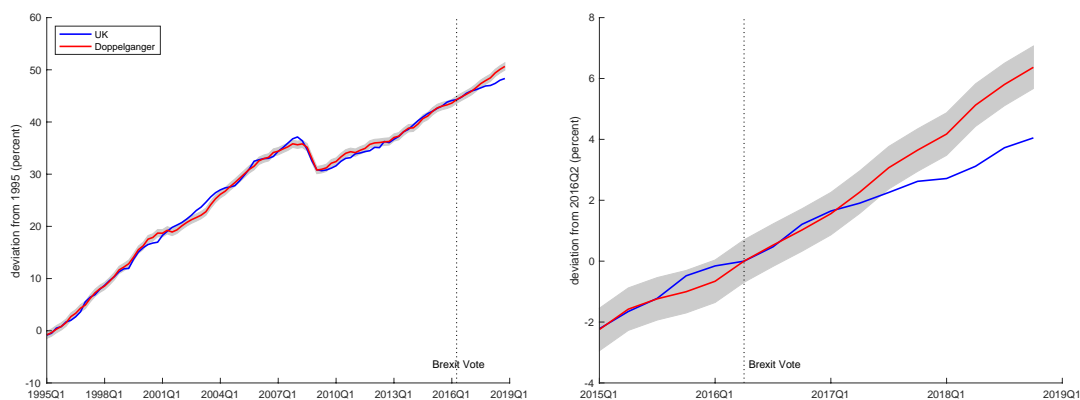


Figure 4: Real GDP of the UK. Actual data (blue line) vs doppelganger (red line). *Note:* shaded area is one standard deviation of difference prior to Brexit vote. Data source: OECD Economic Outlook.

C VAR: details and robustness

This part of the appendix provides additional results for our VAR analysis in the main text. First, we show that the aggregate dynamics following the identified uncertainty shocks are consistent with findings in the literature. Second, we perform a series of robustness checks on our baseline specification.

C.1 Impulse response functions

Figure 5 shows the impulse response functions of the VAR variables to a one standard deviation uncertainty shock. As has been extensively discussed in the literature, uncertainty increases have contractionary effects.

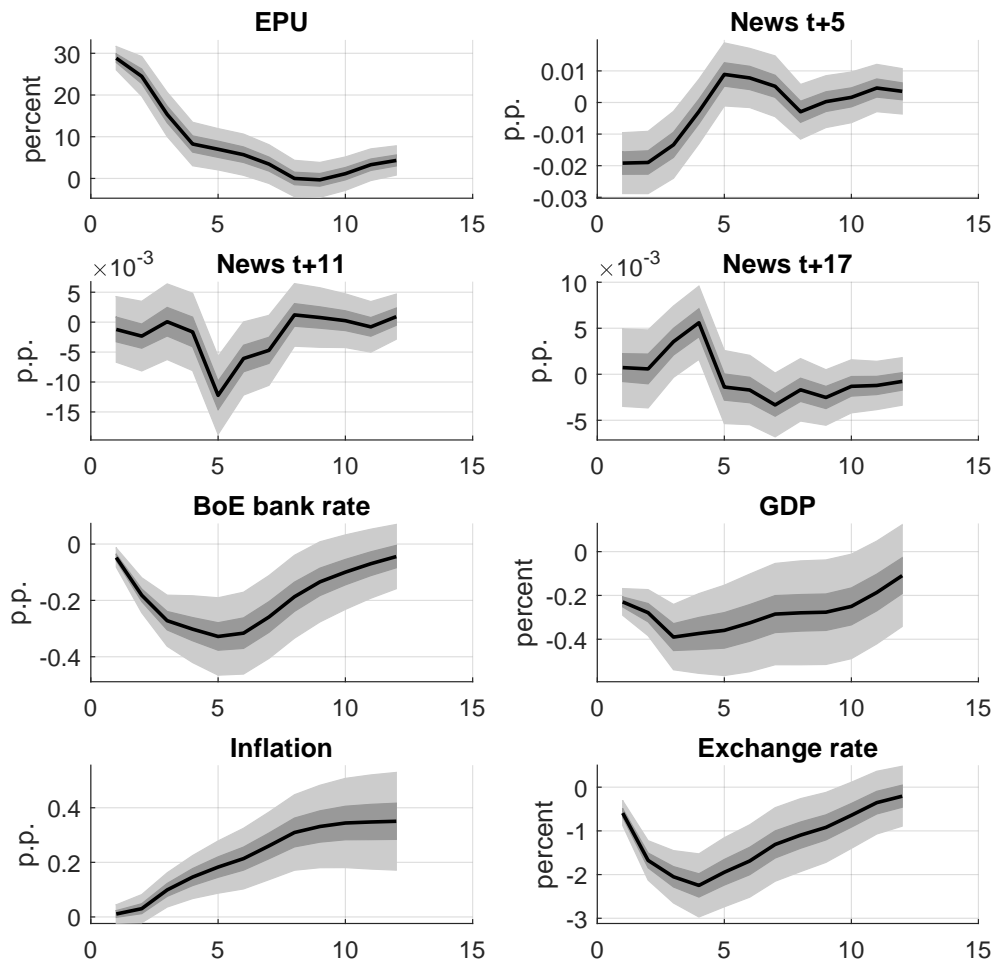


Figure 5: Impulse response functions: economic policy uncertainty. *Note:* impulse response functions to a one standard deviation increase in uncertainty. Light and dark shaded areas indicate one standard deviation and 90 percent bootstrapped confidence bands, respectively.

C.2 Response of the exchange rate to the Brexit vote

In this section, we investigate to what extent the exchange rate depreciation following the Brexit vote was driven by the identified uncertainty and expectation shocks. Towards this end, we use the estimated EVAR to first construct a “no-shock” time path for all the model variables. This is done by simply using the EVAR as a forecasting tool while setting all the shocks (uncertainty, expectations and the other, unidentified, disturbances) to zero from 2016Q3 onwards. The lagged structure of the EVAR then implies particular time-paths for all variables.

In the next step, we use this “no-shock” time path as the baseline to which we compare other time-paths implied by the EVAR depicted in Figure 6. The black line (“data”) simply shows how the exchange rate in the data evolved following the Brexit vote, in comparison to the no-shock scenario. We clearly see the strong depreciation. Second, the dashed red line (“uncertainty shocks”) is the same as the “no-shock” time path, except that we retain the identified uncertainty shock in 2016Q3. This response is very similar to the IRF of uncertainty shown in the previous section. The difference again stems from the endogenous propagation inherent to the EVAR. Finally, the blue line (“uncertainty and anticipation shocks”) retains both the uncertainty and expectation shocks identified in 2016Q3.

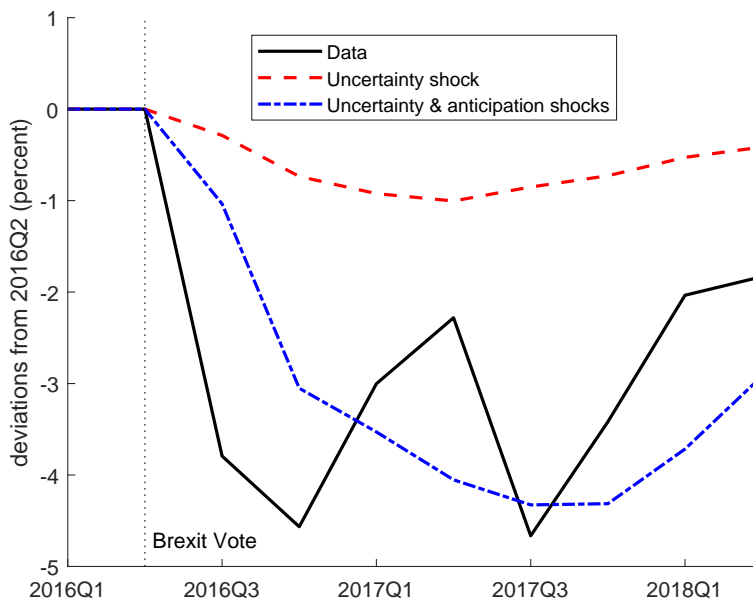


Figure 6: Impulse response functions in 2016Q3. *Note:* impulse response functions to the uncertainty shock (dashed red line) and the uncertainty and anticipation shocks (dash-dotted blue line) identified in 2016Q3. Data is shown in black.

Interestingly, the dash-dotted blue line, capturing the effect that uncertainty and anticipa-

tion shocks had on the exchange rate, is very close to the black line showing the time path of the exchange rate in the data. In other words, the bulk of the exchange rate dynamics following the Brexit vote can be accounted for by the identified uncertainty and anticipation shocks.

C.3 Robustness

We now investigate whether the contributions of uncertainty shocks and growth news shocks to the doppelganger gap depend on the specific VAR setup chosen. The left panel of Figure 7 presents the results for the contribution of uncertainty shocks alone, while the right panel shows the joint contribution of uncertainty and expectation changes. We estimate alternative VARs with one of the following items changed: 6 instead of 4 lags, news horizons of 8, 10, and 12 quarters, investment instead of the 12 quarter ahead news variable, and a linear trend in the VAR. One may also be concerned with the ordering of the variables in the VAR, so we change this as well by ordering the shocks last. We also conduct a check where we replace economic policy uncertainty by a Jurado *et al.* (2015)-style proxy of general macroeconomic uncertainty (available only up until 2017Q2), computed for the UK by Redl (2017). We also exclude either inflation or the exchange rate, order the exchange rate first instead of last and consider the real instead of the nominal exchange rate. The last check we conduct is the dummy EVAR specification described in footnote 30.

Overall, as Figure 7 shows, these changes do not fundamentally change our conclusion that uncertainty can explain at most half of the doppelganger gap and that negative expectations about the future are a major driver of the gap.

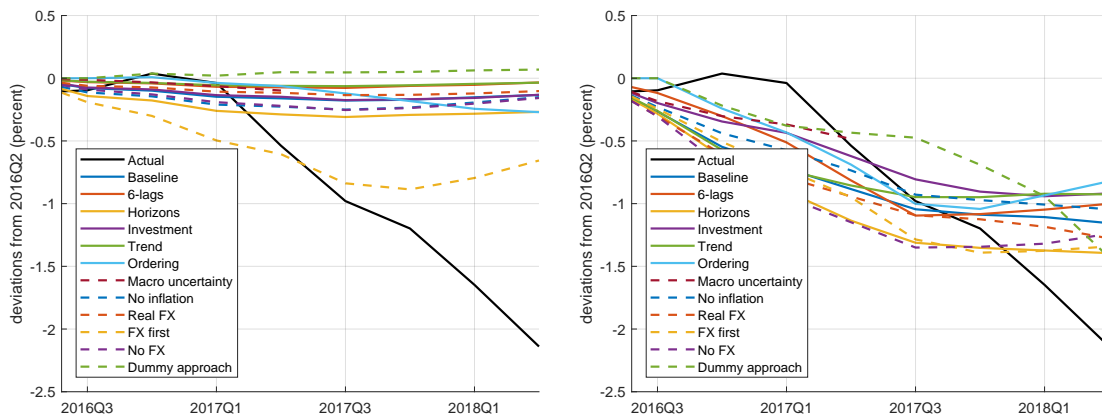


Figure 7: VAR results: robustness. *Note:* doppelganger gaps (difference between doppelganger and data) when uncertainty shock in 2016Q3 is switched off (left panel) and when both uncertainty shock and news shocks in 2016Q3 are switched off (right panel) for alternative specifications.

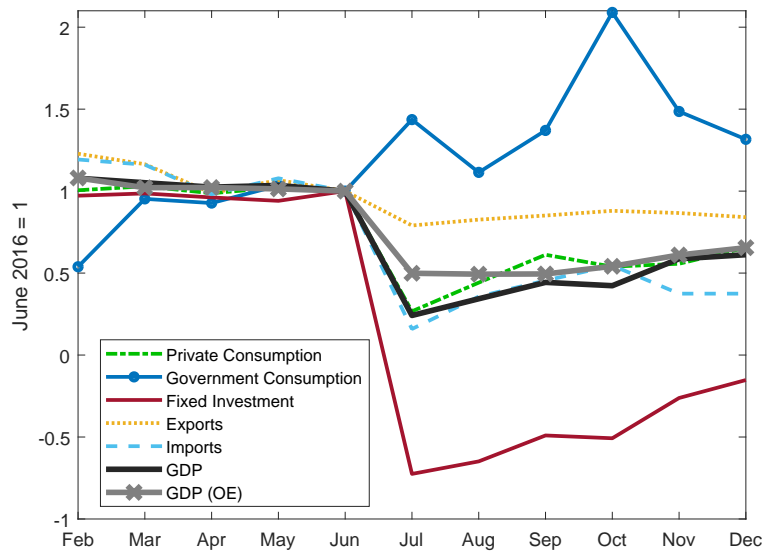


Figure 8: Expectations around the Brexit vote. *Note:* Averages of professional forecasts of 2017 GDP growth and its components published during the months of 2016.

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