The Costs of Economic Nationalism: Evidence from the Brexit Experiment

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BREXIT: Consequences and Challenges
Tübingen, October 26, 2018
The issue

Economic nationalism on the rise, seeks to undo/limit

- International economic integration
- Rule-bound economic order $\rightarrow$ increased policy uncertainty
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Can we measure the economic costs of economic nationalism?

- Identification problem: economic crises may foster economic nationalism
- Structural modelling requires (controversial) assumptions
The issue

Economic nationalism on the rise, seeks to undo/limit

- International economic integration
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This paper

- Exploit a unique natural experiment to address question
Natural experiments are “...historical episodes that provide observable, quasi-random variation in treatment subject to a plausible identifying assumption.”

Here “natural” indicates “a researcher did not consciously design the episode to be analyzed, but can nevertheless use it to learn about causal relationships.”

- Different, but close to controlled experiments, “the holy grail of empirical science” (Nakamura and Steinsson 2018)
Brexit referendum

| Referendum on the United Kingdom's membership of the European Union |
| Vote only once by putting a cross \( \times \) in the box next to your choice |
| Should the United Kingdom remain a member of the European Union or leave the European Union? |
| Remain a member of the European Union |
| Leave the European Union |
On June 23, 2016 “Leave” wins against all odds

Source: BETdata
Interest for “Brexit Leave” only spiked after referendum

Source: Google Trends
Brexit vote as a natural experiment

Crucial aspects

1. Largely unanticipated

2. Orthogonal to macroeconomic performance ("take back control")
Brexit vote as a natural experiment

Crucial aspects

1. Largely unanticipated

2. Orthogonal to macroeconomic performance ("take back control")

Concerns the entire economy: different from typical natural experiment exploited in macroeconomics

- E.g. reaction of household consumption to expected income change (Parker et al. 2013)
- Assessment of macro implications requires structural model (Nakamura and Steinsson 2018)
Our analysis: the first step

Measure effect of Brexit vote on output

- Compare actual GDP development 2016Q3–2018Q2 to *doppelganger* (counterfactual)

- *Doppelganger gap*: actual output in UK minus output of doppelganger

- Identification assumption: that UK received treatment (rather than its doppelganger) entirely random

Results

- 2018Q2: UK GDP 2% lower than doppelganger GDP
  → cumulative loss of about 36 billion pounds

- By 2019Q4: forecasted gap of -3.4% of GDP
Our analysis: the second step

UK still in EU, no Brexit yet

- Effects temporary due to heightened policy uncertainty?
- Use expectations augmented VAR to distinguish uncertainty effects and anticipation effects (long-run)

Result

- Overall effect similar what we find in first step
- Uncertainty explains about a quarter of gap
- Anticipation effects main driver of doppelganger gap
Literature

Brexit

- Prior to referendum: Many model simulations surveyed by Sampson (2017)
- Effect of referendum: Breinlich et al. (2017), Berg et al. (2017), Ramiah et al. (2016)

Policy uncertainty

- Baker et al. (2016), Born and Pfeifer (2014), Fernández-Villaverde et al. (2015), Mumtaz and Surico (2018), and many more

Anticipation effects

The first step: the output costs of the Brexit vote

Construct counterfactual on the basis of synthetic control methods (Abadie and Gardeazabal 2003; Abadie et al. 2010, 2015)

- Construct *doppelganger* as *weighted* average of OECD countries: same GDP path as UK prior to referendum

Identifying assumption

- Given fundamentals, UK and doppelganger equally likely to receive “treatment”
- Plausible because Brexit vote is natural experiment (unanticipated and orthogonal to GDP path)
Constructing the doppelganger

“Donor pool”

• 30 OECD countries, 1995Q1–2016Q2, real GDP

Doppelganger weighted average of donor countries

\[
\min_W (X_1 - X_0 W)' V (X_1 - X_0 W)
\]

• \(X_1\): vector of observations UK real GDP
• \(X_0\): matrix of real GDP observations for donor countries
• \(W\): vector of non-negative weights \(w_j\) with \(\sum_{j=2}^{31} w_j = 1\)
• \(V\): symmetric and positive semidefinite matrix
Doppelganger tracks UK real GDP closely

→ shaded area: one standard deviation of pre-treatment gap
## Composition of doppelganger

<table>
<thead>
<tr>
<th>Country</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Austria</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Belgium</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Canada</td>
<td>0.16</td>
</tr>
<tr>
<td>Chile</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Denmark</td>
<td>0.02</td>
</tr>
<tr>
<td>Estonia</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Finland</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>France</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Germany</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Greece</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Hungary</td>
<td>0.21</td>
</tr>
<tr>
<td>Iceland</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Ireland</td>
<td>0.05</td>
</tr>
<tr>
<td>Israel</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Italy</td>
<td>0.04</td>
</tr>
<tr>
<td>Japan</td>
<td>0.20</td>
</tr>
<tr>
<td>Korea</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Netherlands</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>New Zealand</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Norway</td>
<td>0.12</td>
</tr>
<tr>
<td>Portugal</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Slovenia</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Spain</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Sweden</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Switzerland</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>United States</td>
<td>0.20</td>
</tr>
</tbody>
</table>
Non-targeted variables also close to UK variables

- **Investment**
  - UK
  - Doppelganger

- **Consumption**

- **Exports**

- **Imports**
The result: GDP in UK and doppelganger

Brexit Vote

deviation from 2016Q2 (percent)

2015Q1 2016Q1 2017Q1 2018Q1 2019Q1

-4 -2 0 2 4 6 8 10

Introduction Output Effects Placebo tests et al Gap Decomposition Mechanism Conclusion

15/39
From bad to worse: data in May 2018 vs November 2017

Brexit Vote

2015Q1 2016Q1 2017Q1 2018Q1 2019Q1

-4 -2 0 2 4 6 8 10 deviation from 2016Q2 (percent)

Introduction  Output Effects  Placebo tests et al  Gap Decomposition  Mechanism  Conclusion
First step: summary

Output effect of the Brexit vote

- Hardly any effect throughout second half of 2016
- Since 2017Q1: UK on different growth trajectory relative to doppelganger
  - 2018Q2: doppelganger gap at about $-2.0\%$ of GDP
  - Current forecasts: doppelganger gap $-3.4\%$ in 2019Q4

Andrews (2003) end-of-sample instability test

- Doppelganger gap statistically significant at 1% level
Placebo tests

Time placebo

- Shift the treatment date artificially backward in time: consider all quarters from 2013Q2 to 2016Q1
- Construct new doppelgangers (just like in baseline)

Country placebo

- Estimate synthetic controls for each donor pool country
- Treatment at the end of 2016Q2
Result of time placebo

![Graph showing deviation from 2016Q2 (percent) with Brexit Vote in 2016Q1. The graph includes lines for UK, Doppelganger, and Time placebos. The X-axis represents the quarters from 2015Q1 to 2019Q1, and the Y-axis represents the deviation from 2016Q2.](image)

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**Introduction**  
**Output Effects**  
**Placebo tests et al**  
**Gap Decomposition**  
**Mechanism**  
**Conclusion**
Result of country placebo

<table>
<thead>
<tr>
<th>Year</th>
<th>UK</th>
<th>Donor pool countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015Q1</td>
<td>-6</td>
<td></td>
</tr>
<tr>
<td>2016Q1</td>
<td>-5</td>
<td></td>
</tr>
<tr>
<td>2017Q1</td>
<td>-4</td>
<td></td>
</tr>
<tr>
<td>2018Q1</td>
<td>-3</td>
<td></td>
</tr>
<tr>
<td>2019Q1</td>
<td>-2</td>
<td></td>
</tr>
</tbody>
</table>

Brexit Vote

standardized Doppelganger gaps

UK
Donor pool countries

Introduction  Output Effects  Placebo tests et al  Gap Decomposition  Mechanism  Conclusion
Country placebo: relative pre- and post-treatment fit

Alternative way of quantifying country placebo results

- Compare pre- and post-treatment fit

Relative root mean squared prediction error (RMSPE):

\[
\text{relative } RMSPE = \frac{RMSPE_{\text{post}}}{RMSPE_{\text{pre}}}
\]

where

\[
RMSPE_{\text{pre}} = \sqrt{\frac{1}{T_0 - 1} \sum_{t=1}^{T_0-1} (X_{1,t} - X_{0,t}W)^2}
\]

\[
RMSPE_{\text{post}} = \sqrt{\frac{1}{T - T_0 - 1} \sum_{t=T_0}^{T} (X_{1,t} - X_{0,t}W - X_{1,T_0} + X_{0,T_0}W)^2}
\]
• Max. absolute prediction error (MAPE) looks similar
Doppelganger and GDP forecasts prior to the Brexit vote

Brexit Vote
2015Q1 2016Q1 2017Q1 2018Q1 2019Q1
-4 -2 0 2 4 6 8 10 deviation from 2016Q2 (percent)

UK
Doppelganger
OECD forecast: June 2016
BoE forecast: May 2016
Effect of individual donor countries

Iteratively re-estimate our baseline model with one after the other non-zero-weight donor country omitted
Which components of GDP drive doppelganger gap?

Counterfactual based on expenditure shares of 2016Q2

Introduction

Output Effects

Placebo tests et al

Gap Decomposition

Mechanism

Conclusion
Consumption dominates investment contribution

<table>
<thead>
<tr>
<th>Brexit Vote</th>
<th>2017Q1</th>
<th>2018Q1</th>
<th>2019Q1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption contribution</td>
<td>-3.5</td>
<td>-3</td>
<td>-2.5</td>
</tr>
<tr>
<td>Investment contribution</td>
<td>-3</td>
<td>-2</td>
<td>-1.5</td>
</tr>
<tr>
<td>Doppelganger gap</td>
<td>-3</td>
<td>-2</td>
<td>-1</td>
</tr>
</tbody>
</table>

deviation from 2016Q2 (percent)

Introduction | Output Effects | Placebo tests et al | Gap Decomposition | Mechanism | Conclusion

26/39
Drop in consumer confidence after referendum

Source: OECD
Business confidence: effect varies across sectors

Source: OECD
Inspecting the mechanism

Effect of referendum on GDP sizeable, even though no Brexit yet
- Referendum triggered change in expectations

Dispersion: heightened policy uncertainty
- Details of Brexit still unclear
- Uncertainty effects detrimental to economic activity

Level: anticipation effects
- Less economic integration due to actual Brexit: reduced gains from trade
- Lower living standards in the long run: reduced consumption today per anticipation effect
Economic policy uncertainty around the Brexit vote

Source: http://www.policyuncertainty.com/
Expectations around the Brexit vote

Monthly change of cumulative GDP growth forecast by *Oxford Economics*

![Graph showing monthly change of cumulative GDP growth forecast](graph.png)

- **Introduction**
- **Output Effects**
- **Placebo tests et al**
- **Gap Decomposition**
- **Mechanism**
- **Conclusion**
Define news:

\[ \text{news}_{t+h,t} \equiv x_{t+h,t} - x_{t+h,t-1} \]

- \( x_{t+h,t} \): \( h \)-quarter ahead output growth forecast in period \( t \)
- \( x_{t+h,t-1} \): forecast for same period made one quarter before

Include in conventional VAR model

- VARs have difficulties to deal with foresight
  (Fernández-Villaverde et al. 2007; Leeper et al. 2013; Lippi and Reichlin 1994)
Expectations-augmented VAR (Perotti 2014)

Vector of endogenous variables

\[ Y_t = \begin{bmatrix} EPU_t & \text{news}_{t+h_1,t} & \text{news}_{t+h_2,t} & \text{news}_{t+h_3,t} & r_t & y_t \end{bmatrix} \]

Reduced-form model

\[ Y_t = c + A(L)Y_{t-1} + \nu_t, \]

- \( \nu_t \sim (0, \Omega) \): vector of white noise errors
- \( A(L) \): lag polynomial of order 4
- News horizon: \( h_1 = 8, \ h_2 = 12 \) and \( h_3 = 16 \) (quarters)
- Sample: 1997Q1–2018Q2
Identify impact effect of uncertainty and news shocks via recursive scheme

- Choleski decomposition of $\Omega$: uncertainty shocks impact other variables contemporaneously (but not vice versa)
- Allows uncertainty shocks to play the largest possible role
- Common approach in the literature on uncertainty shocks (relax this assumption in the robustness checks)

No structural interpretation of other shocks in the model
VAR-based counterfactual

Brexit as natural experiment caused policy uncertainty and downward revision of expectations

- By construction: all six shocks together generate endogenous variables that exactly track the data
- Switch off uncertainty and news shocks in 2016Q3
- Compute counterfactual GDP path to quantify effect of uncertainty and anticipation channel
Contribution of uncertainty and anticipation

Brexit Vote

2016Q1  2016Q3  2017Q1  2017Q3  2018Q1

-1  0  1  2  3  4  5  6
deviations from 2016Q2 (percent)

Actual  No uncertainty  No uncertainty & anticipation  Doppelganger

Graph showing deviations from 2016Q2 (percent) for different scenarios: Actual, No uncertainty, No uncertainty & anticipation, and Doppelganger.
VAR robustness: uncertainty

The graph shows the deviations from 2016Q2 (percent) for various economic indicators. The x-axis represents the quarters from 2016Q3 to 2017Q3, while the y-axis represents the deviations from 2016Q2 in percent.

The following indicators are depicted:
- Actual
- Baseline
- 2-lags
- Horizons
- Investment
- Trend
- Ordering
- Macro uncertainty
- Inflation
- Real FX
- Dummy identification

The graph illustrates the changes over time and the impact of different variables on economic indicators.
VAR robustness: uncertainty and anticipation
Conclusion

Initial observation: Brexit vote natural experiment

- Outcome surprising and unrelated to macroeconomic performance
- Allows us to measure the output costs of economic nationalism

Results

- Doppelganger gap by 2018Q2: -2.0%
- Cumulative loss of about 36 billion pounds
- Uncertainty effects explain at most one quarter, and less towards end of sample
- Gap reflects anticipated long-run effect
Country placebo: RMSPE full sample

United Kingdom  Slovenia  Austria  Norway  Sweden  Hungary  Iceland  France  Germany  Czech Republic  United States  Spain  Denmark  Finland  Israel  Luxembourg  Norway  Chile  Canada  Slovak Republic  Korea  Ireland  Estonia  Japan  Australia  Greece  New Zealand  Portugal  Italy
Country placebo: MAPE full sample

Postperiod MAPE / Preperiod MAPE

United Kingdom, Slovenia, Switzerland, Netherlands, Austria, Hungary, Belgium, Germany, Iceland, Sweden, Denmark, France, Spain, United States, Finland, Luxembourg, Czech Republic, Canada, Israel, Chile, Estonia, Norway, Japan, Slovak Republic, Ireland, Australia, Korea, New Zealand, Greece, Portugal, Italy.