

The Impact of Brexit Uncertainty on UK Firms

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Disclaimer: Any opinions and conclusions expressed herein are those of the author and do not necessarily represent the views of the Bank of England.

Brexit key dates

June 2016 52% voted leave. David Cameron resigns, succeeded by Theresa May

September 2018 EU rejects the “Chequers plan”, chance of “no deal” increases

Jan-Mar 2019 Withdrawal Agreement voted down three times by UK Parliament

Mar-Apr 2019 Date UK due to leave EU extended to 31 Oct

July 2019 Theresa May resigns, succeeded by Boris Johnson

31 Oct 2019 Date UK due to leave EU extended again to Jan 2020

31 Jan 2020 Britain leaves EU and enters transition period



In Aug 2016, a Bank-Nottingham-Stanford team started the Decision Maker Panel (DMP)

- Monthly 5-minute online survey
- Recruit randomly from population 42K firms with 10+ employees
- Panel 8K, ~ 3K firms respond per month, $\approx 14\%$ private employment



Key findings

- UK's decision to leave the EU has generated a large, broad and long-lasting increase in uncertainty
- Anticipation of Brexit is estimated to have gradually reduced investment by about 12% and employment by about 1% over the three years following the June 2016 vote
- Brexit process is estimated to have reduced UK productivity: both *within* and *between*-firm effect, partly linked to time/resources spent preparing for Brexit

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Brexit uncertainty

Impact of Brexit uncertainty

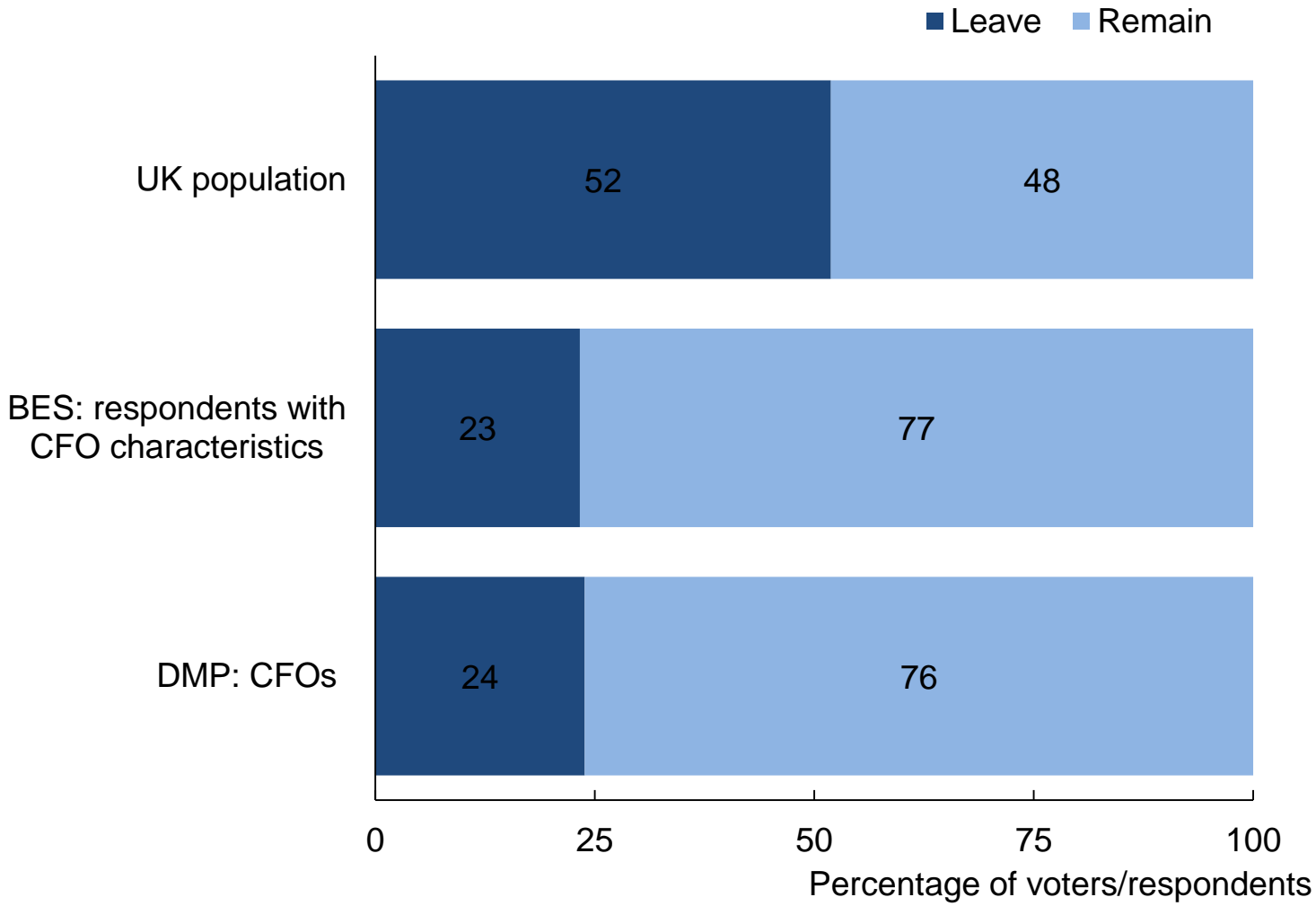
Survey response not significantly correlated with local Brexit vote share

Dependent Variable. Respond to a survey				
	(1)	(2)	(3)	(4)
Leave vote share	0.014 (0.012)	0.011 (0.012)	0.015 (0.012)	0.017 (0.012)
Employment (in logs)		0.015*** (0.001)	0.011*** (0.002)	0.010*** (0.002)
Sales (in logs)			0.005*** (0.001)	0.001 (0.002)
Assets (in logs)				0.004*** (0.001)
Observations	42,102	42,102	42,102	42,102
R-squared	0.063	0.067	0.067	0.067

Note: Linear probability model for whether a firm is in the sampling frame and has ever responded to a DMP survey between September 2016 and June 2019 (1=responded to DMP, 0=Not responded). Firm characteristics are from latest accounts data. 'Leave vote share' is the share of vote for leaving the EU in the local authority that a firm is headquartered in. Robust standard errors.

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

DMP members personal views on Brexit match CFO population



Source: Electoral Commission, British Election Study, Decision Maker Panel and authors’ calculations.

Notes: Personal views of DMP members at the time of the June 2016 referendum are taken from February to April 2018 surveys. Respondents who did not have a strong view either way (4 per cent) were excluded. The question asked respondents ‘Taking everything into account, how do you personally view the UK voting to leave the European Union at the time of referendum? Very positive; Somewhat positive; Neither positive nor negative; Somewhat negative; Very negative; Prefer not to state; Don't know’. British Election Study data are self-reported referendum votes. Respondents with CFO characteristics are defined as managers/professionals by work type with a degree and annual income of over £50,000.

Quick monthly internet survey – e.g. sales question



BANK OF ENGLAND



Decision Maker Panel (September 2018)

1.

In the second quarter of 2018 (April to June), what was the approximate sterling value of your **SALES REVENUE** (in £ THOUSANDS)?

Notes:


- a) Please reply to two significant figures (eg. 15 [thousand], 150 [thousand], 1500 [thousand]).*
- b) For businesses that finance themselves mainly from grants or donations, rather than sales, please provide figures from those sources instead.*
- c) Please include sales of UK-based businesses only and not from any overseas part of the group.*


£'000

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Quick monthly internet survey – e.g. expectations

 BANK OF ENGLAND



Decision Maker Panel (September 2018)

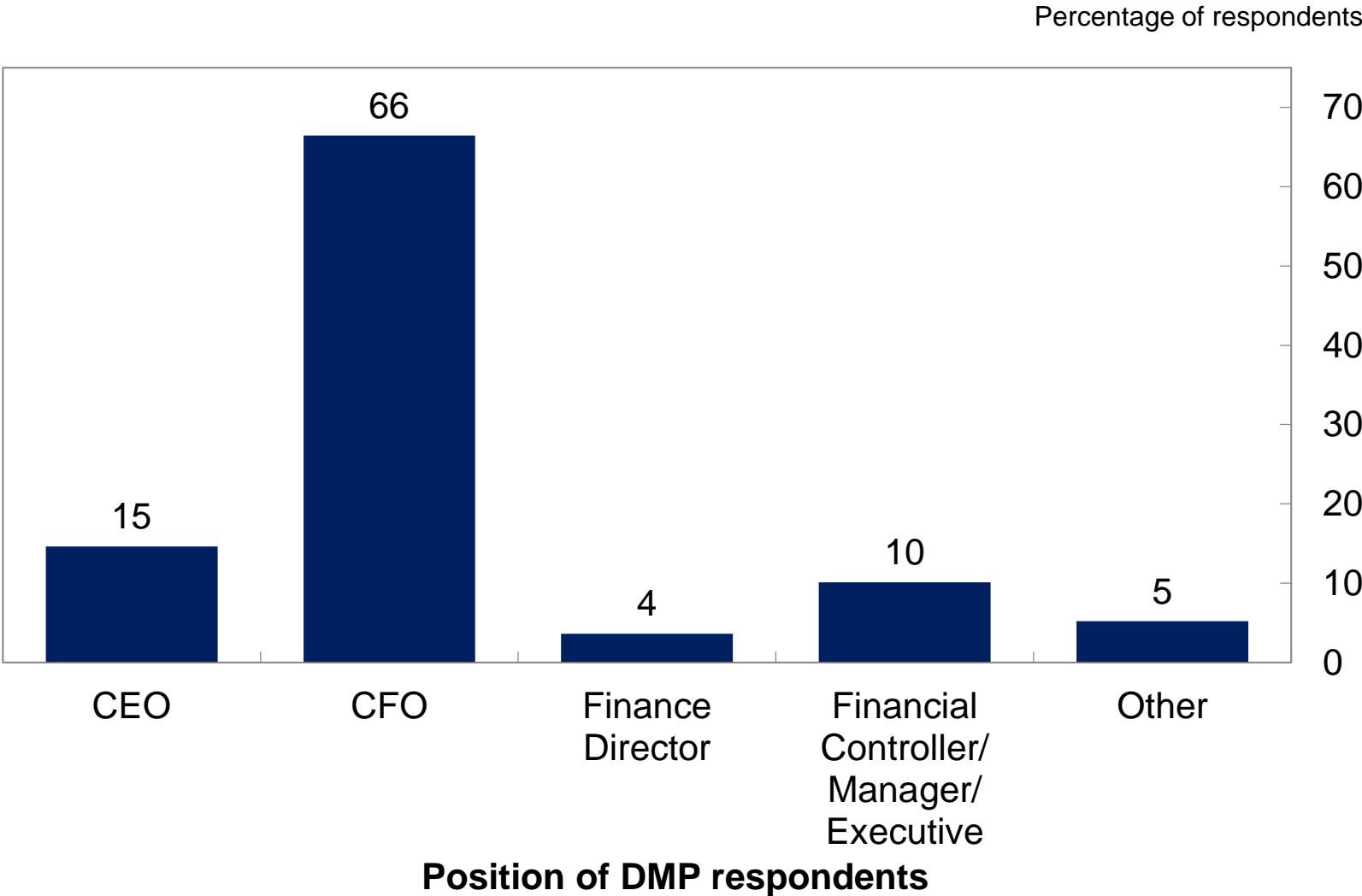
3. Looking a year ahead from the second quarter of 2018 to the second quarter of 2019, by what % amount do you expect your **SALES REVENUE** to have changed in each of the following scenarios?

The LOWEST % change in sales revenue would be about:	<input type="text" value="0.0 %"/>	
A LOW % change in sales revenue would be about:	<input type="text" value="3.0 %"/>	
A MIDDLE % change in sales revenue would be about:	<input type="text" value="5.0 %"/>	
A HIGH % change in sales revenue would be about:	<input type="text" value="7.0 %"/>	
The HIGHEST % change in sales revenue would be about:	<input type="text" value="10.0 %"/>	

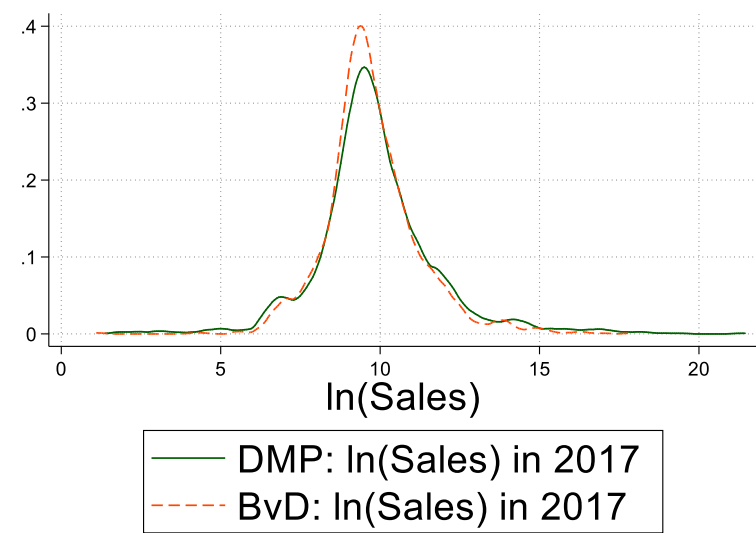
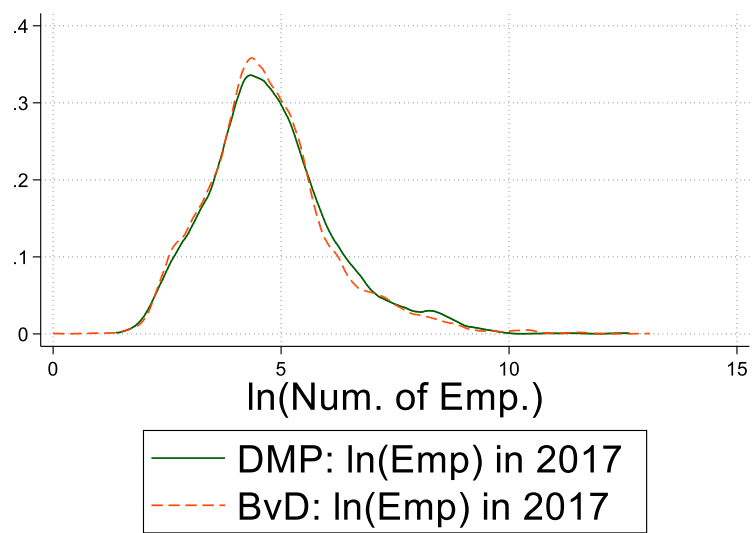
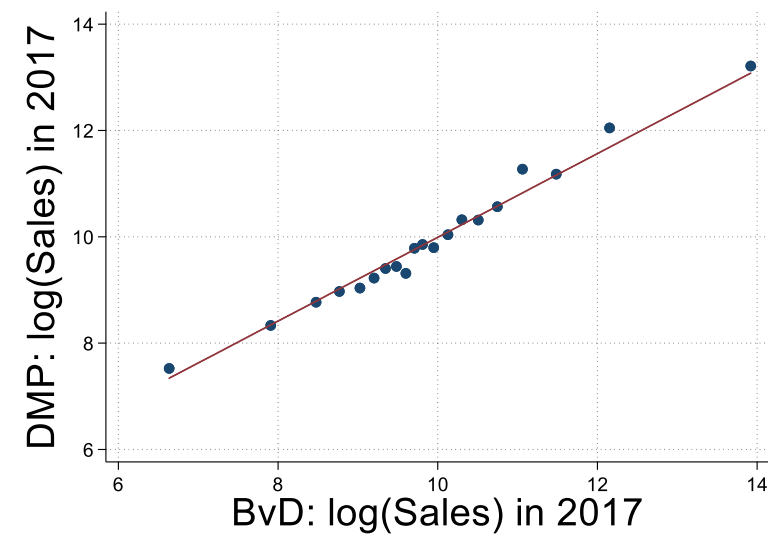
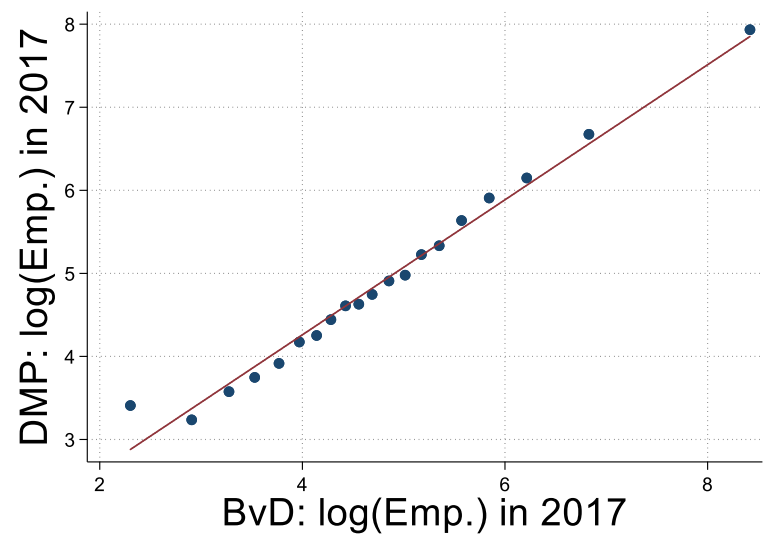
September 2018 – SALES AND PRICES

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81% respondents are CFO/CEOs

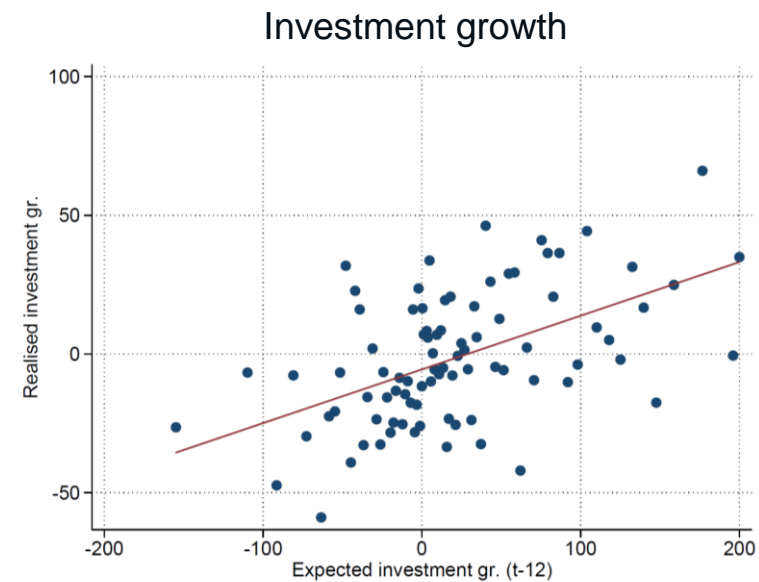
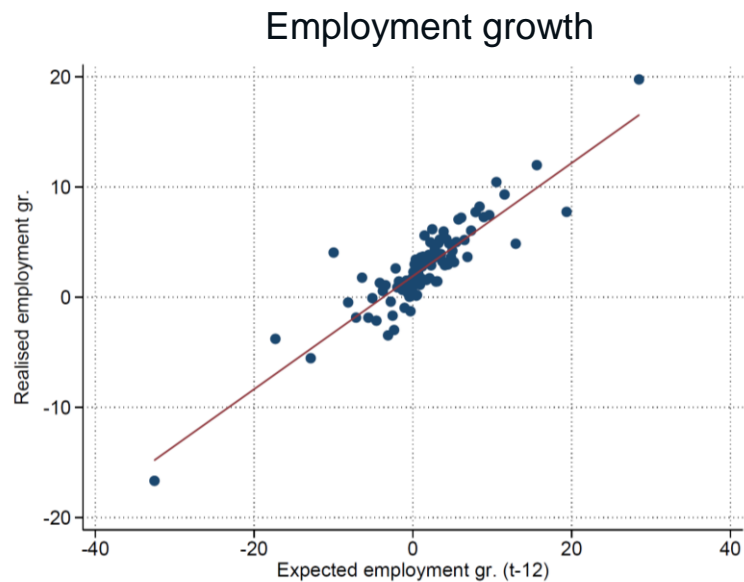
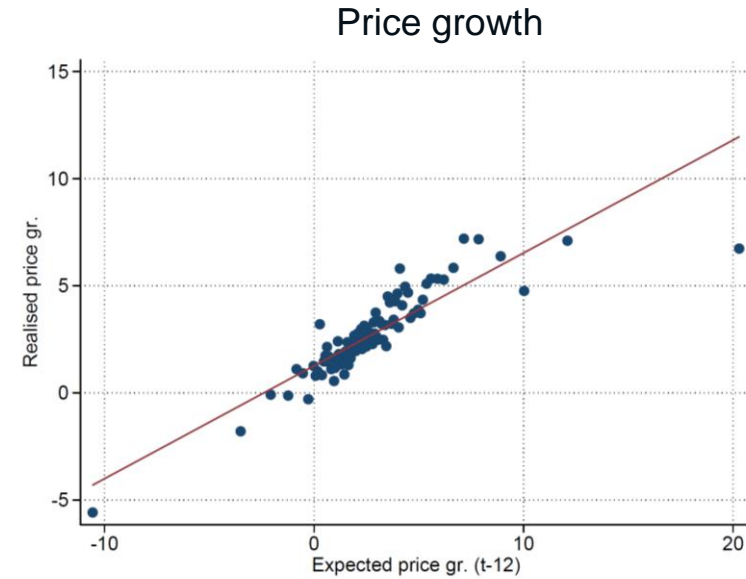
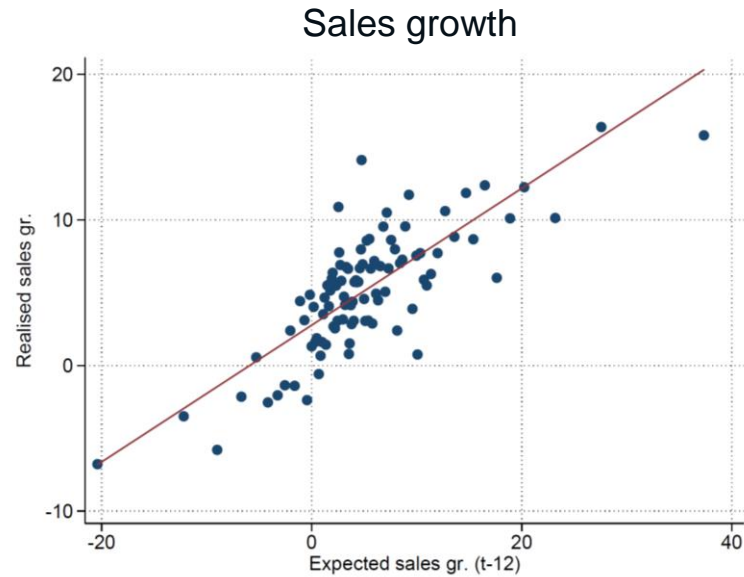


Matches accounts data



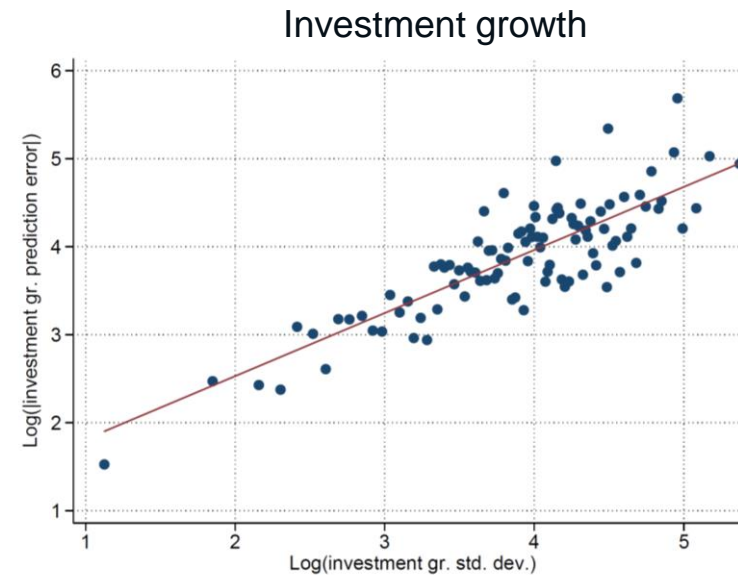
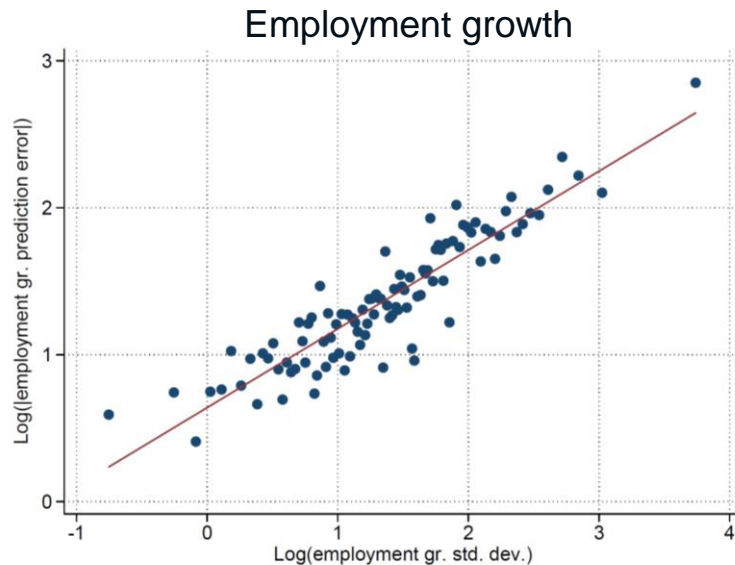
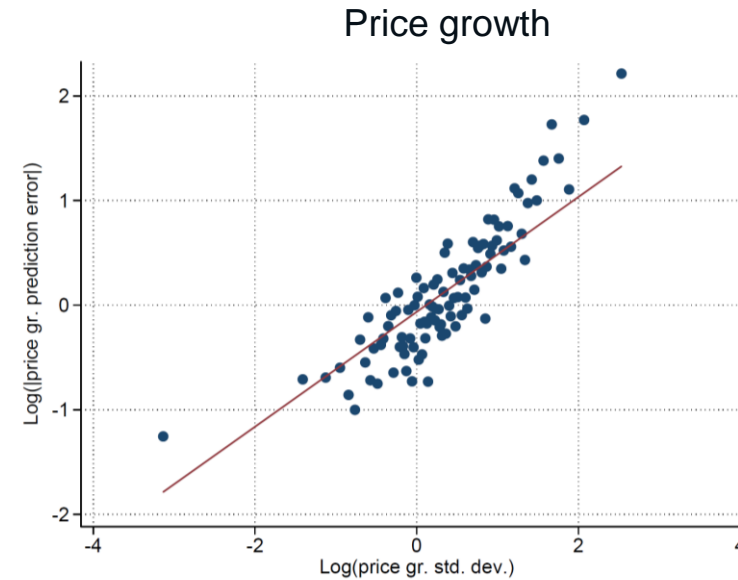
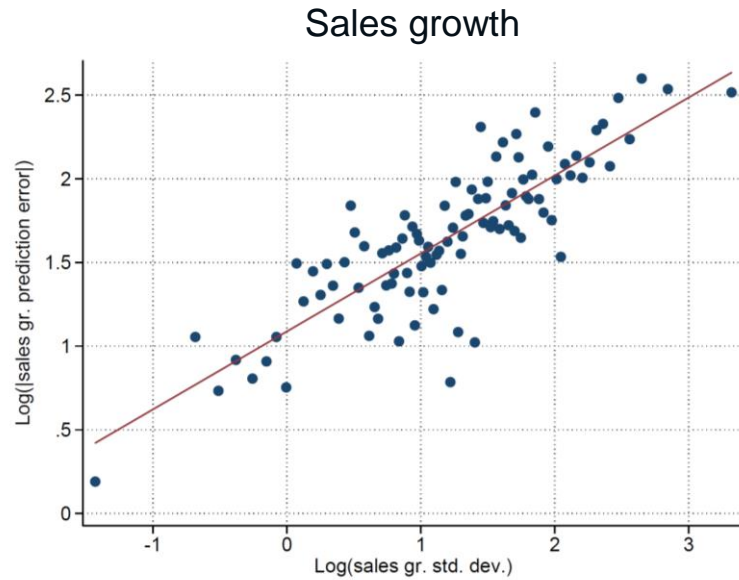
Source: Bureau van Dijk FAME dataset, Decision Maker Panel and authors' calculations.
Notes: Sales values from the DMP survey are based on annualised quarterly sales reported by businesses.

Forecasts matches realizations



Notes: Y-axes show realised growth in sales, prices, employment and investment. X-axes show expectations for year-ahead growth rates calculated from the 5-bin outcomes and probabilities. Forecasts made between September 2016 and June 2018. Binscatter plots which split responses into 100 groups according to expected sales/price/employment/investment growth.

Subjective uncertainty correlates with forecast errors



Notes: Y-axes show forecast errors defined as the absolute value of a forecast less realised growth over the following 12-month period. X-axes show subjective uncertainty around the year-ahead growth rates calculated from the 5-bin outcomes and probabilities. Forecasts made between September 2016 and June 2018. Binscatter plots which split responses into 100 groups according to the standard deviation of expected sales/price/employment/investment growth.

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Prolonged period of uncertainty

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UK MPs debate **eight** Brexit options

The House of Commons tries to find a way to break the political deadlock over leaving the EU.

🕒 19m | UK Politics | 💬 5552



- What Brexit options are MPs voting on?

- Kuenssberg: A strange mood

- What are indicative votes?

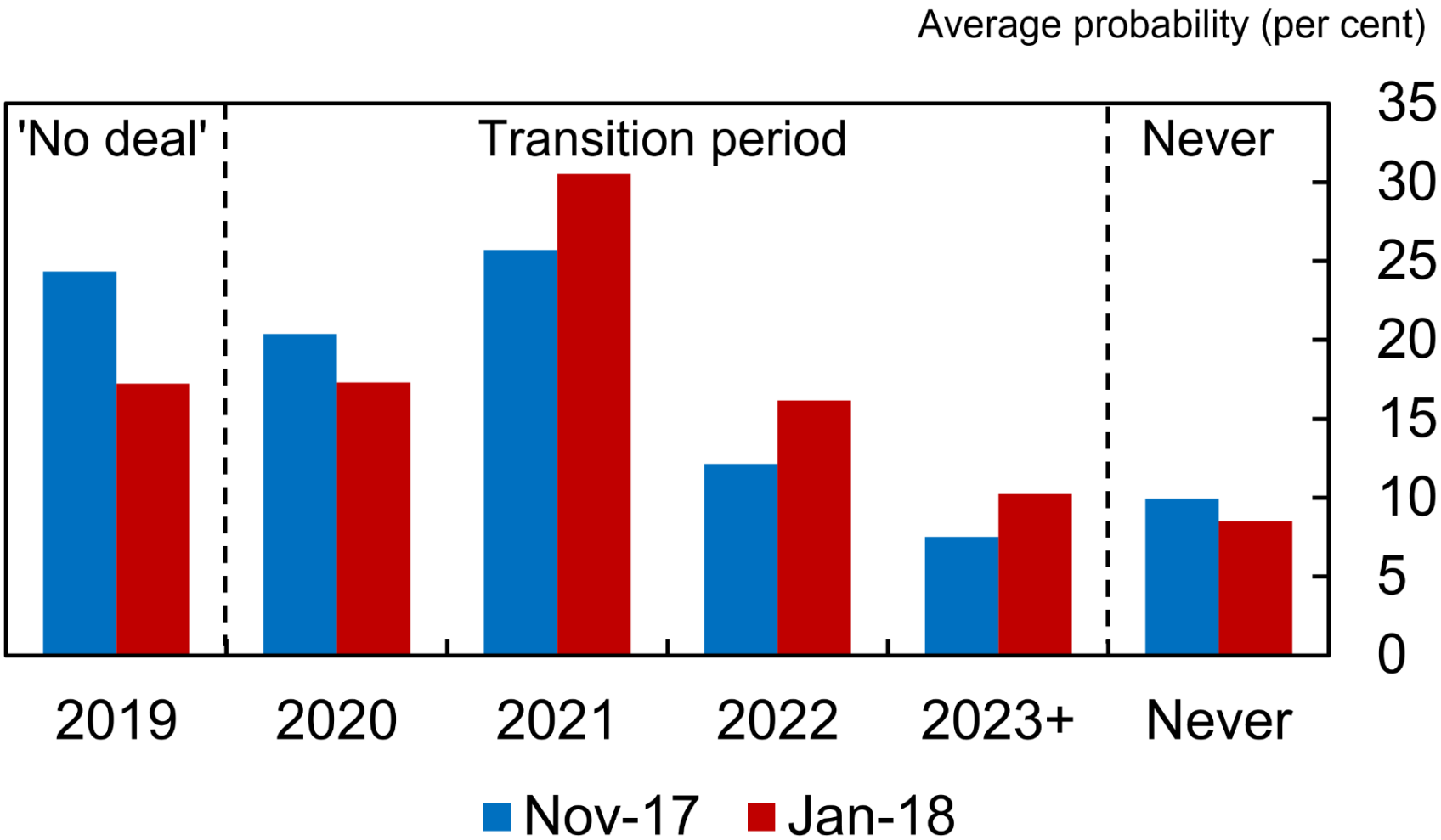
📍 **LIVE**

MPs debate way forward for Brexit

- **2m** Is today a bit like voting for Switzerland at Eurovision?
- **11m** This debate is 'really quite liberating' - Labour MP
- **14m** EU 'prepared' for no-deal Brexit

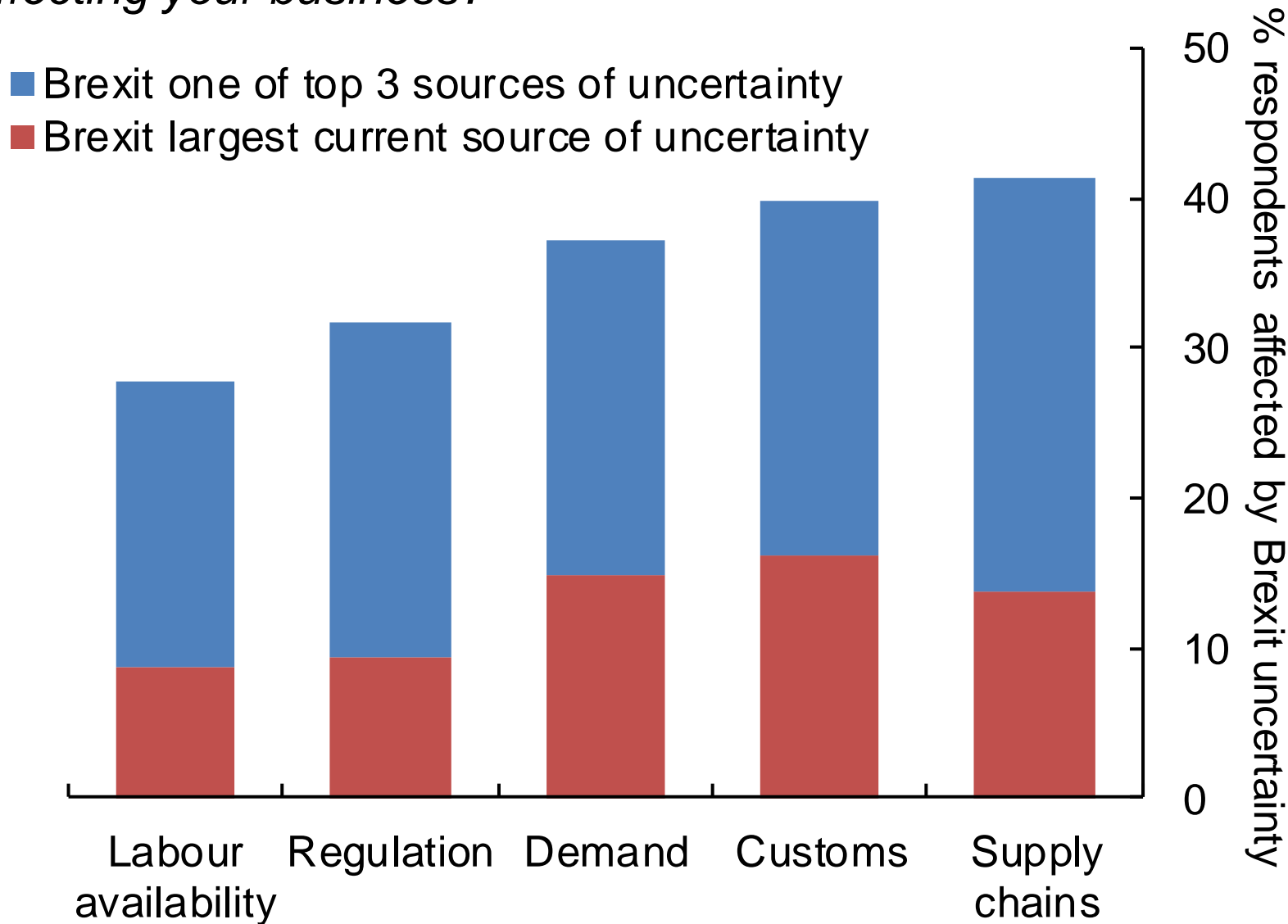
Uncertainty over when/if Brexit will happen

Question: “*When do you expect the UK to leave the EU?*”



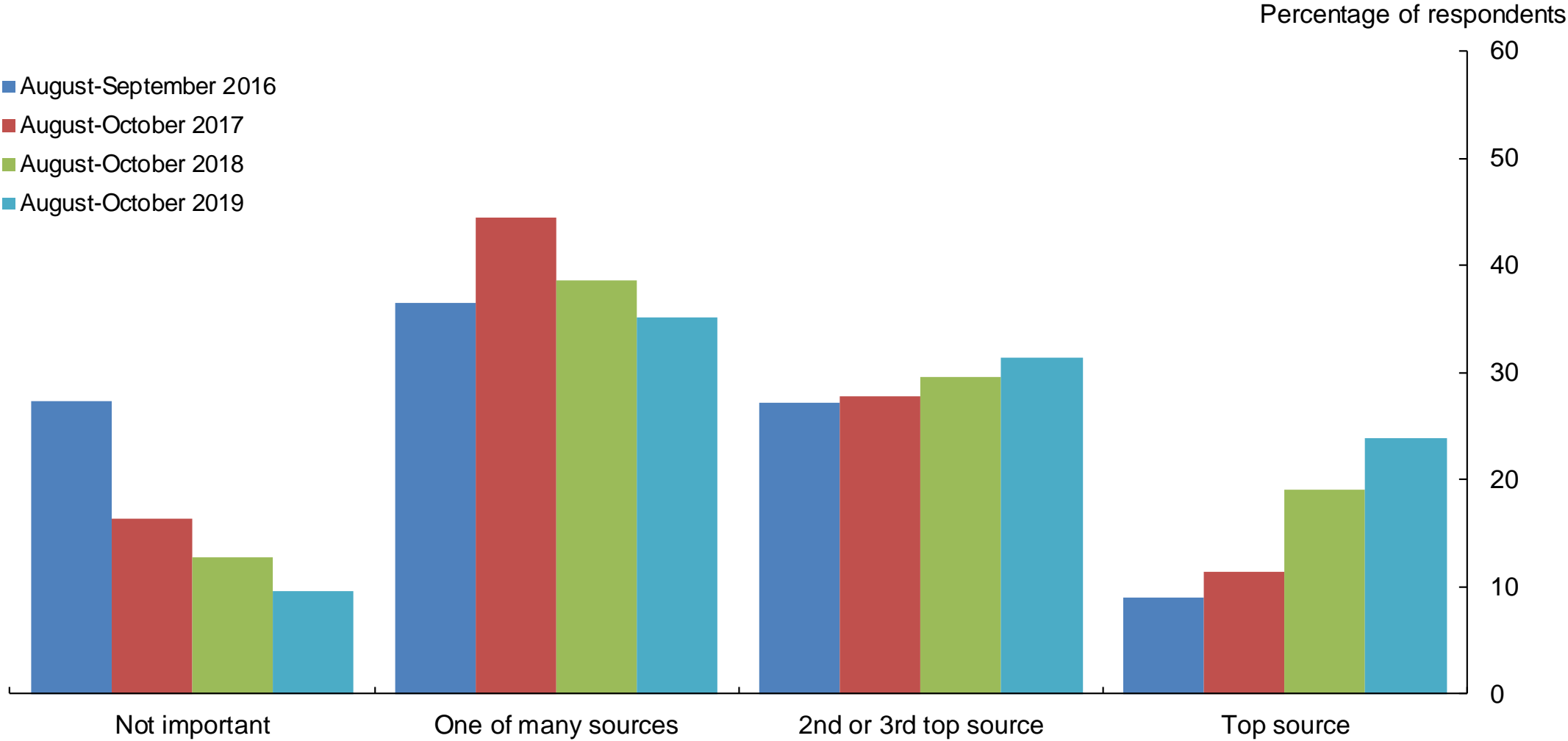
Uncertainty over the impact of Brexit

Question: “How much has the result of the EU-referendum impacted the level of uncertainty affecting your business?”

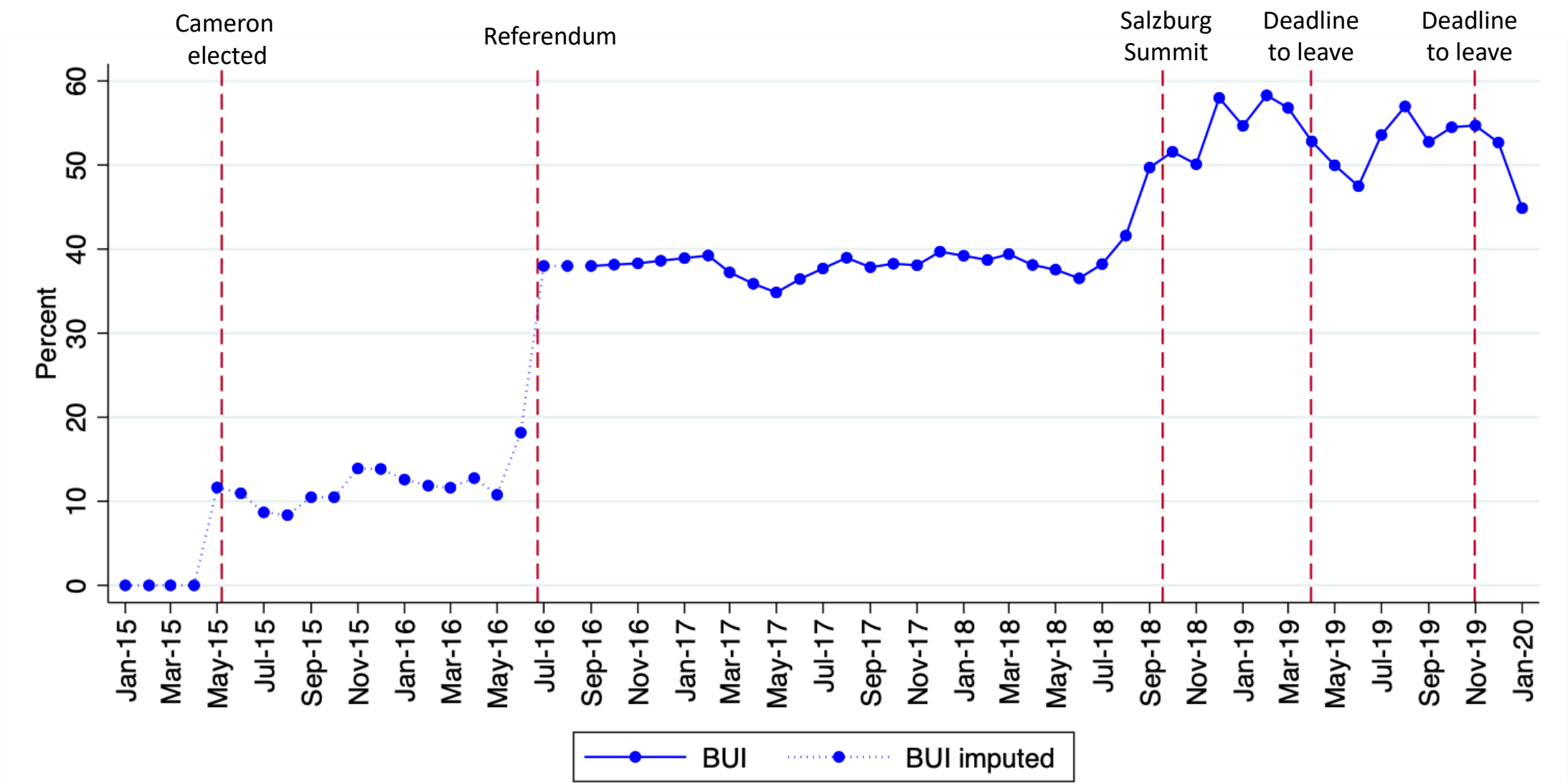


Overall uncertainty measure

Question: *How much has the result of the EU referendum affected the level of uncertainty affecting your business?*

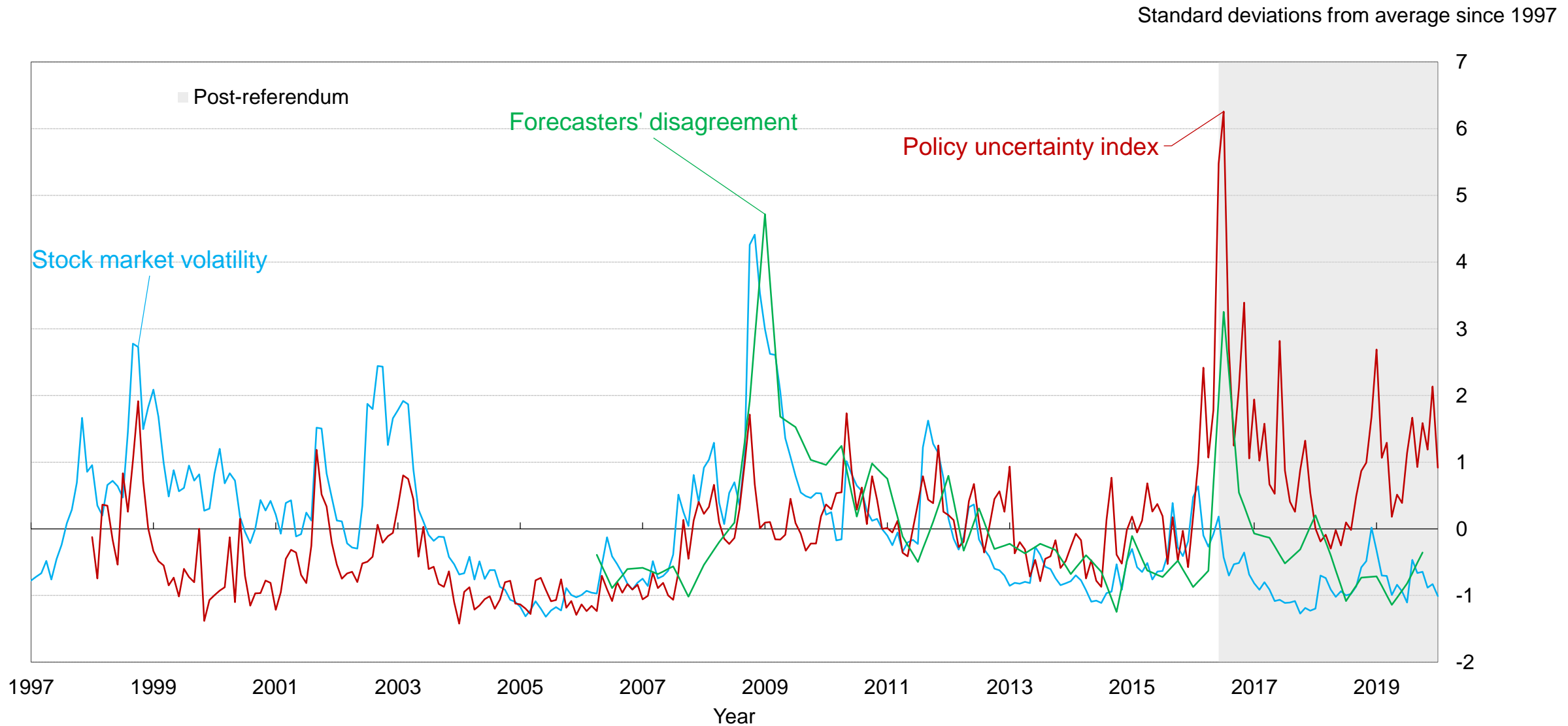


Brexit Uncertainty Index (BUI)– risen since summer 2018



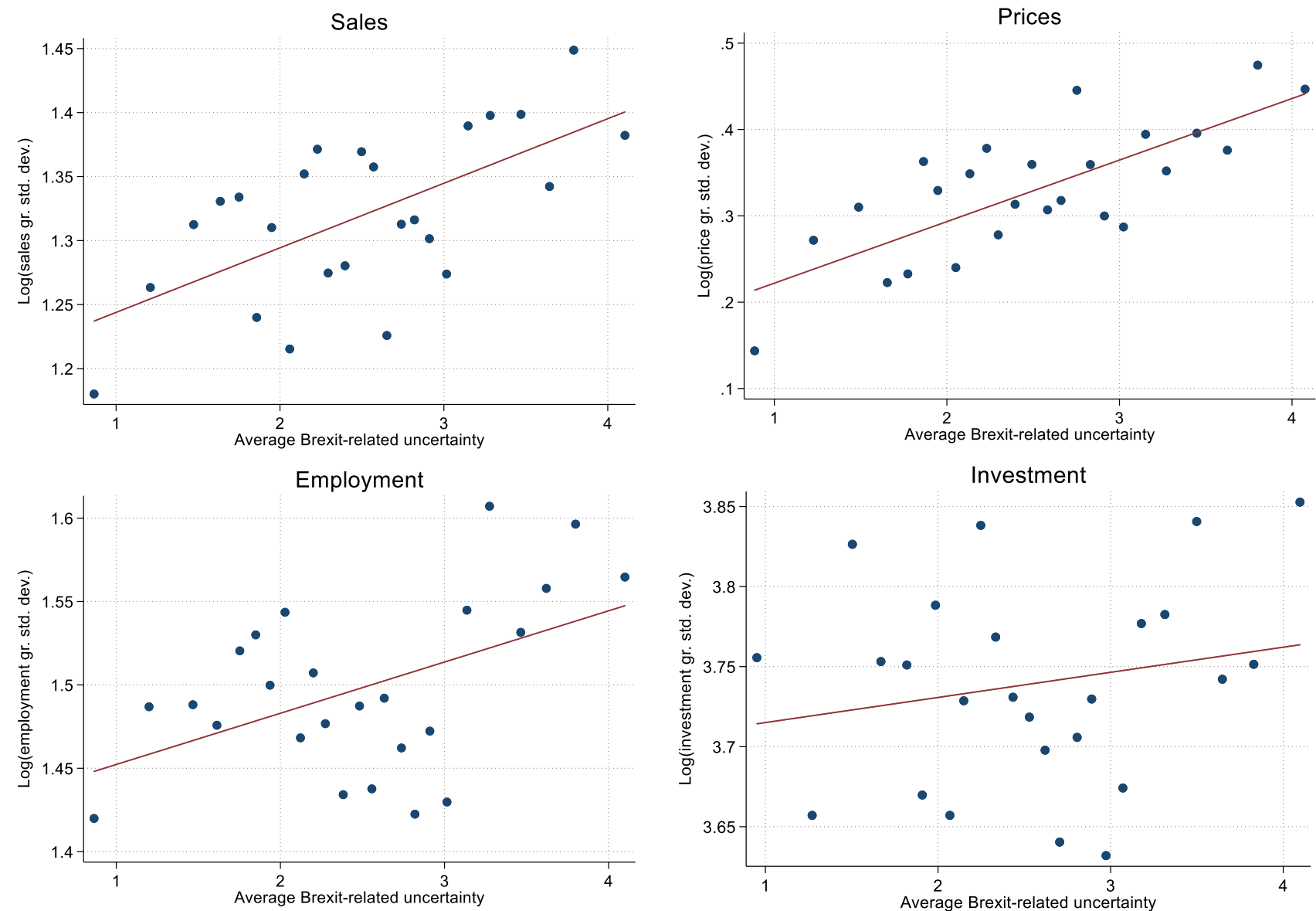
Notes: Shows the percentage of respondents who view Brexit as their “top” or “one of their top three” sources of uncertainty in response to the question ‘How much has the result of the EU referendum affected the level of uncertainty affecting your business?’. Values interpolated for months before August 2018 when the question was not asked. BUI prior to the referendum imputed using betting odds from oddschecker.

Pattern not seen in other measures of uncertainty



Source: Bank of England Survey of External Forecasters, Bloomberg, Baker, Bloom and Davis (2016) and authors' calculations. **Notes:** All indices normalized to mean 0 and standard deviation 1 since 1997 to fit on the same scale. Forecasters' disagreement defined as the standard deviation of point forecasts of one-year-ahead GDP growth predictions provided to the Bank of England by professional forecasters. Stock market volatility defined as three-month option implied volatility of the FTSE-All Share Index. Policy uncertainty index defined as in Baker, Bloom and Davis (2016) and is based on newspaper reports.

Brexit uncertainty significantly correlates with subjective uncertainty



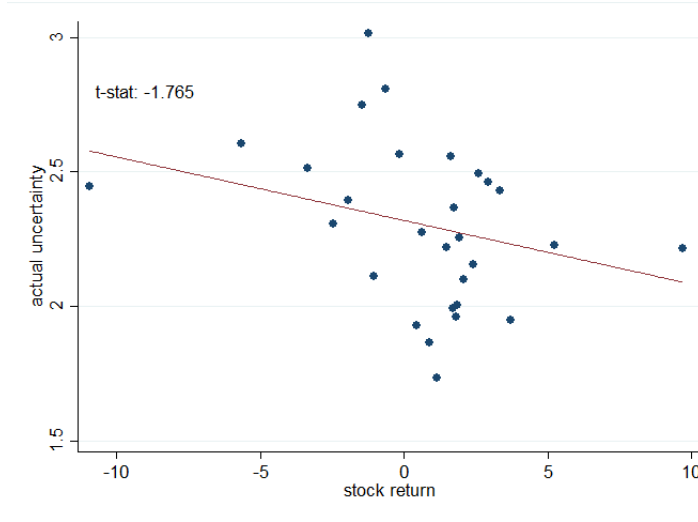
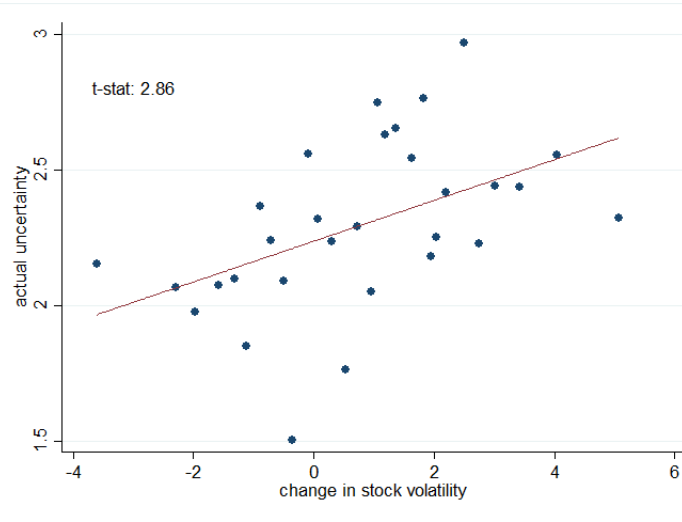
Notes: X-axes show average Brexit uncertainty on the 1 (not important) to 4 (largest source of uncertainty) scale based on responses to the question reported in the footnote to Figure 1. Y-axes show subjective uncertainty around the year-ahead growth rates calculated from the 5-bin outcomes and probabilities for each variable. Binscatter plots which split responses into 25 groups according to average Brexit uncertainty. Charts are based on data collected between September 2016 and June 2019.

Brexit uncertainty significantly correlates with stock market performance

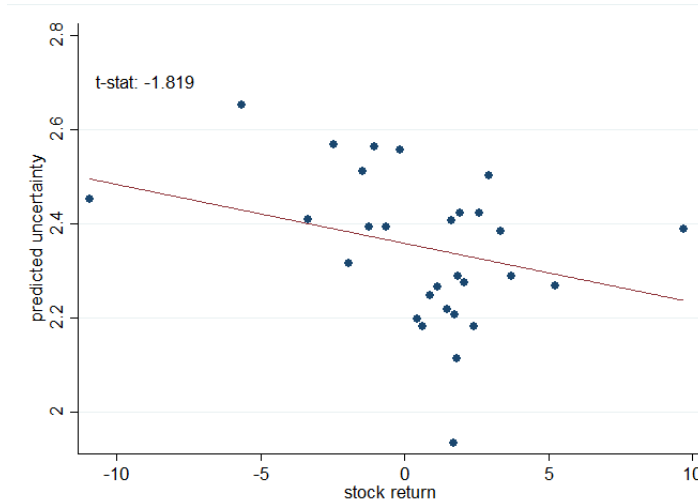
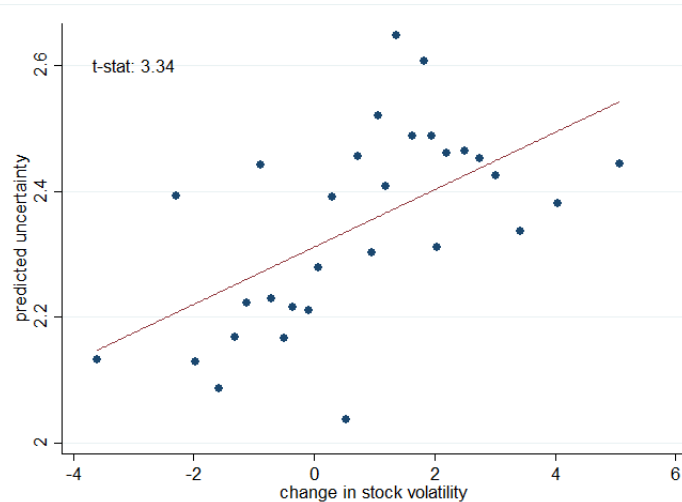
Change in stock volatility around vote

Stock return around the vote

Actual uncertainty



Predicted uncertainty



Note: change in stock volatility defined as the difference between the log of SD of daily stock return from the 30 days after the referendum to the same 30 days a year ago; stock return defined as the return from the average price of the 3 days after the referendum to the average price of the 30 days before the referendum. Stock price is residualized on sterling exchange rate before the above calculations.

Brexit uncertainty significantly correlates with stock market performance

Dependent variable:	Change in stock returns around referendum	Change in stock volatility around referendum	Brexit uncertainty		
	(1)	(2)	(3)	(4)	(5)
Brexit uncertainty	-0.614* (0.326)	0.457*** (0.139)			
Change in stock returns around referendum			-0.022* (0.012)		-0.020 (0.013)
Change in stock volatility around referendum				0.075*** (0.024)	0.073*** (0.025)
Observations	238	228	238	228	228
R-squared	0.014	0.034	0.014	0.034	0.045

Notes: Stock price data are from Compustat. DMP data for all other variables, except ownership which is from the Bureau Van Dijk FAME database. Sample is all public firms in the DMP who have responded to the Brexit uncertainty question and were actively trading in the 30 days before and after Brexit vote. Changes in stock returns around the referendum are calculated as the difference in the returns from the average price in the 30 days after the vote to the 30 days before the vote. Changes in stock volatility are calculated as the difference between the average standard deviation of daily stock returns in the 30 days after and the 30 days before the referendum. Instruments for Brexit exposure are “Share of sales exported to EU”, “Share of costs imported from EU”, “Share of migrant workers”, “Coverage of EU regulations” and “EU ownership” just before the referendum. Dummy variables are included for any firms with missing EU exposure data (coefficients not reported). All equations are estimated by OLS with robust standard errors. *** p<0.01, ** p<0.05, * p<0.1.

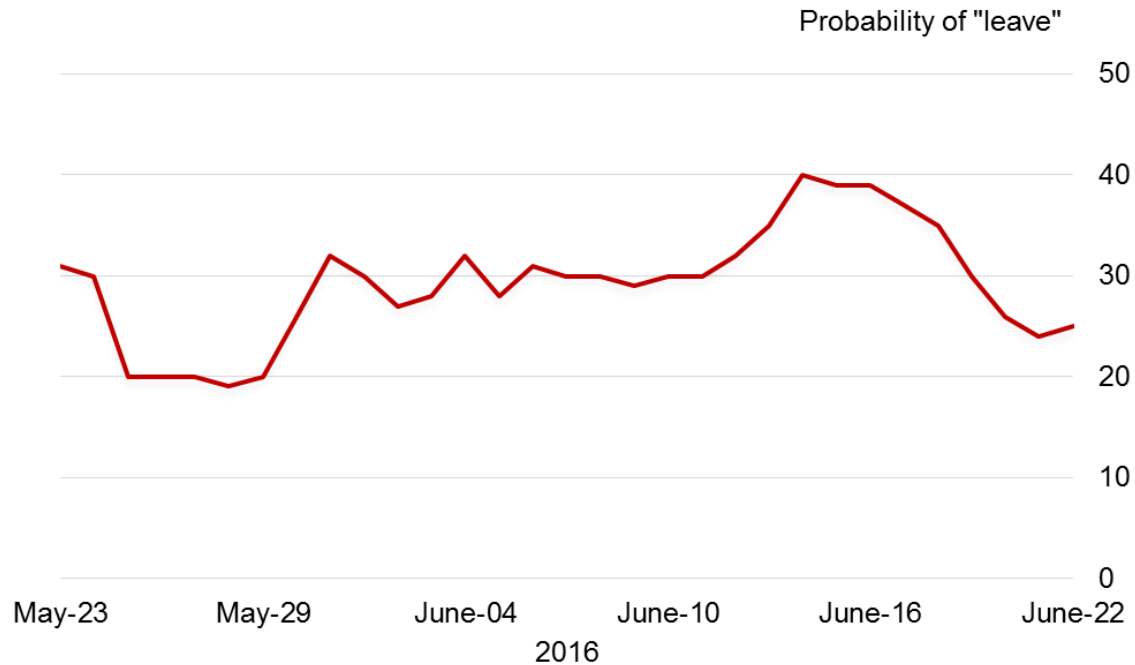
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Result of the referendum was unexpected - difference-in-difference strategy



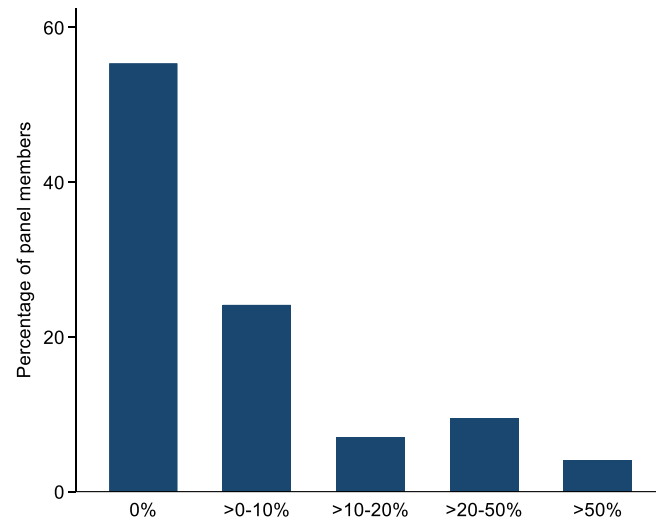
Source: oddschecker.com, University of Stirling Management School and Centre on Constitutional Change

$$Y_{it} = \beta E_i \times Post_t + f_i + m_t + e_{it}$$

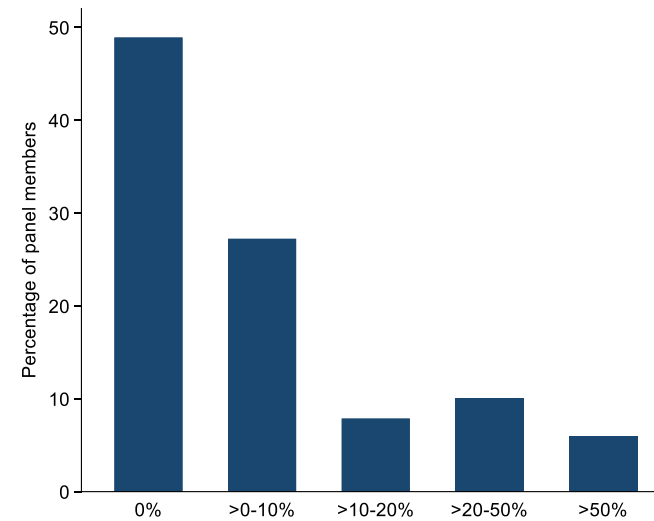
- DMP data for pre-referendum period; BvD company accounts data for post-referendum
- Y_{it} : outcome (investment, employment, etc.)
- E_i : Brexit exposure measure
- $Post_t$: post-referendum (i.e. 2016 Q3 onwards)
- f_i : firm fixed effect
- m_t : time fixed effect

Instruments: Exposure to the EU prior to the referendum

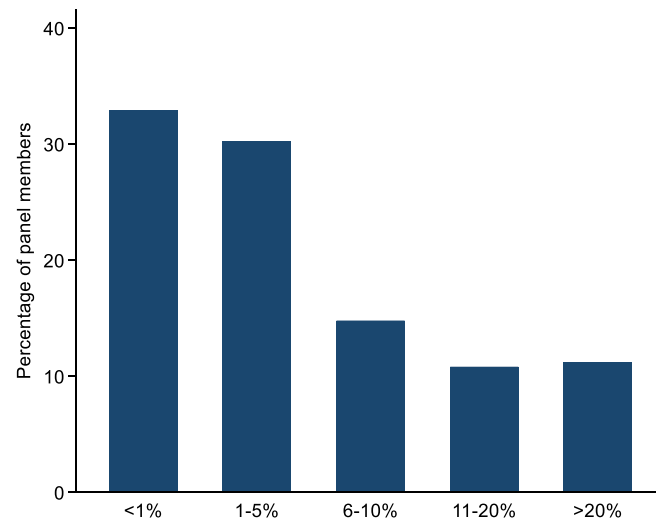
Percentage of sales that are exports to the EU



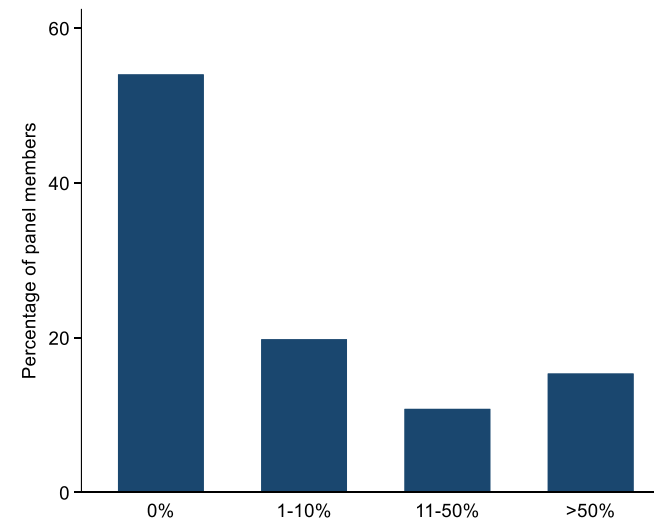
Percentage of costs that are imports from the EU



Percentage of workforce who are EU migrants



Percentage of sales covered by EU regulations



Source: Decision Maker Panel and authors' calculations. **Notes:** EU exposure measures are for 2016 H1, just before the Brexit referendum.

Brexit uncertainty strongly correlated with EU exposure

Dependent variable:	Brexit uncertainty (1-4 scale)						(0-1 scale)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Share of sales to EU	0.820*** (0.079)					0.334*** (0.084)	0.161*** (0.041)
Share of costs from EU imports		0.999*** (0.068)				0.474*** (0.073)	0.196*** (0.036)
Share of EU migrants in workforce			1.791*** (0.143)			1.293*** (0.150)	0.629*** (0.077)
Share of sales covered by EU regulation				0.835*** (0.053)		0.522*** (0.055)	0.248*** (0.028)
EU owned (dummy variable)					0.351*** (0.042)	0.153*** (0.044)	0.068*** (0.023)
3 digit industry dummies	No	No	No	No	No	Yes	Yes
Observations	5,870	5,870	5,870	5,870	5,870	5,870	5,870
R-squared	0.020	0.040	0.026	0.041	0.011	0.175	0.157

Notes: DMP data for all variables, except ownership which is from the Bureau Van Dijk FAME database. EU exposure measures are for 2016 H1, just before the Brexit referendum. Dependent variable is average uncertainty per firm in the three years after the referendum. Missing values for uncertainty in a given year are imputed from a regression using time and firm fixed effects. Dummy variables are included for any firms with missing EU exposure data (coefficients not reported). All equations are estimated by OLS with robust standard errors. *** p<0.01, ** p<0.05, * p<0.1.

Brexit estimated to have reduced investment by about 12% over 3 years

Dependent variable:	Investment growth					
All equations estimated 2011-2018	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	IV	OLS	OLS	OLS
Brexit uncertainty*all years post referendum	-2.821*** (0.862)		-8.154*** (2.928)		-2.337** (0.999)	
Brexit uncertainty*2016 dummy		-2.495* (1.294)				
Brexit uncertainty*2017 dummy		-2.540** (1.173)				
Brexit uncertainty*2018 dummy		-3.397*** (1.162)				
Expected eventual impact of Brexit on sales*all years post referendum				0.537*** (0.157)	0.315* (0.179)	
Expected eventual impact of Brexit on sales standard deviation*all years post referendum						-0.065 (0.252)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	24,051	24,051	24,051	23,445	22,970	21,851

Notes: Sample uses DMP data where available (all post August 2016) and company accounts from Bureau Van Dijk FAME otherwise. Only observations with investment growth rates between -100% and 100% (measured using DHS growth rates) are used. All regressions include a data source dummy. Data from 2011-2018 (years are defined from Q3 to Q2 in next calendar year, post Brexit defined as 2016 Q3 onwards). Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

Brexit estimated to have reduced investment by about 12% over 3 years

Dependent variable: All equations estimated 2011-2018	Investment growth					
	(1) OLS	(2) OLS	(3) IV	(4) OLS	(5) OLS	(6) OLS
Brexit uncertainty*all years post referendum	-2.821*** (0.862)		-8.154*** (2.928)		-2.337** (0.999)	
Brexit uncertainty*2016 dummy		-2.495* (1.294)				
Brexit uncertainty*2017 dummy		-2.540** (1.173)				
Brexit uncertainty*2018 dummy		-3.397*** (1.162)				
Expected eventual impact of Brexit on sales*all years post referendum				0.537*** (0.157)	0.315* (0.179)	
Expected eventual impact of Brexit on sales standard deviation*all years post referendum						-0.065 (0.252)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	24,051	24,051	24,051	23,445	22,970	21,851

Average of uncertainty
measure across 3 years

$$\downarrow$$

$$-2.821 * (2.38 - 1) * 3 \sim -12$$

↑

Value of uncertainty
measure for 'Brexit ...
not important at all'

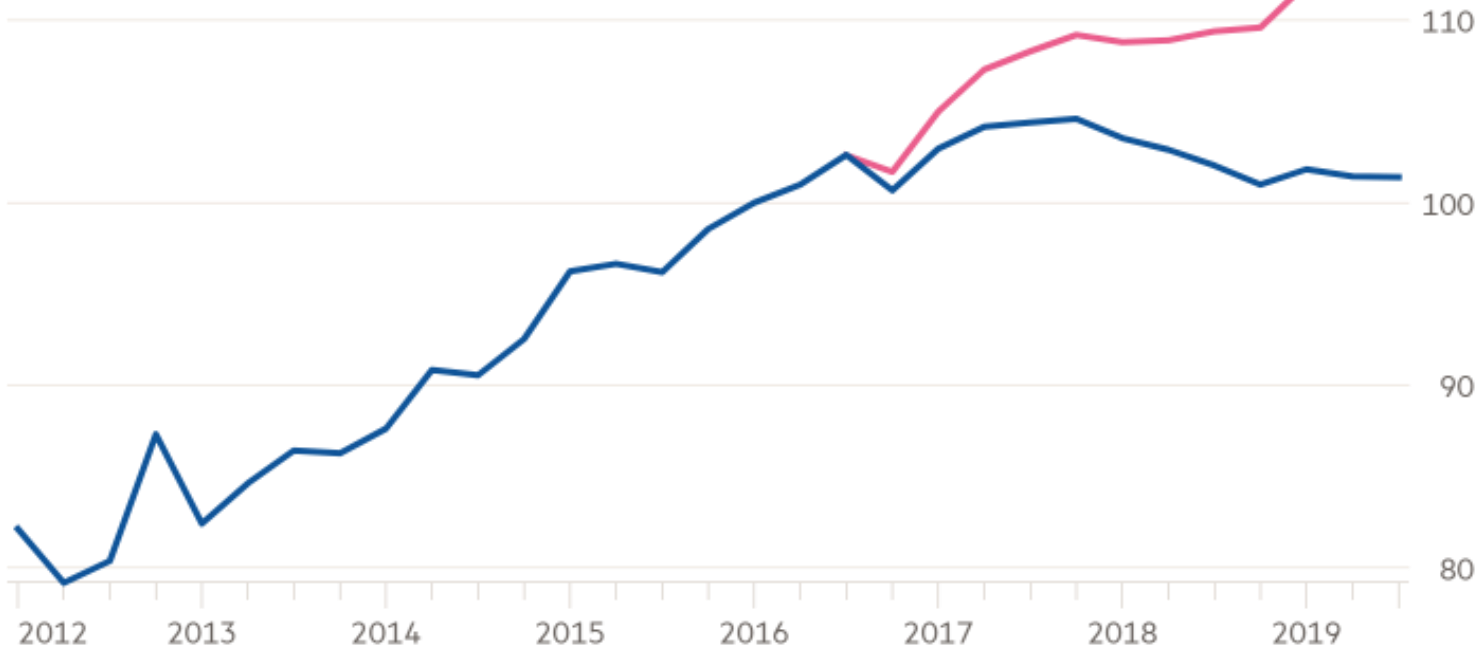
Notes: Sample uses DMP data where available (all post August 2016) and company accounts from Bureau Van Dijk FAME otherwise. Only observations with investment growth rates between -100% and 100% (measured using DHS growth rates) are used. All regressions include a data source dummy. Data from 2011-2018 (years are defined from Q3 to Q2 in next calendar year, post Brexit defined as 2016 Q3 onwards). Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

Quantification result matches other sources of estimates

UK business investment has stagnated

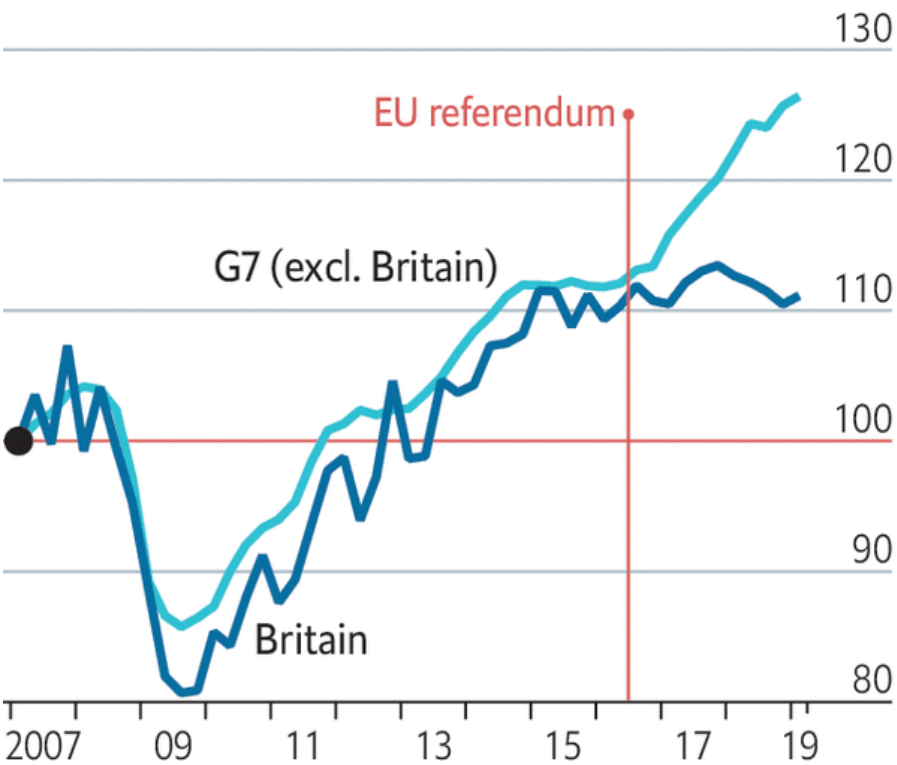
Real value, rebased

Actual Estimate without Brexit



Sources: ONS, Refinitiv, Bank of England
© FT

Real business investment, Q1 2007=100



Sources: Bank of England;

The Economist

Brexit estimated to have reduced employment by about 1% over 3 years

Dependent variable:	Employment growth					
All equations estimated 2011-2018	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	IV	OLS	OLS	IV
Brexit uncertainty*all years post referendum	-0.269 (0.212)		-1.213* (0.673)		-0.022 (0.247)	
Brexit uncertainty*2016 dummy		-0.072 (0.290)				
Brexit uncertainty*2017 dummy		-0.269 (0.269)				
Brexit uncertainty*2018 dummy		-0.483* (0.268)				
Expected eventual impact of Brexit on sales*all years post referendum				0.114*** (0.038)	0.109** (0.044)	0.283* -0.162
Expected eventual impact of Brexit on sales standard deviation*all years post referendum						
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	39,689	39,689	39,689	38,623	37,689	38,623

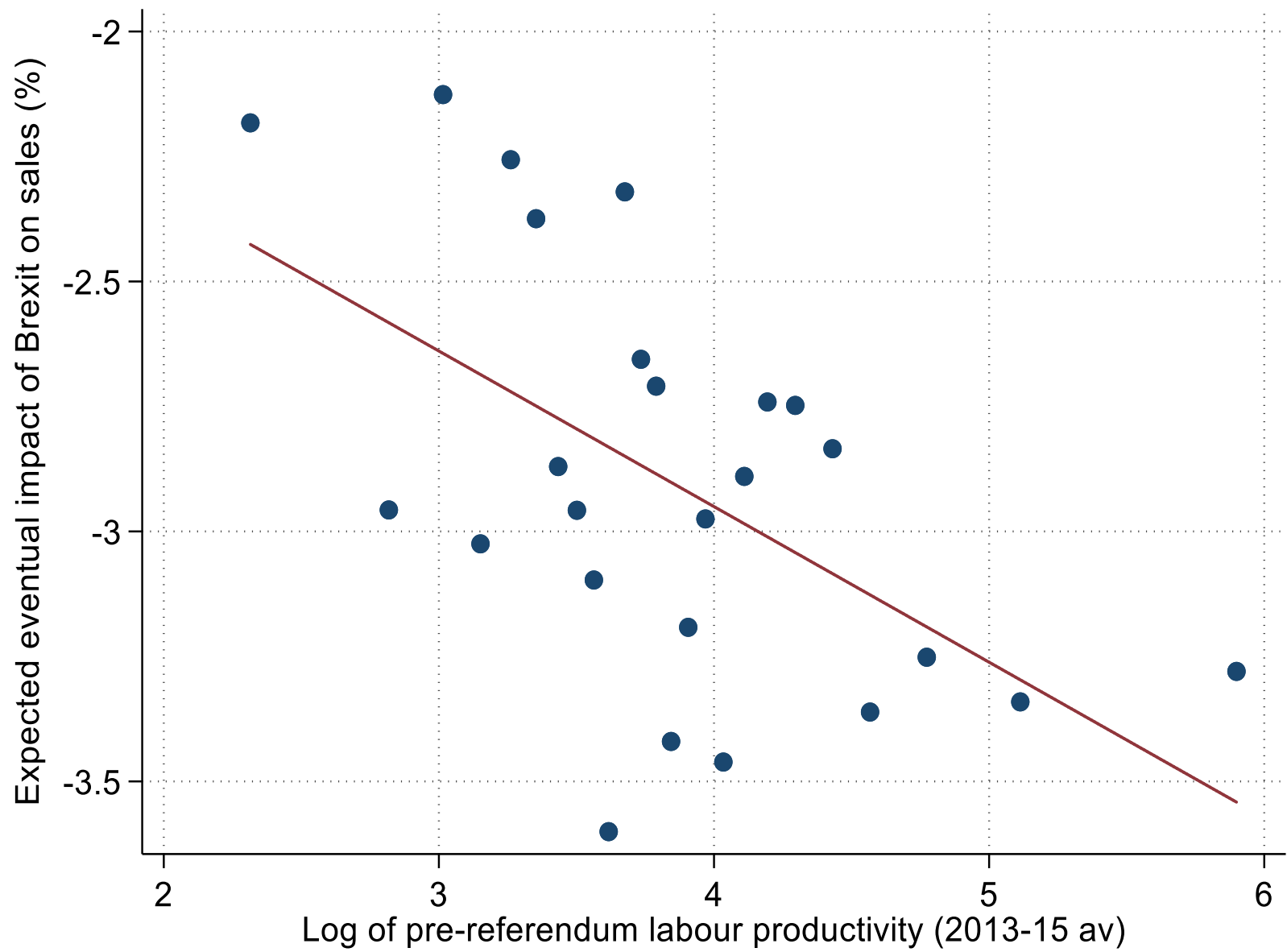
Notes: Sample uses DMP data where available (all post August 2016) and company accounts from Bureau Van Dijk FAME otherwise. Only observations with employment growth rates between -100% and 100% (measured using DHS growth rates) are used. All regressions include a data source dummy. Data from 2011-2018 (years are defined from Q3 to Q2 in next calendar year, post Brexit defined as 2016 Q3 onwards). Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

Significant impact on productivity *within* firms

Dependent variable (all in growth terms):	Labour productivity	TFP	Labour productivity
	(1)	(2)	(3)
Brexit uncertainty*all years post referendum	-0.993*** (0.353)	-0.985*** (0.363)	
Brexit uncertainty*2016 dummy			-1.122** (0.538)
Brexit uncertainty*2017 dummy			-1.118** (0.527)
Brexit uncertainty*2018 dummy			-0.606 (0.585)
Time fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Observations	28,893	28,893	28,893

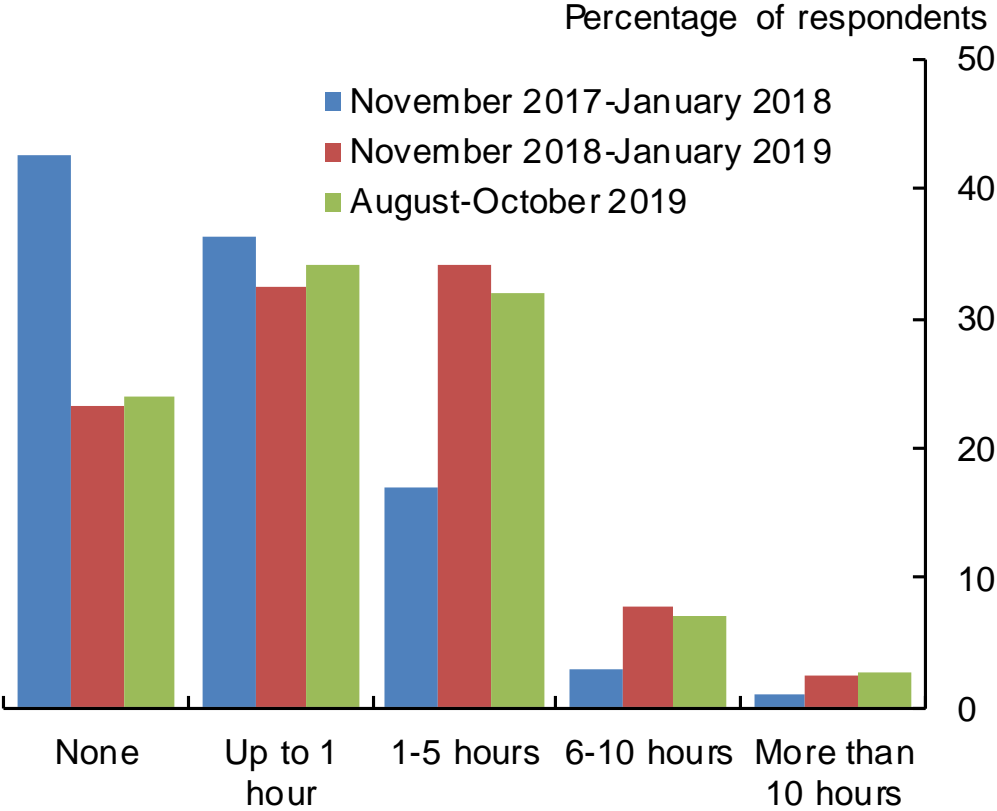
Notes: Sample uses company accounts data from the Bureau Van Dijk FAME database for value-added, labour productivity and TFP. Only observations with value-added, labour productivity, TFP and employment growth rates between -100% and 100% (measured using DHS growth rates) are used. Data from 2011-2017 (years are defined from Q3 to Q2 in next calendar year, post Brexit defined as 2016 Q3 onwards). Labour productivity is defined as real value-added (operating profits plus total labour costs divided by the aggregate GDP deflator) per employee using accounting data. TFP is calculated as the residual from a production function $\ln(Y_{it}) = 0.7\ln(L_{it}) + 0.3\ln(K_{it})$ where Y_{it} is real value-added of firm i in year t , L is labour input (total real labour costs) and K is capital (total real fixed assets), nominal values from accounting data are deflated using the GDP deflator. TFP data are normalised by 4 digit industry (using data for the full DMP sampling frame) within each year. Standard errors are clustered at the firm level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

between-firm effect on productivity too

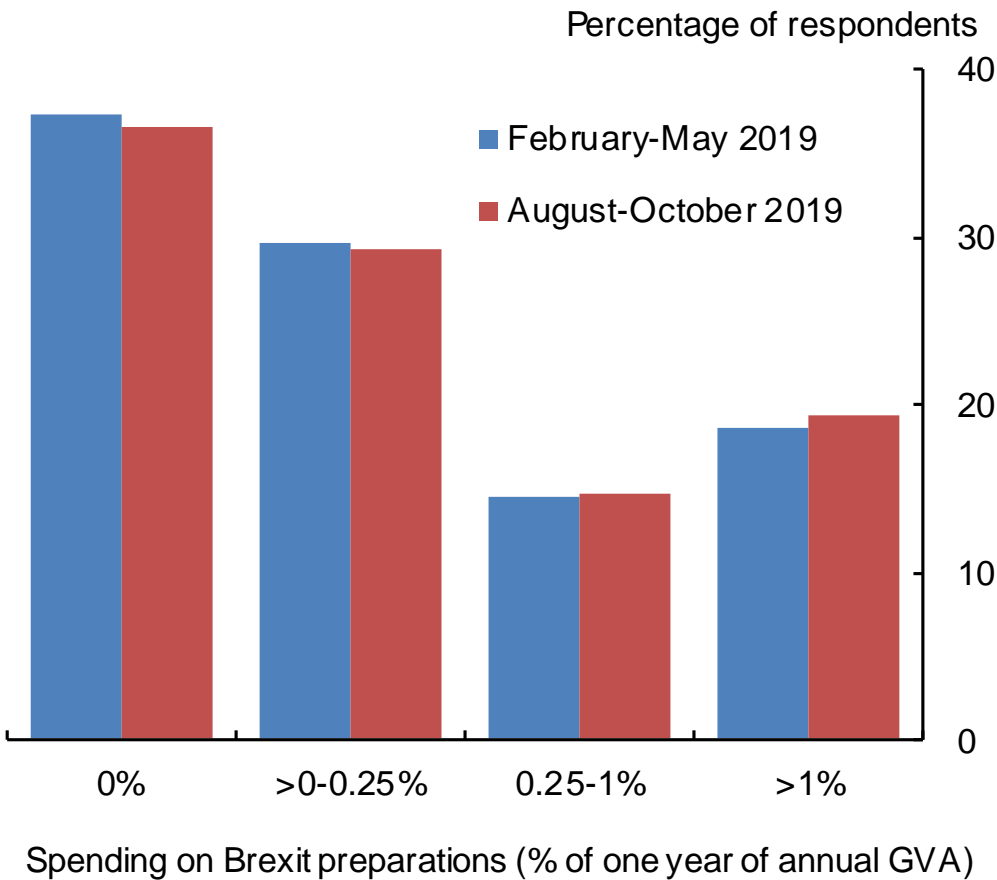


Firms are spending significant time and resources planning for Brexit

Weekly CFO hours



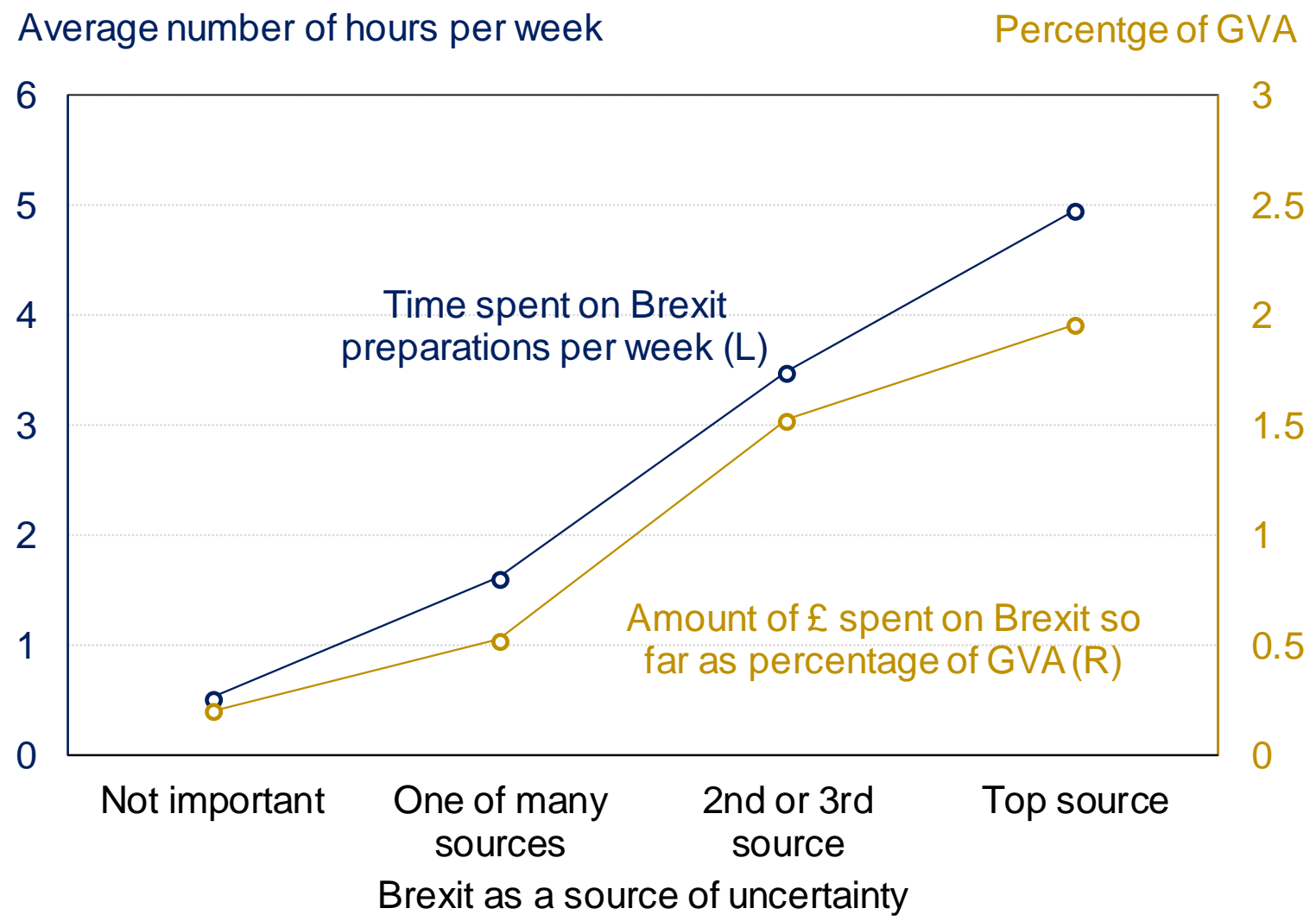
£ amount spent



Source: Bureau van Dijk FAME dataset, Decision Maker Panel and authors' calculations.

Notes: Results are based on the questions 'On average, how many hours a week are the CEO and CFO of your business spending on preparing for Brexit at the moment?' and 'Approximately how much do you estimate that your business has spent on preparing for Brexit so far?'.

Time and resources spent on Brexit planning closely related to uncertainty



Source: Bureau van Dijk FAME dataset, Decision Maker Panel and authors' calculations.

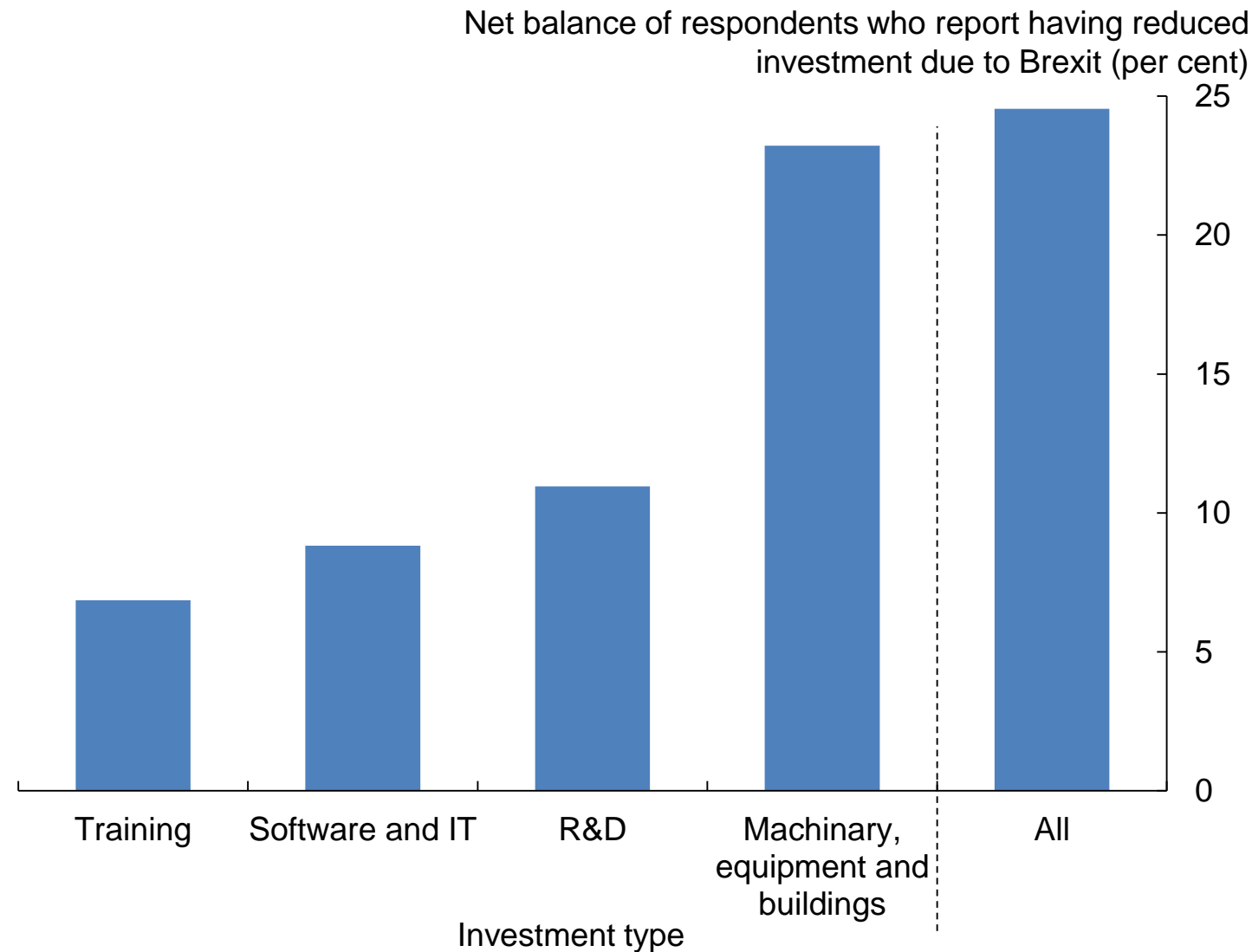
Notes: Results are based on the questions 'On average, how many hours a week are the CEO and CFO of your business spending on preparing for Brexit at the moment?' and 'Approximately how much do you estimate that your business has spent on preparing for Brexit so far?'.

Evidence that resources spent on Brexit planning have lowered productivity

Dependent variable (all in growth terms):	Labor Productivity				TFP	
	(1)	(2)	(3)	(4)	(5)	(6)
Brexit uncertainty*all years post referendum	-0.624 (0.499)	-0.659 (0.601)		-1.036** (0.502)	-0.803 (0.622)	
Average CEO/CFO hours Brexit planning* all years post referendum	-0.052 (0.084)		-0.002 (0.110)	-0.086 (0.083)		0.028 (0.108)
Spending on Brexit planning as % of GVA* all years post referendum		-0.306** (0.151)	-0.298* (0.163)		-0.400** (0.169)	-0.463** (0.183)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	19,253	11,759	10,892	19,221	11,727	10,862

Notes: Sample uses company accounts data from the Bureau Van Dijk FAME database for labour productivity and TFP. Only observations with labour productivity and TFP growth rates between -100% and 100% (measured using DHS growth rates) are used. Data from 2011-2017 (years are defined from Q3 to Q2 in next calendar year, post Brexit defined as 2016 Q3 onwards). Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

Brexit and intangible investment



Source: Decision Maker Panel and authors' calculations.

Notes: The results are based on the question 'Could you say how the UK's decision to vote 'Leave' in the EU referendum has affected your capital expenditure since the referendum? Please select one option for each type of investment [Training of employees; Software, data, IT, website; Research and development; Machinery, equipment and buildings]: a large positive influence, adding 5% or more; a minor positive influence, adding less than 5%; no material impact; a minor negative influence, subtracting less than 5%; a large negative influence, subtracting 5% or more.' 'Net balance' is defined as the share who say that Brexit has reduced investment less the share saying it has increased investment. Data were collected between February and April 2019. All values are weighted.

Conclusions

- UK's decision to leave the EU has generated a large, broad and long-lasting increase in uncertainty
- Anticipation of Brexit is estimated to have gradually reduced investment by about 12% and employment by about 1% over the three years following the June 2016 vote
- Brexit process is estimated to have reduced UK productivity: both *within* and *between*-firm effect, partly linked to time/resources spent preparing for Brexit
- For more details see: <https://www.decisionmakerpanel.co.uk> and <https://www.nber.org/papers/w26218>