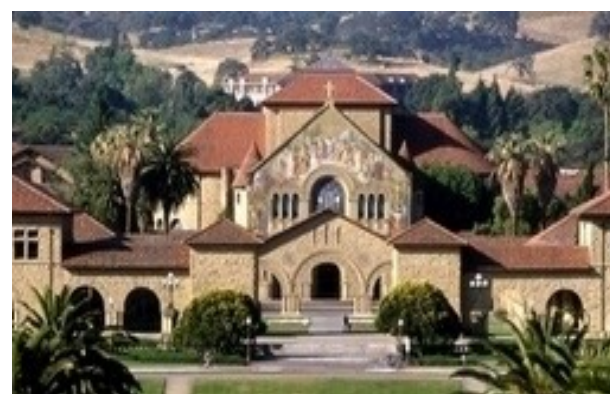


Brexit as a Misallocation Shock

Nick Bloom (Stanford), Phil Bunn (Bank of England), Scarlet Chen (Stanford)
Paul Mizen (Nottingham), Pawel Smietanka (Bank of England), Greg
Thwaites (Bank of England)

Preliminary – Chicago, October 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.

Uncertainty

Norway +
UK in EEA,
EFTA but out
of the CAP,
CFP, and
ECJ.



WTO
Arrange trade
in goods and
services
separately.
NI? Scotland?



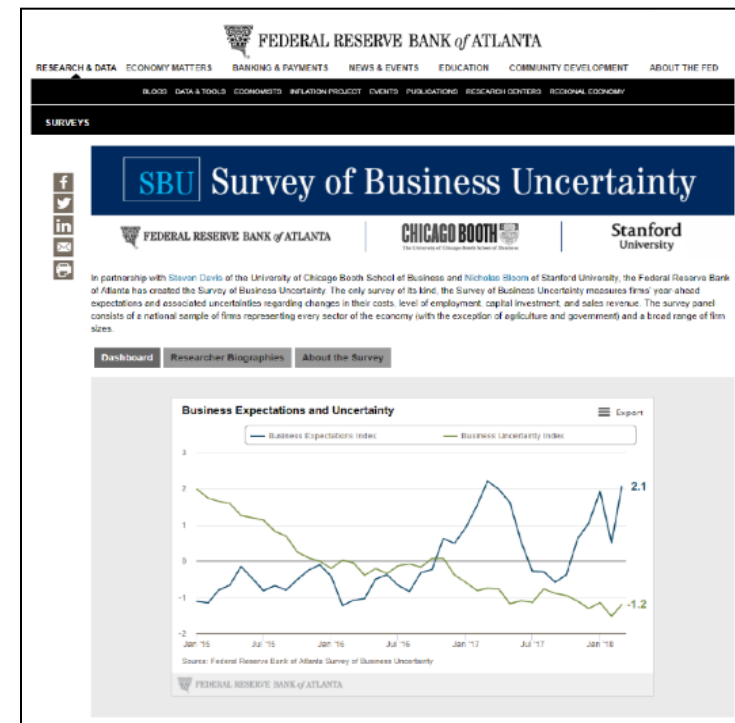
Canada +
No tariffs on
most goods; no
deal on services;
NI in separate
customs union.



Another Vote
Referendum 2.0
General Election

Following Brexit vote a Bank-Nottingham-Stanford team rapidly started a new firm survey

- Used an approach pioneered by the Atlanta Fed (Altig, Barrero, Bloom, Davis, Meyer and Parker, 2015)
- In UK randomly contacted population of all 42K UK firms with 10+ employees inviting them to join the monthly Decision Maker Panel
- To date about 6K have, providing a large sample of timely firm data



Key findings

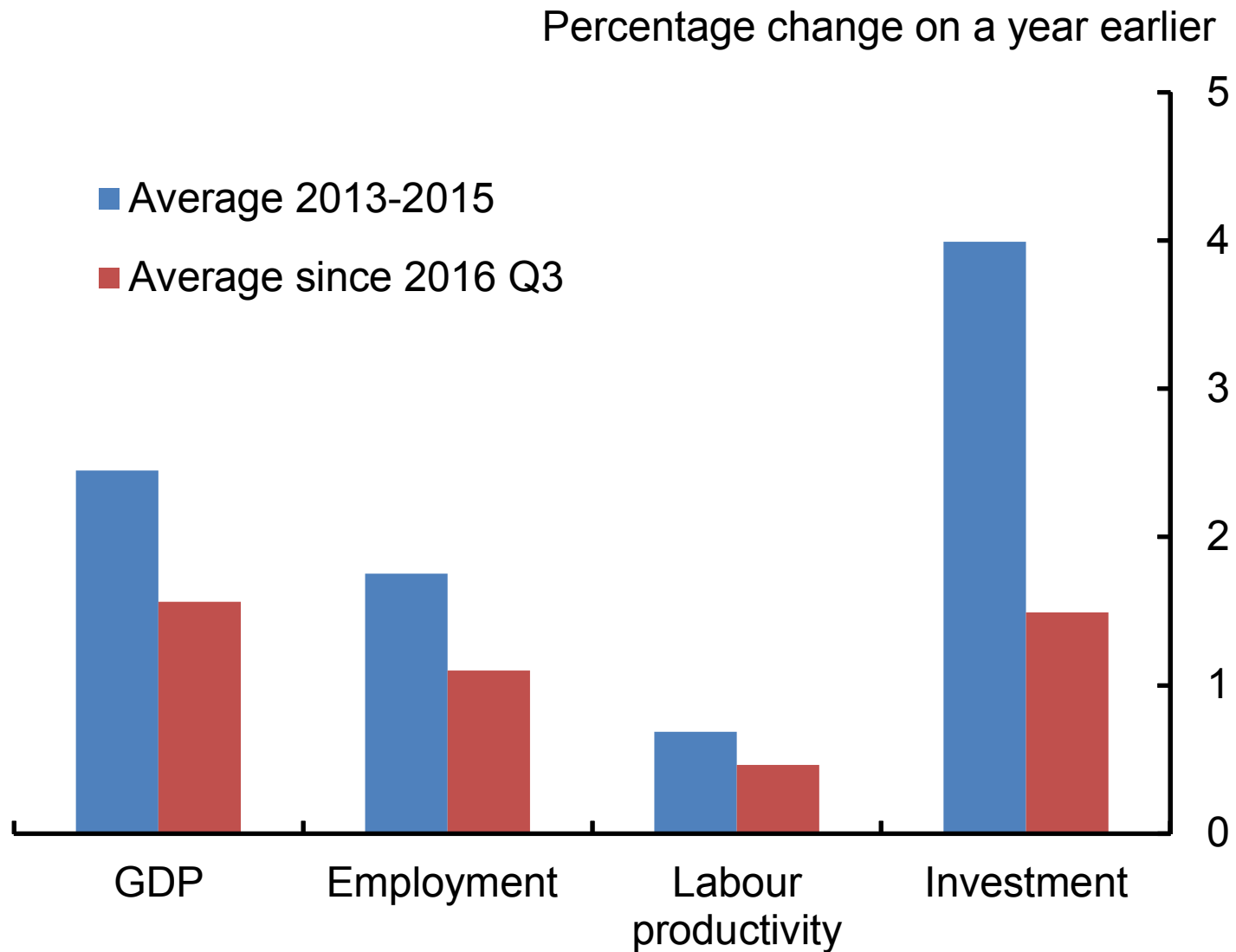
Opinions:

- A) Brexit seen by most firms as large negative first moment shock and second moment (uncertainty) shock
- B) Firms with more EU exports, imports, and more EU workers more heavily affected

Regression results:

- A) Brexit associated with around 1.5% lower employment and 6% less investment
- B) Misallocation could reduce productivity by around 0.5% (likely to be negative effect within firm effects too)

Consistent with UK (macro) data

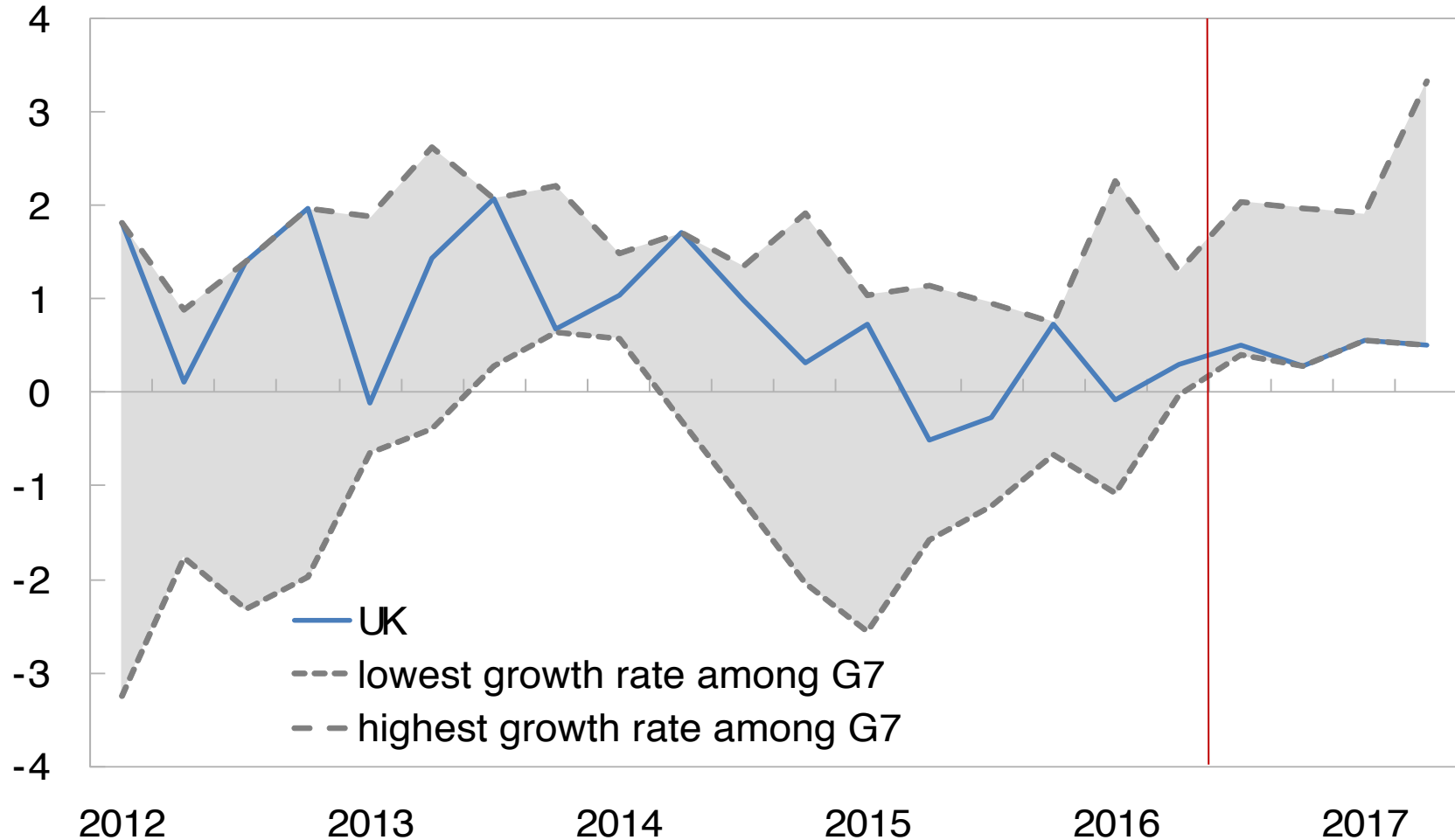


Source: ONS national accounts data

UK slowed while rest G7 higher growth since 2016

Business Investment in G7 Economies

(In percent, Q/Q growth rate, 4-quarter moving average)





Decision Maker Panel

Basic Data

Firms are recruited from a Nottingham call center



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. sales question



BANK OF ENGLAND


Decision Maker Panel (September 2018)


2. Looking back over the past year, by what % amount has your SALES REVENUE changed since the same quarter a year ago (April to June 2017)?

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Quick monthly internet survey – e.g. sales question

 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 %"/>

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September 2018 – SALES AND PRICES

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Quick monthly internet survey – e.g. sales question



Decision Maker Panel (September 2018)

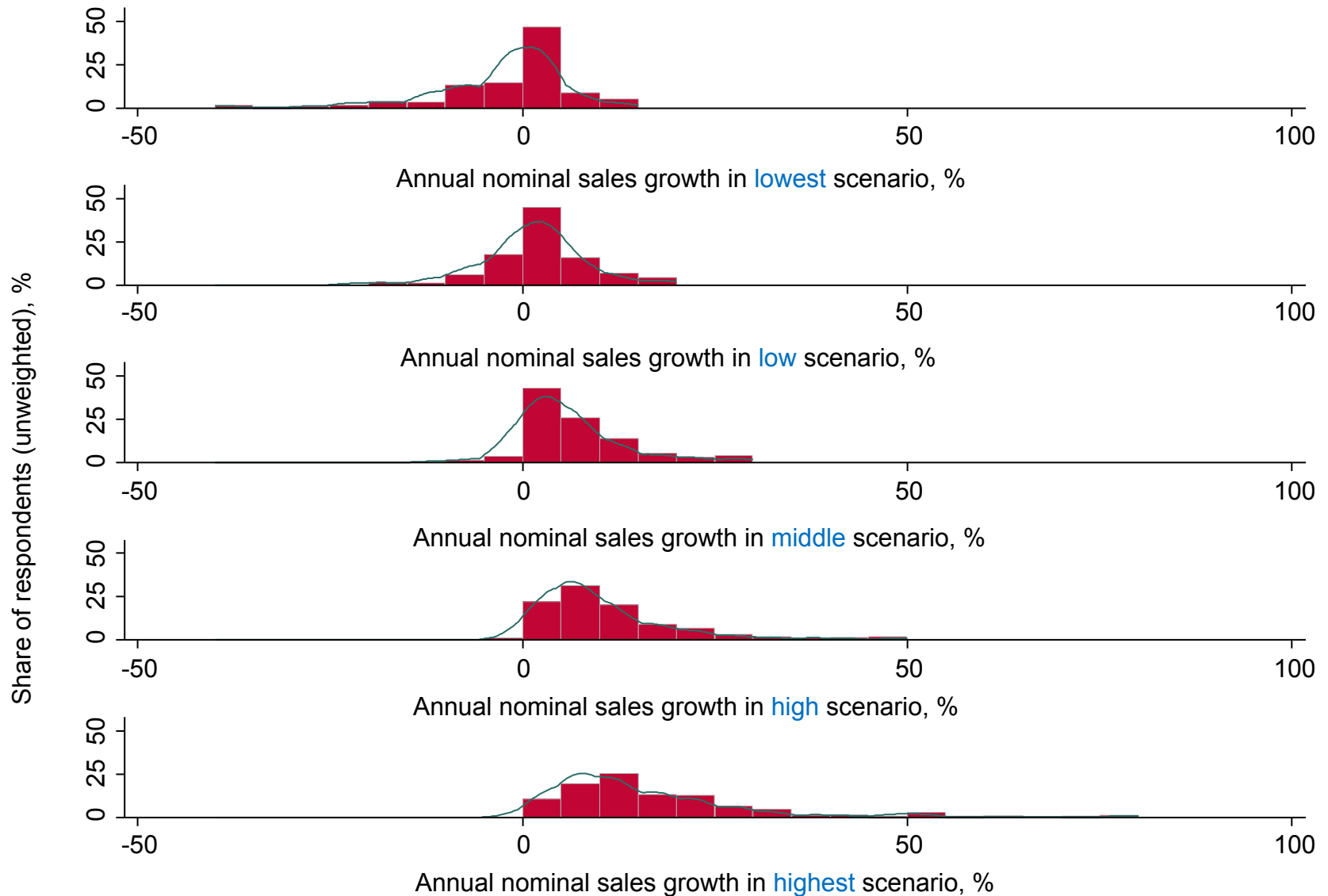
4. Please assign a percentage likelihood (probability) to the % changes in SALES REVENUE you entered (values should sum to 100).

LOWEST: The likelihood of realising about 0.0 % would be:	<input type="text" value="10"/>	
LOW: The likelihood of realising about 3.0 % would be:	<input type="text" value="20"/>	
MIDDLE: The likelihood of realising about 5.0 % would be:	<input type="text" value="40"/>	
HIGH: The likelihood of realising about 7.0 % would be	<input type="text" value="20"/>	
HIGHEST: The likelihood of realising about 10.0 % would be:	<input type="text" value="10"/>	
Total	<input type="text" value="100"/>	

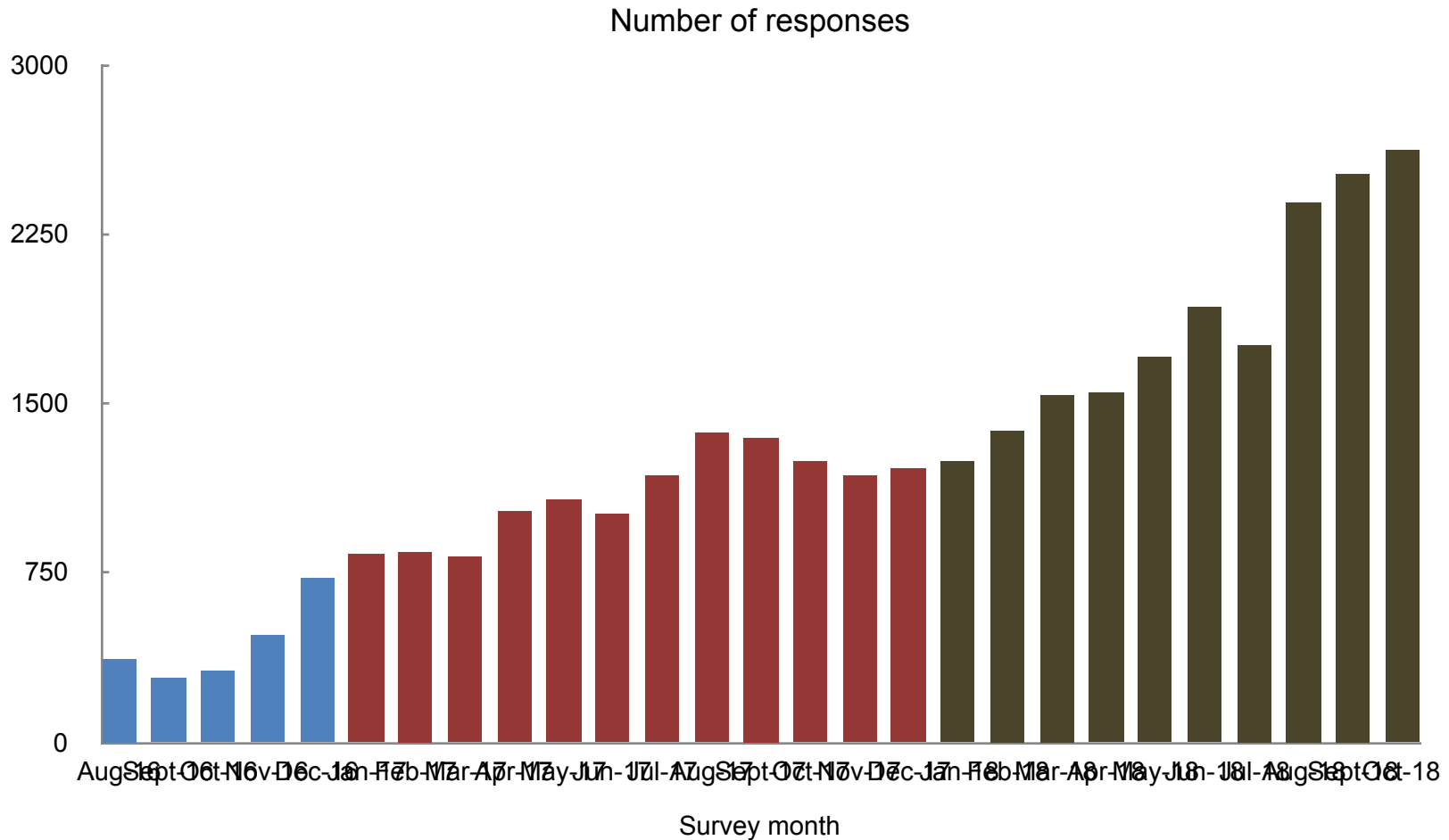
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Average data for sales growth scenarios



By September 2018 obtaining 2.5K responses per month spanning all industries and regions

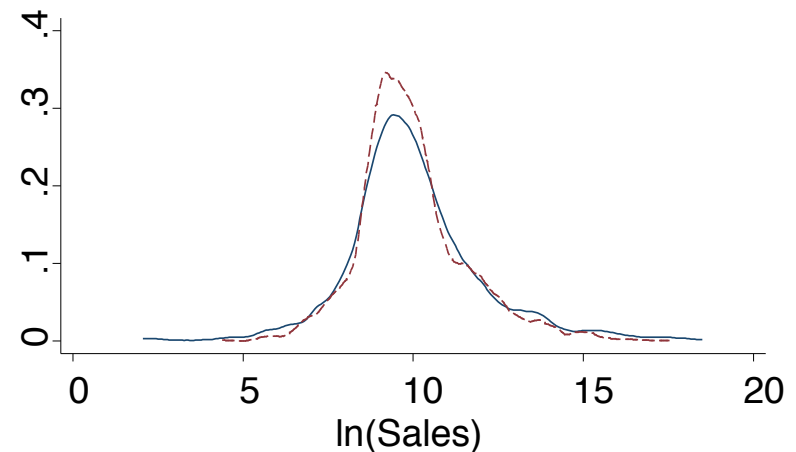
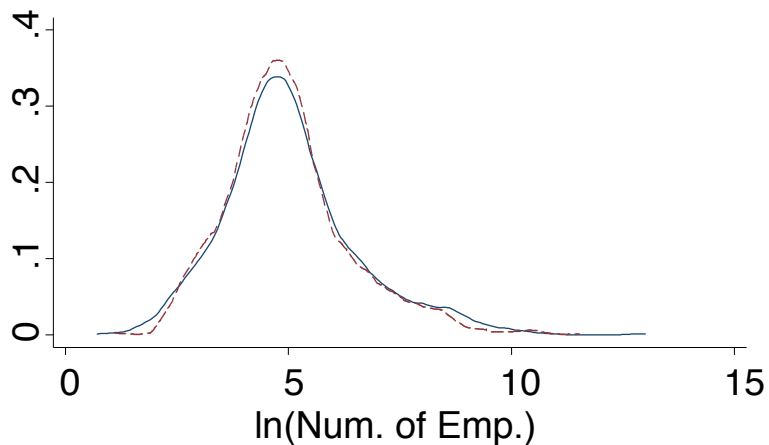
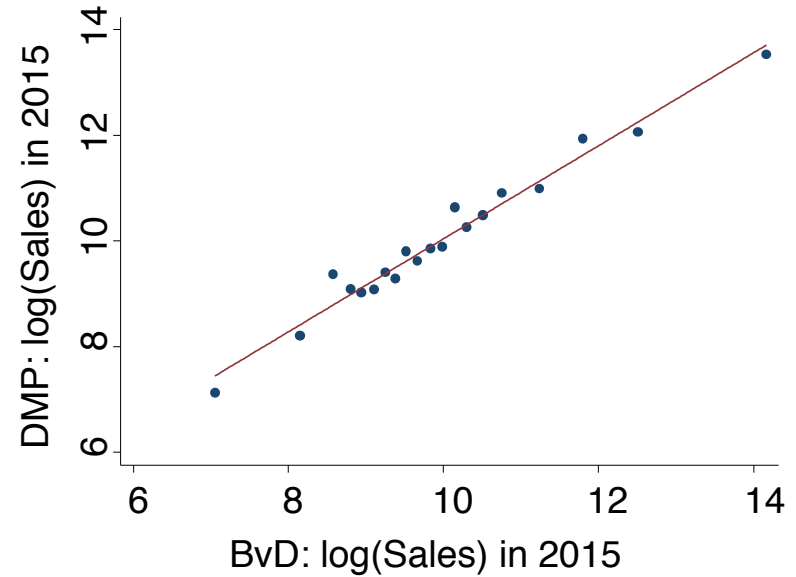
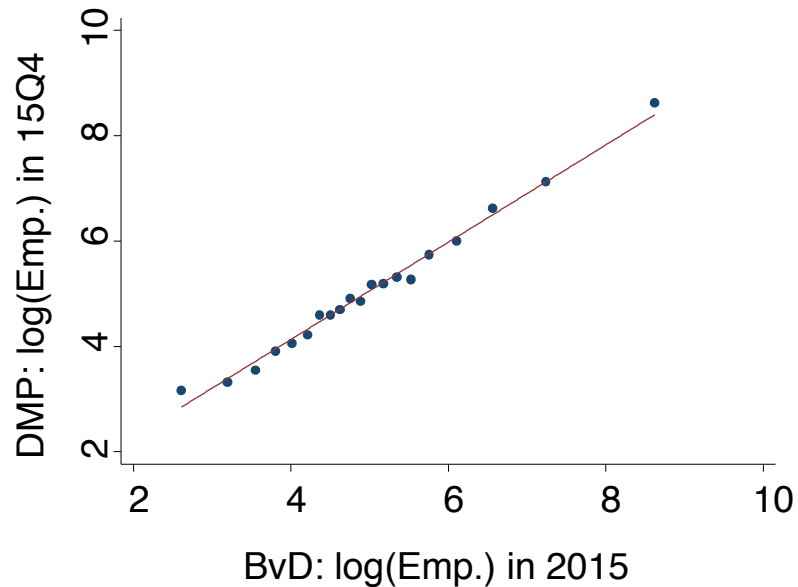


Sampling frame 42K UK firms with 10+ employees: 28% response, uncorrelated with Brexit vote share

Dependent variable: Ever respond to a survey given being in the sampling frame	(1)	(2)	(3)	(4)
Referendum leave vote share	0.014	0.011	0.015	0.017
	-0.012	-0.012	-0.012	-0.012
Log of employment		0.015***	0.011***	0.010***
		-0.001	-0.002	-0.002
Log of sales			0.005***	0.001
			-0.001	-0.002
Log of assets				0.004***
				-0.001
Industry dummies	Yes	Yes	Yes	Yes
Observations	42,102	42,102	42,102	42,102
R-squared	0.063	0.067	0.067	0.067

Notes: Robust standard errors in parentheses. Dependent variable equals one if a firm responded to any of the first 23 waves of surveys. Firm characteristics are taken from latest available year of accounts data. The dependent variable is the referendum share of vote for leaving the EU in the local authority area that a firm has its headquarters in. There are 380 local authorities in the sample. *** p<0.01, ** p<0.05, * p<0.1.

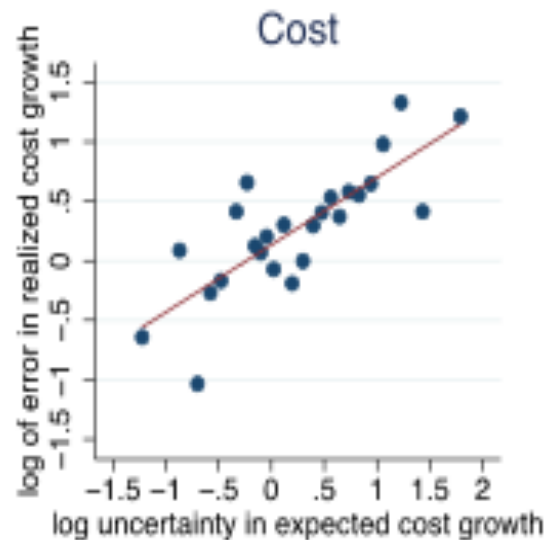
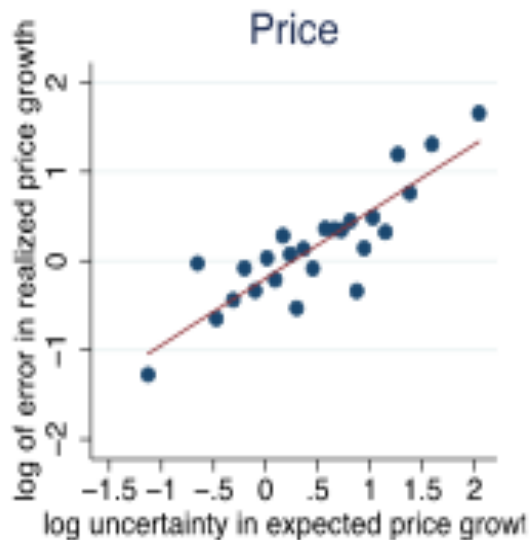
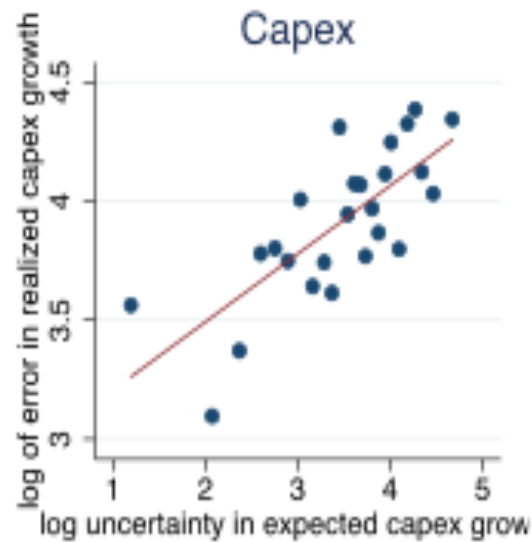
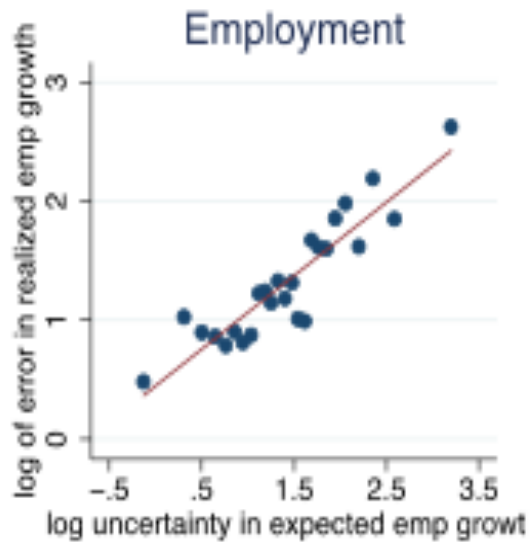
Data quality looks good – for example, comparing DMP to Company Accounts



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

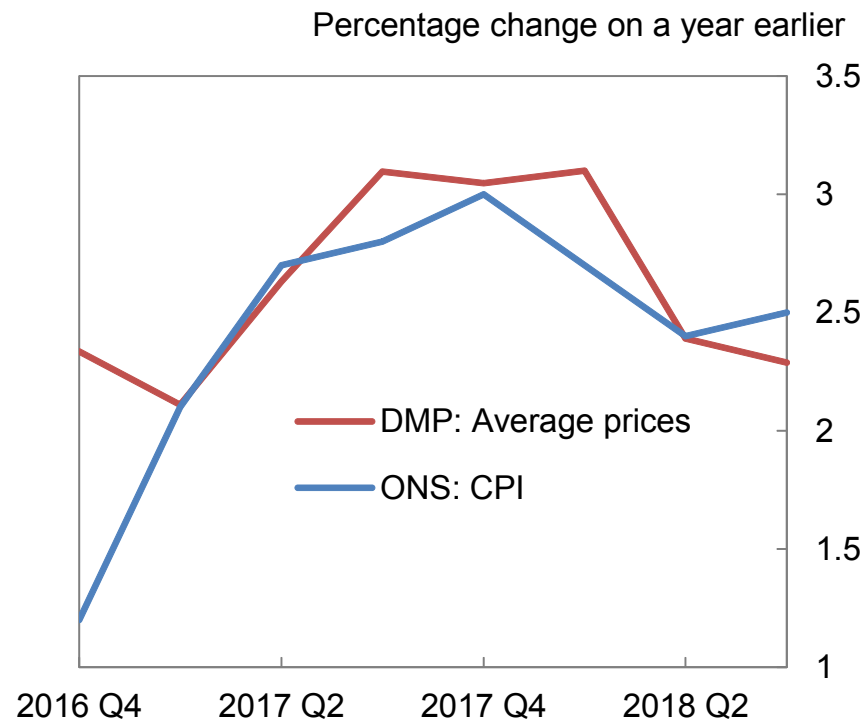
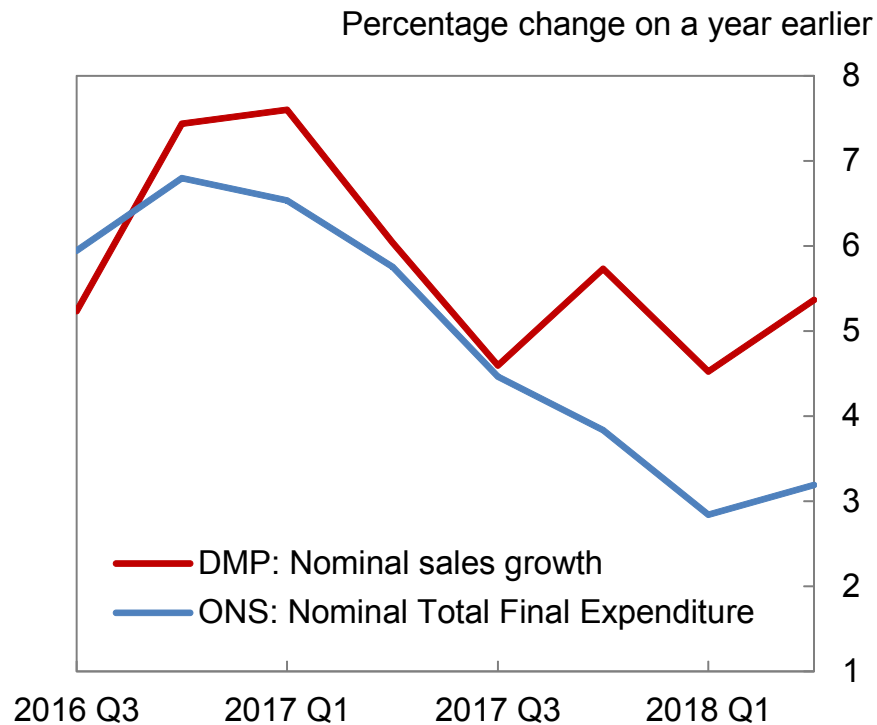
— DMP: ln(Sales) in 2015
- - BvD: ln(Turnover) in 2015

Data quality looks good – for example, uncertainty and forecast errors



Note: Uncertainty defined as subjective uncertainty from the DMP 5-bin responses. Forecast errors defined as $|\text{forecast-actual}|$ growth over the following 12 month period

Data quality looks good – macro aggregates

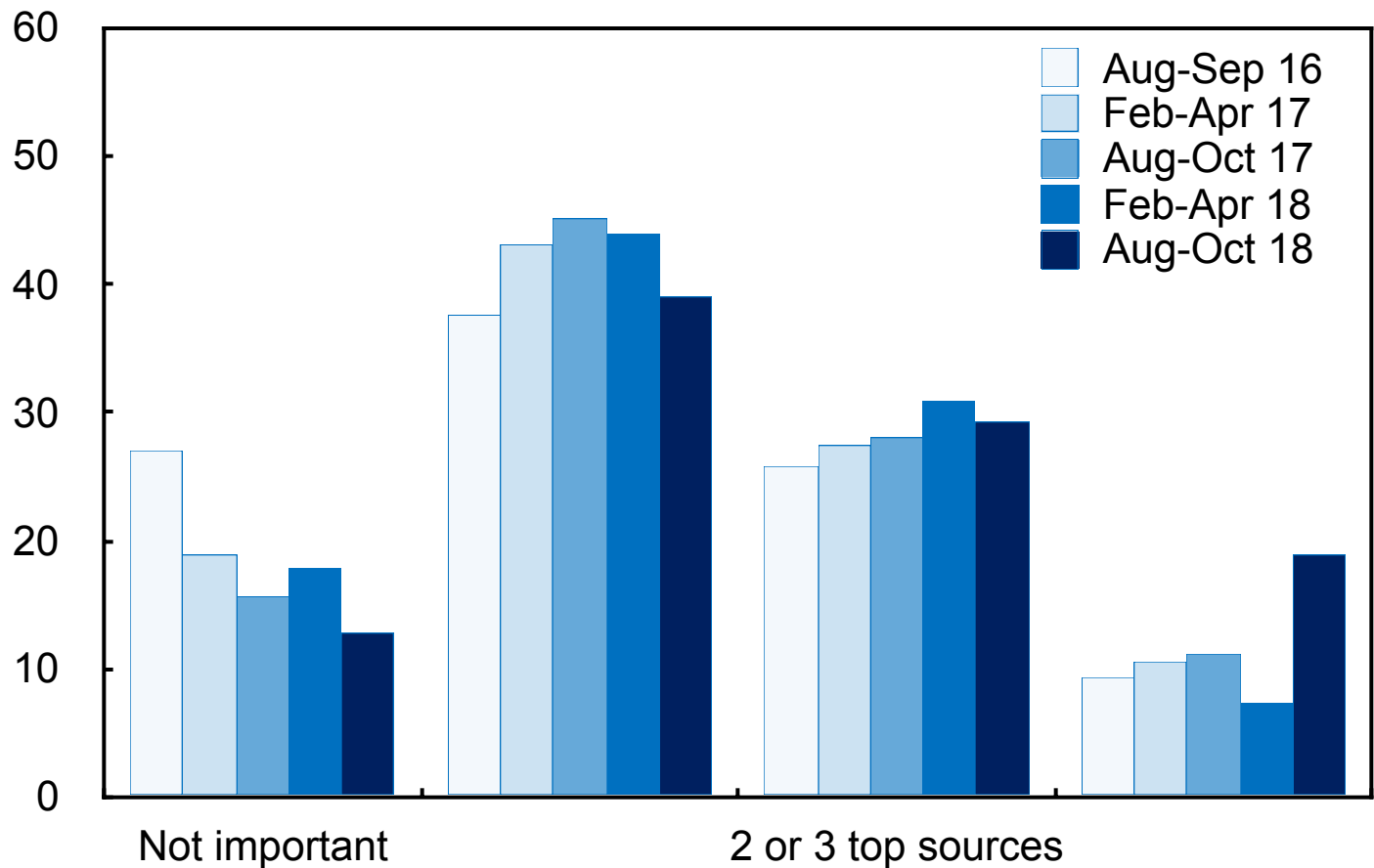


Decision Maker Panel

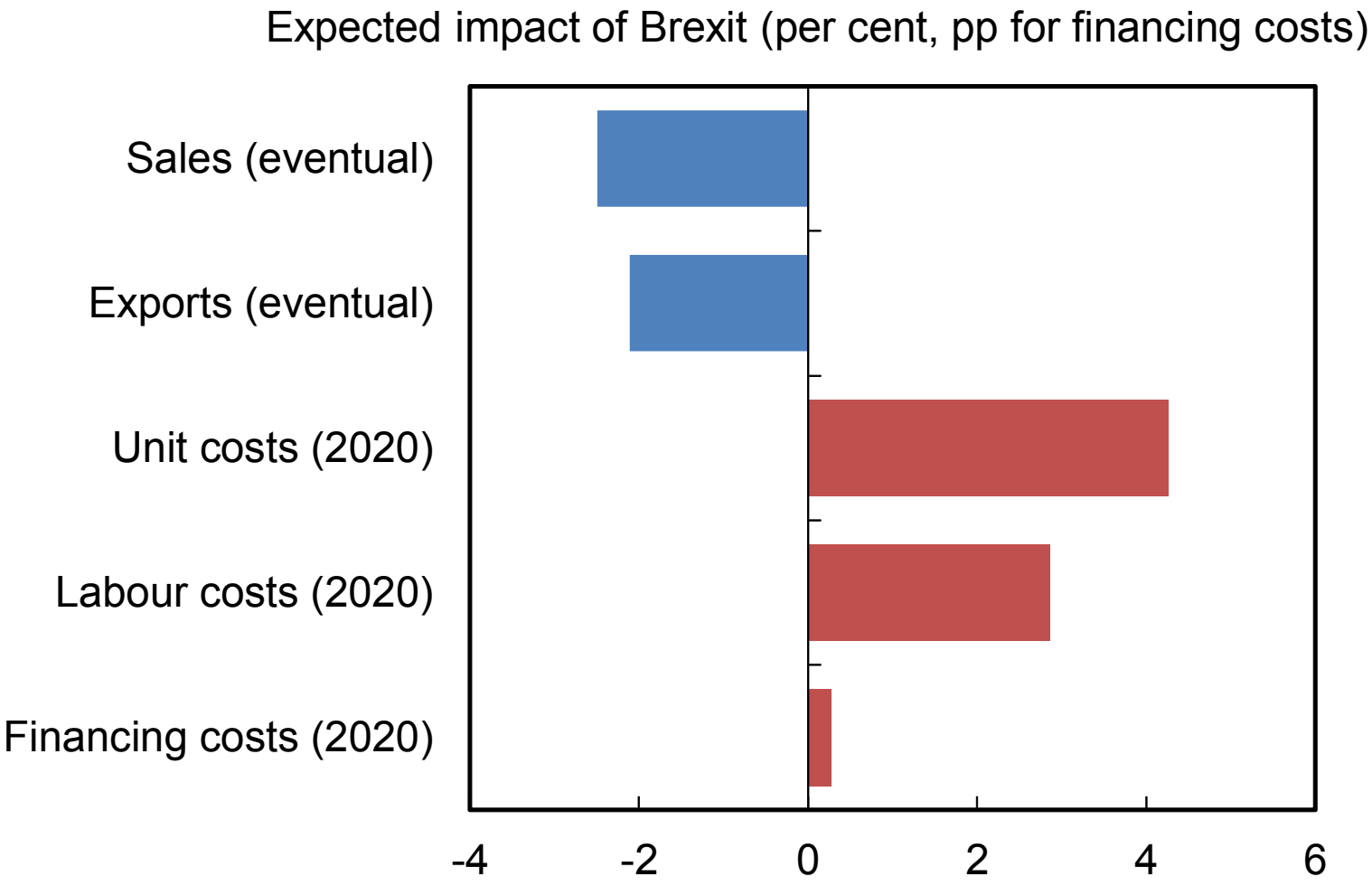
Basic Data

Brexit important source of uncertainty for 40%+

Share of respondents (per cent)



Firms report Brexit will not only cut sales, but also exports, while pushing up costs.



Source: Decision Maker Panel

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.

Decision Maker Panel

Basic Data

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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

Notes: 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.

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.

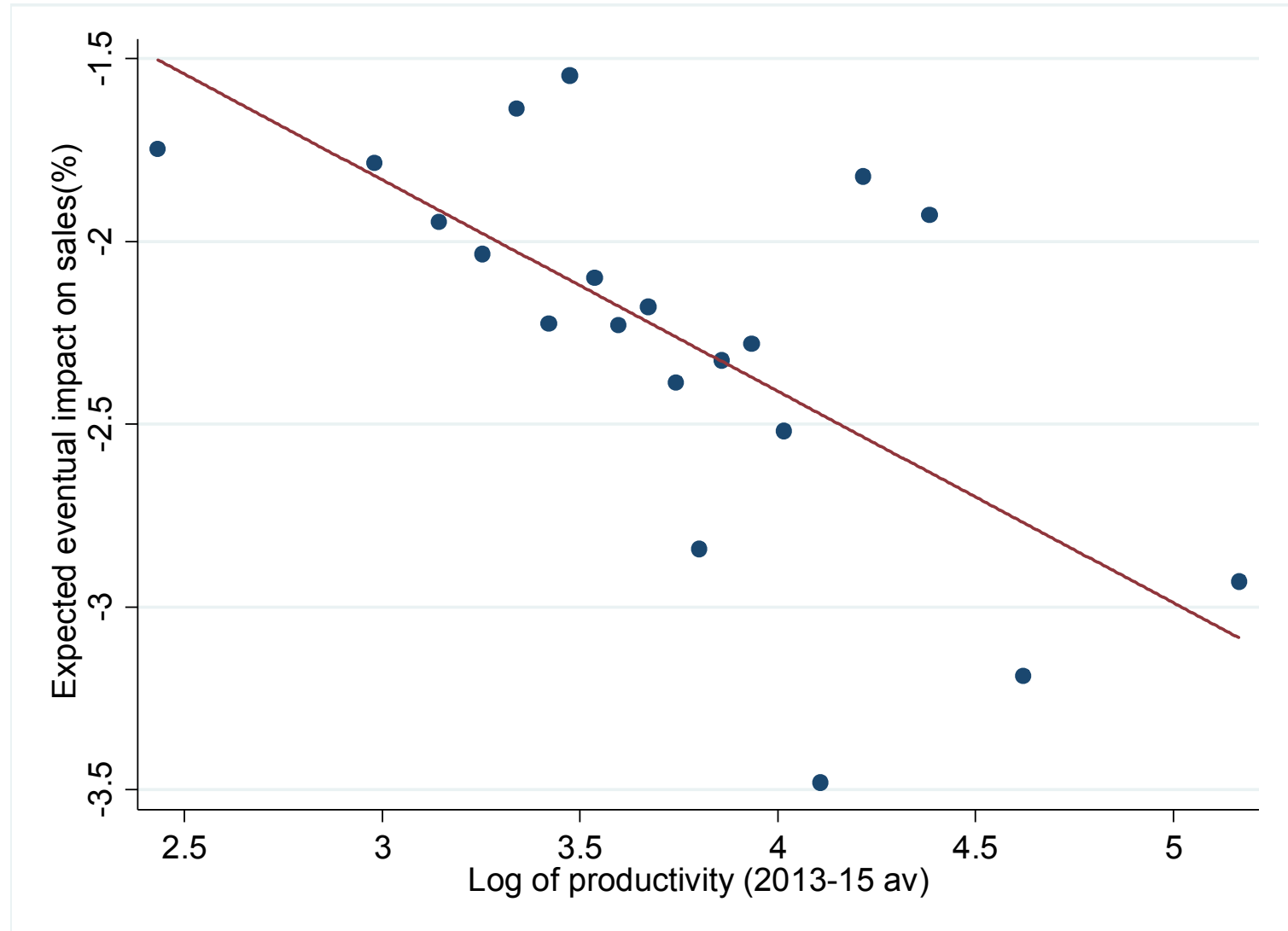
And Brexit is associated with less investment

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

Aggregate productivity effect, weighted by sales

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%

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

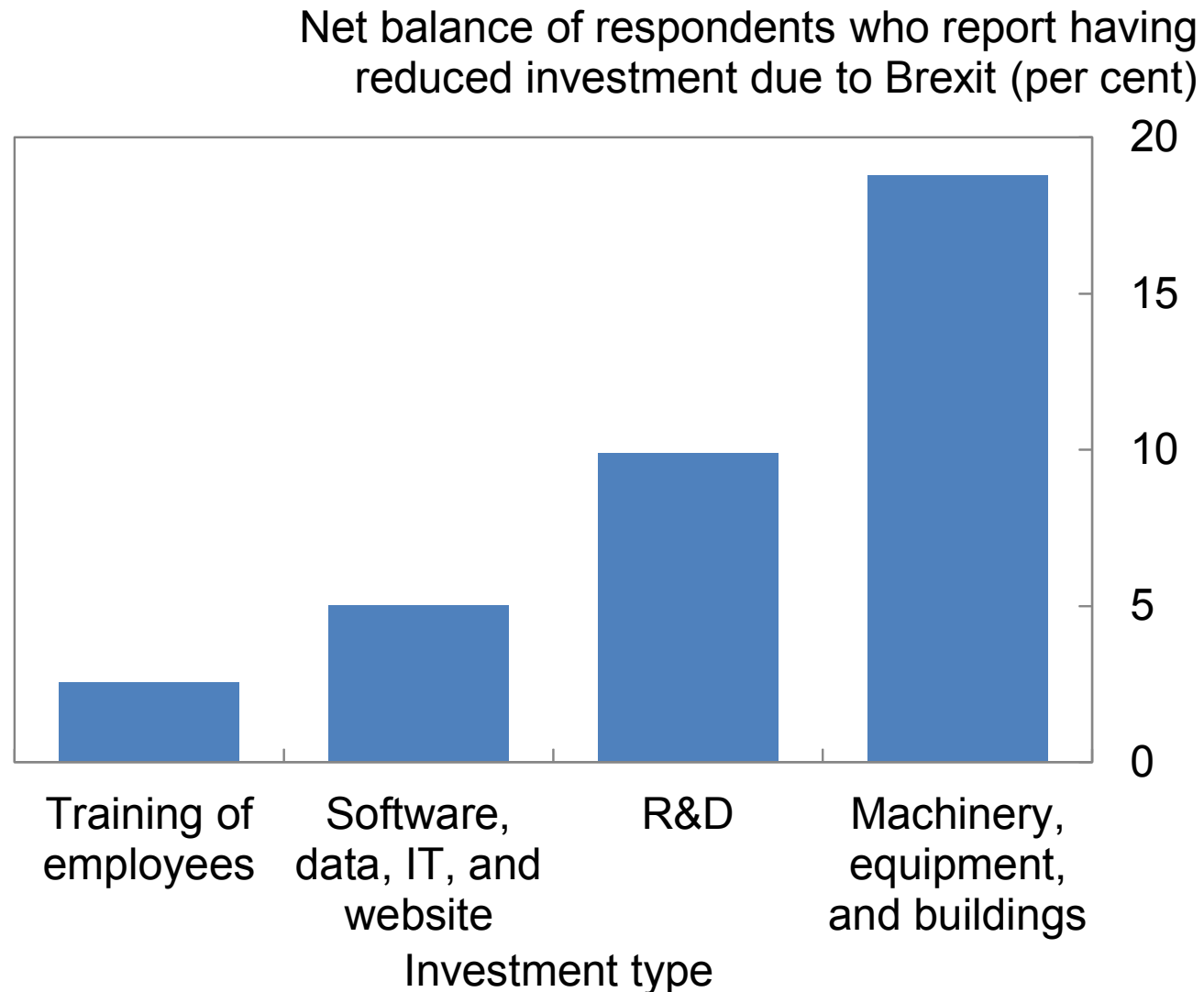
Number of hours a week spent on preparing for Brexit (share)

	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

Source: Decision Maker Panel. Data collected November 2017-January 2018.

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



Conclusions: Key findings

Opinions:

- A) Brexit seen by most firms as large negative first moment shock and second moment (uncertainty) shock
- B) Firms with more EU exports, imports, and more EU workers more heavily affected

Regression results:

- A) Brexit associated with around 1.5% lower employment and 6% less investment
- B) Misallocation could reduce productivity by around 0.5% (likely to be negative effect within firm effects too)