

# Understanding Brexit-Related Uncertainties

## Exploration of the Decision Maker Panel Survey

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ifo, Munich, December 2018

**Disclaimer:** Any opinions and conclusions expressed herein are those of the authors and do not necessarily represent the views of the Bank of England or its Committees.

## EU-UK relations

- 1969 – 3<sup>rd</sup> and successful application for membership in the EC
- 1973 – Entry to the EC
- 1974 – Harold Wilson's (Labour) commitment to renegotiate Britain's terms of membership of the EC
- 1975 – National referendum on whether the UK should remain in the European Communities (67.5% voted to stay, 37.5% voted to leave)
- 2013 – David Cameron's (Conservative) promise to hold an EU referendum
- 2016 – National referendum on whether UK should remain a member of the EU (48.1% voted to remain, 51.9% voted to leave)
- 2016 – Cameron's resignation as PM, succeeded by Theresa May
- 2017 – Invocation of Article 50 to leave by March 2019

What next?

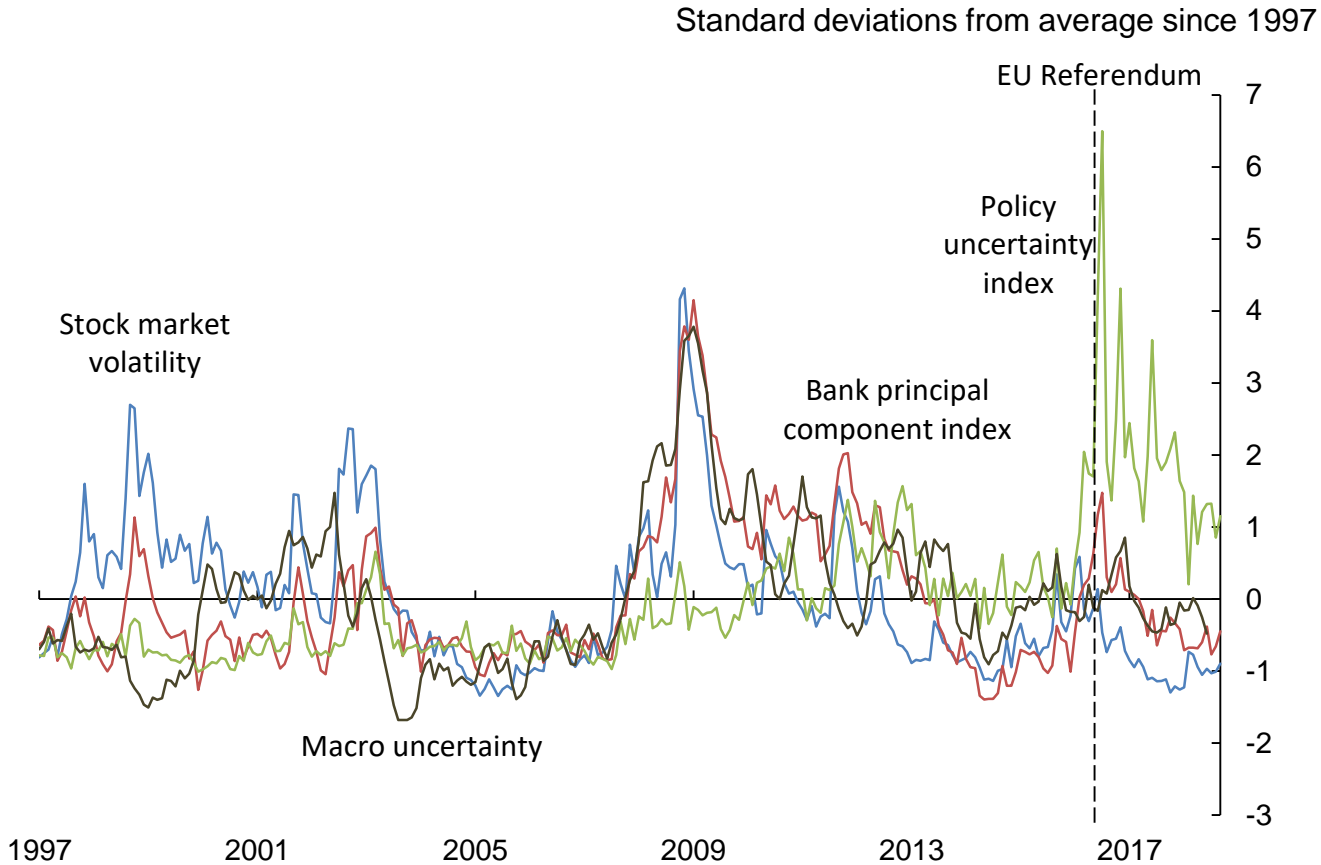
# Probability of UK leaving the EU was low ahead of the referendum

Prediction Odds for BREXIT

Source: own calculations based on [www.oddschecker.com](http://www.oddschecker.com)  
University of Stirling Management School and Centre on Constitutional Change



# Uncertainty indicators provided conflicting messages since the referendum



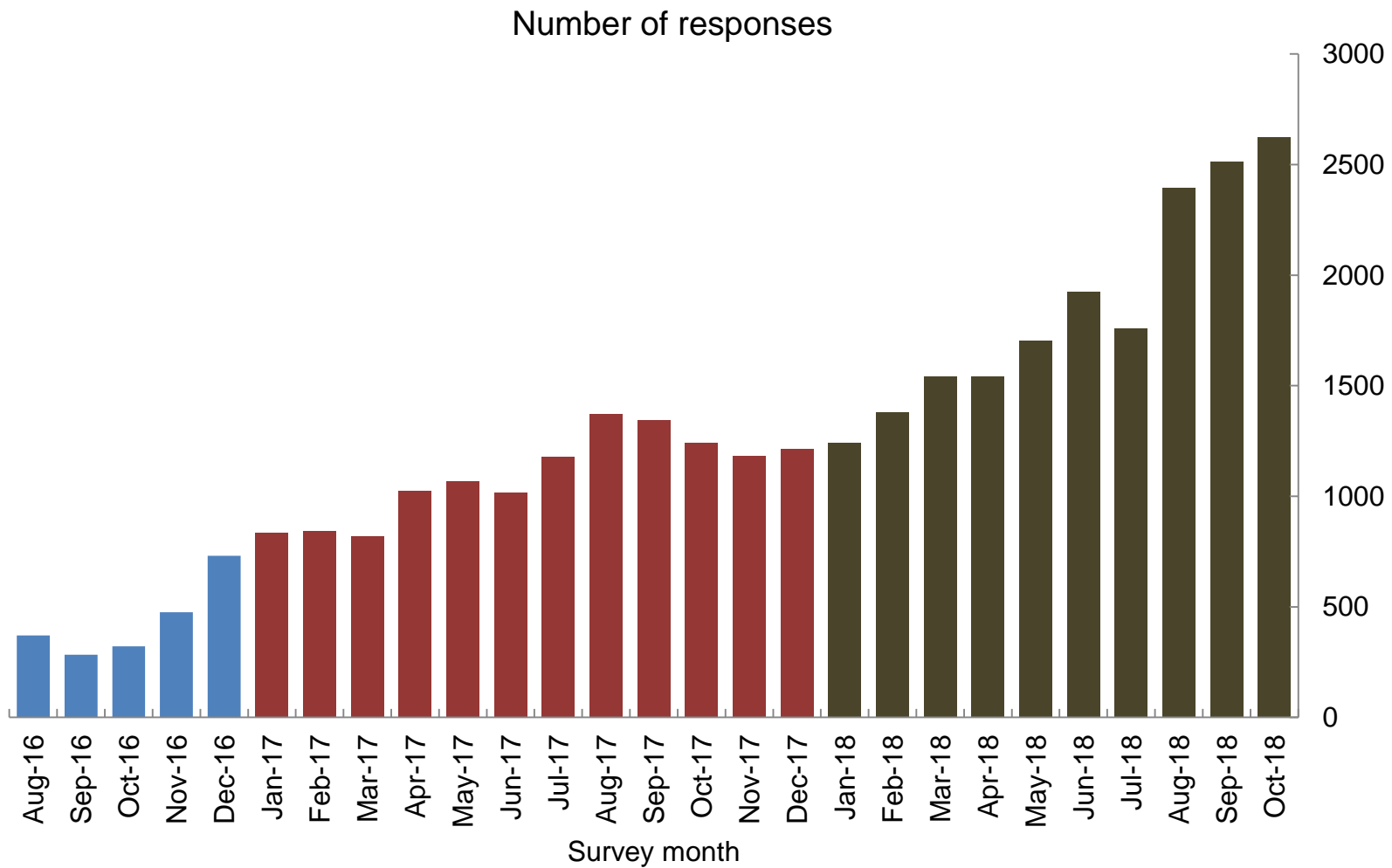
## Decision Maker Panel – a new survey of UK-based companies – allows the assessment of the impact of Brexit

- Decision Maker Panel was launched in August 2016 by the Bank of England, Stanford University and the University of Nottingham.
- Used an approach pioneered by the Atlanta Fed (Altig, Barrero, Bloom, Davis, Meyer and Parker, 2018)
- In UK, randomly contacted population of 31K UK firms with 10+ employees inviting them to join the monthly Decision Maker Panel
- As of October, around 6K have been part of the panel, providing a large sample of timely firm data.

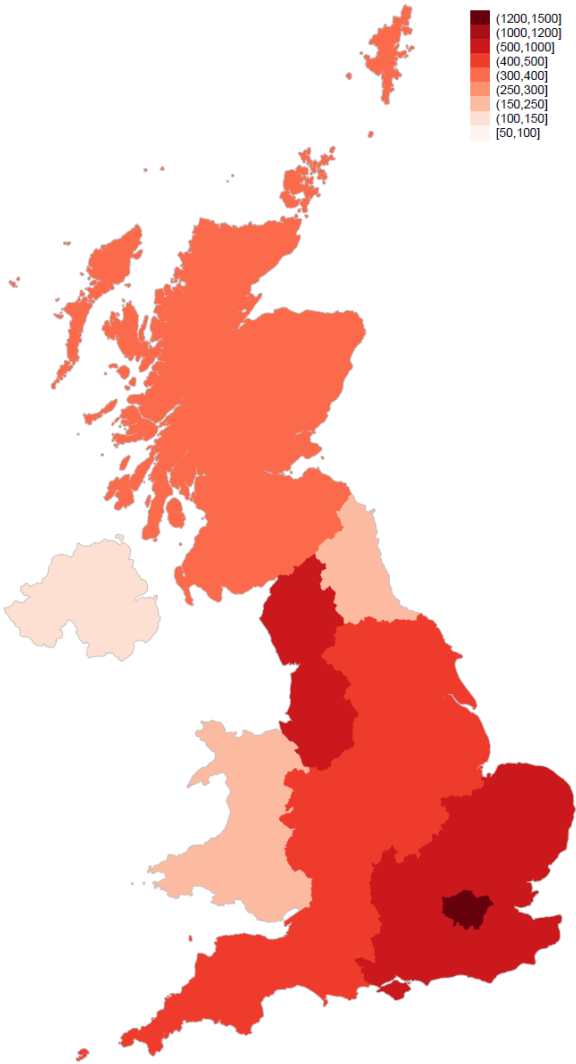
## Key messages

- Brexit has been seen by most firms as large second moment (uncertainty) shock.
- Firms with greater exposure to the EU, e.g. through exports, imports, and more EU workers are more heavily affected.
- Uncertainties around Brexit are primarily about the impact on businesses over the longer term rather than shorter term.
- Brexit-related uncertainty associated with around 1.5% lower employment and 6% less investment
- Misallocation could reduce productivity by around 0.5% (likely to be negative effect within firm effects too)

# By October 2018 obtaining 2.6K responses per month spanning all industries and regions



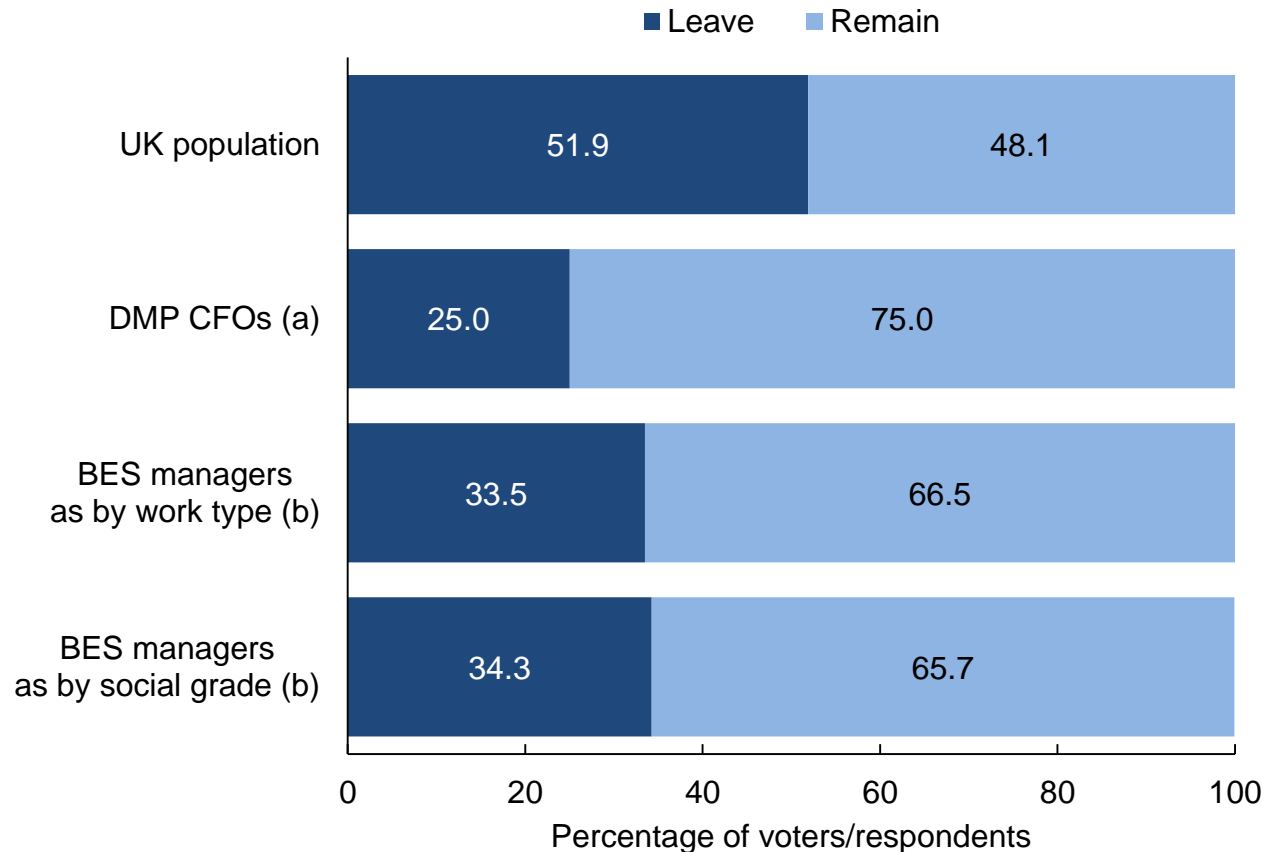
# Respondents are spread across the UK



**Notes:** Data as of October 2018. The map shows location of businesses that have ever responded to the DMP survey since August 2016. The location of a business corresponds to the location of the registered office, hence it does not always match up with the actual location of the business.



## There is not a strong Brexit-related bias in the survey



(a) Personal views of DMP members at the time of the June 2016 referendum taken from February to April 2018 surveys. The question asked respondents about whether they view Brexit in a positive or negative way rather than how they voted in the referendum.

(b) To identify managers in the British Election Study by their stated work type, only participants doing professional or higher technical work/higher managerial work that required at least degree-level qualifications or who worked as manager or senior administrator/intermediate managerial/professional (company director, finance manager, etc.) were included. To identify managers in the BES by their stated social grade, only participants who identified themselves as in a higher managerial, administrative and professional or intermediate managerial, administrative and professional occupation were included. Only respondents working and aged 66 or lower for males or aged 60 or lower for females were included.

## Sampling frame of 31K UK firms with 10+ employees: 20% responded, uncorrelated with Brexit vote share

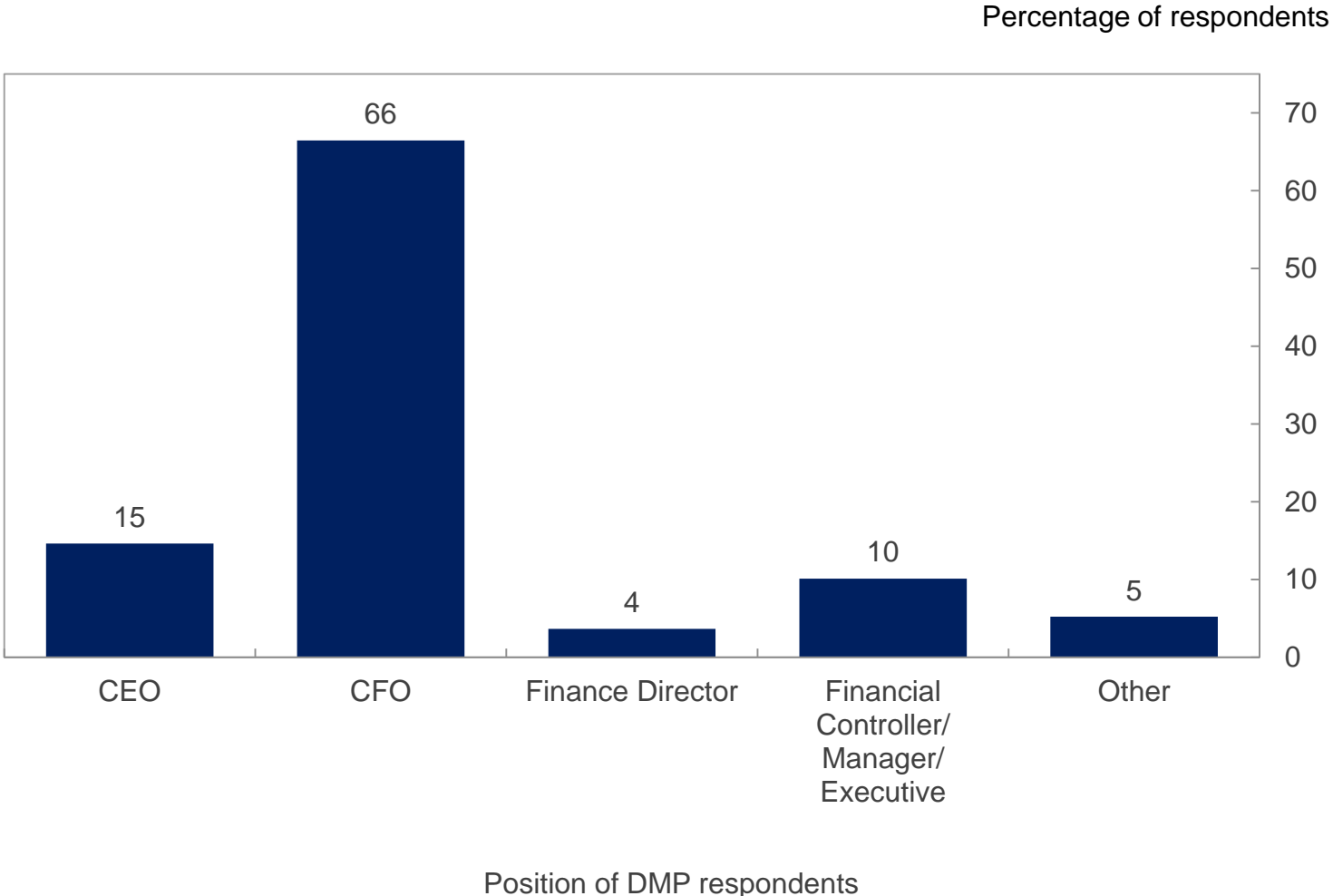
	Ever respond to a survey if in the sampling frame			
	(1)	(2)	(3)	(4)
Leave vote share	-0.022 (0.019)	-0.026 (0.019)	-0.020 (0.019)	-0.018 (0.019)
Log of employment		0.017*** (0.002)	0.011*** (0.003)	0.011*** (0.003)
Log of sales			0.007*** (0.002)	0.004 (0.003)
Log of assets				0.003 (0.002)
Observations	29,802	29,802	29,802	29,802
R-squared	0.010	0.013	0.014	0.014

Robust standard errors in parentheses

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

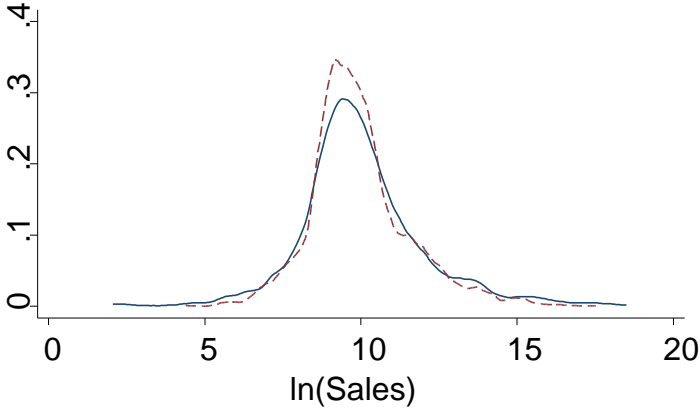
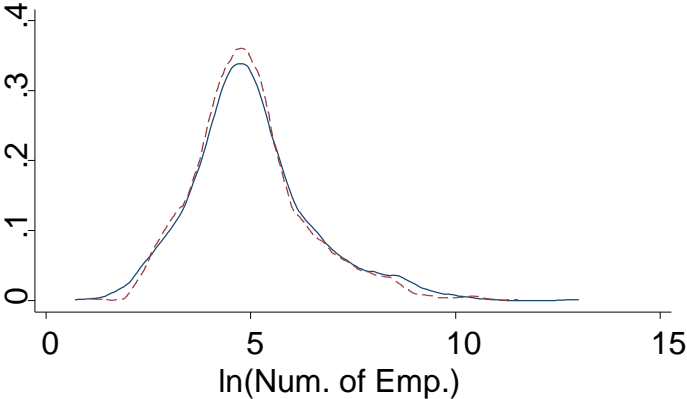
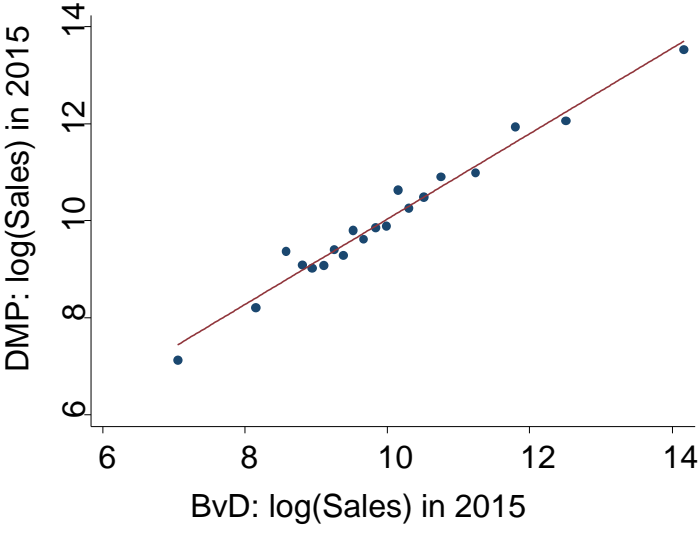
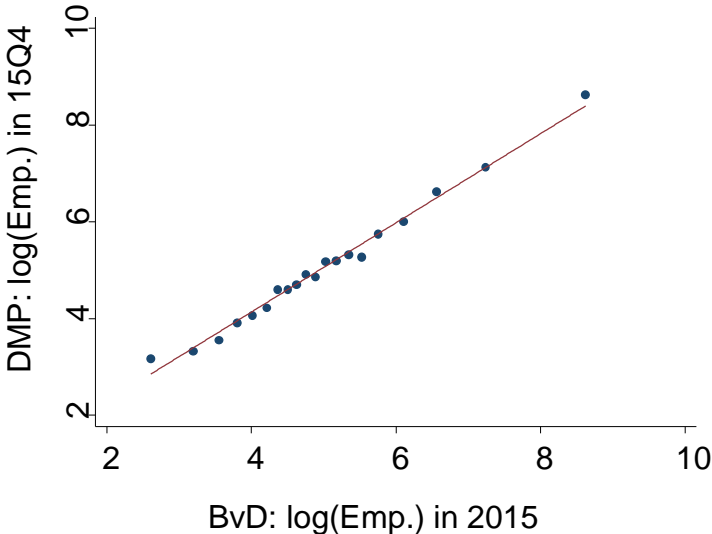
**Notes:** Data as of October 2018. Two-digit UK SIC industry controls are included in all columns. Dependent variable equals 1 if a firm responded to any wave of the survey between September 2016 and October 2018 and 0 if it is part of the sampling frame but has never completed a survey. Firm characteristics are taken from Bureau van Dijk FAME data and are the latest available observations. 'Leave vote share' is the share of vote for leaving the EU in the local authority that a firm is headquartered in. There are 380 local authorities. Robust standard errors are given in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

# The majority of DMP respondents are finance directors or senior managers



**Notes:** Data as of November 2018. The question asked 'Could you tell us the position of the person in your business that typically completes the Decision Maker Panel Survey?'

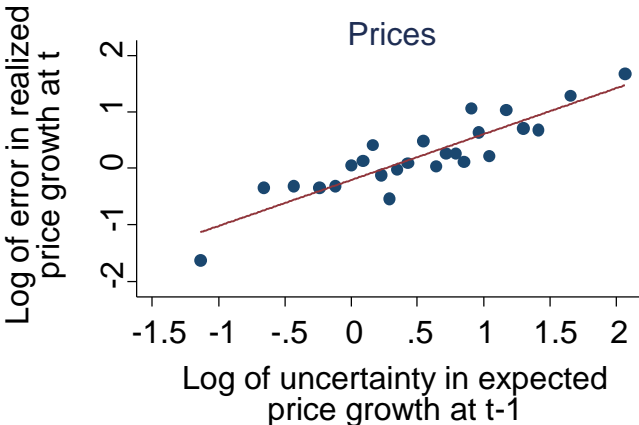
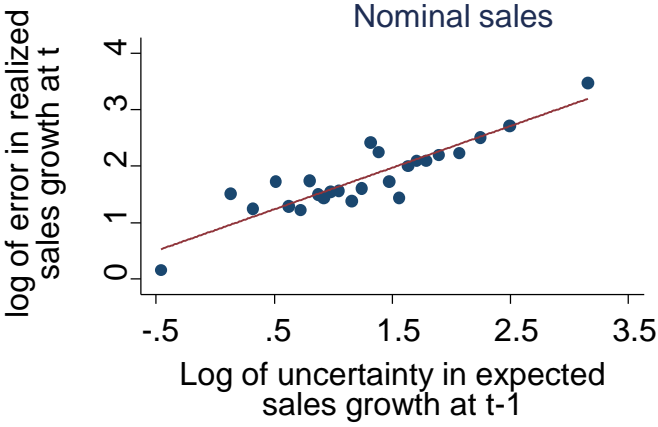
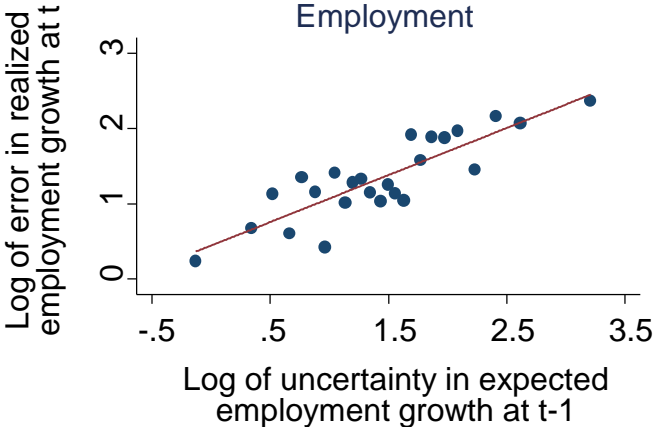
# Data quality looks good – for example, comparing DMP to Company Accounts



— DMP: ln(Emp) in 2015Q4  
- - BvD: ln(Emp) in 2015

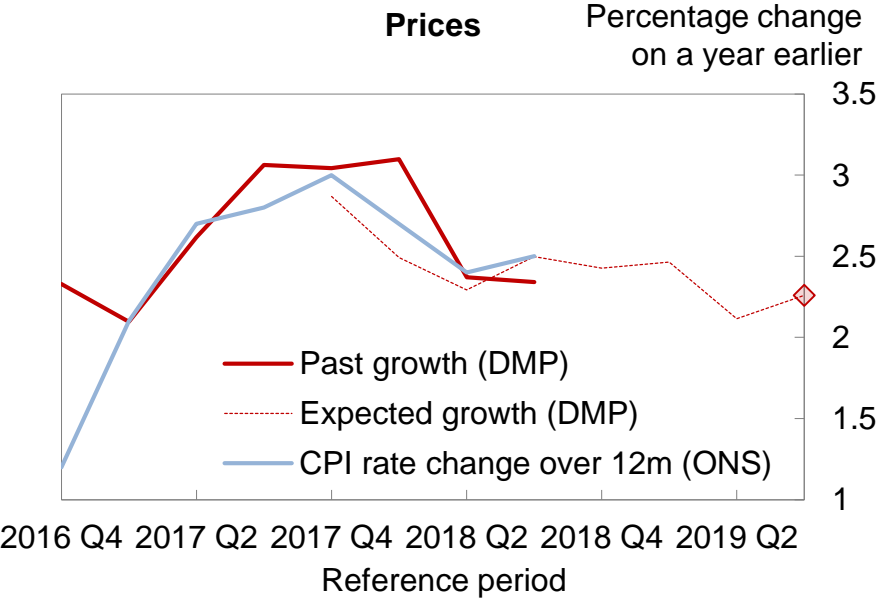
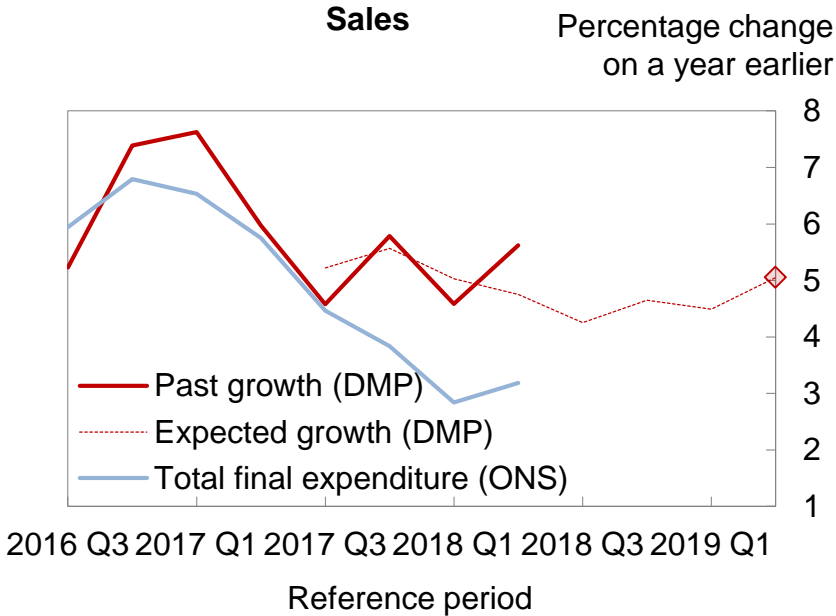
— DMP: ln(Sales) in 2015  
- - BvD: ln(Turnover) in 2015

# Data quality looks good – for example, comparing uncertainty to forecast errors

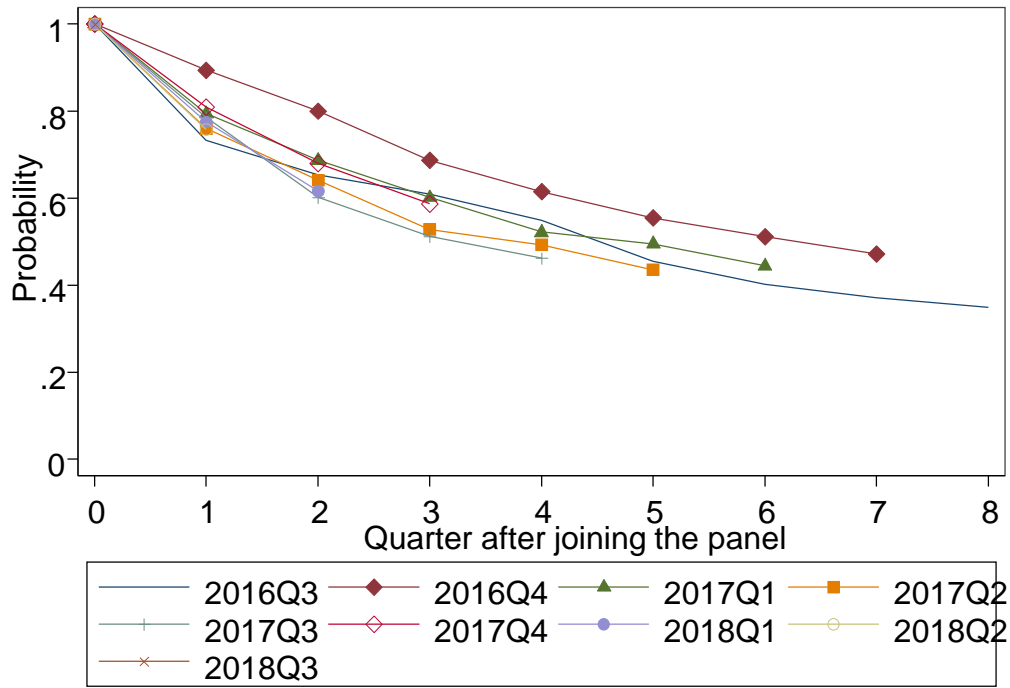


**Note:** Uncertainty defined as subjective uncertainty from the DMP 5-bin responses. Forecast errors defined as ABS(forecast - actual) growth over the following 12 month period.

# Data quality looks good – macro aggregates and outturns

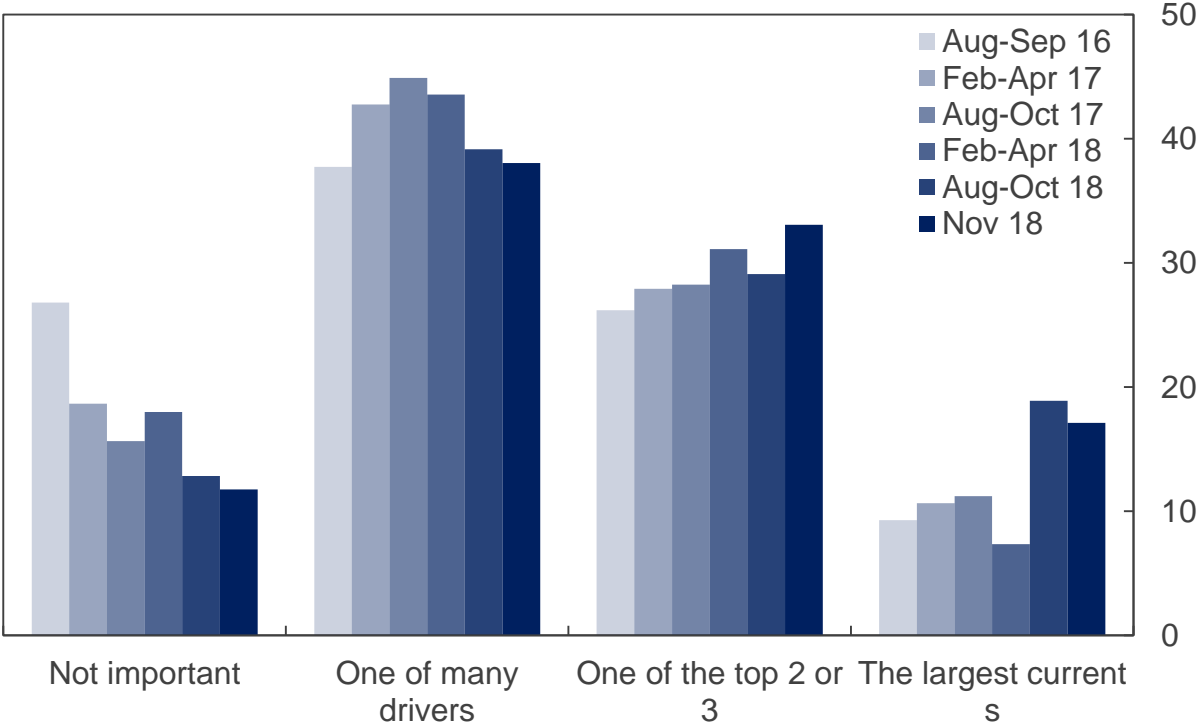


# Hazard functions reveal no substantial difference between different cohorts



Note: Based on panel members who joined between 2016Q3 and 2018Q3.

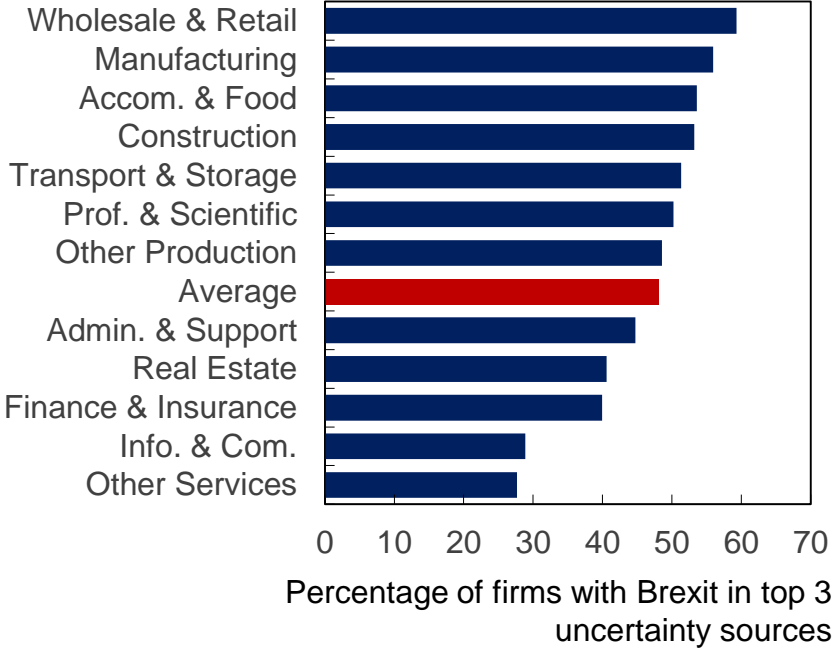
# Brexit important source of uncertainty for around 50%



**Note:** The question asked ‘How much has the result of the EU referendum affected the level of uncertainty affecting your business?’. Respondents could select one of the options shown as response categories.



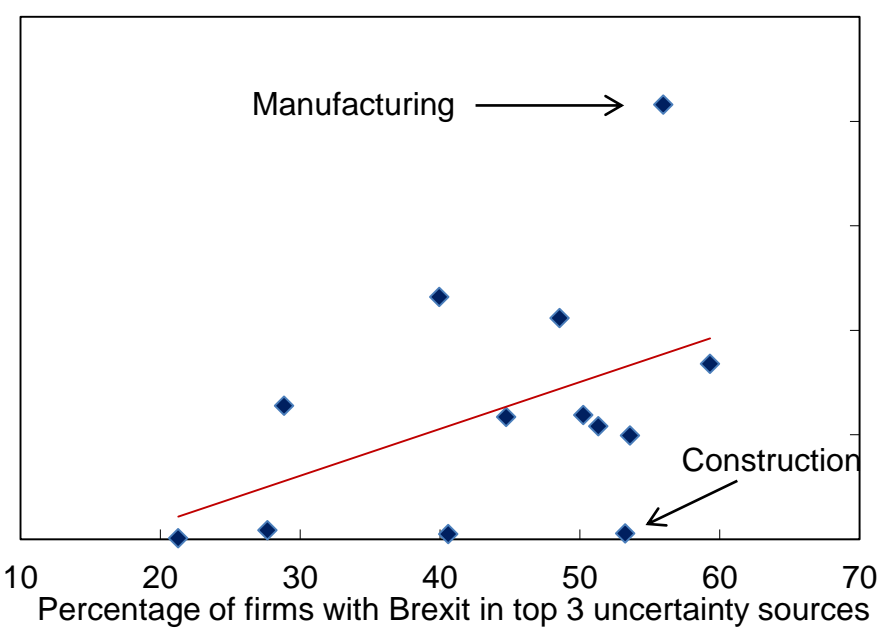
# In recent surveys, uncertainty was highest in wholesale & retail and manufacturing and lowest in human health & social work



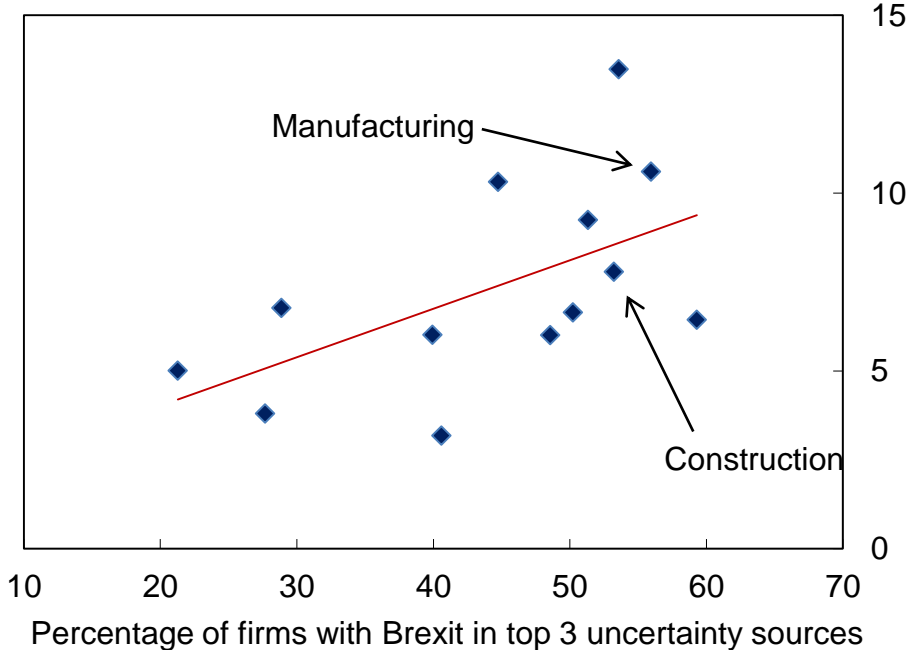
**Note:** The question asked 'How much has the result of the EU referendum affected the level of uncertainty affecting your business?'. Industries' employment shares are shown in square brackets. DMP data from August to October 2018 surveys.

# Positive correlation between the share of firms in each industry viewing Brexit as an important source of uncertainty and exposure to the EU

Percentage of output exported to EU



Percentage of workforce who are EU nationals



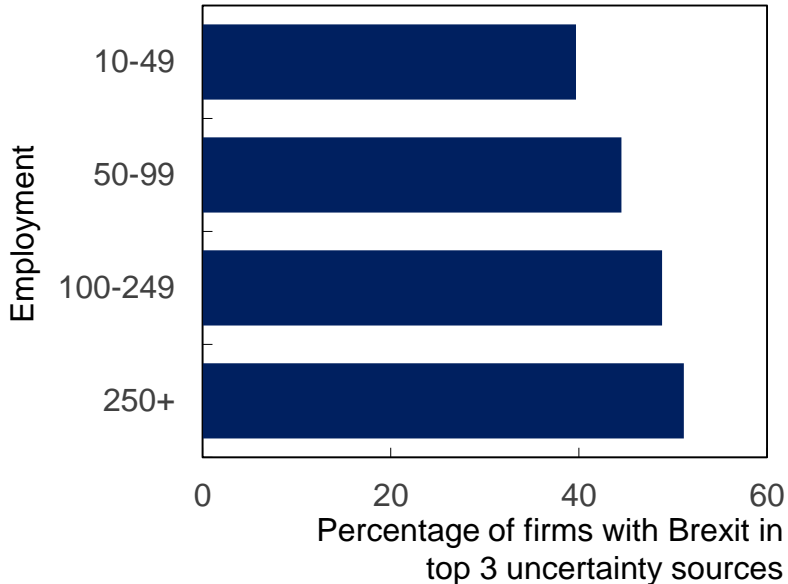
## EU exports/imports and use of migrant labour all help explain which firms are uncertain about Brexit

Dependent variable: Brexit uncertainty (4 point scale)	(1)	(2)	(3)	(4)	(5)
Share of sales to EU	0.010*** (0.002)				0.006** (0.002)
Share of sales to non-EU	-0.003* (0.002)				-0.004** (0.002)
Share of costs from EU imports		0.008*** (0.002)			0.007*** (0.002)
Share of costs from non-EU-imports		0.005*** (0.002)			0.004*** (0.002)
EU migrants 1-5% workforce (dummy)			0.207*** (0.064)		0.178*** (0.062)
EU migrant 6-10% workforce (dummy)			0.339*** (0.083)		0.291*** (0.083)
EU migrants 11-20% workforce (dummy)			0.286*** (0.090)		0.243*** (0.089)
EU migrants > 20% workforce (dummy)			0.547*** (0.108)		0.456*** (0.110)
Foreign owned (dummy)				0.173* (0.092)	0.041 (0.094)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Observations	1,213	1,213	1,213	1,213	1,213
R-squared	0.218	0.233	0.225	0.198	0.265

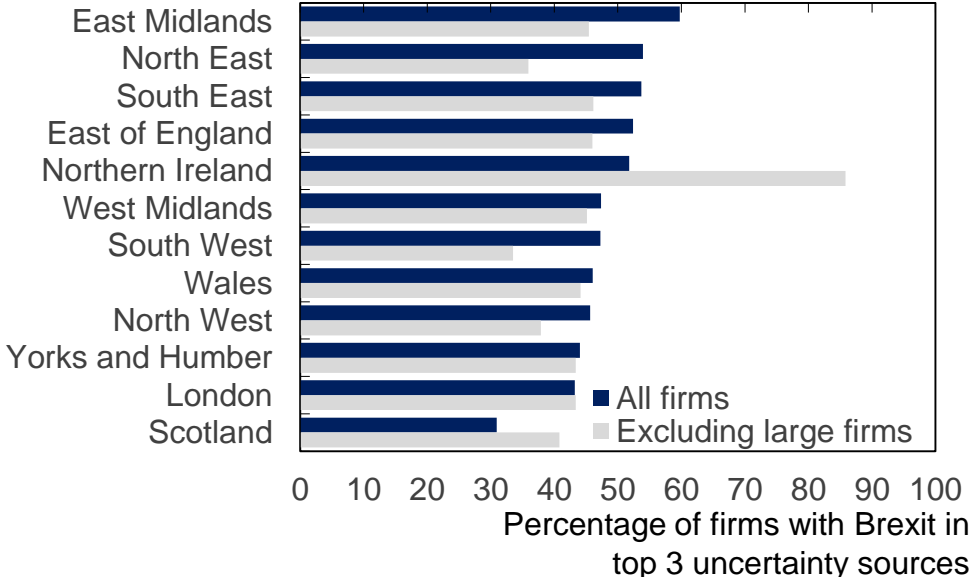
**Note:** Robust standard errors in parentheses. Dependent variable is defined as average uncertainty per firm in the two years after the referendum.

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

# Differences in the importance of Brexit uncertainty by firm size and by region

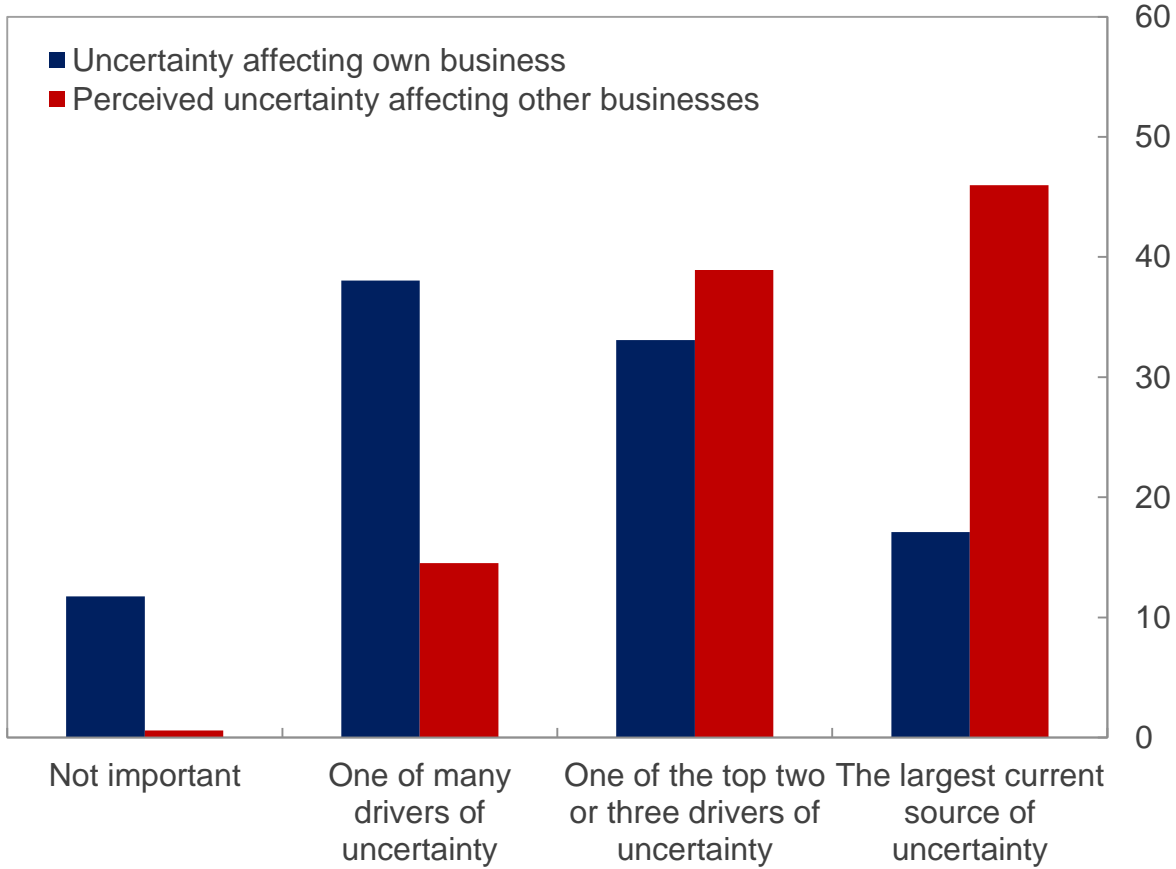


**Note:** The question asked ‘How much has the result of the EU referendum affected the level of uncertainty affecting your business?’. DMP data from August to October 2018 surveys.



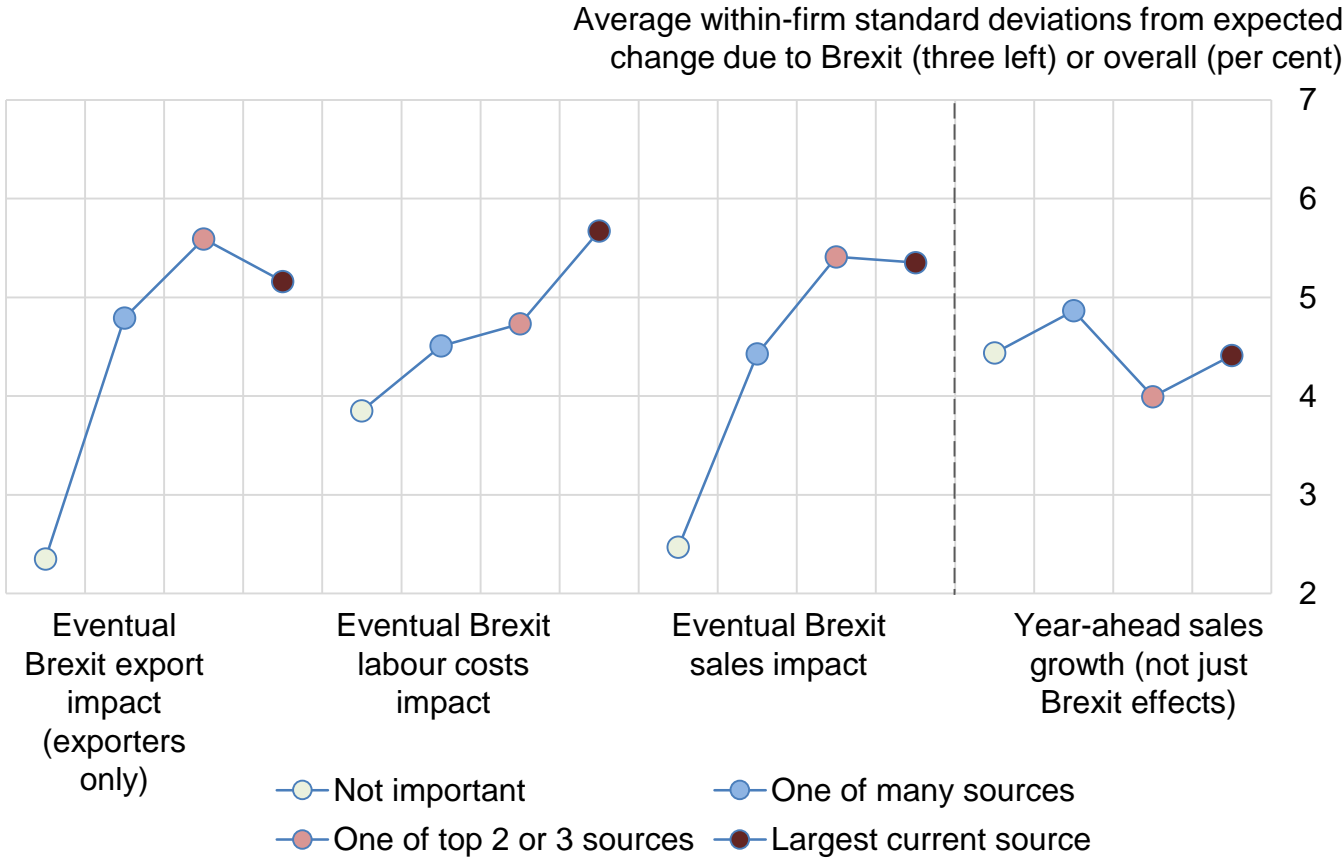
**Note:** The question asked ‘How much has the result of the EU referendum affected the level of uncertainty affecting your business?’. Large firms are defined as those with 250 or more employees. Region is based on the location of head office. DMP data from August to October 2018 surveys.

# Firms' own uncertainty lower than perceived overall economic uncertainty



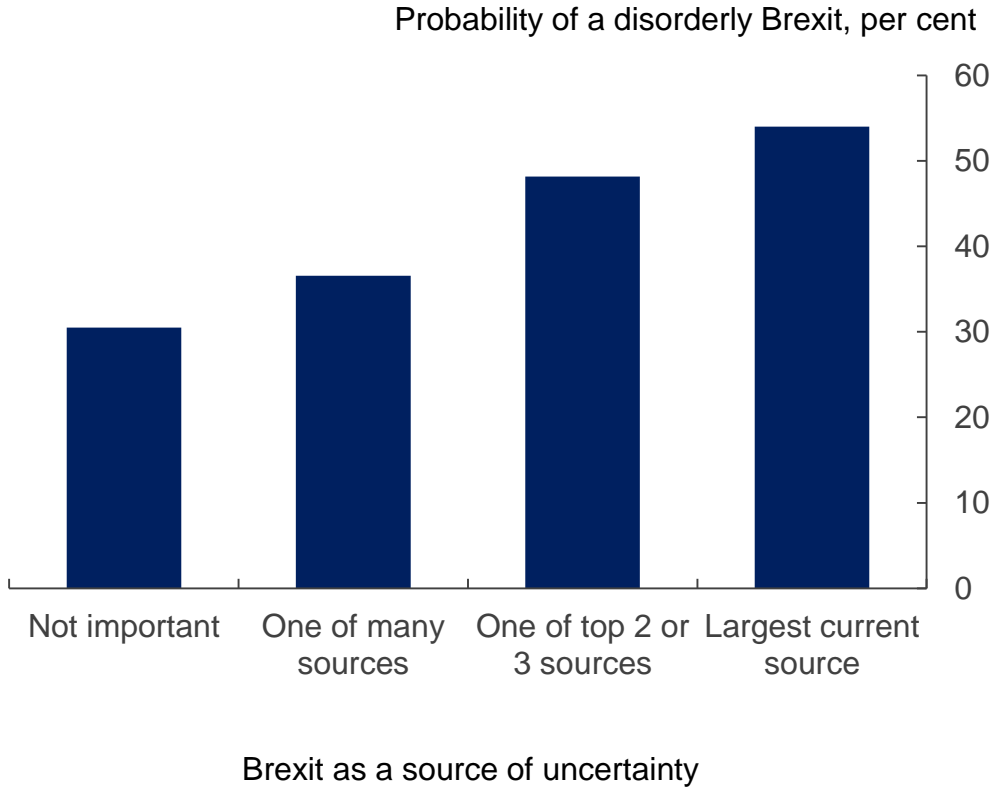
**Note:** The questions asked 'How much has the result of the EU referendum affected the level of uncertainty affecting your business?' and 'How much do you think the result of the EU referendum is likely to have influenced the level of uncertainty affecting businesses in the UK economy other than yours?' DMP data from November 2018 survey.

# Businesses viewing Brexit as an important source of uncertainty find it more difficult to pin down the eventual impact of Brexit



**Notes:** The questions are as defined in notes to Figures 13 and 14. Graphs show mean standard deviation per firm. Brexit effects are calculated using mid-points of 0 per cent for no impact, 5 per cent for an effect of less than 10 per cent, and 15 per cent for an effect of 10 per cent or more. Eventual Brexit sales impact and year-ahead sales data are from August to October 2018 surveys, export data are from May to July 2018 surveys and labour costs data are from February to April 2017 surveys.

# Businesses viewing Brexit as an important source of uncertainty also judge probability of a disorderly Brexit to be higher



**Note:** The questions asked 'How much has the result of the EU referendum affected the level of uncertainty affecting your business?' and 'What percentage likelihood (probability) do you attach to a disorderly Brexit, whereby no deal is reached by the end of March 2019?' DMP data from February to April 2018 surveys.

## Brexit uncertainty is associated with lower firm employment...

Dependent variable: Annual employment growth	(1)	(2)	(3)
Uncertainty*Year 1 after referendum	-0.732* (0.445)		
Uncertainty*Year 2 after referendum	-1.099*** (0.367)		
Uncertainty*Post referendum		-0.960*** (0.340)	
Predicted uncertainty*Year 1 after referendum			-0.546 (0.998)
Predicted uncertainty*Year 2 after referendum			-1.327* (0.780)
Year dummies	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Observations	12,602	12,602	12,602
R-squared	0.281	0.281	0.281

**Notes:** Post Brexit data from Decision Maker Panel combined with pre-Brexit data from company accounts. All regressions include a data source dummy and are estimated from 2011 onwards (years are defined from Q3 to Q2 in next calendar year). Post Brexit defined as 2016 Q3 onwards. Standard errors are clustered by firm. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

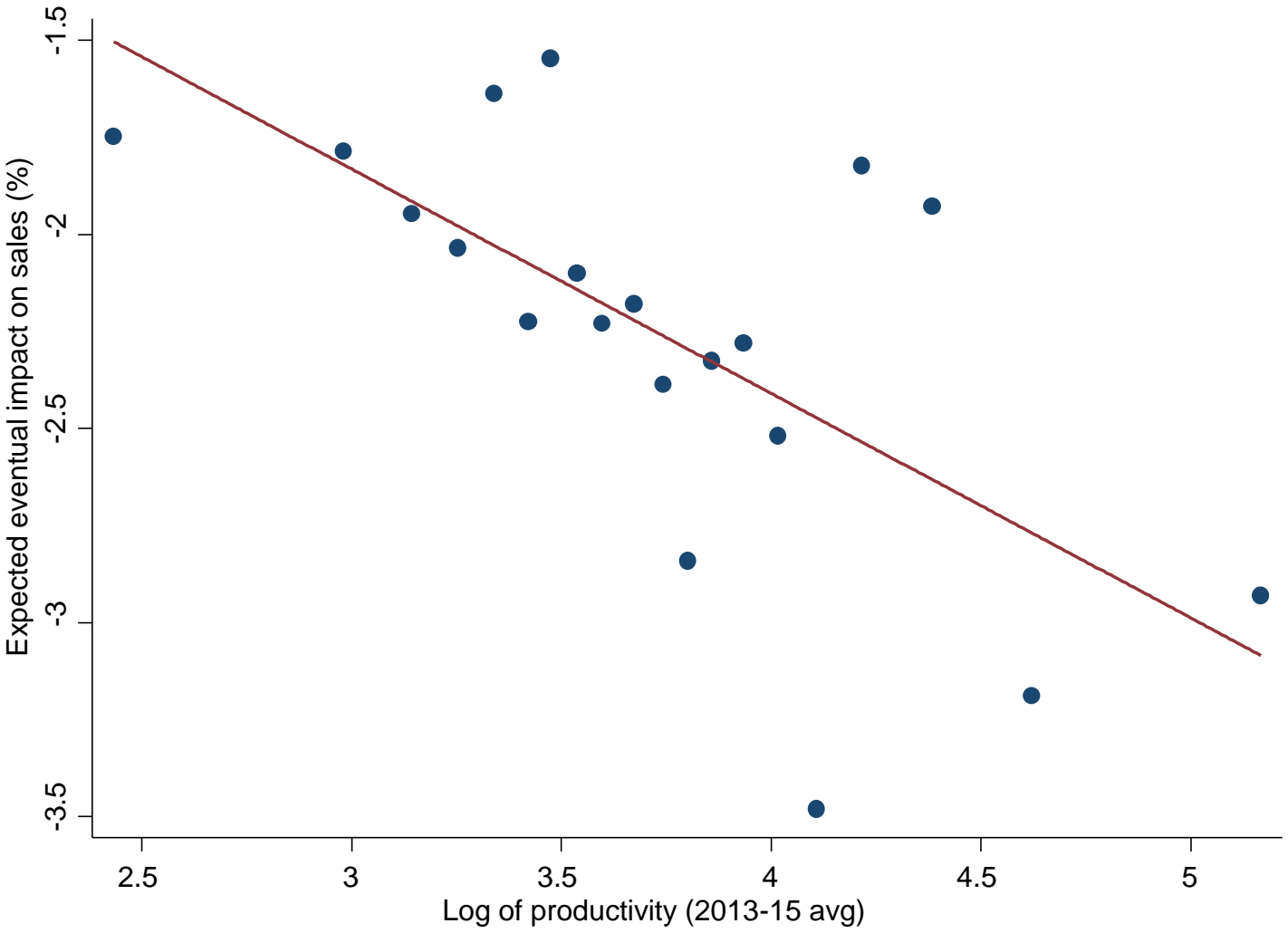


## ...and with less investment

Dependent variable: Annual investment growth	(1)	(2)	(3)
Uncertainty*Year 1 after referendum	-4.629** (2.154)		
Uncertainty*Year 2 after referendum	-0.739 (2.105)		
Uncertainty*Post referendum		-2.675 (1.723)	
Predicted uncertainty*Year 1 after referendum			-7.802* (4.698)
Predicted uncertainty*Year 2 after referendum			1.704 (4.719)
Year dummies	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Observations	6,676	6,676	6,676
R-squared	0.237	0.236	0.236

**Notes:** Post Brexit data from Decision Maker Panel combined with pre-Brexit data from company accounts. All regressions include a data source dummy and are estimated from 2011 onwards (years are defined from Q3 to Q2 in next calendar year). Post Brexit defined as 2016 Q3 onwards. Standard errors are clustered by firm. Only firms with an investment growth rate between -100% and +100% are included. DHS growth rates are used. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

# Misallocation: More productive firms perceive a greater Brexit effect on sales



## As a result Brexit shrinks productive firms more

Dependent variable: Firms' expected eventual impact of Brexit on sales (%)	(1)	(2)	(3)	(4)	(5)	(6)
Log of pre-referendum productivity	-0.553** (0.217)	-0.447** (0.220)	-0.463** (0.218)	-0.480** (0.211)	-0.523** (0.220)	-0.373* (0.217)
Share of sales to EU		-0.038*** (0.009)				-0.027*** (0.010)
Share of sales to non-EU		0.008 (0.007)				0.012* (0.007)
Share of costs from EU imports			-0.011 (0.007)			-0.005 (0.007)
Share of costs from non-EU imports			-0.016** (0.006)			-0.012* (0.006)
EU migrants 1-5% workforce (dummy)				-0.562* (0.287)		-0.468 (0.287)
EU migrant 6-10% workforce (dummy)				-1.643*** (0.367)		-1.476*** (0.368)
EU migrants 11-20% workforce (dummy)				-1.582*** (0.411)		-1.322*** (0.421)
EU migrants > 20% workforce (dummy)				-1.730*** (0.552)		-1.583*** (0.550)
Foreign owned (dummy)					-0.370 (0.369)	-0.104 (0.379)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1000	1000	1000	1000	1000	1000
R-squared	0.074	0.093	0.084	0.105	0.075	0.121

**Notes:** Robust standard errors in parentheses. Dependent variable is defined as self reported average eventual impact of Brexit on sales per firm in the two years after the referendum. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

## Estimate misallocation impact from Brexit at around -0.5% of TFP

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### Aggregate productivity effect, weighted by sales

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Winsorize at:	Point estimate	95% Confidence Interval	
1 & 99 pct	-0.46%	-0.11%	-0.82%
2.5 & 97.5 pct	-0.40%	-0.09%	-0.70%

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#### Method:

Calculate difference in Brexit sales effect for each firm if high productivity firms are more affected versus counterfactual where they are not. Sales weight productivity with and without this adjustment. Difference is an estimate of the misallocation effect

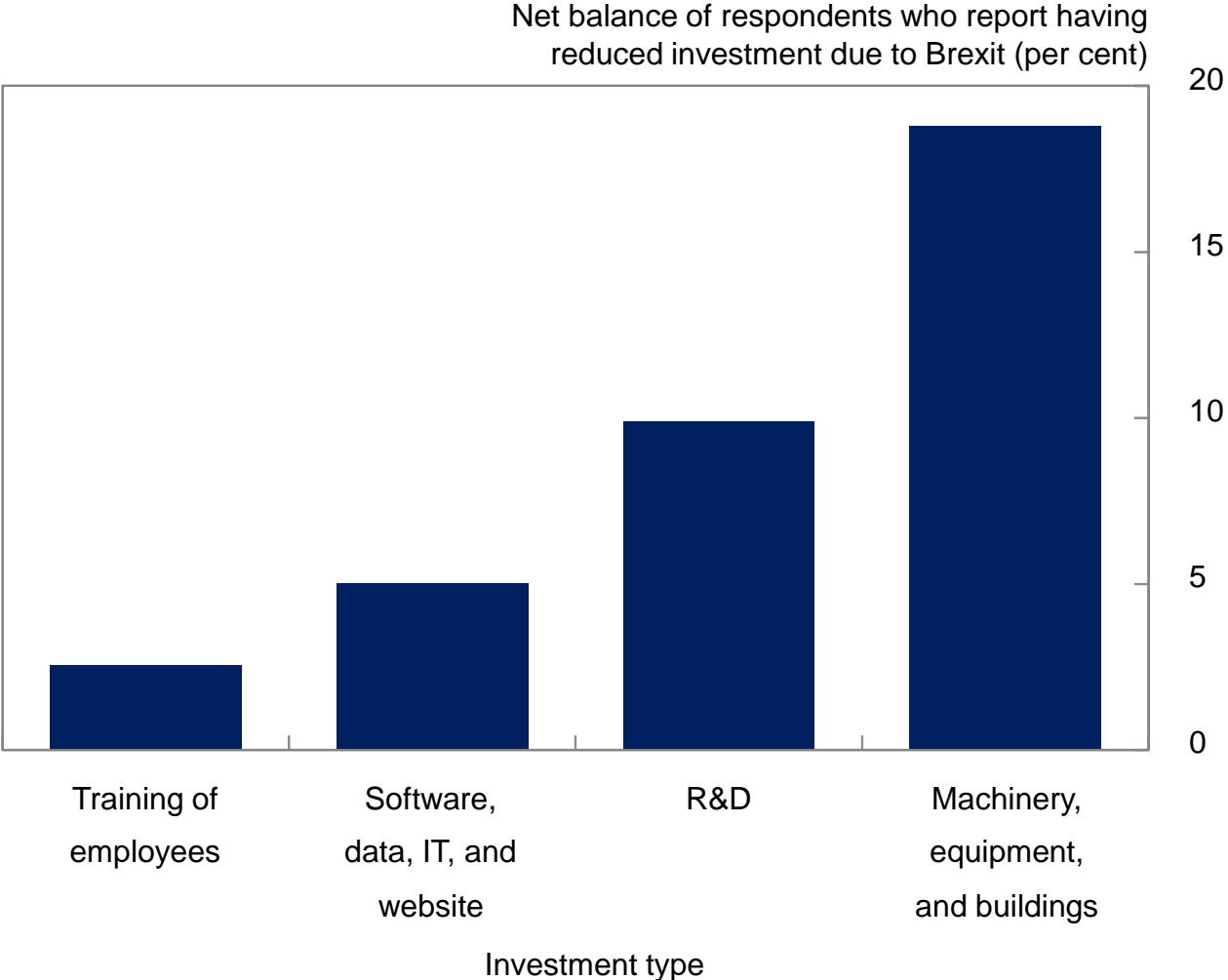
Also likely negative within firm TFP impact - e.g. from wasted hours of senior management

Number of hours a week spent on preparing for Brexit (share)

	CEO	CFO
None	41%	38%
Up to 1 hour	37%	39%
1 to 5 hours	14%	18%
6 to 10 hours	3%	3%
More than 10 hours	1%	1%
Don't know	4%	2%

**Note:** Growth in productivity has slowed to 0.45% a year since the referendum, compared to 0.7% between 2013 and 2015

# Might also be a TFP effect if intangible investment (R&D and training) is reduced



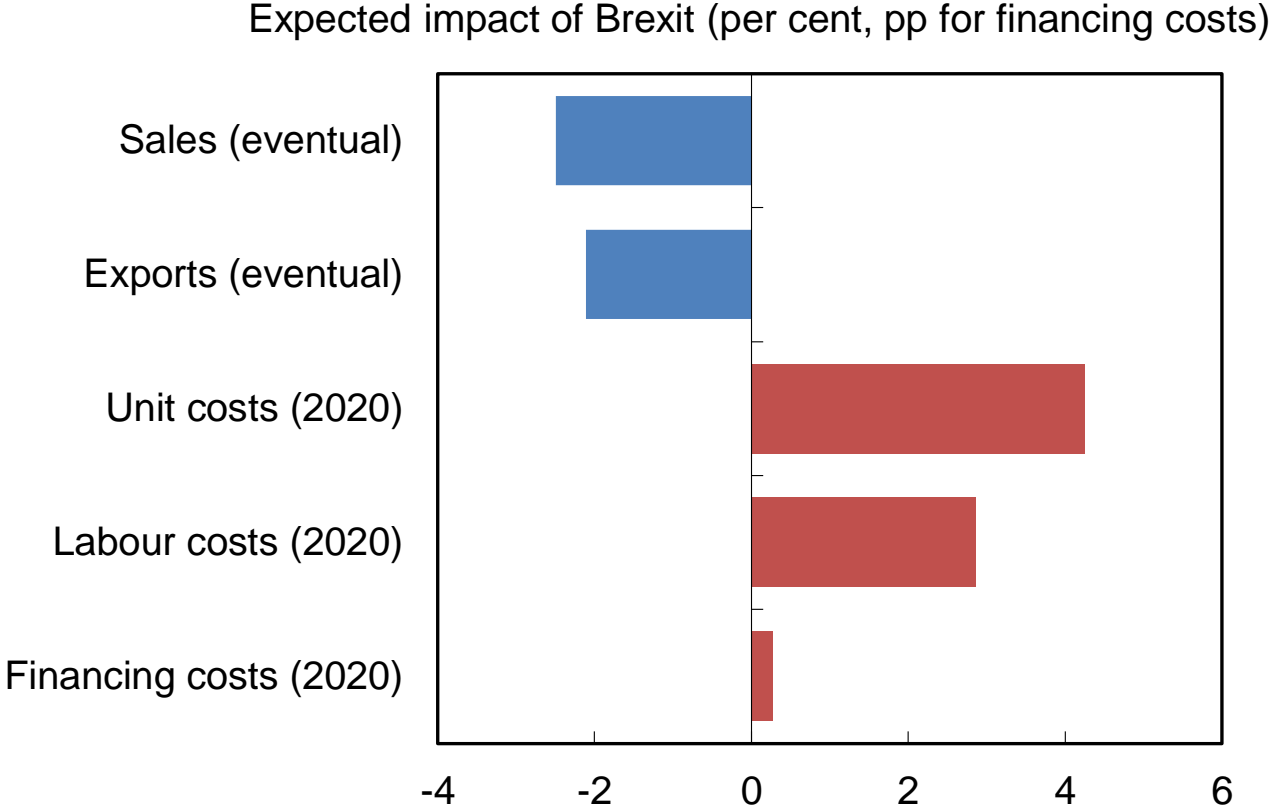
## Key messages

- Brexit has been seen by most firms as large second moment (uncertainty) shock.
- Firms with greater exposure to the EU, e.g. through exports, imports, and more EU workers, are more heavily affected.
- Uncertainties around Brexit are primarily about the impact on businesses over the longer term rather than shorter term.
- Brexit associated with around 1.5% lower employment and 6% less investment
- Misallocation could reduce productivity by around 0.5% (likely to be negative effect within firm effects too)

**Back-Up**

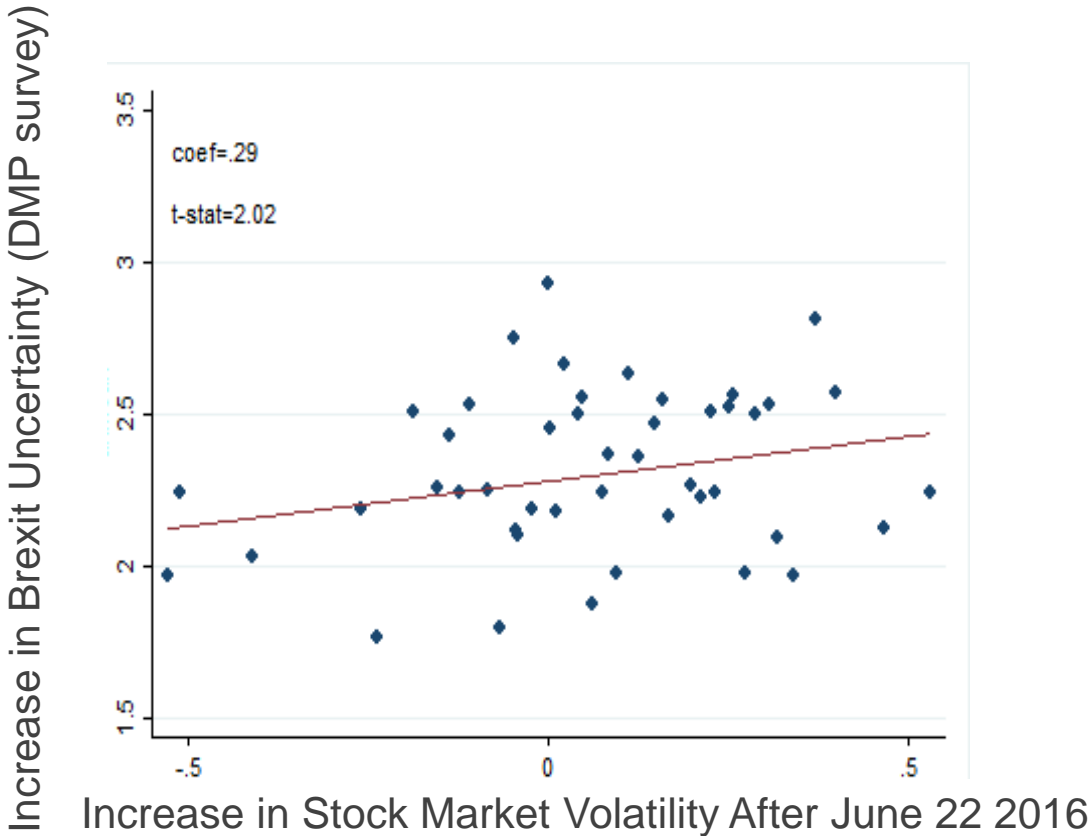


# Firms report Brexit will cut sales, but also exports, while pushing up costs.



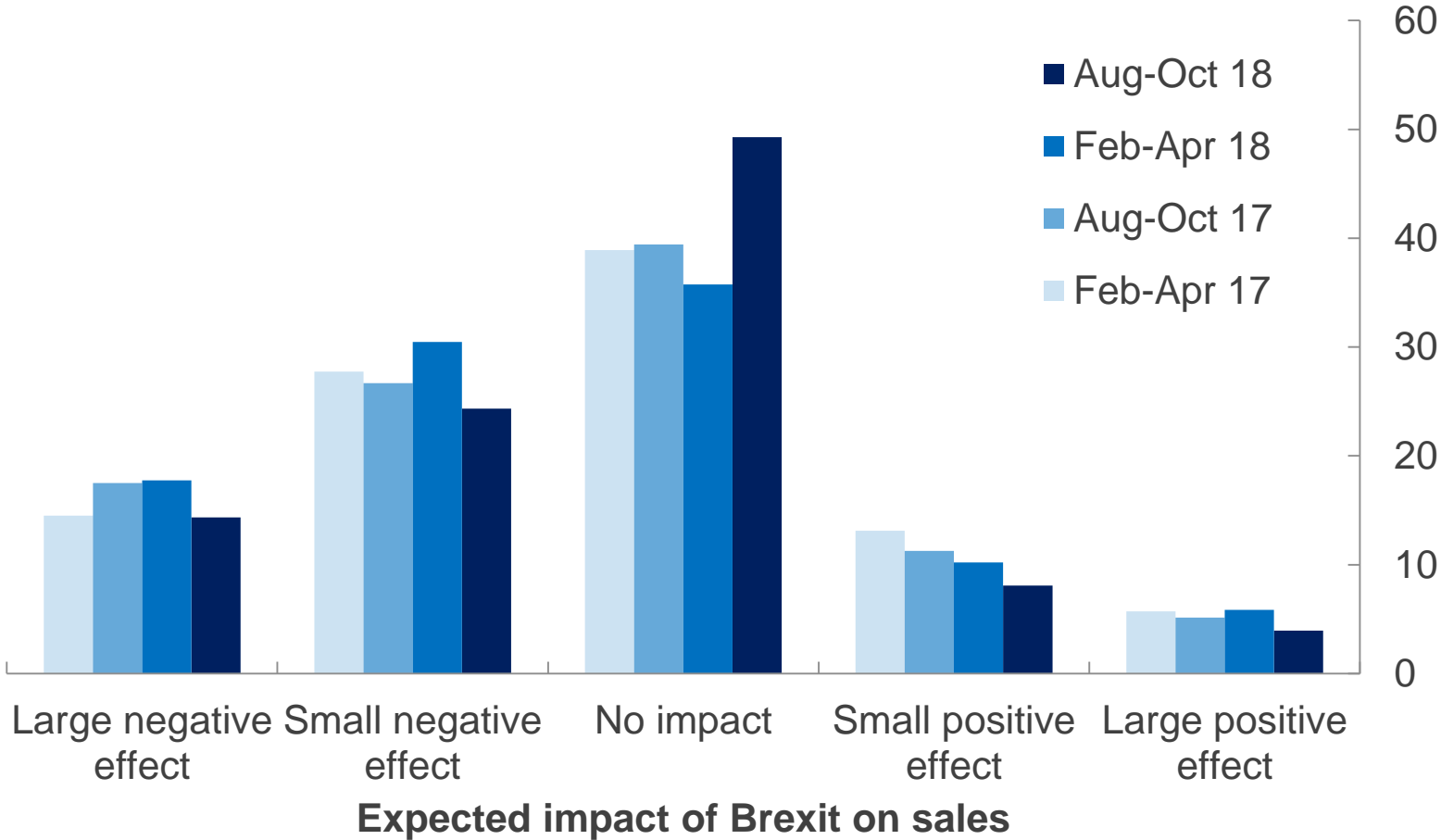
**Notes:** Self reported responses. In each case respondents were asked to assign probabilities to five different outcomes for each variables. Midpoints were then attached to each outcome to calculate mean expectations. Time horizon reported in parentheses. Data are expected percentage impacts of Brexit except for financing costs which are percentage point changes. Data are average values collected across all waves of the survey.

# Brexit Uncertainty Measure is Correlated with Stock Market Volatility



**Notes:** The graph plots firms' reported uncertainty against increase in stock market volatility at industry level. It is plotted using binscatter with 50 bins. Each dot in the underlying graph is a 3-digit UKSIC industry. For the uncertainty measure in DMP, we take the average of a firm's reported uncertainty among all waves, and then collapse to 3-digit UKSIC level by taking the mean of each industry. For the stock volatility measure, we use Compustat stock price data on all public listed firms in UK. We calculate the daily return, and then calculate the log of standard deviation in the 60 days right after Brexit and the 5 years before Brexit, and take the difference between the two (post minus pre). Then we winsorize this firm-level increase in stock volatility at 1 and 99 percentile, and collapse to 3-digit UKSIC level by taking the mean.

# Expected impact of Brexit on sales



## Results with investment level

Dependent variable:	Capex growth (1)	Capex growth (2)	Capex/assets(t-1) (3)
Uncertainty*Year 1 after referendum	-4.629** (2.154)		
Uncertainty*Year 2 after referendum	-0.739 (2.105)		
Uncertainty*Post referendum		-2.675 (1.723)	-2.103** (1.024)
Year dummies	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Observations	6,676	6,676	5,819
R-squared	0.237	0.236	0.611

**Notes:** Post Brexit data from Decision Maker Panel combined with pre-Brexit data from company accounts. All regressions include a data source dummy and are estimated from 2011 onwards (years are defined from Q3 to Q2 in next calendar year). Post Brexit defined as 2016 Q3 onwards. Standard errors are clustered by firm. Only firms with an investment growth rate between -100% and +100% are included. DHS growth rates are used. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.