The Impact of Brexit on UK Firms Exploration of the Decision Maker Panel Survey

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Brexit Key Dates

- 1. <u>June 2016</u> referendum, 52% voted leave. David Cameron resigned, succeeded by Theresa May.
- Jan-Mar 2019 Withdrawal Agreement (result of Brexit negotiation Nov 2018) voted down three times by parliament.
- 3. <u>7 Jun 2019</u> Theresa May resigned, succeeded by Boris Johnson.
- 4. <u>31 Jan 2020</u> Britain (currently) needs to leave (Article 50).

Following the vote 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, ≈14% private employment









Key Findings

- 1. Brexit process generated a large, broad and long-lasting increase in uncertainty
- 2. Investment reduced by around **11%** since the referendum; took longer to occur than predicted
- 3. Productivity reduced by between **2%** and **5%** since the referendum; both *within* and *between*-firm effect

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Decision Maker Panel (DMP)

Basic Data

Impact of Brexit

Survey response uncorrelated local Brexit vote share (but weakly correlated with size)

Dependent Variable. Respond to a survey								
	(1)	(2)	(3)	(4)				
Leave vote share	0.014	0.011	0.015	0.017				
	(0.012)	(0.012)	(0.012)	(0.012)				
Employment (in logs)		0.015***	0.011***	0.010***				
		(0.001)	(0.002)	(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.

Quick monthly internet survey – e.g. sales question



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	250	
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Quick monthly internet survey – e.g. expectations



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 <u>changed</u> in each of the following scenarios?

The LOWEST % change in sales revenue would be about:	0.0 %	
A LOW % change in sales revenue would be about:	3.0 %	
A MIDDLE % change in sales revenue would be about:	5.0 %	
A HIGH % change in sales revenue would be about:	7.0 %	
The HIGHEST % change in sales revenue would be about:	10.0 %	

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81% respondents are CEO/CFOs

Percentage of respondents



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 versus 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 versus prediction 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.

Decision Maker Panel (DMP)

Basic Data

Impact of Brexit

Uncertainty over when/if Brexit will happen

Question: "When do you expect the UK to leave the EU?"

Average probability (per cent)



Uncertainty over the impact of Brexit

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



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Prolonged period of uncertainty



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?

OLIVE

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 nodeal Brexit

Brexit Uncertainty Index

Share of firms reporting Brexit as one of their top 3 sources of uncertainty



Source: Decision Maker Panel and authors' calculations.

Notes: The results are based on the question '*How much has the result of the EU referendum affected the level of uncertainty affecting your business?*'. The first index shows average responses to the uncertainty question, ranging from 1 to 4. The second index shows the percentage of respondents that view Brexit as one of the top 3 sources of uncertainty. Values are interpolated for months before August 2018 when the question about uncertainty was not asked. All values are weighted.

Increase in uncertainty not seen in other measures



Standard deviations from average since 1997

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 lines up with subjective uncertainty



Notes: X-axes show average Brexit uncertainty on the 1 (not important) to 4 (largest source or 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 lines up with stock market return and volatility

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*	0.457***				
	(0.326)	(0.139)				
Change in stock returns around referendum			-0.022*		-0.020	
			(0.012)		(0.013)	
Change in stock volatility around				0.075***	0.073***	
referendum				(0.024)	(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 referendnum 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.

Decision Maker Panel (DMP)

Basic Data

Impact of Brexit

In the post-referendum period investment and productivity have been weaker for more uncertain firms than less uncertain firms

Investment and productivity growth in pre- and post-referendum periods by uncertainty



Source: Decision Maker Panel, Bureau Van Dijk FAME database and authors' calculations.

Notes: The results are based on the question 'How much has the result of the EU referendum affected the level of uncertainty affecting your business?'. The 'high uncertainty' group includes respondents who ranked Brexit as one of their top 3 sources of uncertainty, whilst those who ranked Brexit as one of many sources or not an important source are included the 'low uncertainty' category.

In the post-referendum period investment and productivity have been weaker in the UK compared with other G7 countries

Output per head **Business investment** Indices: 2016 Q2=100 Indices: 2016 Q2=100 Post EU-referendum Post EU-referendum G7 (excl. UK) UK G7 (excl. UK) UK

Business investment and productivity in UK and other G7 economies

Source: OECD and authors' calculations.

Using average firm-level data and a diff-in-diff approach we estimate the impact of Brexit process on firms in UK

$$y_{it} = \beta E_i \times POST + \gamma_i + \lambda_t + \epsilon_{it}$$

- *i* firm
- t year
- y_{it} investment/employment/productivity growth
- *POST* dummy variable for 2016Q3 onwards
- E_i is Brexit exposure of firm i

Brexit first moment (demand/costs) and second moment (uncertainty) are correlated across firms

Expected impact of Brexit on sales by uncertainty



Per cent

Source: Decision Maker Panel and authors' calculations.

Notes: Question 'How do you expect the eventual Brexit agreement to affect your sales once the UK has left the EU, compared to what would have been the case had the UK remained a member of the EU?' See footnote on slide 20 for question about Brexit uncertainty.

Firms are exposed to Brexit in many different ways, not only through trade with the EU

Characteristics of firms uncertain about Brexit



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

Notes: All EU exposure measures are for 2016 H1, just before the Brexit referendum. Charts show the average uncertainty per firm reported 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. See footnote on slide 15 for definition of the Brexit Uncertainty Index (BUI).

Brexit has had a negative impact on investment and employment over the past three years...

Dependent variable:		Investme	nt growth		Employment growth				
All equations estimated 2011-2018	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
	OLS	OLS	OLS	IV	OLS	OLS	OLS	IV	
Brexit exposure*all years post referendum	-2.749***		-2.165**	-6.245**	-0.230		0.042	-0.856	
	(0.896)		(1.031)	(2.937)	(0.207)		(0.245)	(0.678)	
Brexit exposure*2016 dummy		-2.993**				-0.166			
		(1.356)				(0.292)			
Brexit exposure*2017 dummy		-2.081*				-0.296			
		(1.194)				(0.267)			
Brexit exposure*2018 dummy		-3.215**				-0.226			
		(1.272)				(0.244)			
Eventual Brexit sales impact*all years post			0.366*				0.112**		
referendum			(0.187)				(0.047)		
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Observations	21,537	21,537	20,456	21,537	35,499	35,499	33,512	35,499	
F-test of excluded instruments (p-value)				0.000				0.000	
Overidentification test (p-value)				0.658				0.160	

Impact of the Brexit process on investment and employment

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

...as well as a negative impact on within-firm productivity growth

Dependent variable (all in growth terms):	Value-added			Labour productivity			TFP			TFP
All equations estimated 2011-2017	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	IV
Brexit exposure*all years post referendum	-1.054**		-0.830	-1.056**		-1.051**	-1.114***		-0.885*	-1.689
interacted with firm size dummy:	(0.429)		(0.508)	(0.421)		(0.499)	(0.427)		(0.501)	(1.497)
10-49 employees		-1.740***			-1.492***			-1.503***		
		(0.563)			(0.536)			(0.558)		
50-99 employees		-1.323***			-1.657***			-1.202**		
		(0.498)			(0.494)			(0.491)		
100-249 employees		-0.706			-0.493			-0.837*		
		(0.465)			(0.458)			(0.457)		
250-999 employees		-0.859*			-1.092**			-0.895*		
		(0.496)			(0.476)			(0.489)		
1000+ employees		-0.208			-0.277			-1.202**		
		(0.548)			(0.555)			(0.562)		
Eventual Brexit sales impact*all years post			0.115			0.017			0.065	
referendum			(0.095)			(0.091)			(0.087)	
Time fixed effects	Yes	Yes		Yes	Yes		Yes	Yes		Yes
Firm fixed effects	Yes	Yes		Yes	Yes		Yes	Yes		Yes
Observations	23,308	23,308		23,308	23,308		23,308	23,308		23,308
F-test of excluded instruments (p-value)										0.000
Overidentification test (p-value)										0.161

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

Brexit-related uncertainty is linked to the amount of resources spent on Brexit



Resources spent on Brexit by 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?'. See footnote on slide 20 for the question on Brexit uncertainty.

The impact of Brexit on investment spending

Net balance of respondents who reported reducing investment due to Brexit, per cent



Source: Bureau van Dijk FAME dataset, 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 less than 5%; a large negative influence, subtracting less the share saying it has increased investment. Data were collected between February and April 2019. All values are weighted.

The impact on uncertainty on (within-firm) productivity might be due to resources thrown into Brexit preparations

Resources spent planning for Brexit and Brexit uncertainty/exposure

Dependent variable:	CEO & CFO	weekly hours	Brexit spending as % of		
	Brexit p	Brexit planning		al GVA	
	(1)	(2)	(3)	(4)	
	013	1 V	013	IV	
Brexit exposure	1.953***	3.323***	1.051***	2.987***	
	(0.089)	(0.307)	(0.089)	(0.317)	
Observations	3,215	3,215	1,490	1,490	
R-squared	0.130		0.086		
F-test of excluded instruments (p-value)		0.000		0.000	
Overidentification test (p-value)		0.067		0.262	

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

But there has been a between-firm impact of Brexit on productivity too

Dependent variable:	Brexit e (uncertaint)	exposure y, 1-4 scale)	Expected impact o sale	Log of pre- referendum labour productivity		
	(1)	(2)	(3)	(4)	(5)	
	OLS	OLS	OLS	OLS	OLS	
Log of pre-referendum labour productivity	0.069***		-0.289**			
	(0.020)		(0.123)			
Share of sales to EU		0.335***		-2.777***	0.374***	
		(0.089)		(0.667)	(0.084)	
Share of costs from EU imports		0.504***		-1.636***	0.185***	
		(0.078)		(0.475)	(0.057)	
Share of EU migrants in workforce		1.183***		-4.690***	-0.159	
		(0.168)		(1.126)	(0.146)	
Share of sales covered by EU regulations		0.499***		-2.174***	0.095*	
		(0.059)		(0.393)	(0.051)	
EU owned (dummy variable)		0.144***		-0.187	0.116***	
		(0.046)		(0.287)	(0.039)	
3 digit industry dummies	Yes	Yes	Yes	Yes	Yes	
Observations	4,349	4,349	4,349	4,349	4,349	
R-squared	0.166	0.110	0.098	0.066	0.298	

Impact of the Brexit process on between-firm productivity

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

Using the evidence from micro data analysis, we estimated aggregate impact of Brexit on investment, employment, and productivity level in the UK



Aggregate impact of Brexit

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

Notes: Results presented here are based on regression analysis and difference-in-difference estimator. Productivity is defined as real value-added (operating profits plus total labour costs divided by the aggregate GDP deflator) per employee using accounting data. Productivity estimates include both within and between-firm effects. Lower productivity estimate allows within-firm effects to vary by firm size, the higher estimate assume the effects are the same for firms of all sizes.

Concluding remarks

- 1. Using a business survey, offering high quality of data at high frequency, we are able to measure how uncertain firms are about the UK's withdrawal from the EU alongside their various characteristics.
- 2. We found that firms exposed to the EU report higher level of uncertainty but also are less confident about the future.
- Combined survey and accounts data and applying diff-in-diff approach we found that Brexit process decreased investment by ca.
 11% and productivity by about 2% (varying effects by firms size considered and if weighted by firms size)
- 4. The marginal impact of Brexit on productivity was larger for smaller firms.