Economic and Social Research Council

The Impact of COVID-19 on Productivity

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Banco de España

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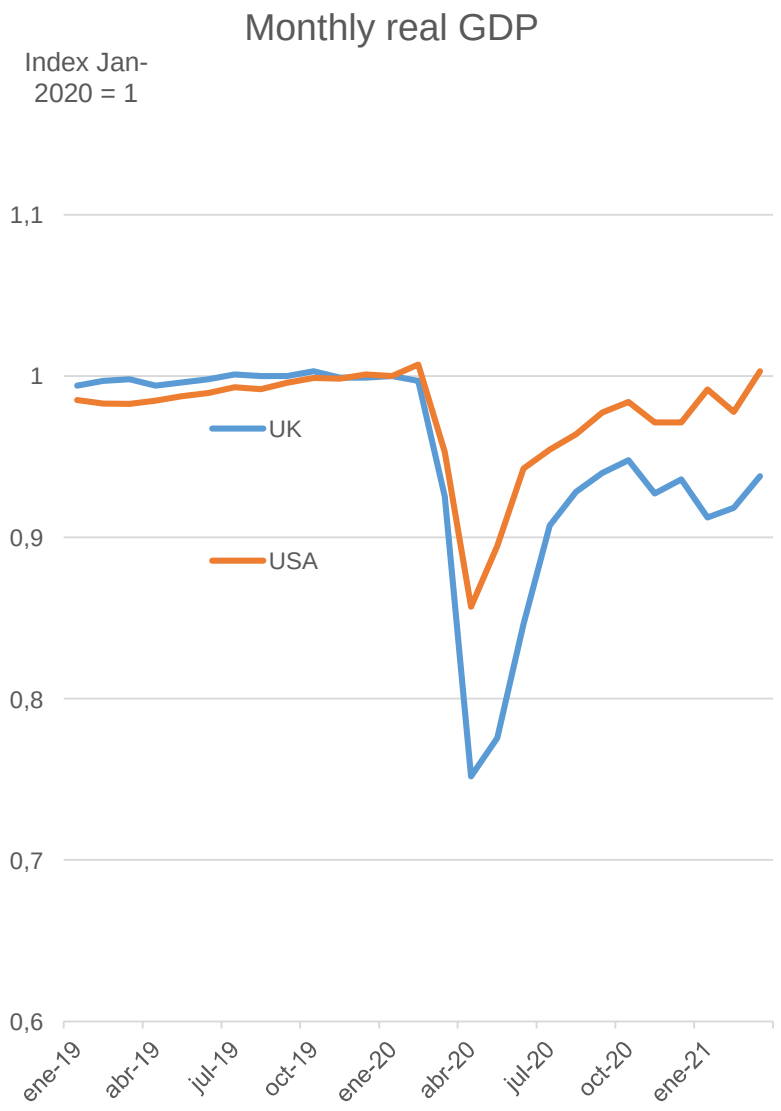
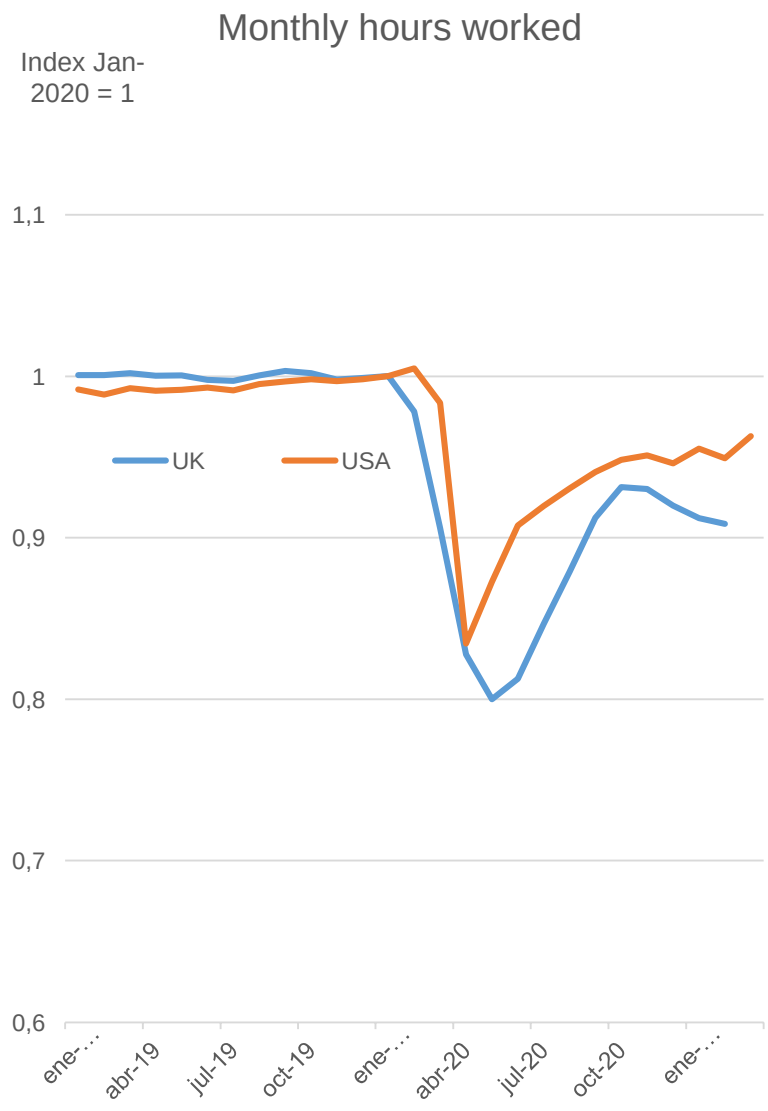
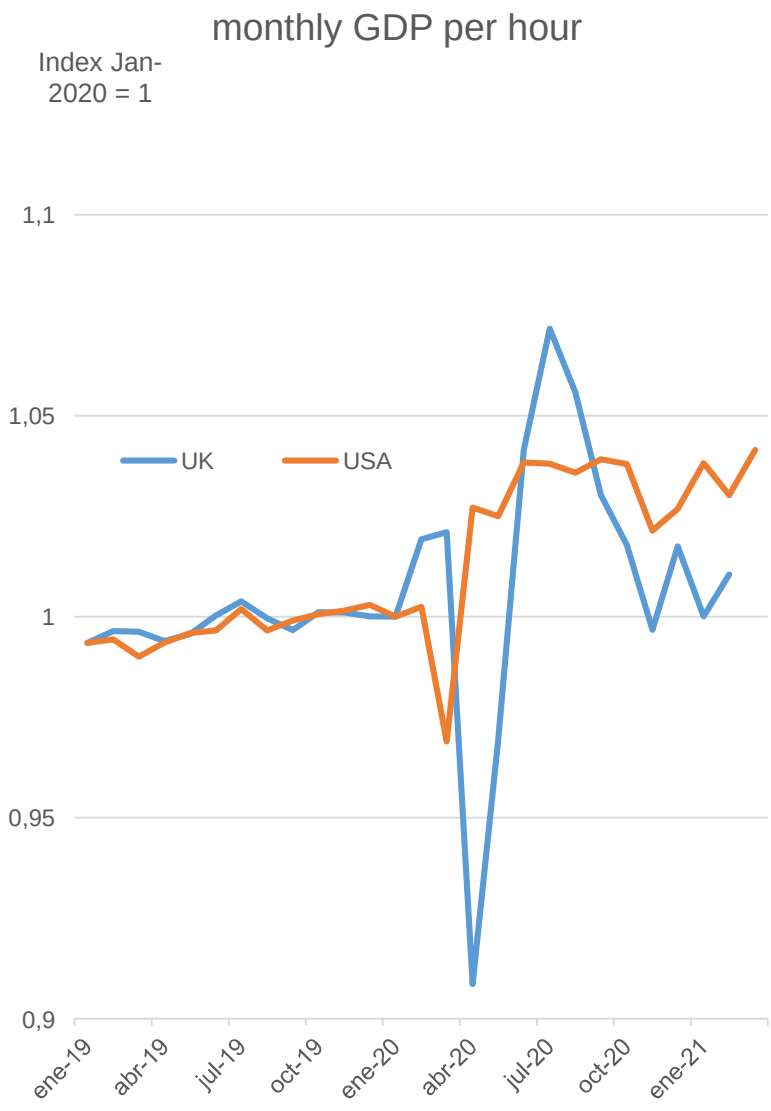
COVID had a huge impact on UK and US GDP and Employment







Notes: UK GDP from ONS. Hours worked data subtract end-month furloughed employees from total employment, assuming avg. hours fixed for remaining employees. US monthly GDP from IHS markit. US hours are the product of total private employees (USPRIV) and average weekly hours of all private employees (AWHAETP).

Key Issues for Productivity During Covid

Labour Productivity (LP)

Output and Employment fell (previous charts)

Hours fell more than output so productivity per hour rose

Total Factor Productivity (TFP)

Capital utilisation also fell, higher costs weigh on TFP

Productivity on TFP basis also fell.

Complications:

Some sectors much more affected than others – within and between effects

Furlough in UK => employed but zero hours worked and zero output

WFH adds to the complications – capital utilisation declined at work, but capital utilisation at home increased.

Survey measures of Productivity (LP and TFP)

We explore labor productivity (LP) and total factor productivity (TFP) using survey data.

Advantages.

Timeliness. DMP survey data are available in close to real time, whilst administrative data typically lag by one to two years.

Frequency. DMP estimates are quarterly, whereas administrative data are typically only annual.

Decomposition. Aggregate impacts split into ‘within-firm’ and ‘between-firms’ effects using the accounting framework of Baily et al. (1992).

Accuracy. Marginal impact of Covid-19, so our data abstract from the effects of other firm specific shocks

Forward-looking. We calculate medium-term impacts using firms’ forecasts.

This Paper Looks at the Impact on Productivity (LP and TFP)

5,000 firm panel members were asked about the impact of Covid-19 on the main components of productivity, covering labor and capital inputs, outputs and prices.

This was combined with accounts data to estimate impact of COVID-19 on firm and macro productivity

Key findings:

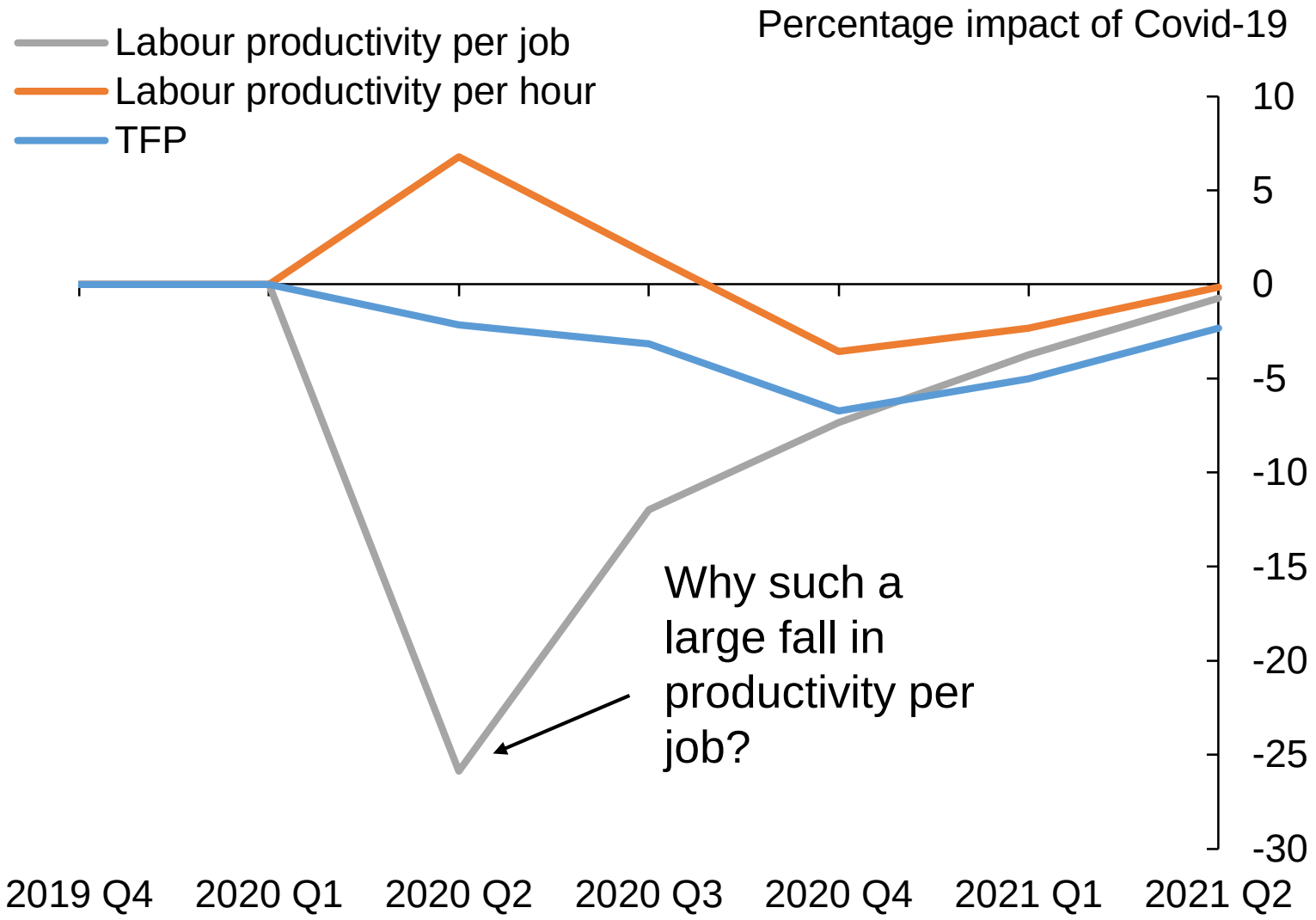
1. Impact effect on TFP of -5.9% from two offsetting components
2. Within firms: LP -2.6%; TFP -5.9, largely from higher costs
3. Between firms: TFP +0.1 to +0.2% increase from two sources:
   - inter-industry, lower TFP firms shrink fastest (accommodation, food & entertainment)
   - intra-industry, lower TFP firms shrink fastest (badly managed firms struggle more)
4. Medium term effects LP -1%, TF -0.5%

Ominous for long run growth: productivity growth already slowing, now turned negative

Literature

- **Decomposition of productivity.** Baily et al. (1992), Foster et al. (2001), Syverson (2011). Bartelsman et al. (2013) differences in the covariance between size and productivity drive productivity differences across countries. Hsieh and Klenow (2009) highlight the importance of misallocation for productivity.
- **Productivity and Business Cycles.** Fernald and Wang (2016) show that TFP acyclical in the US since mid-1980s. Cerra and Saxena (2008), Ball (2014) effect of recession persistently negative for US and 23 OECD countries.
- **Surveys and Shocks.** Altig et al. (2020b) and Bhandari et al. (2020). Coibion and Gorodnichenko (2012) and Coibion et al. (2018) inflation.
- **Covid-19 impacts.** Brodeur et al. (2020), Fernald (2022) and Criscuolo (2022). Bartik et al. (2020a, 2020b), Brynjolfsson et al. (2020), Gourinchas et al. (2020), and Papanikolaou and Schmidt (2020) effects on firms.

Key (Short-Run) Results in One Figure – United Kingdom



Source: Decision Maker Panel, Bank of England

UK Survey data (Decision Maker Panel)

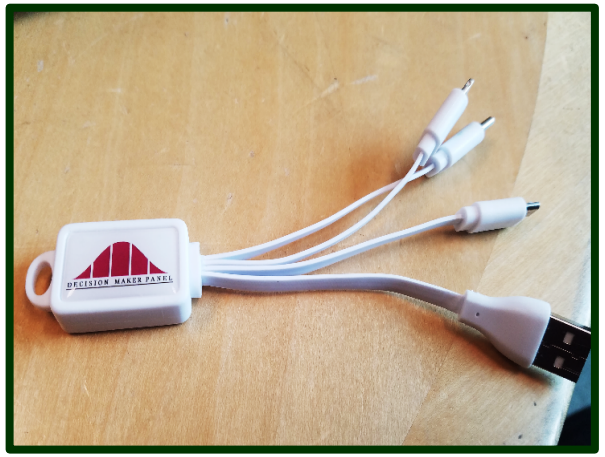
Impact of Covid-19 on productivity

Other considerations

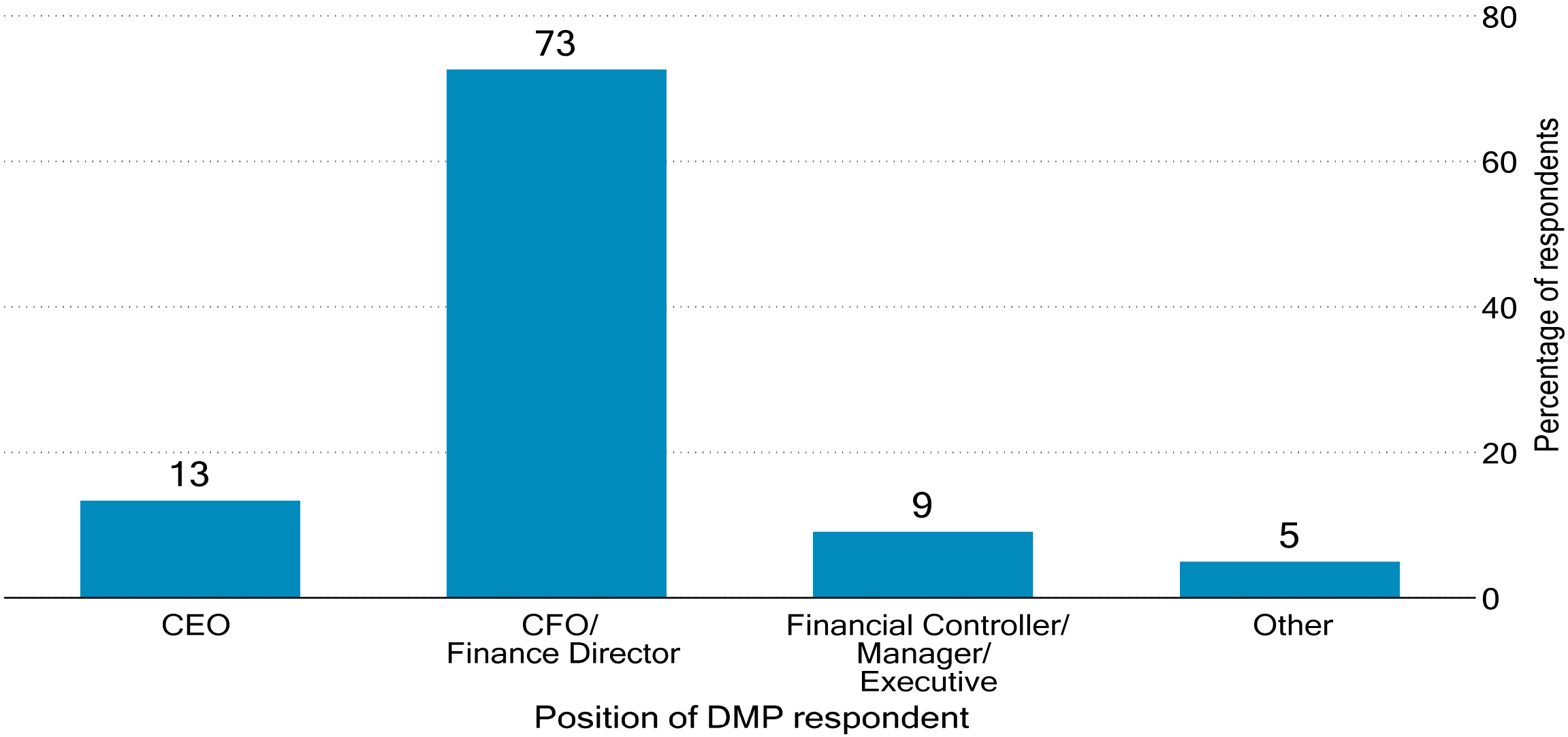
Conclusions

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 (from Amadeus) with 10+ employees
- Panel 10K, ~ 3K firms respond per month, ≈14% private employment
- Similarities with Survey of Business Uncertainty (Atlanta Fed) and Duke CFO survey – but an order of magnitude larger.

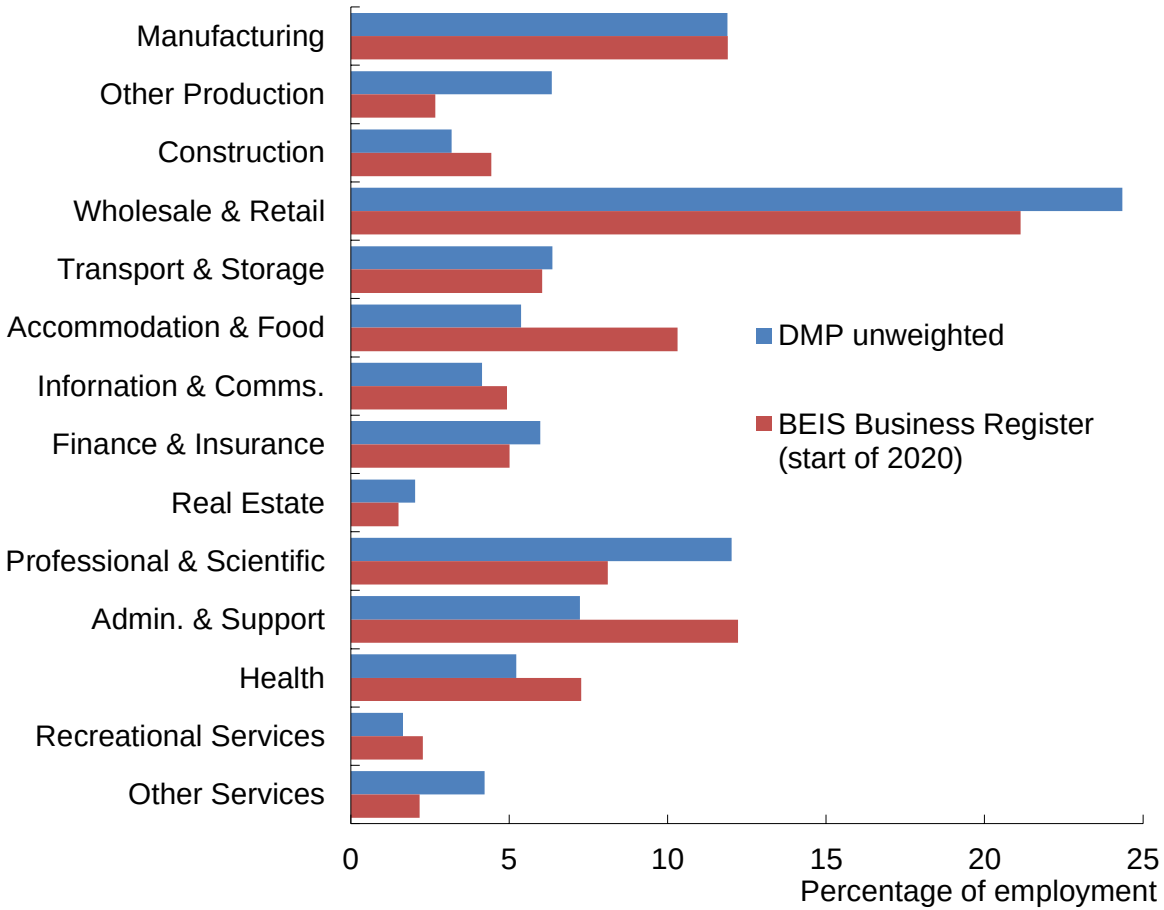


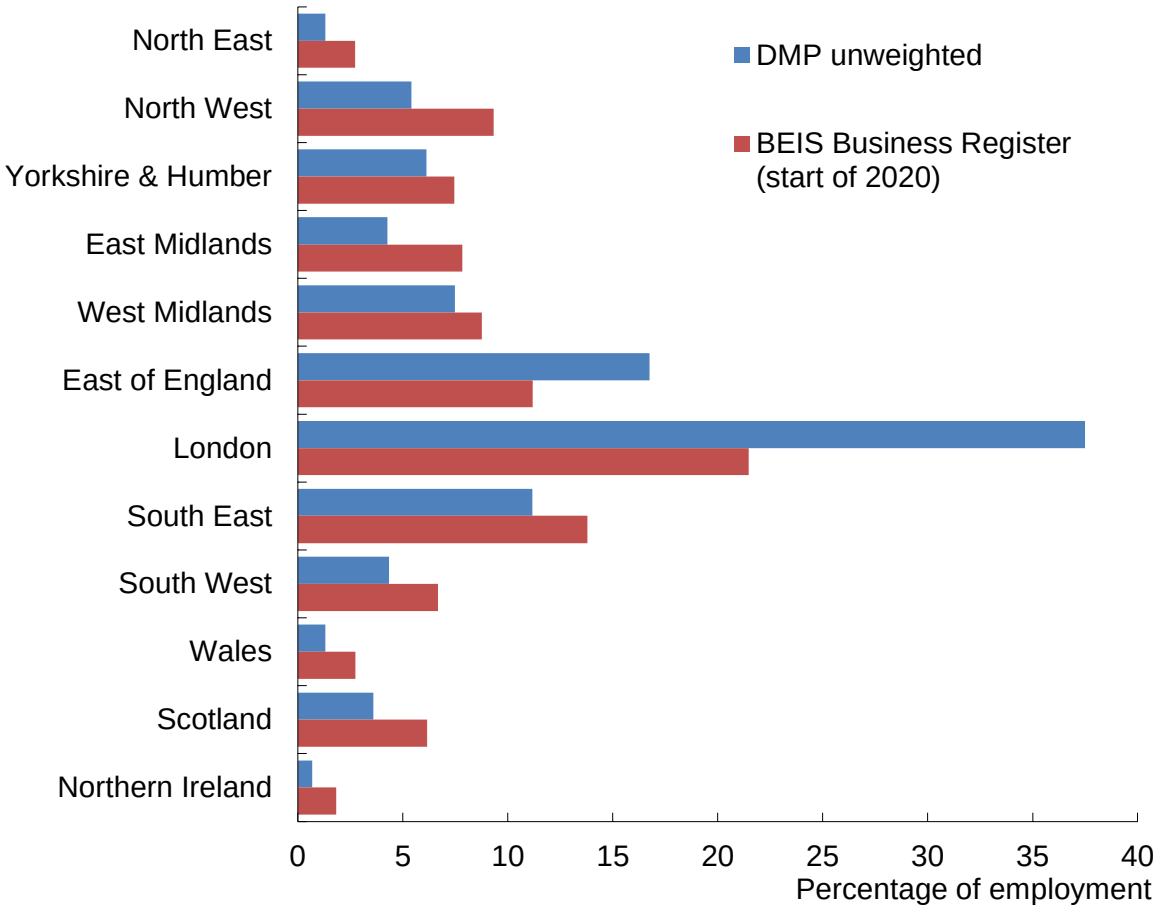
86% respondents CEOs or CFOs (median firm has 60 employees)



Source: Results are based on the question: 'Could you tell us the position of the person in your business that typically completes the Decision Maker Panel Survey?' and respondents were asked to choose from the following options: 'CFO', 'CEO', 'Other (please state): …'.

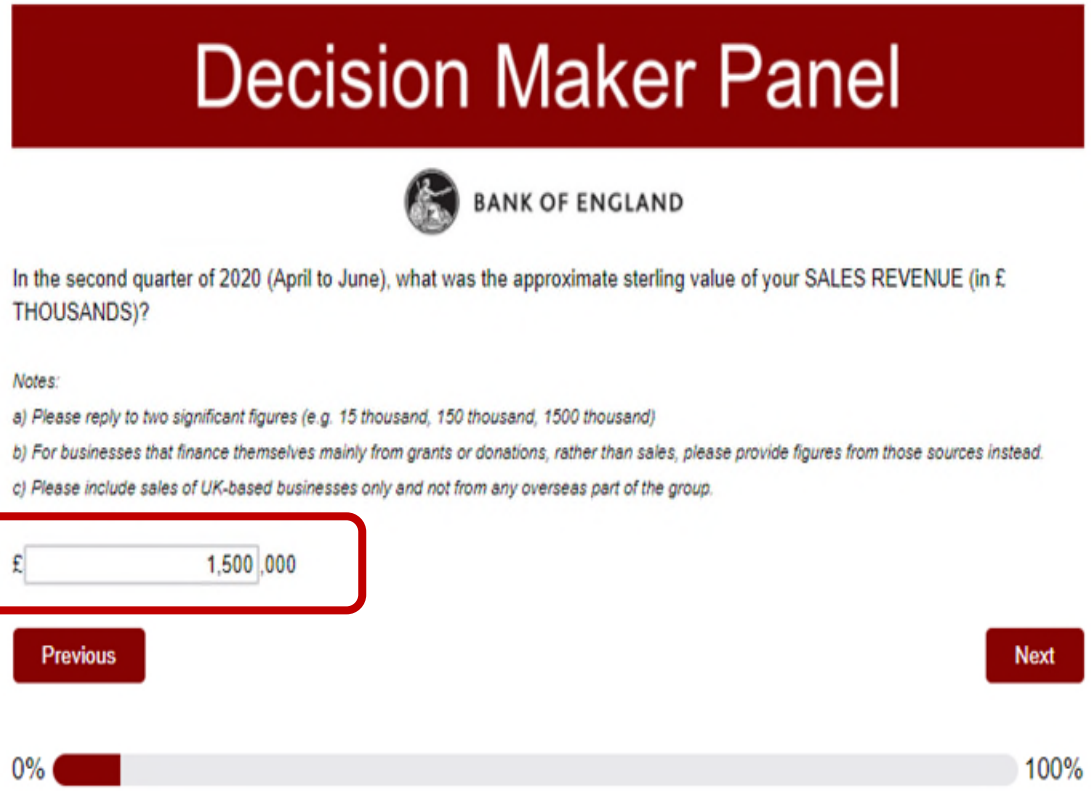
DMP broadly matches UK industry and regional spread

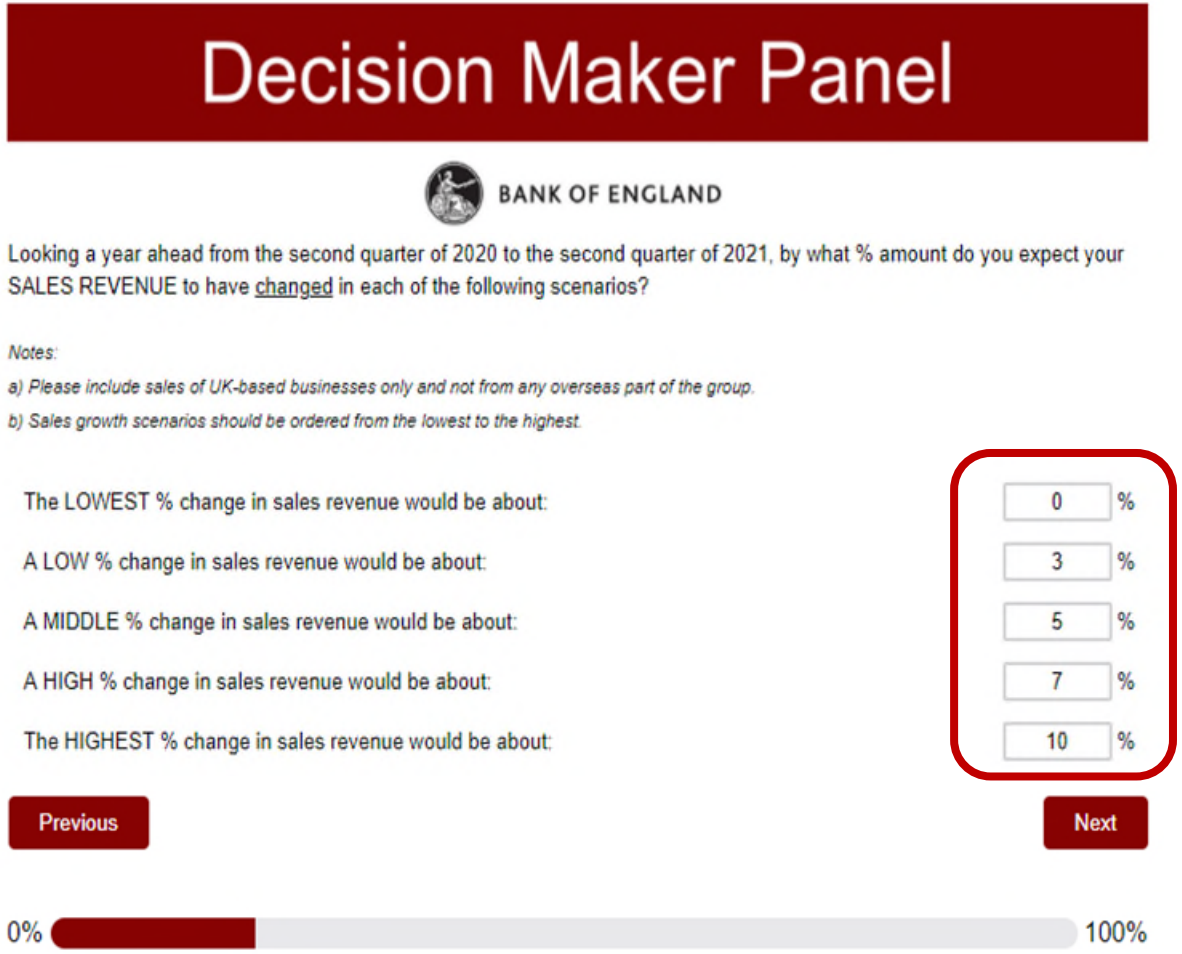




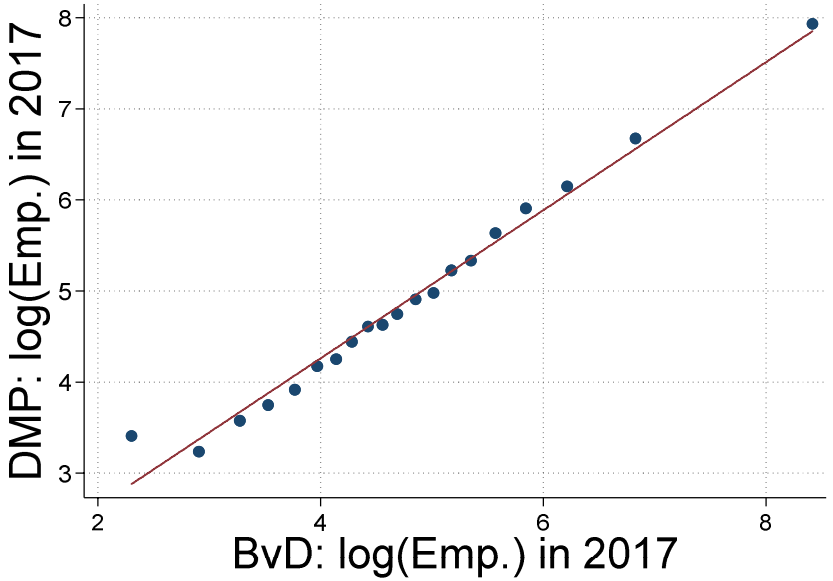
Notes: DMP members who were sent the September 2020 survey. BEIS Business Register data from the start of 2020.

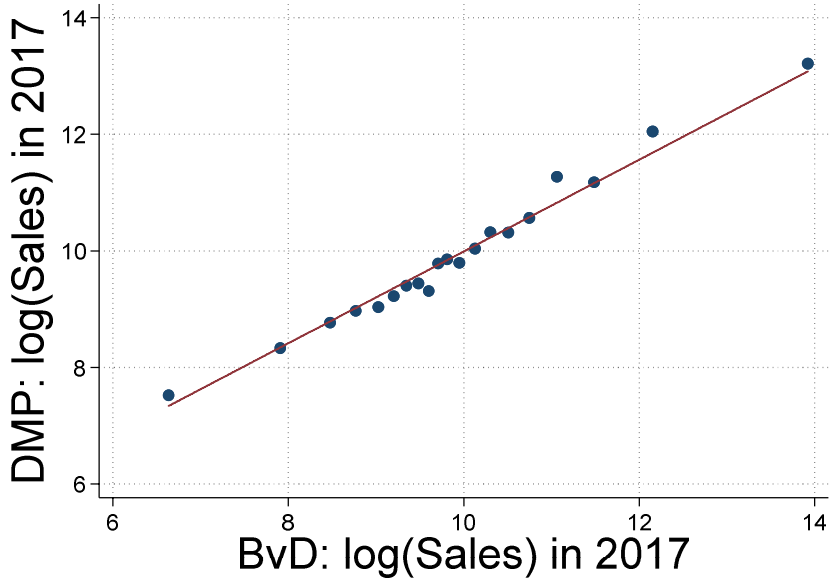
Ask a range of questions about past, present and future sales

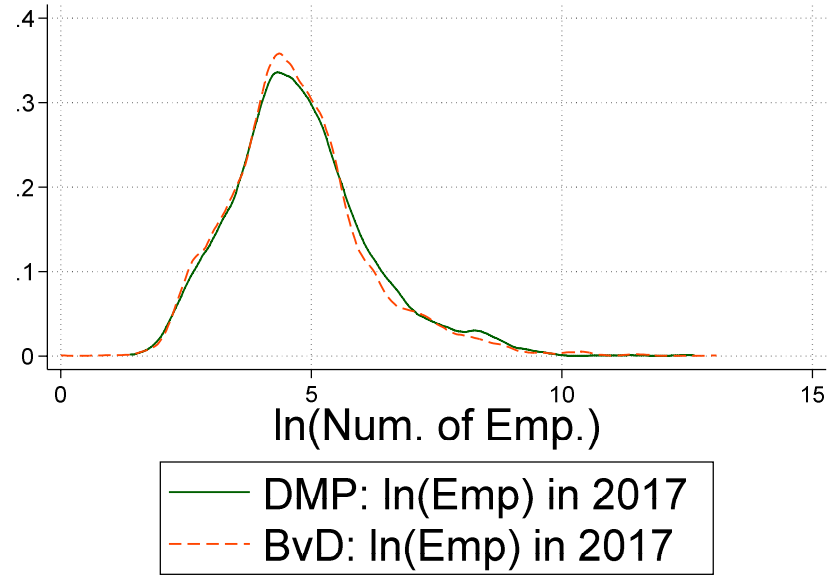


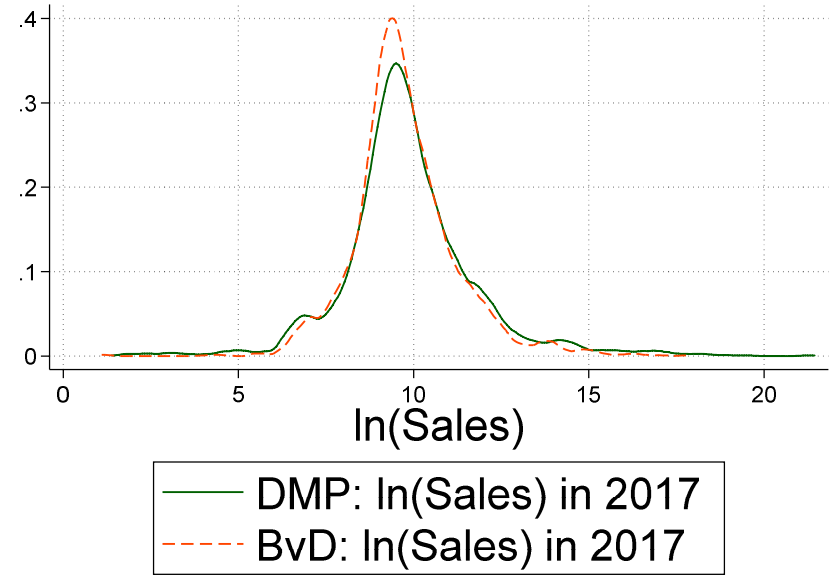


DMP data looks highly quality – e.g. matches accounts data





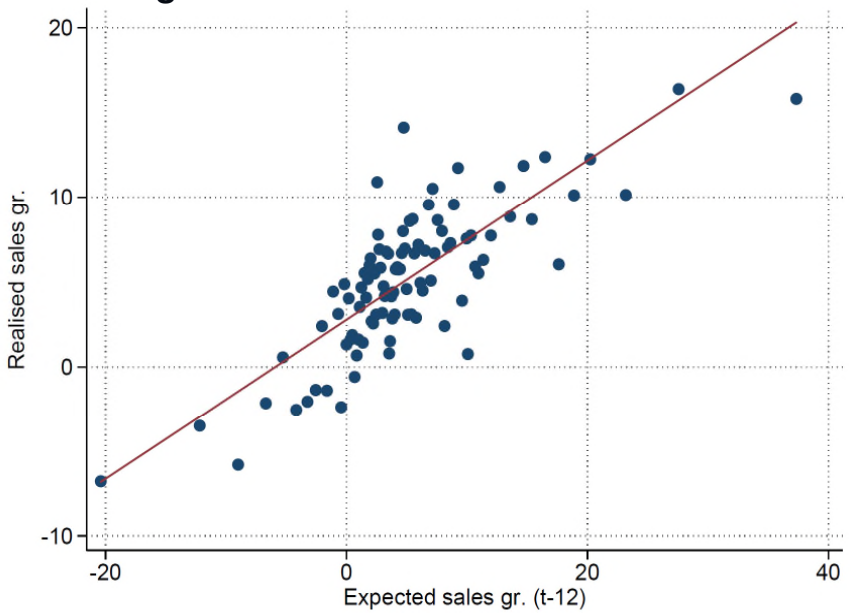




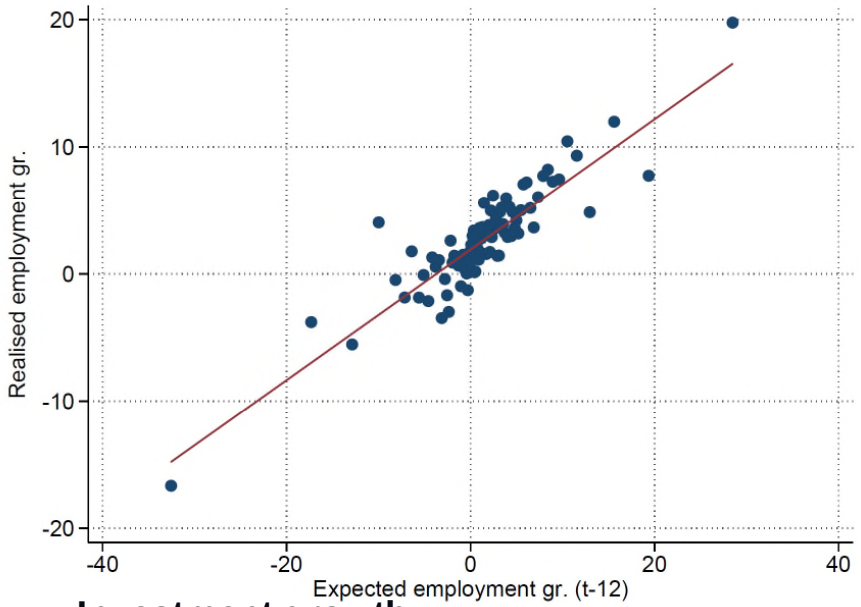
Notes: Sales values from the DMP survey are based on annualised quarterly sales reported by businesses plotted here against Bureau Van Dijk (BVD) Amadeus Company Accounts data (includes public and private firms)

Forecasts that DMP respondents provide also appear accurate

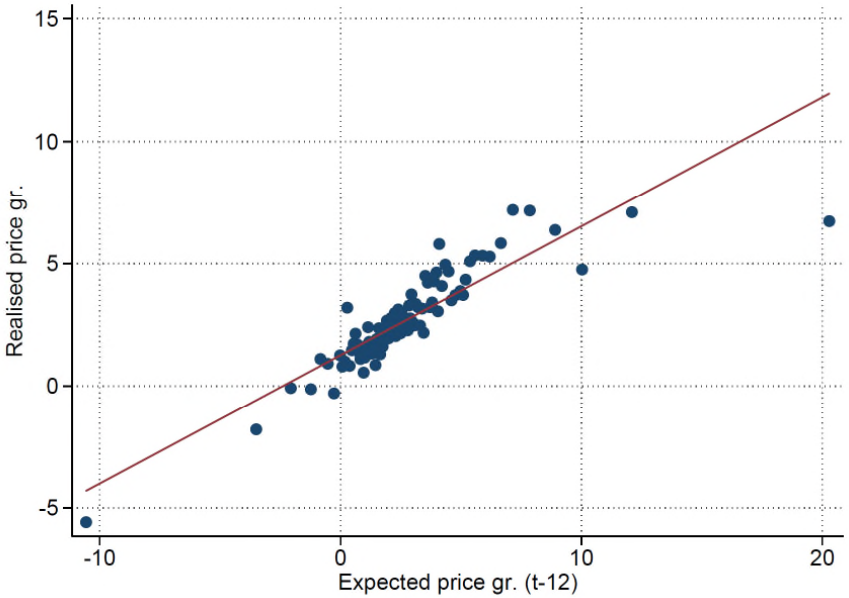
Sales growth



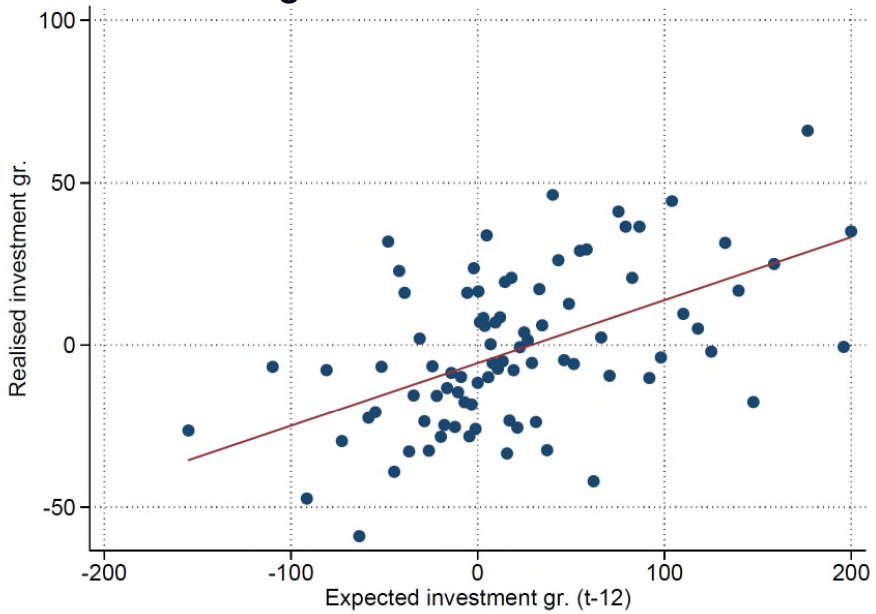
Employment growth



Price growth



Investment growth



Notes: Y-axes show realised growth in sales, employment, prices, 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

DMP regularly used for MPC briefings, speeches, official outputs

BANK OF ENGLAND

Monetary Policy Summary and minutes of the Monetary Policy Committee meeting ending on 18 September 2019

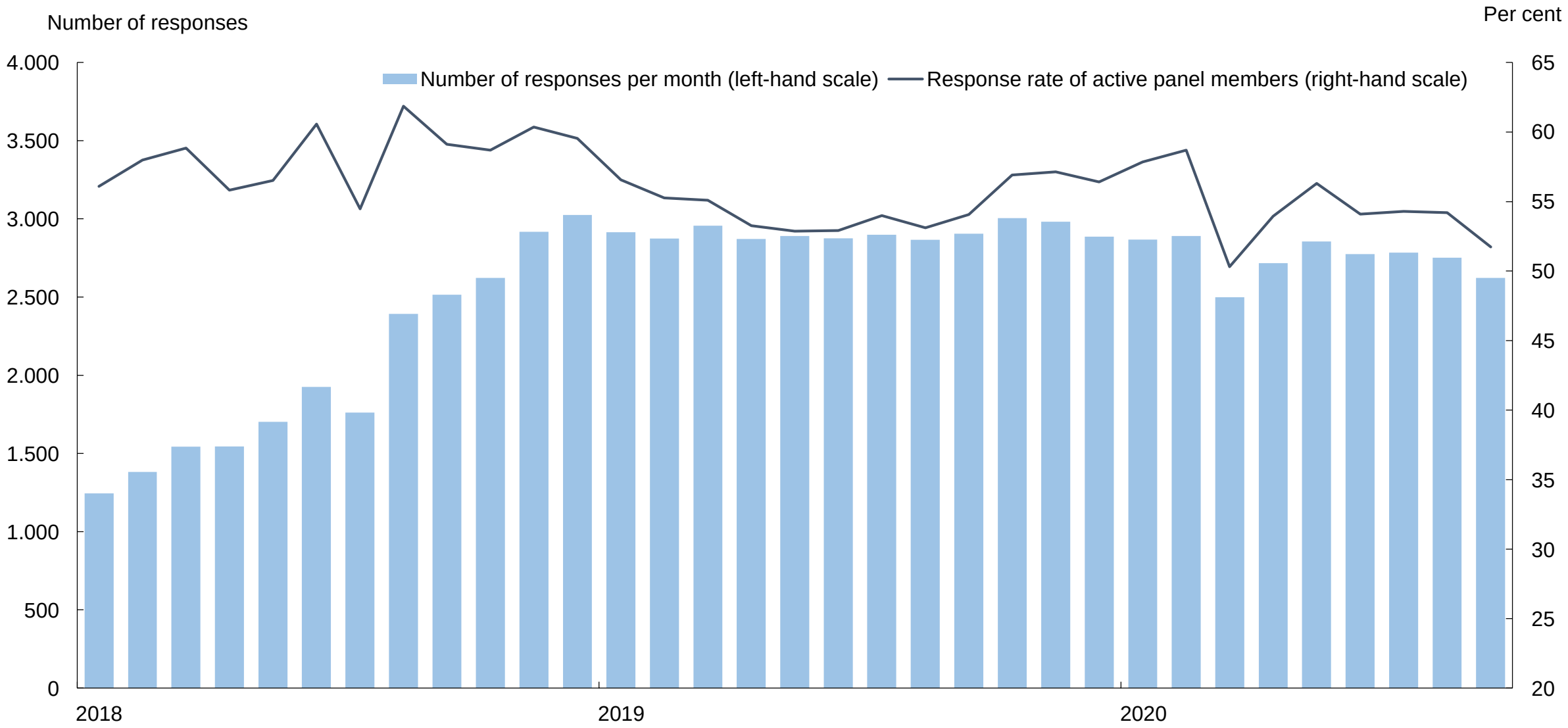
Publication date: 19 September 2019

BANK OF ENGLAND

Quarterly Bulletin
2017 Q2

Topical article
Tracking the views of British businesses: evidence from the Decision Maker Panel

COVID: DMP response rate roughly flat during the pandemic



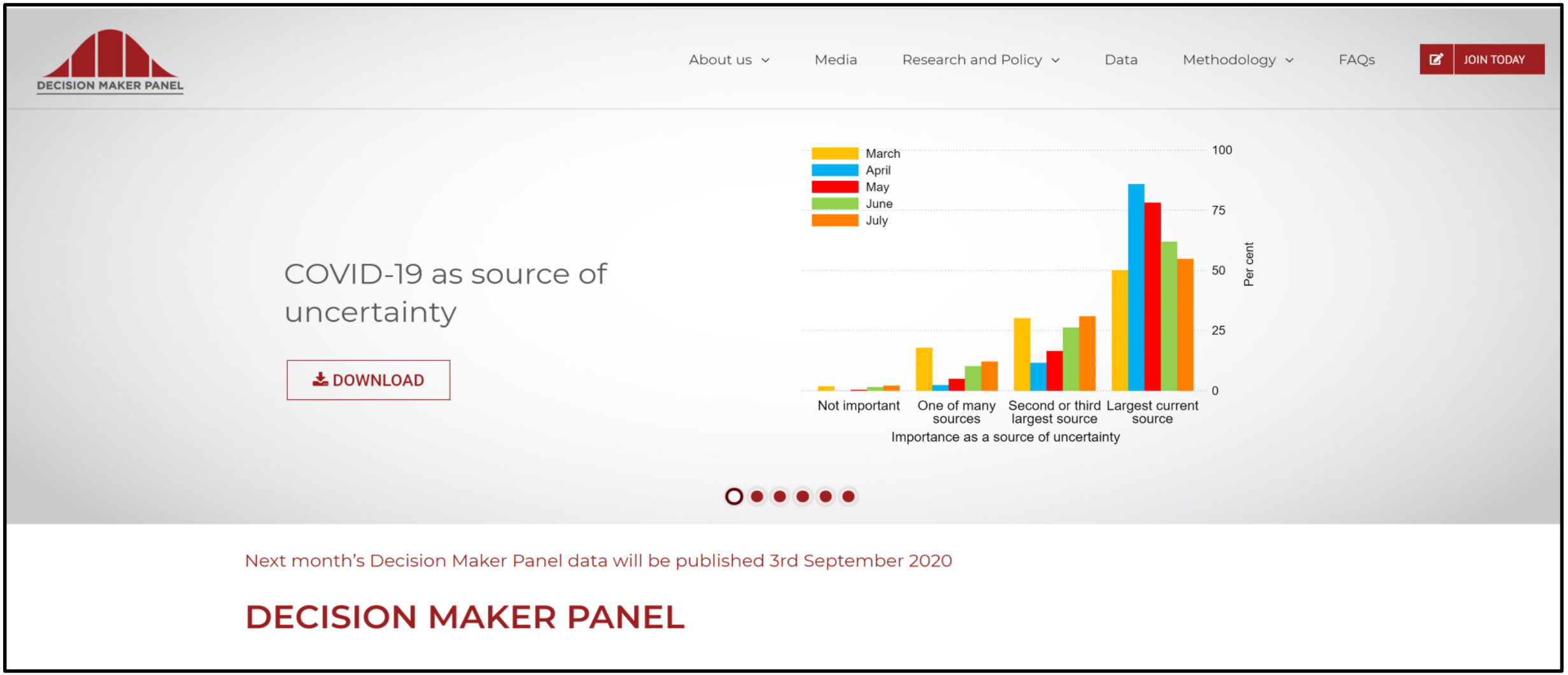
Notes: The response rate of active panel members is calculated as the percentage of panel members who had completed at least one survey over the twelve months who responded to the survey in a given month.

Response rates also uncorrelated with COVID industry impact

Sample	(1) Mar-Sep 20	(2) Jan19-Sep 20	(3) Jan19-Sep 20
Industry impact of Covid on sales in 2020 Q2	-0.002		
	(0.007)		
Ln(labour productivity)			0.602***
			(0.042)
Industry impact of Covid on sales in 2020 Q2 interacted with Covid period dummy variable		0.002	
		(0.004)	
Ln(labour productivity) interacted with Covid period dummy variable			-0.016
			(0.071)
Survey wave dummies	Yes	Yes	Yes
1 digit industry dummies	No	Yes	Yes
Individual firm fixed effects	No	No	No
Observations	252,217	793,160	793,160
R-squared	0.004	0.007	0.008

Notes: Linear probability model for whether a firm in the sampling frame responds to the DMP survey in each month between January 2019 and September 2020 (1=responded to DMP, 0=Not responded). Firm characteristics are averages of 2017 to 2019 accounts data from Bureau Van Dijk FAME database. 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. Regressions only includes firms who were part of the sampling frame in January 2019 and who have productivity and sales data available from company accounts. Covid period dummy variable takes the value of one for March to September 2020. All equations are estimated by OLS. Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

More information available on the DMP website



www.decisionmakerpanel.com

UK Survey data (the Decision Maker Panel)

Impact of Covid-19 on productivity

Other Considerations

Conclusions

Calculation of TFP

We measure the proportional impact of Covid-19 at the firm level as real final sales *dy* and infer the impact on value added *dv* in a manner similar to the national accounts

$dv = (dy - s_M\, dm)/(1 - s_M)$

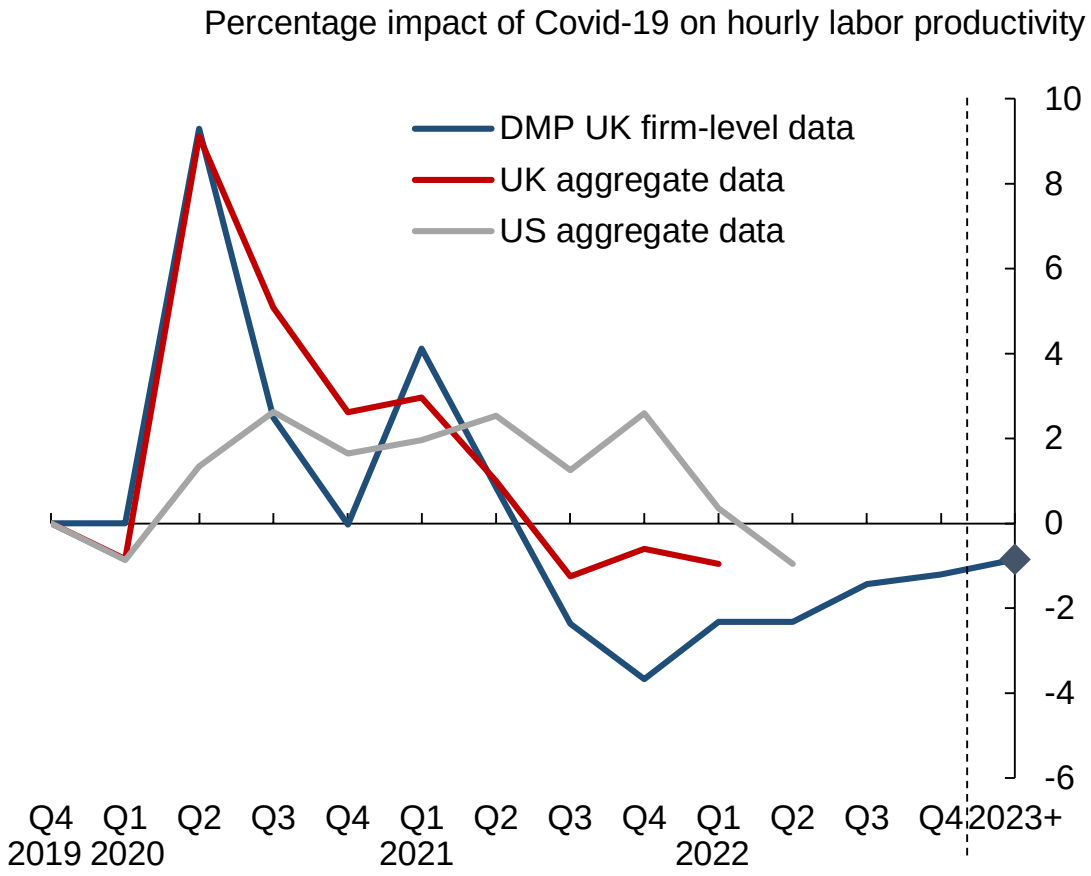
TFP is $da = dv - \alpha\, dk - \beta\, dl = dy - s_M\, dm)/(1 - s_M) - \alpha\, dk - \beta\, dl$

Note $\ln(VA_{it}) = \alpha \ln(L_{it}) + \beta \ln(K_{it})$

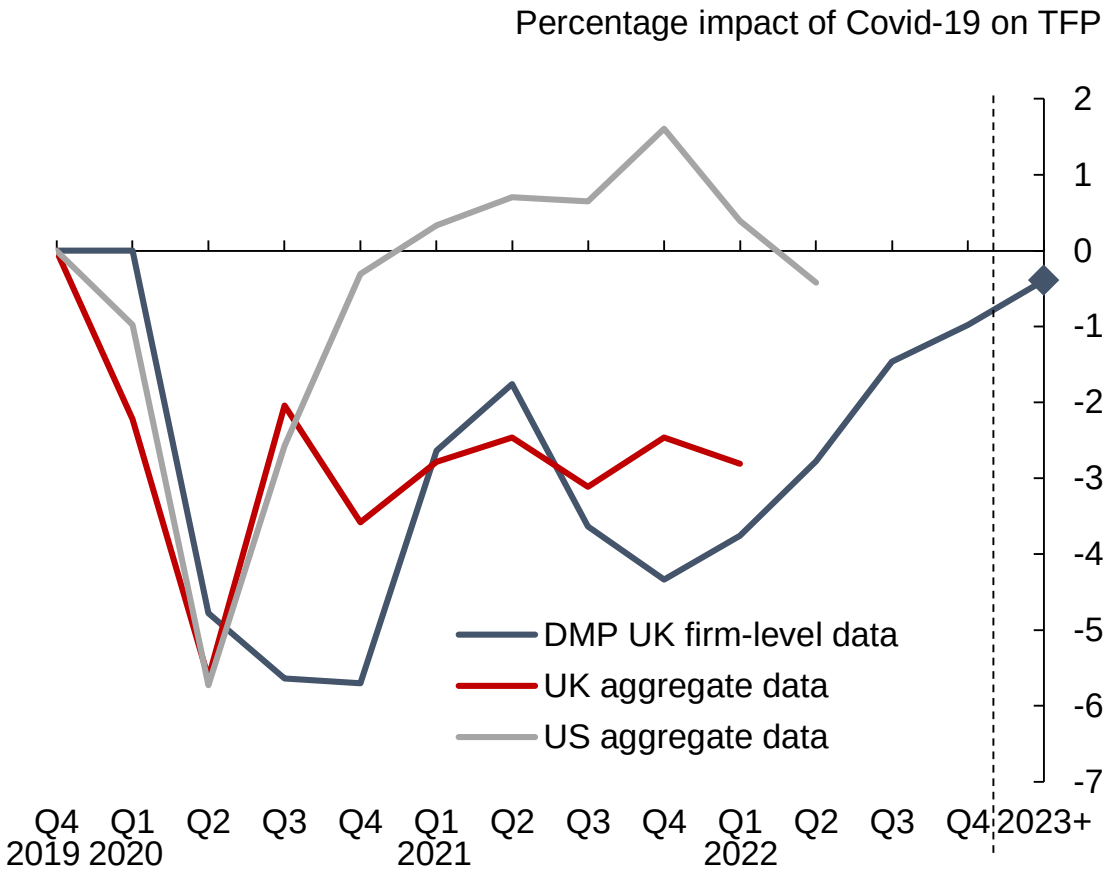
There is a question whether firms interpret our survey question on unit cots to refer to ‘intermediate input costs’ or ‘whole cost of production. The impact on TFP in each case is the same (robustness in the paper)

Figure 1: Estimates of the impact of Covid-19 on productivity
(data sample Jul 2020 – Apr 2022)

Panel A: Labor productivity per hour

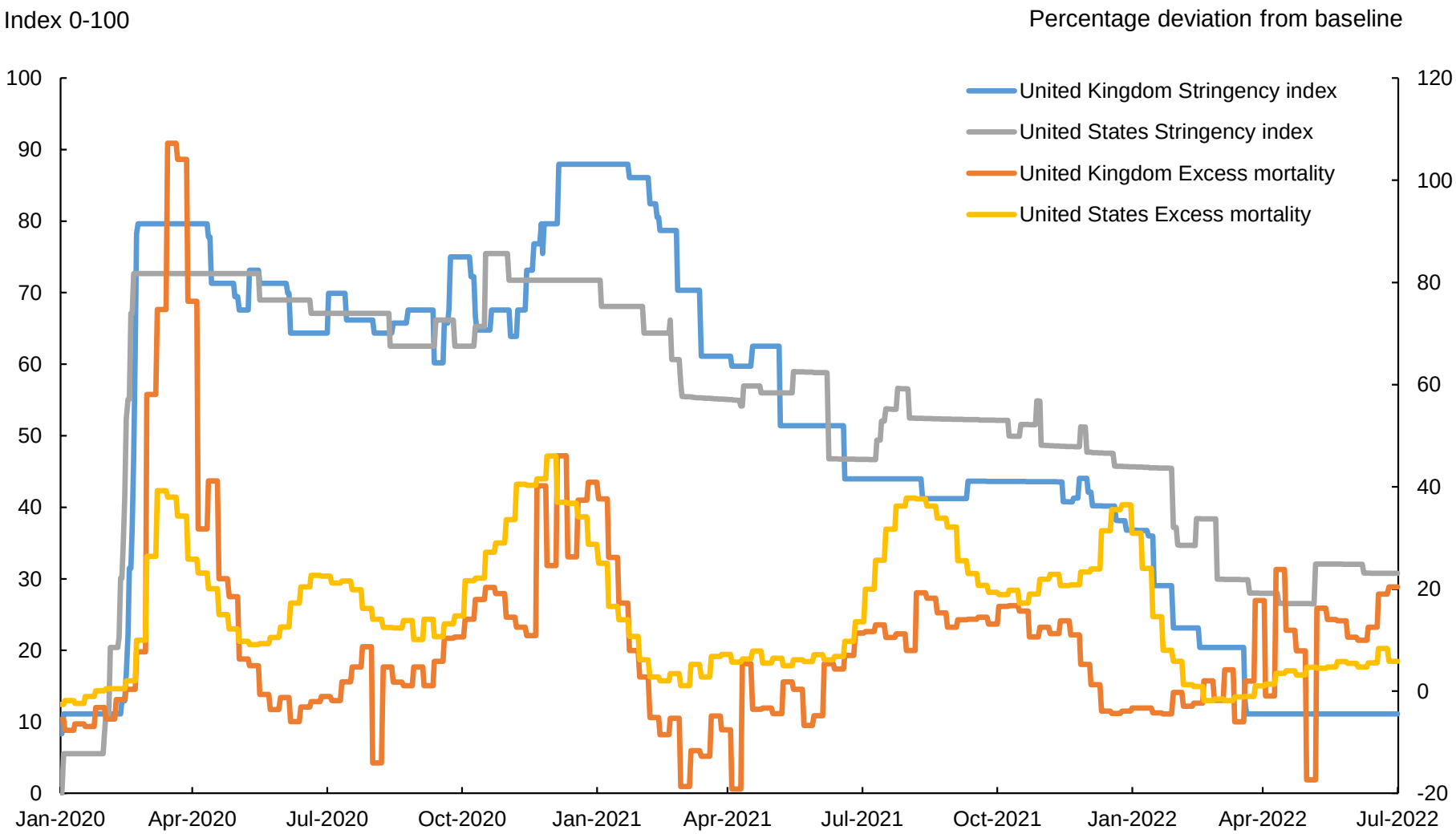


Panel B: TFP



***Notes*: UK aggregate data are from the Office for National Statistics and are for the market sector. They are adjusted for an experimental series for hours worked (see Figure A1 in the online appendix and ONS (2021) for more details on this). US labor productivity data are from the Bureau of Labor Statistics and are for the non-farm business sector. US TFP data are from John Fernald and are for the business sector. TFP data are not adjusted for capacity utilisation. The impact of Covid-19 for UK and US aggregate data is estimated as the deviation of productivity from a 1% trend growth rate from 2020 Q1 onwards. The impact of Covid-19 in the DMP data is estimated directly from survey responses.**

Figure 2: Measures of lockdown stringency and mortality



Similarity between US and UK lockdown stringency and mortality experiences suggests international comparability of results

***Notes*: Lockdown stringency data are from the Oxford Covid-19 Government Response Tracker. Excess mortality data are from the Human Mortality Database and World Mortality Dataset.**

Decomposition – Bailey et al. (1992)

'within effect' $$\Delta\Pi_t = \sum_{i \in Surv} \bar{\varphi}_i \Delta\pi_{i,t}$$ … within firms (1)

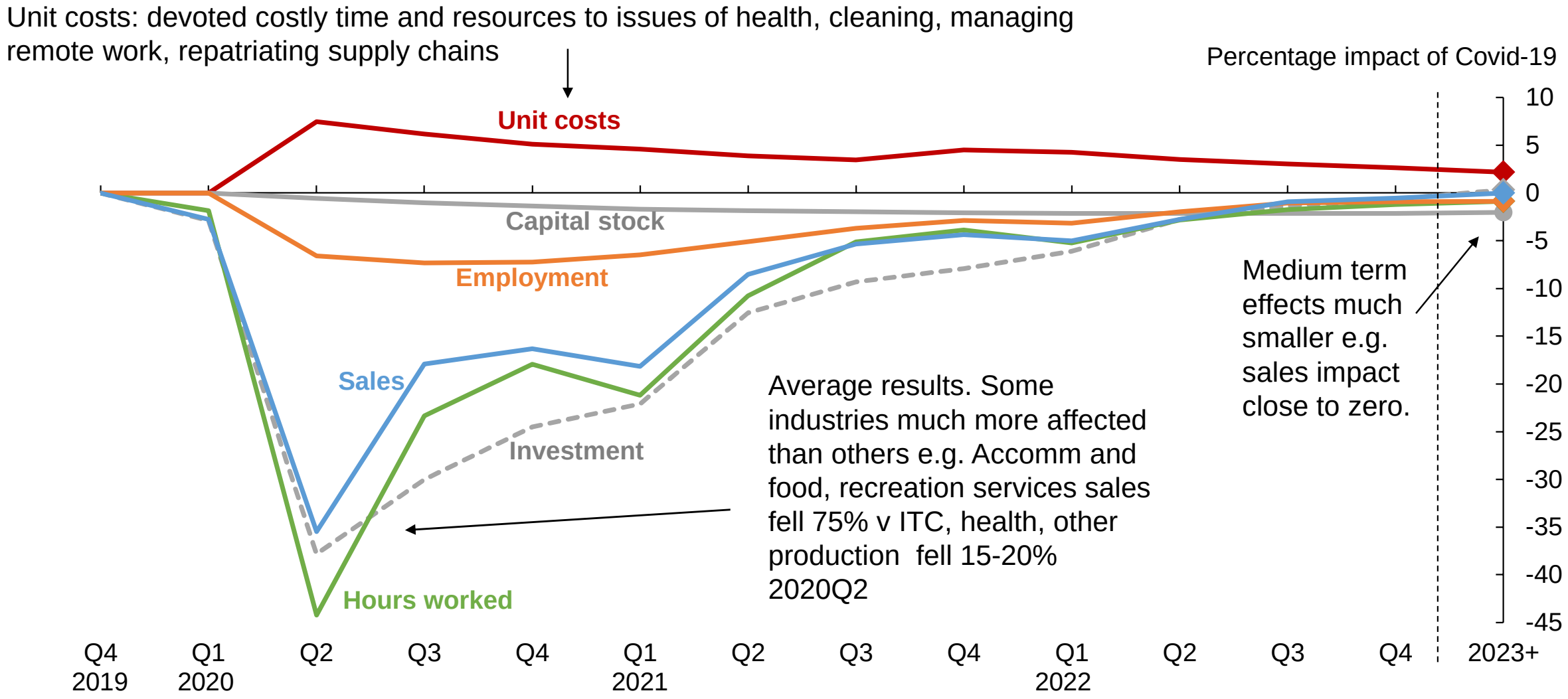
'between effect' $$+ \sum_{i \in Surv} \Delta\varphi_{i,t}(\bar{\pi}_i - \bar{\Pi})$$ … reallocation between surviving firms (2)

'entry effect' $$+ \sum_{i \in \Delta Entry} \varphi_{i,t}(\bar{\pi}_i - \bar{\Pi})$$ …. reallocation to new firms (3)

'exit effect' $$- \sum_{i \in \Delta Exit} \Delta\varphi_{i,t-1}(\pi_{i,t-1} - \bar{\Pi})$$ …. reallocation from exiting firms (4)

Where $\pi_{i,t}$ is GVA per head in firm i at time t, Π_t is aggregate GVA per head at time t, $\varphi_{i,t}$ is the employment share of firm i at time t and a bar over a variable indicates the average of the variables across times t-1 and t. Δ is with respect to Covid, not time. So ΔEntry and ΔExit denote the firms that, as a result of Covid, enter the set of entering and exiting firms.

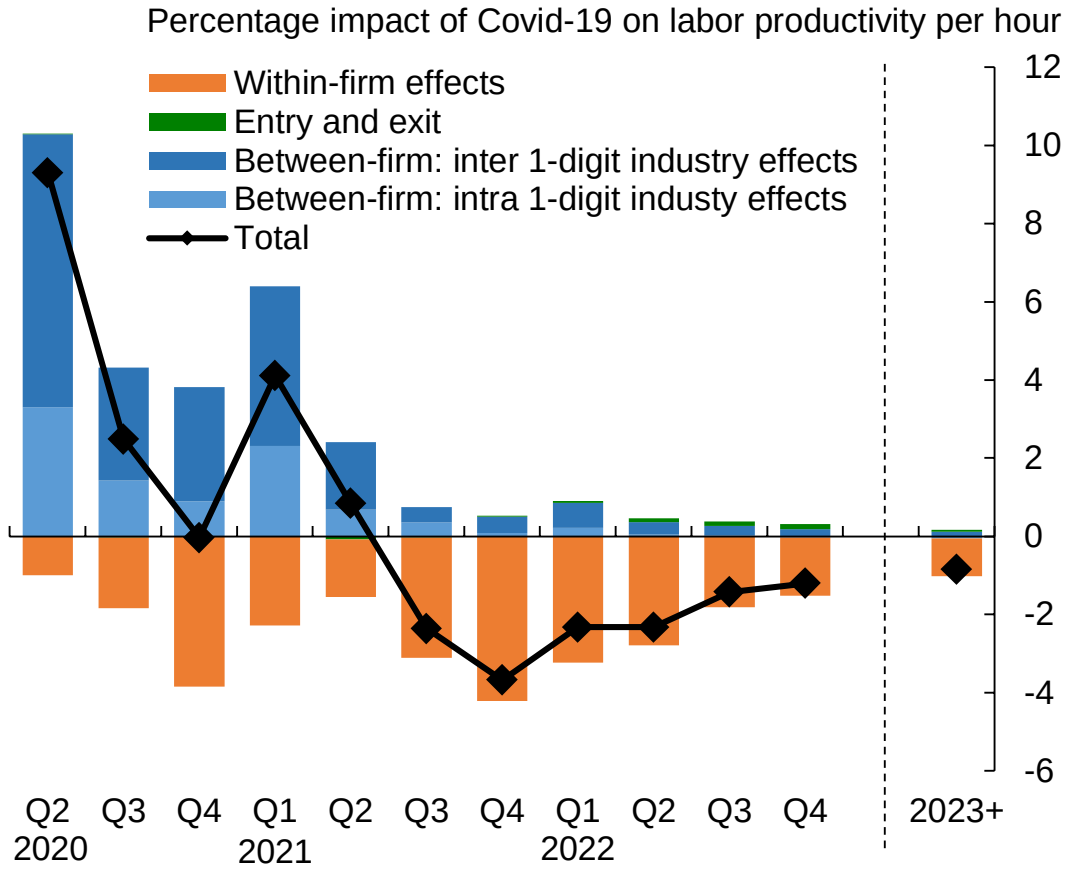
Figure 3: Impact of Covid-19 on businesses (survey data inputs)



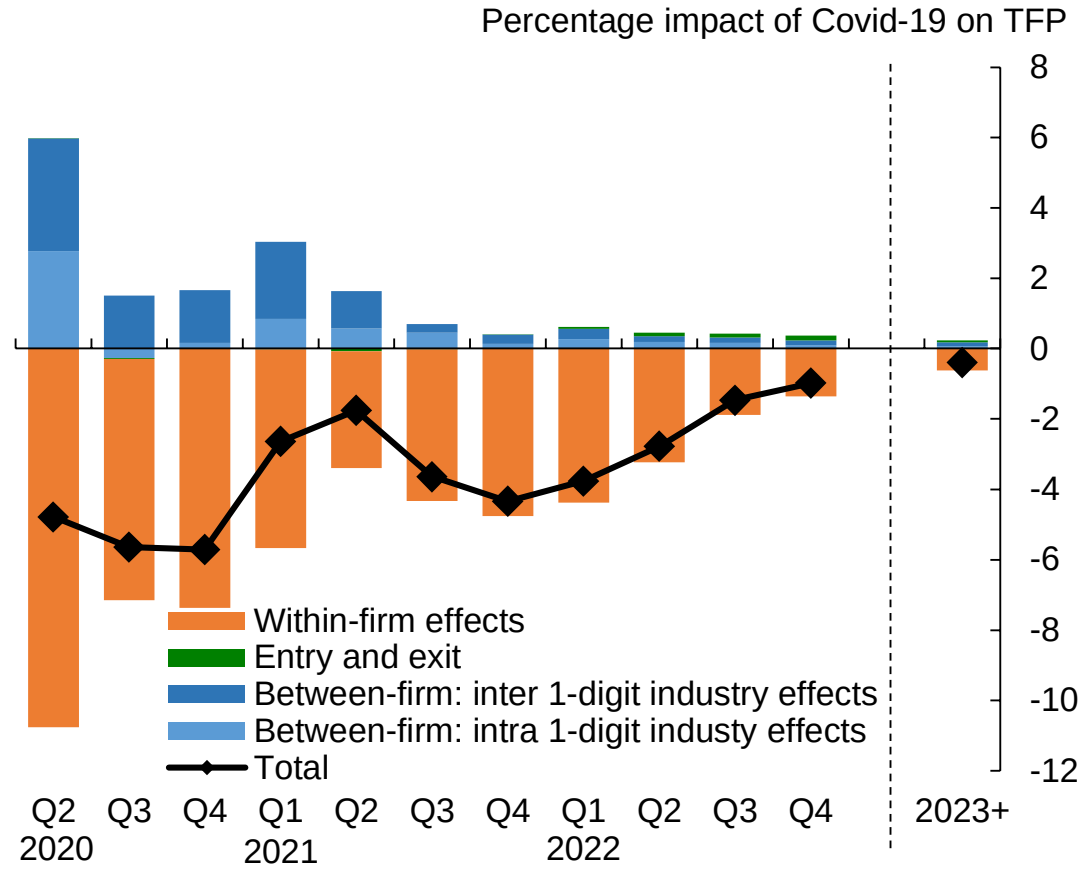
***Notes*: Data are the most recent observation per firm for each period collected between July 2020 and April 2022. Data on the impact of Covid-19 in 2020 Q1 have not been collected in the DMP. Data shown for 2020 Q1 are absolute changes in aggregate ONS data for private sector output, business investment, private sector employment and hours worked between 2019 Q4 and 2020 Q1. The impact on unit costs is assumed to be zero in 2020 Q1. Effects on the capital stock are estimated using by cumulating the investment impacts.**

Figure 4: Within and between-firm contributions to Covid-19 productivity impact

Panel A: Labor productivity per hour



Panel B: TFP



Within effects –ve, Between effects +ve, entry and exit negligible.

Balance of within and between firm effects

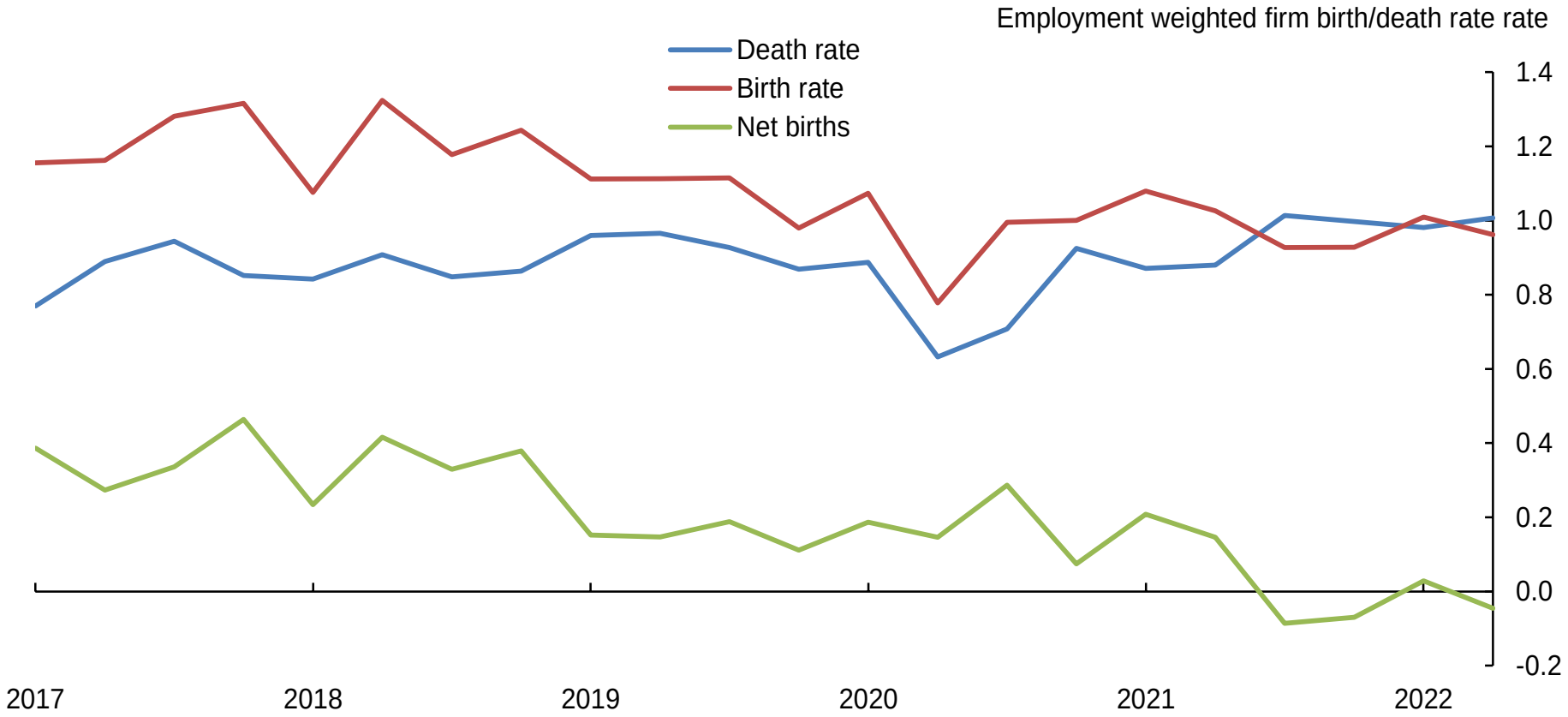
LP:

- Between firms effects (low productivity firms closed) dominate within firm effects. Raised the average, LP boom 2020Q23 – 2021Q2.
- Negative 2021Q2 onwards due to only within firm effects.
- Diminishing negative effect as unit cost pressures ease. Medium term -1%.

TFP:

- Within firms effects dominate between firm effects. Lowered the average, TFP consistently negative 2020Q23 – 2022Q2. Capital utilisation fell, higher costs weigh on TFP.
- Within firm TFP worse than within firm LP due to elasticity weighting formula.
- Medium term effects also smaller negative number for same reason.

Figure 7: Firm entry and exit – flat and negligible impact



Criscuolo (2022) finds "support measures stifling the reallocation process" across EA, similar effect in UK

***Notes*: Firm birth and death rate data are from the Office for National Statistics. These data have been seasonally adjusted by the authors.**

UK Survey data (the Decision Maker Panel)

Impact of Covid-19 on productivity

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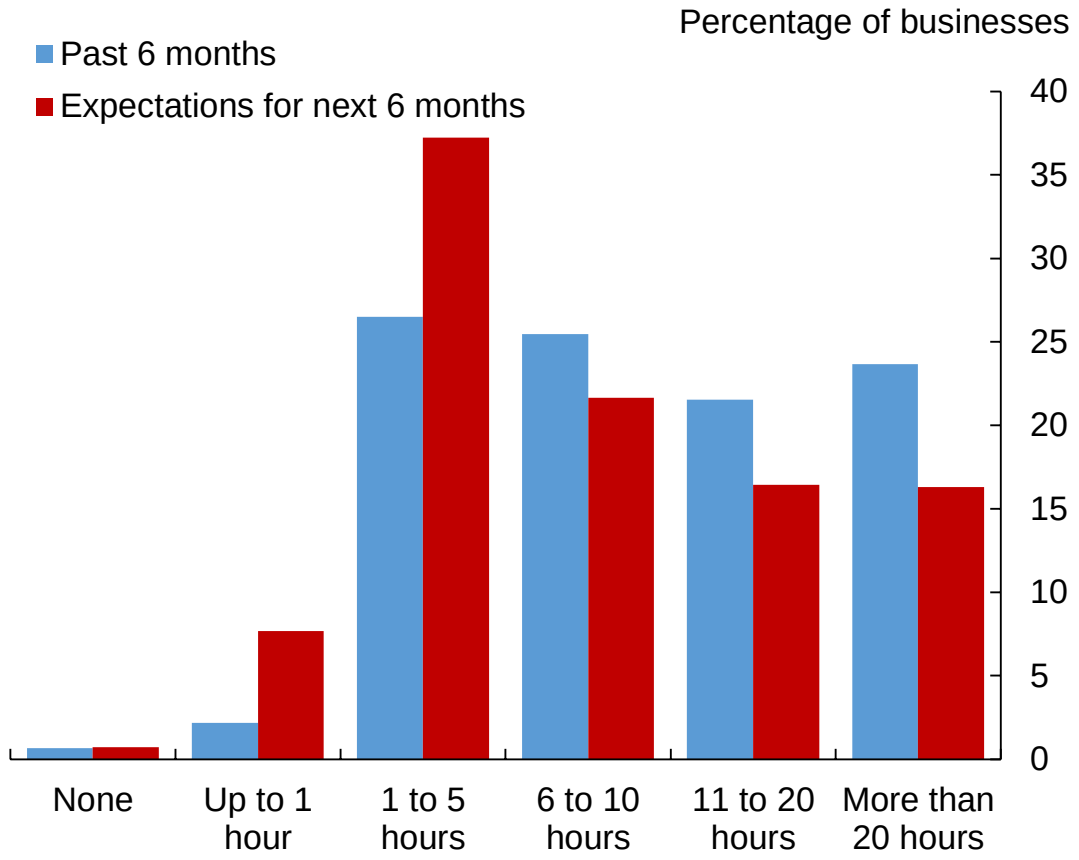
Conclusions

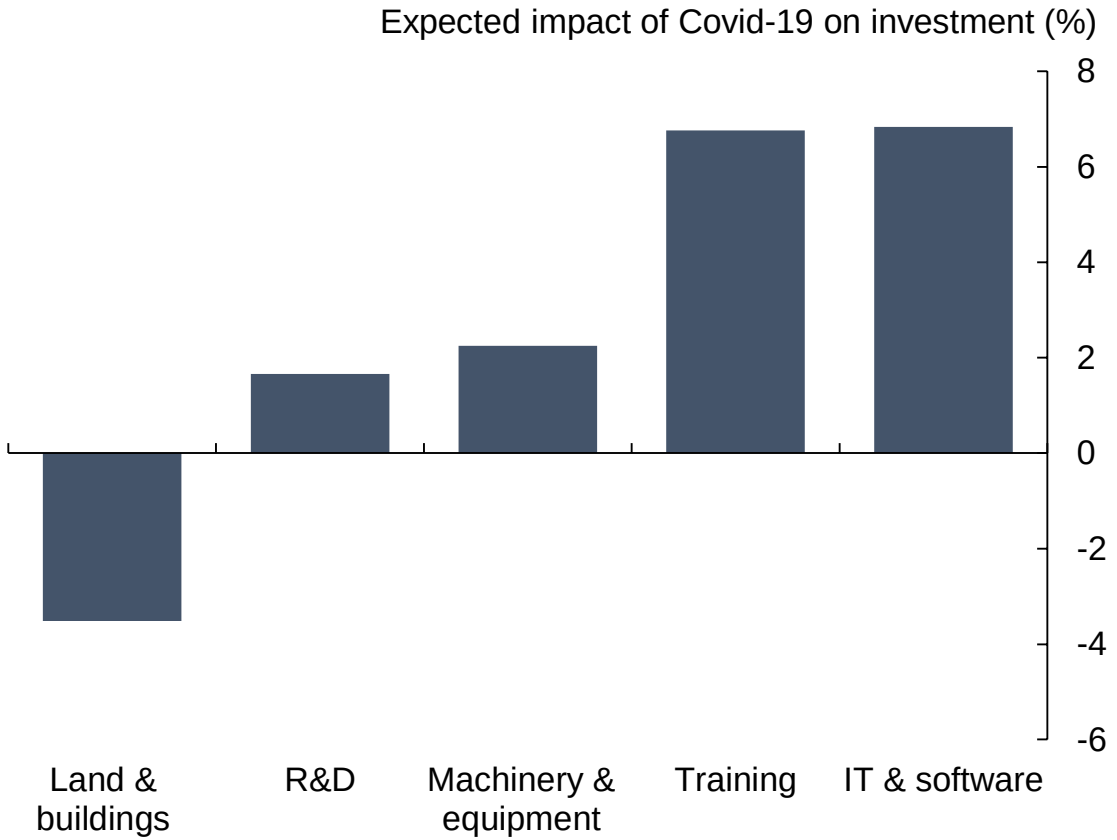
Figure 5: Covid-related influences on longer-term productivity – diverted time and investment

Panel A: Average hours per week spent by CEOs managing effects of Covid-19



***Notes*: Based on the question 'Approximately how many hours a week has the CEO of your business spent managing the effects of Covid-19 on your business over the past six months? And how many hours a week do you expect them to spend on this over the next six months?'. Data were collected between November 2020 and January 2021.**

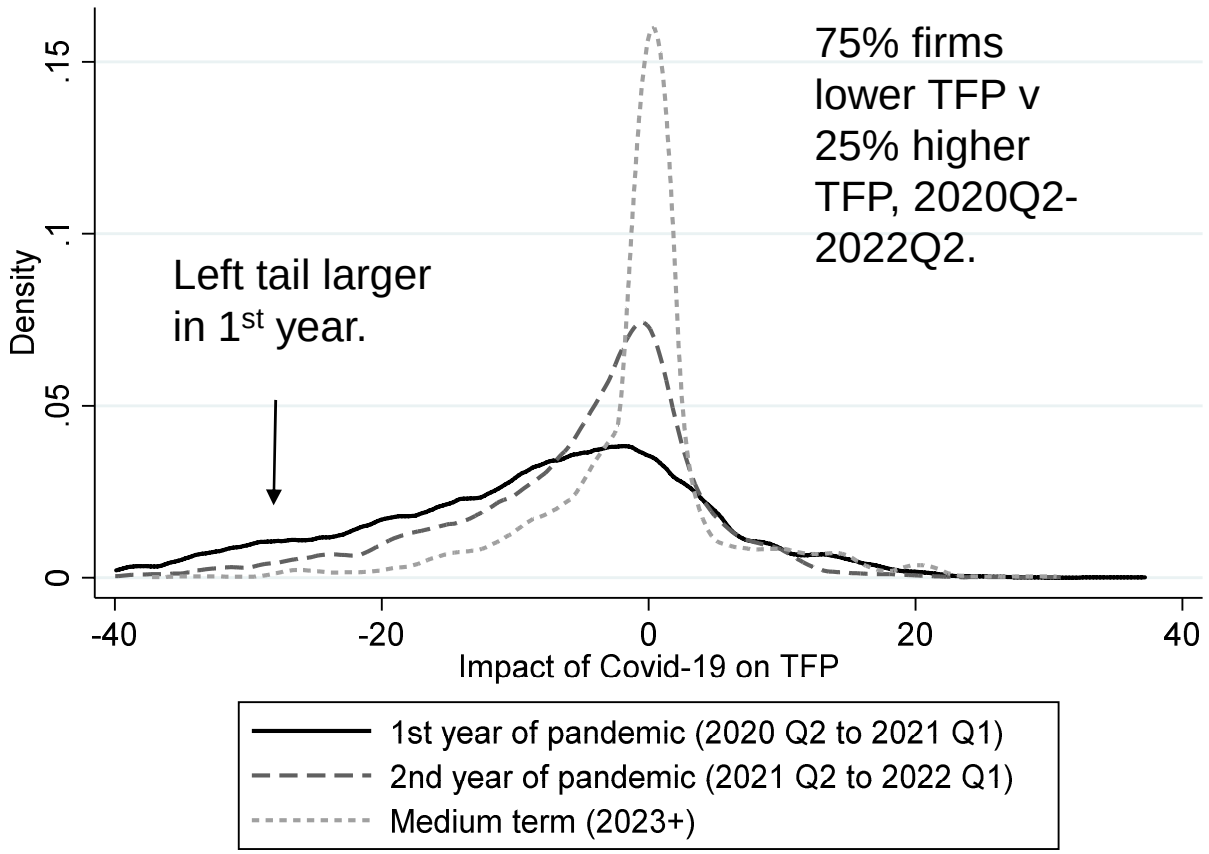
Panel B: Impact of Covid-19 on different types of investment



***Notes*: Based on the question 'In 2022+, how do you expect the Covid-19 pandemic to affect the following types of expenditure made by your business, relative to what have otherwise happened?'. Data were collected between July and September 2021.**

Figure 6: Heterogeneity of impacts on TFP

Panel A: Distribution of within-firm impacts on TFP across firms



Panel B: Medium term impact of Covid-19 on TFP by industry

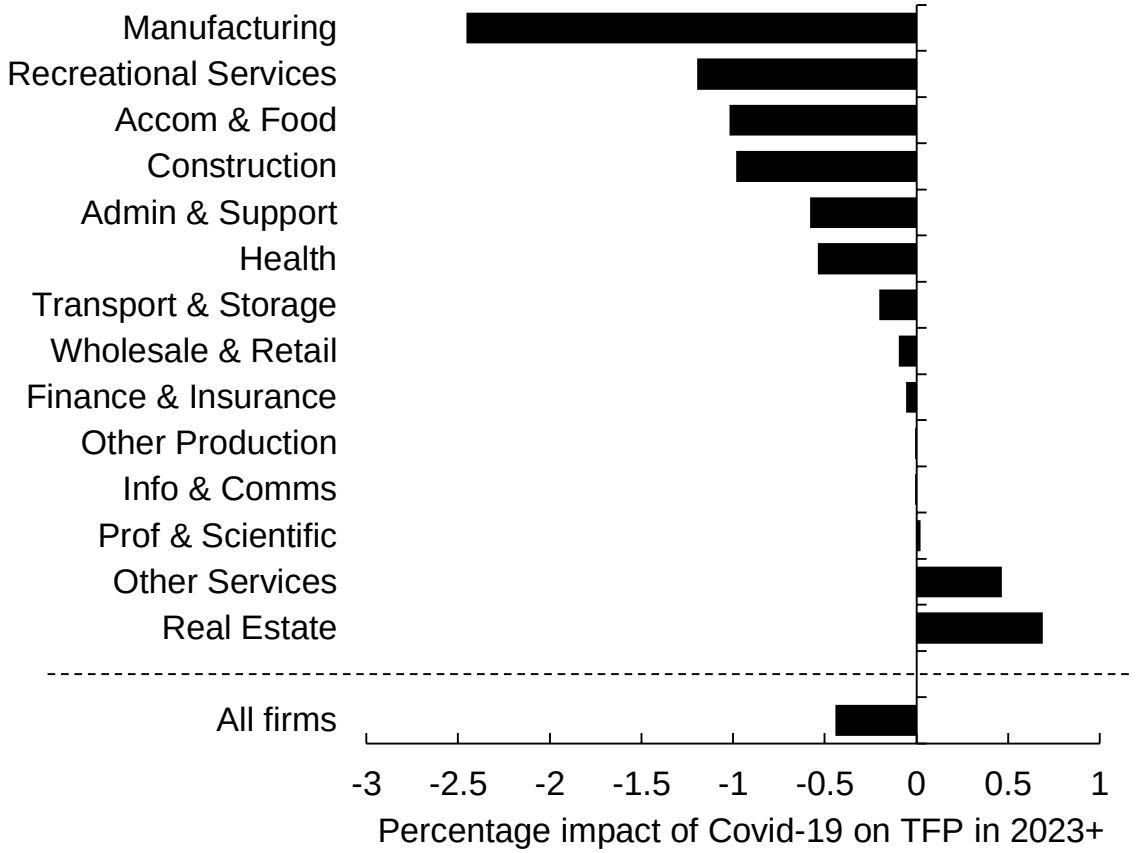
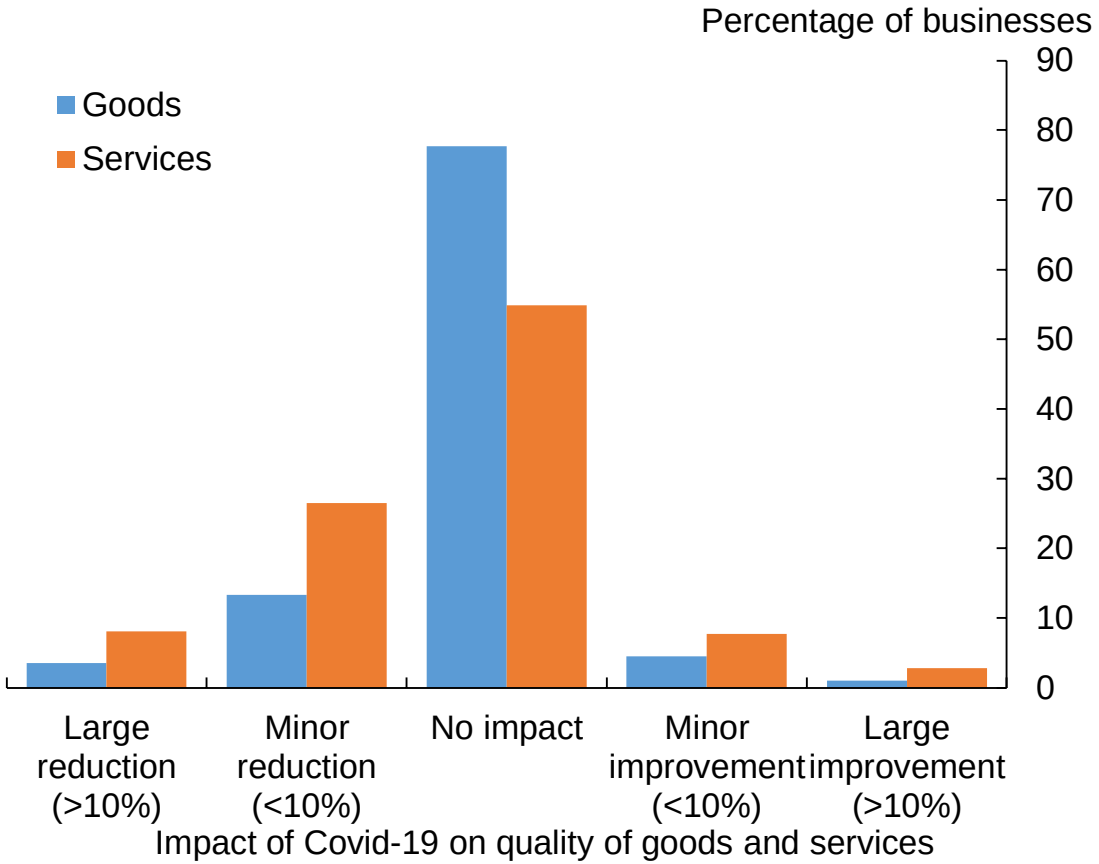


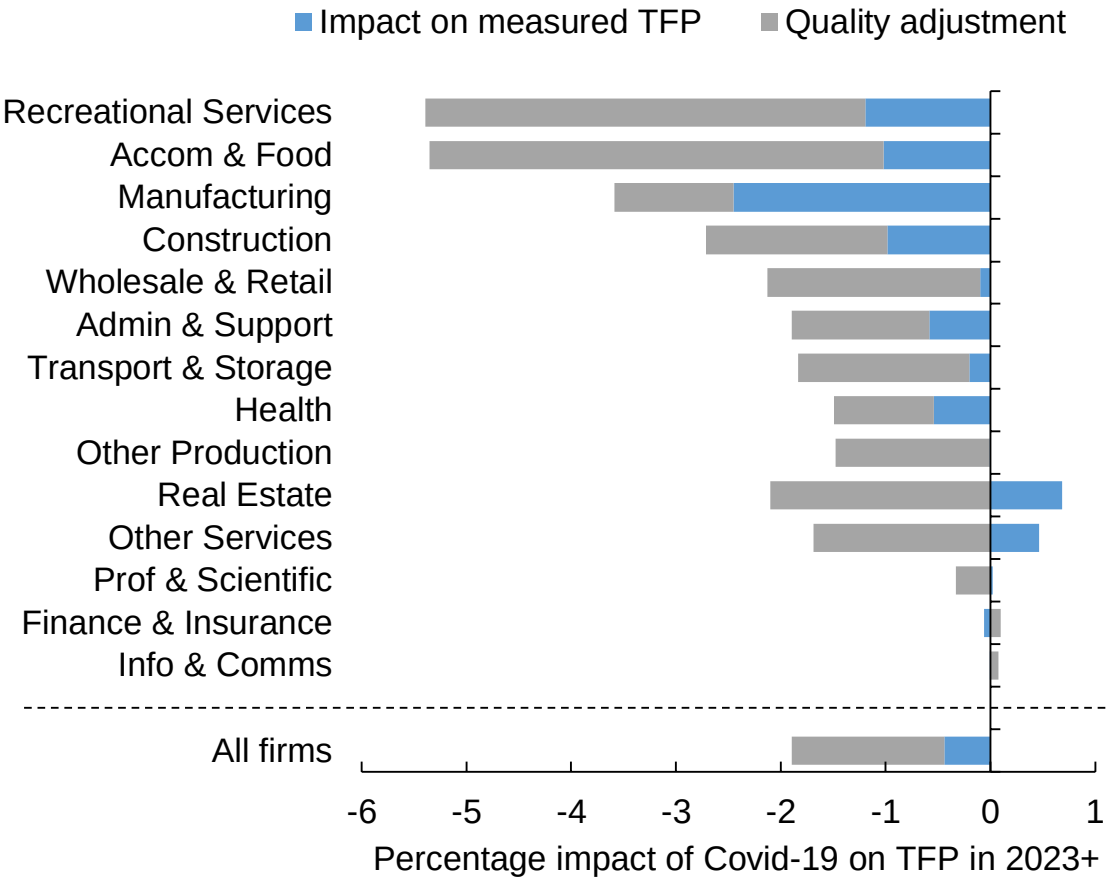
Figure 8: Potential impact of Covid-related quality changes on TFP

Panel A: Impact of Covid-19 on quality of goods and services



***Notes*: Based on the question: 'Has the Covid pandemic affected the average quality of the goods and/or services that your business produces in a way that is not reflected in the price?'. Data were collected between November 2021 and January 2022.**

Panel B: Medium term impact of Covid-19 on TFP by industry



***Notes*: Quality adjustments to within-firm TFP are calculated using the data shown in panel A. The adjustment is applied to both inputs and output.**

Table 1: Covid-19 impacts and Covid exposure measures

Dependent variable:	Impact of Covid-19 on TFP			Impact of Covid-19 on hours worked		
Time period	2020Q2 to 2021Q1	2021Q2 to 2022Q1	2023+	2020Q2 to 2021Q1	2021Q2 to 2022Q1	2023+
	(1)	(2)	(3)	(4)	(5)	(6)
Exposure						
Percentage of jobs that can be done from home$_J$	0.058***	0.051***	0.026***	0.138***	0.030***	0.012***
	(0.011)	(0.007)	(0.006)	(0.015)	(0.006)	(0.004)
Percentage of sales in 2019 that involved face-to-face contact$_i$	-0.028***	-0.019***	0.000	-0.083***	-0.016***	0.000
	(0.008)	(0.005)	(0.004)	(0.012)	(0.005)	(0.003)
Pre-Covid average wage per employee$_i$	0.189	1.221***	0.544**	11.233***	2.100***	0.071
	(0.525)	(0.335)	(0.236)	(0.744)	(0.284)	(0.177)
Observations	3,024	3,024	3,024	3,024	3,024	3,024
R-squared	0.019	0.031	0.013	0.150	0.044	0.005

Results match entry effects in Criscuolo (2022) for telecom potential (+) customer contact (-) Fernald (2022) new ways of doing business

Greater flexibility from WFH

Lesser flexibility from sales mode

Greater flexibility from workforce skills

***Notes*: This is a cross-sectional firm-level regression. Data on the percentage of jobs that can be done from home for firms in 1 digit industry *J* are taken from Dingel and Neiman (2020). Data on the percentage of sales in 2019 that involved face-to-face contact for each firm, *i*, are taken from a question in the DMP: 'What percentage of your sales in 2019 involved face-to-face contact with customers?'. Pre-Covid average wage per employee for each firm, *i*, are calculated using accounting data from Bureau Van Dijk FAME database (latest observation between 2017 and 2019). Regressions also include dummy variables for having missing exposure data. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.**

Table 2: Impact of Covid-19 on hours worked and pre-Covid productivity

Dependent variable: Impact of Covid-19 on total hours worked	2020Q2 to 2021Q1		2021Q2 to 2022Q1		2020Q2 to 2021Q1		2021Q2 to 2022Q1	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log pre-Covid labor productivity	10.679***	5.070***	2.278***	0.678***				
	(0.569)	(0.544)	(0.217)	(0.232)				
Log pre-Covid TFP					5.466***	1.796***	1.715***	0.711***
					(0.645)	(0.563)	(0.238)	(0.237)
Constant	-66.500***	-45.589***	-14.762***	-8.797***	-28.291***	-27.212***	-6.771***	-6.476***
	(2.156)	(2.053)	(0.823)	(0.876)	(0.453)	(0.371)	(0.167)	(0.156)
1 digit industry dummies	No	Yes	No	Yes	No	Yes	No	Yes
Weighted	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024
R-squared	0.105	0.379	0.035	0.166	0.023	0.363	0.017	0.166

***Memo*: Explanatory variable means: Log labor productivity per job = 3.92 , Log TFP = 0.40**

Explanatory variable standard deviations: Log labor productivity per job = 0.75, Log TFP = 0.72

***Notes*: All regressions are weighted using employment data. Labor productivity is defined as real value-added (operating profits plus total labor costs divided by the aggregate GDP deflator) per employee using accounting data from Bureau Van Dijk FAME database. TFP is calculated as the residual from a production function $\ln(Y_{it}) = 0.63\ln(L_{it})+0.37\ln(K_{it})$ where Y_{it} is real value-added of firm i in year t, L is labor input (total real labor costs) and K is capital (total real fixed assets), nominal values from accounting data are deflated using the GDP deflator. Pre-Covid data are the most recent observation between 2017 and 2019. *** p<0.01, ** p<0.05, * p<0.1.**

Comparison of odd and even column coefficients shows reallocation effect from inter-industry effects (off/on) for total hours worked.

Reallocation occurs, Criscuolo => less cleansing than previous recessions

UK Survey data (the Decision Maker Panel)

Impact of Covid-19 on productivity

Other Considerations

Conclusions

Conclusions

1. Covid had a significant effect on productivity. Support measures => Covid different from previous recessions. Covid-19 ‘short but deep’ recession.

2. Our unique survey approach reveals
   A. Within firms: LP -2.6%; TFP -5.9, largely from higher costs
   B. Between firms: TFP +0.1 to +0.2% increase from two sources:
   - inter-industry, lower TFP firms shrink fastest (accommodation, food & entertainment)
   - intra-industry, lower TFP firms shrink fastest (badly managed firms struggle more)

   C. Smaller medium term effects (despite huge shock and initial impact)

3. Heterogeneity reveals winners and losers, linked to ability to WFH, online sales, skills. Criscuolo (2022) EA and Fernald (2022) US find similar effects.

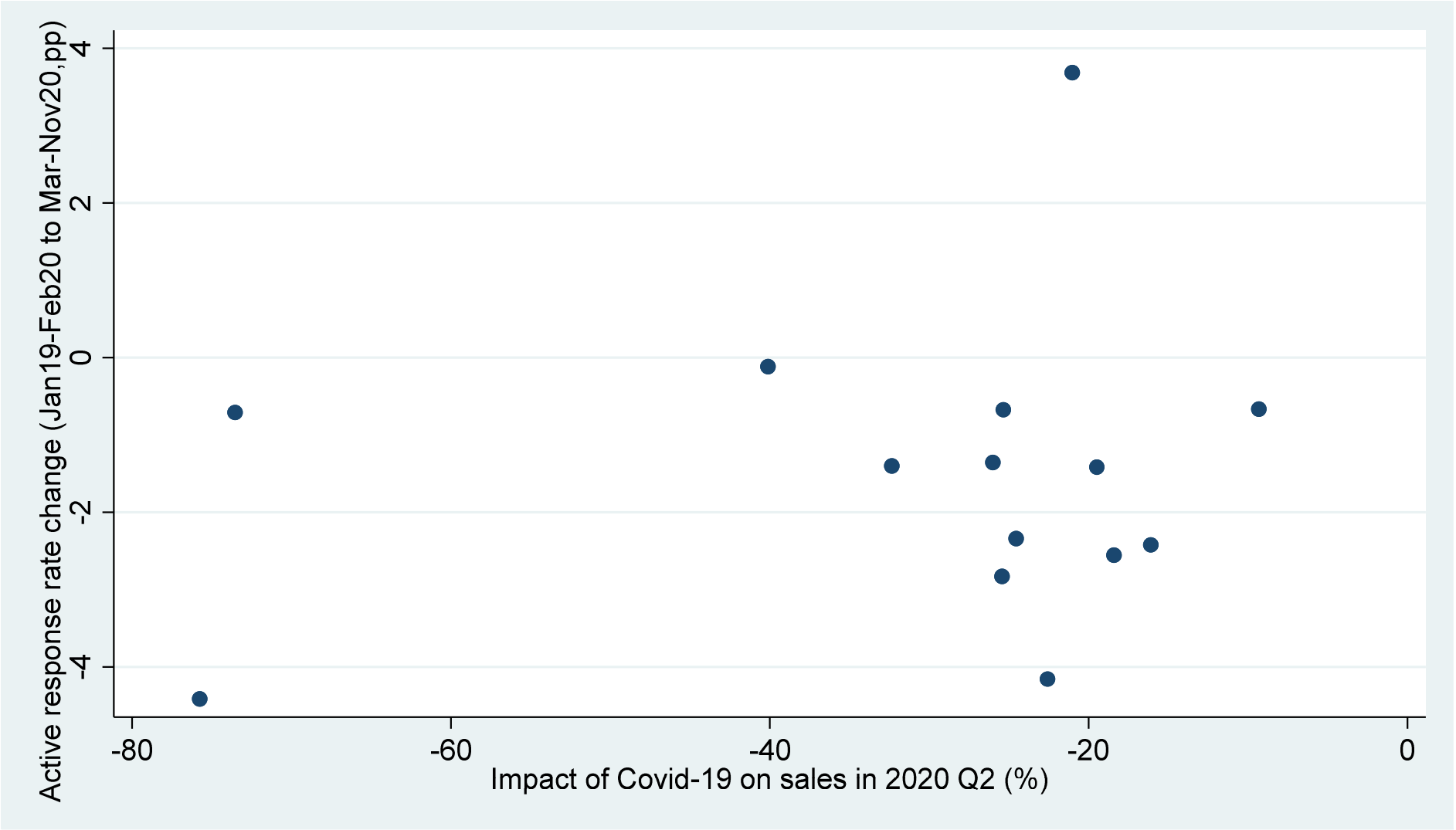
Hidden slides

Potential measurement issues

Effect	Description	Likely sign and size of impact on measured TFP and LP
Price measurement	Price adjustments are harder as the range of goods and services is restricted, some products are seeing large price swings, and some markets are not fully clearing – for example, rationing in supermarkets.	?
Social distancing and capital utilisation	Utilization of equipment will be reduced by social distancing if this is located too closely together to be fully used (think of a barber shop that can only use every other chair). This will overstate capital inputs unless there is a correct adjustment for capital utilization.	- - -
Working from home and capital and intermediate inputs	Workers working from home will employ capital (e.g. home offices) and consume intermediates (e.g. electricity) which contribute to firms' value added but are not recorded as such.	+ +
Working from home and labour inputs	Labour hours may be understated by working from home, if home-based employees work longer hours per day. There is evidence to suggest workers at home work longer hours as part of the commute is used to work. In reverse, however, labour hours at home may be lower than reported if employees have to carry out childcare while working.	?
Labour utilisation	Labour employee numbers may be overstated if workers remain on payroll but are not working and this is not corrected in labor inputs.	- -
Survey response rates	Response rates to Government surveys have dropped due to the lockdown, with for example one notable example being the response rate to the US Current Population Survey dropping by 15%. This could be because firms have temporarily shutdown, do not receive mail and/or due to the pandemic do not have the resources to respond to government surveys. Lower response rates will increase the variance of the associated measurements, and may also introduct bias.	?

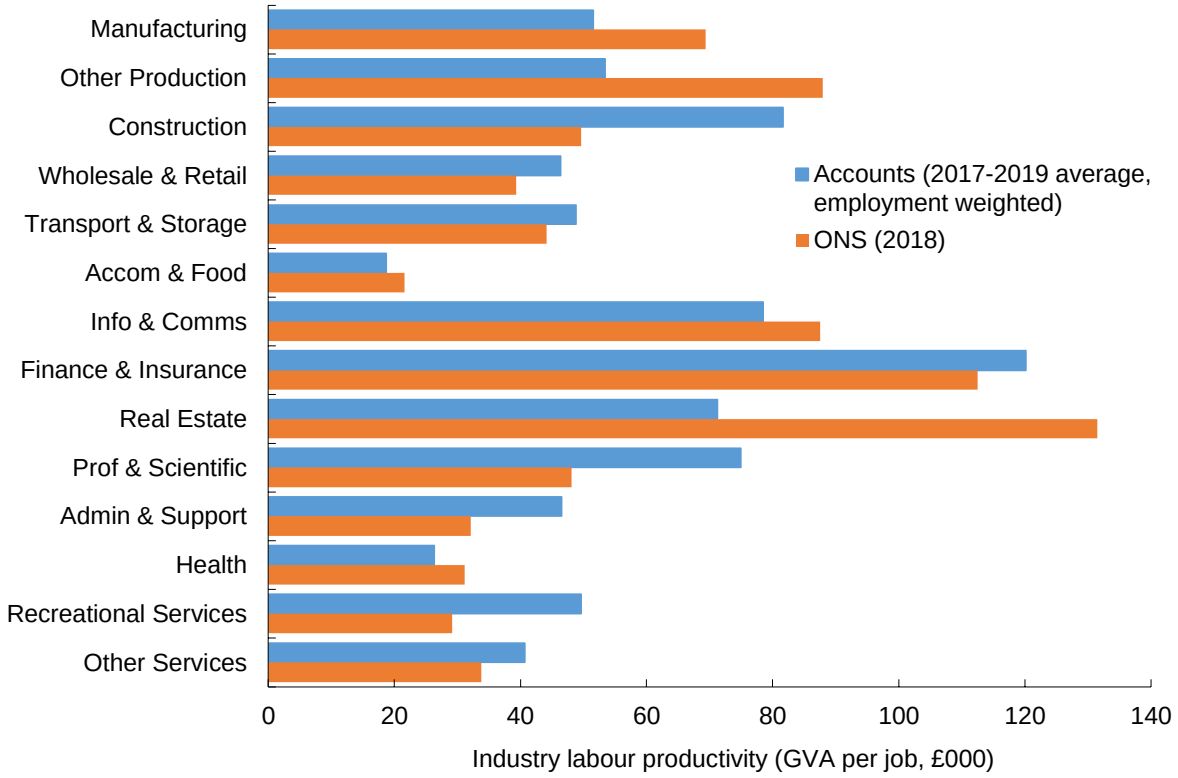
- **ONS articles on measurement issues: National Accounts; Prices; Labour Market; Productivity**

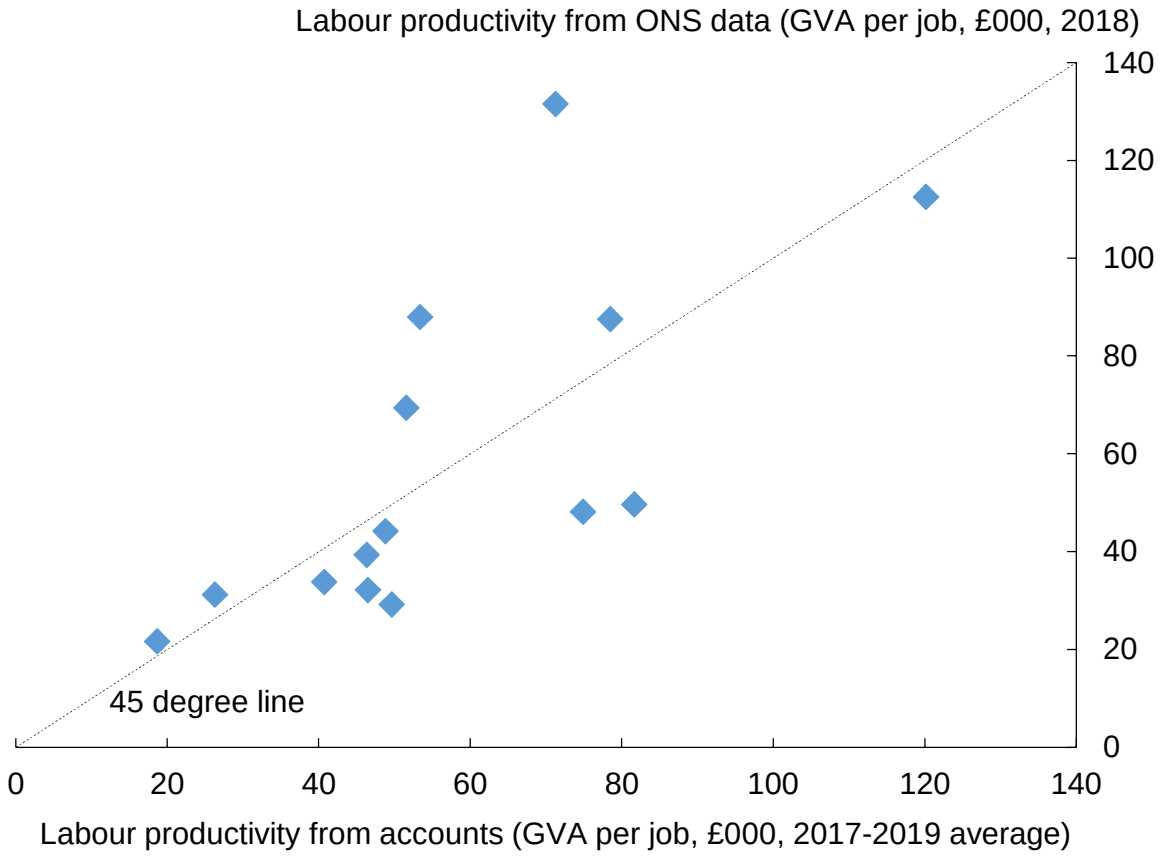
Figure A4: Changes in DMP active response rate by industry and impact of Covid-19 on sales in 2020 Q2



Notes: **The response rate of active panel members is calculated as the percentage of panel members who had completed at least one survey over the last twelve months who responded to the survey in a given month. Each dot represents a 1-digit industry. See Figure 3 for details of question on the impact of Covid-19 on sales in 2020 Q2.**

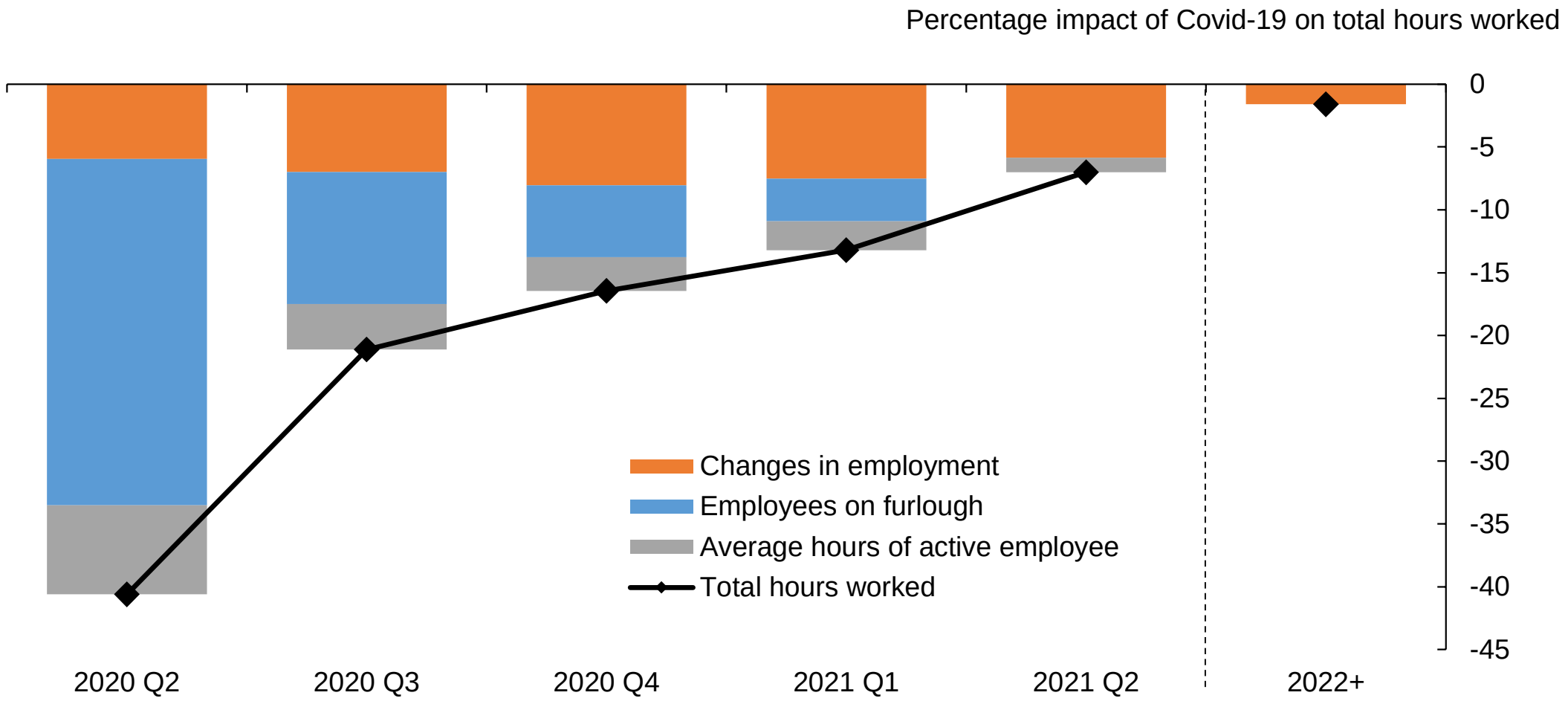
Figure A5: Different measures of industry-level labour productivity per job





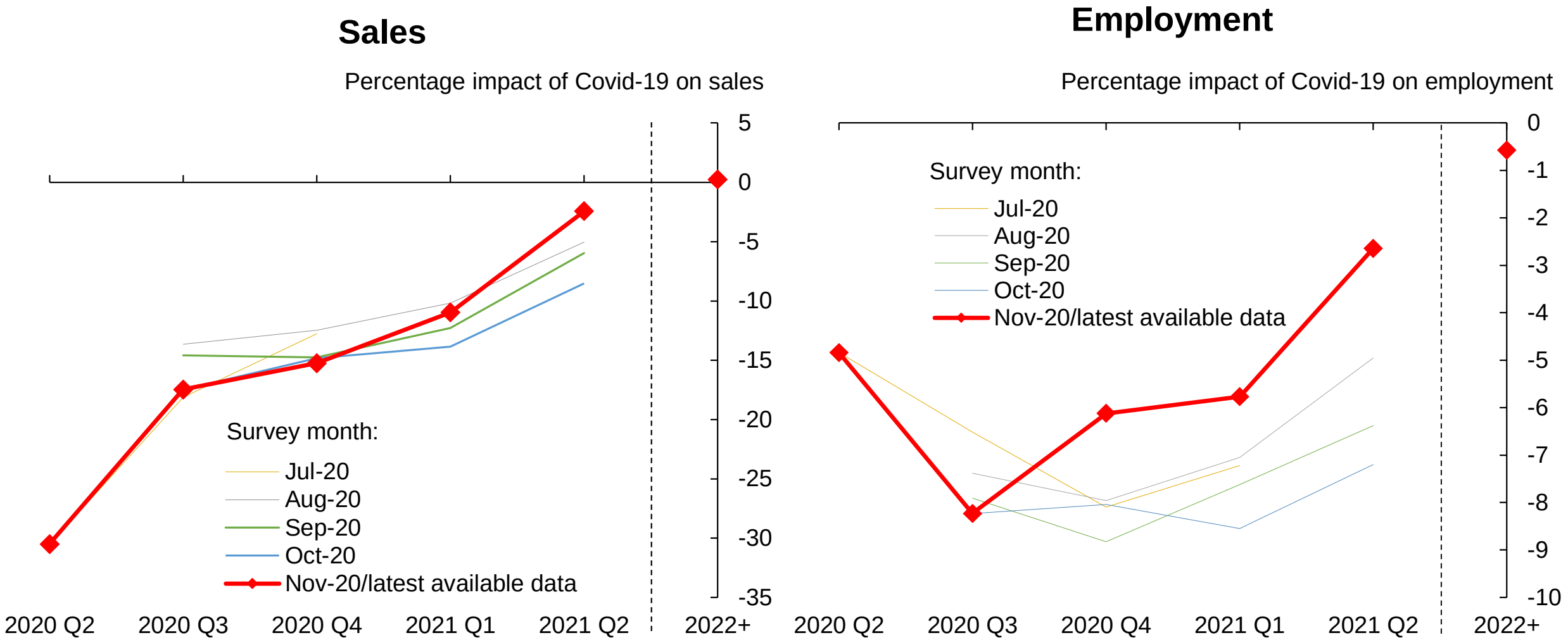
***Notes*: Labour productivity from company accounts is defined as real value-added (operating profits plus total labour costs divided by the aggregate GDP deflator) per employee using accounting data from Bureau Van Dijk FAME database.**

Figure A6: Contributions to impact of Covid-19 on total hours worked



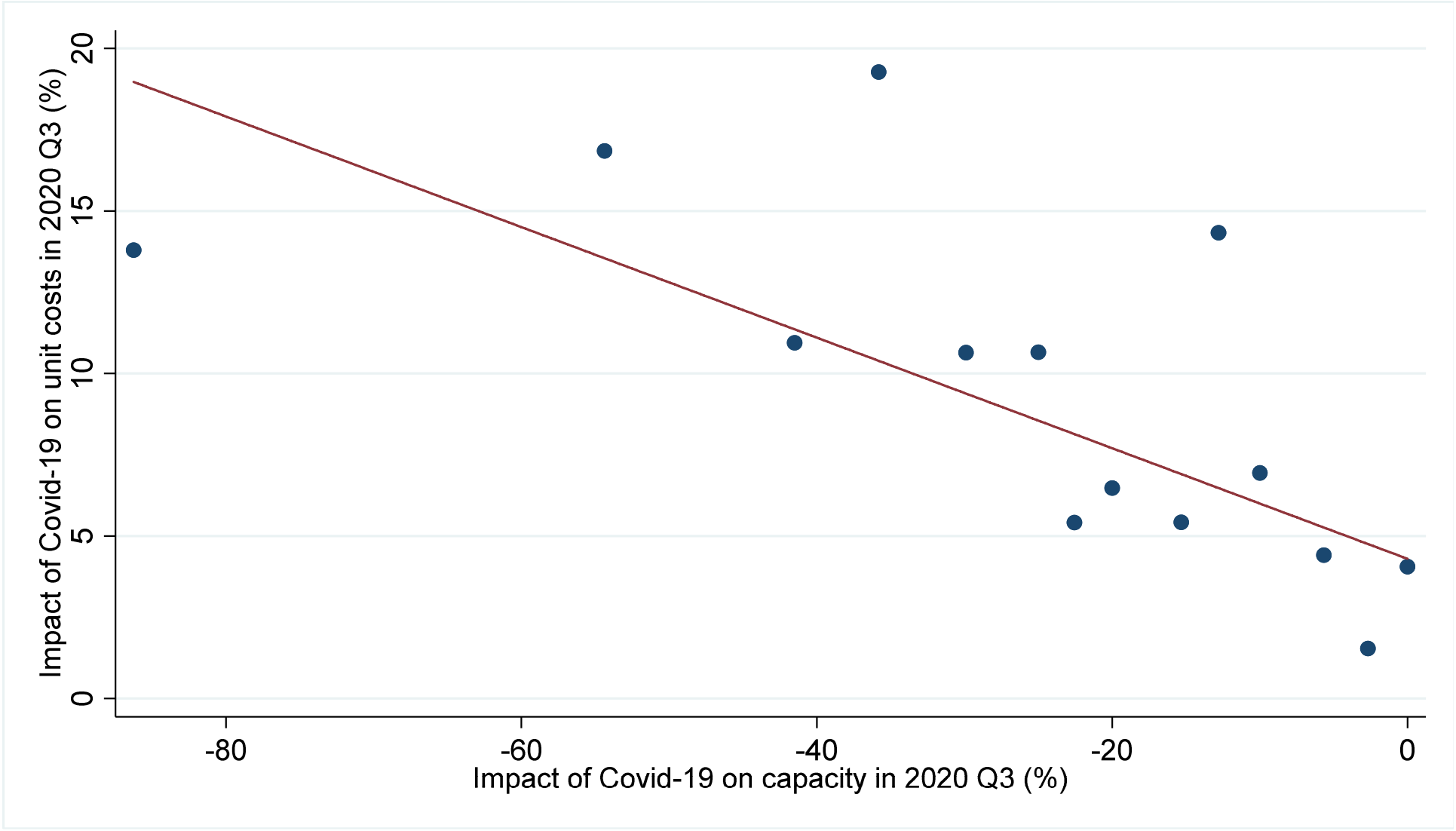
***Notes*: See Figure 3 for details of the questions used to calculate the impact of Covid-19 on hours worked.**

Figure A7: Vintages of DMP data



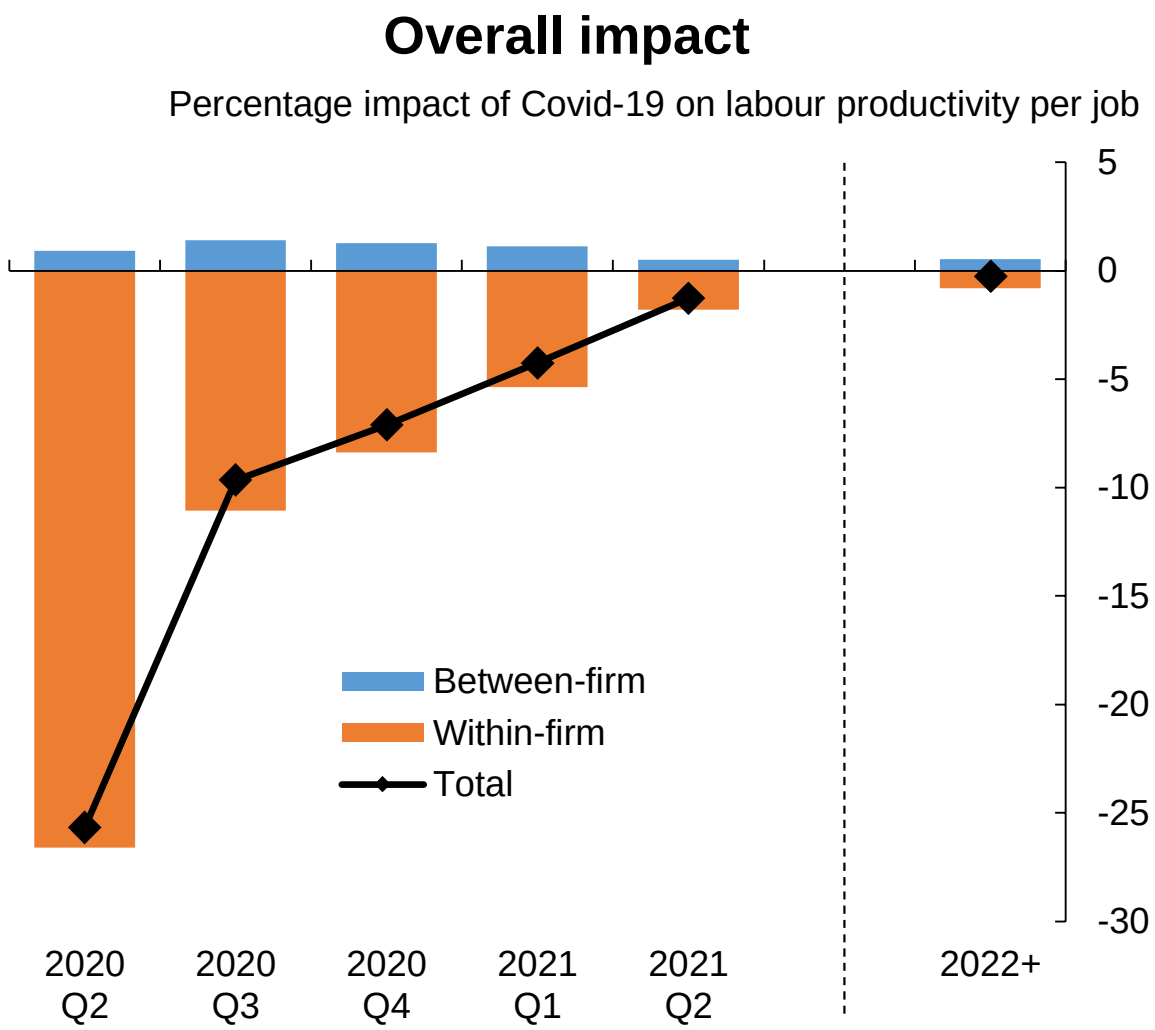
***Notes*: Aggregate DMP data as published on the Bank of England website. The results are based on the question: 'Relative to what would otherwise have happened, what is your best estimate for the impact of the spread of Covid-19 on the sales/employment of your business in each of the following periods?'. Each monthly survey did not ask about all periods.**

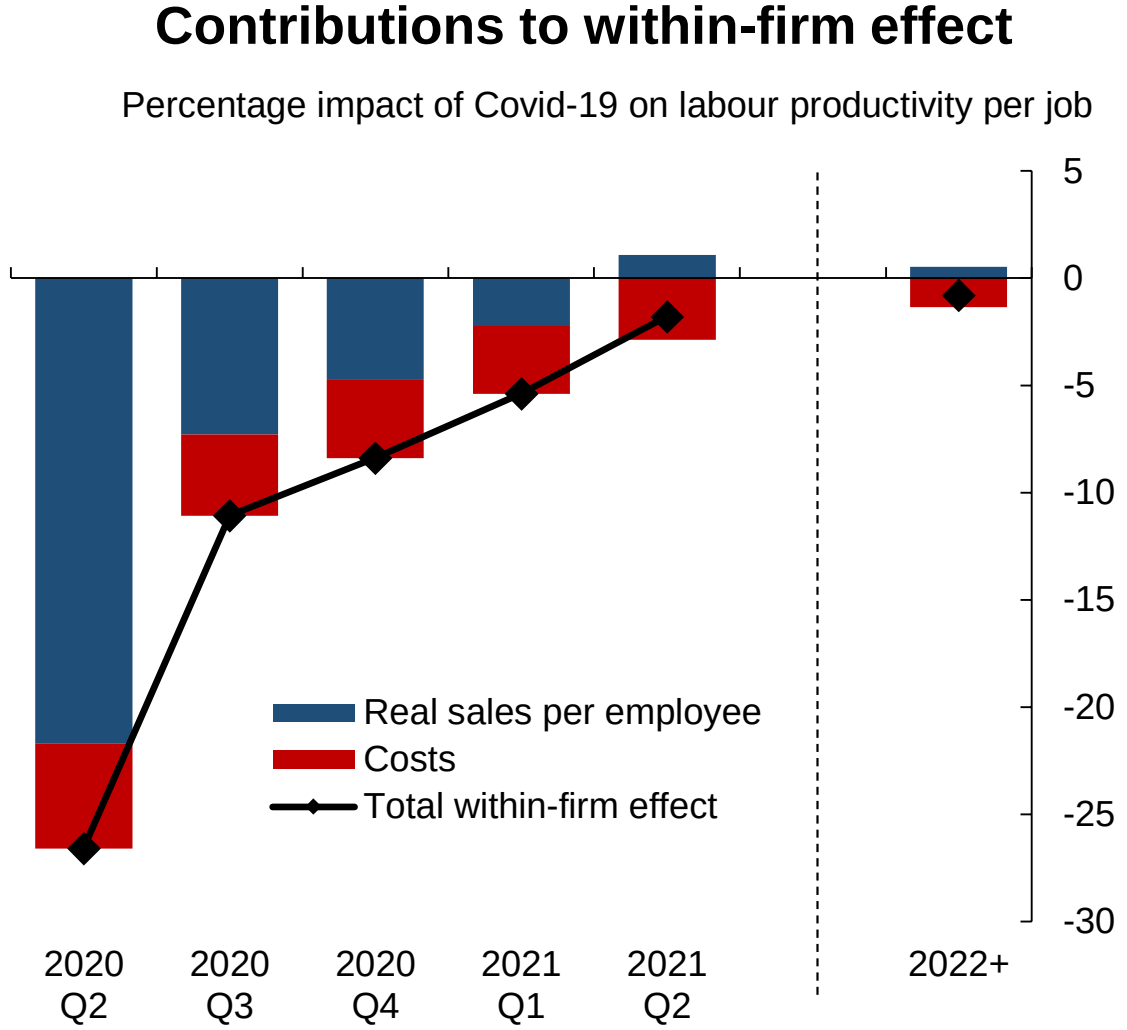
Figure A8: Impact of Covid-19 on unit costs and capacity constraints



***Notes*: The results are based on the questions: 'Relative to what would otherwise have happened, what is your best estimate for the impact of measures to contain coronavirus (social distancing, hand washing, masks and other measures) on the average unit costs of your business in each of the following periods?'; and 'Do you expect the measures to contain the coronavirus such as social distancing, hand washing, masks, and other measures to reduce the amount of goods or services that your business will be able to produce or offer in 2020 Q3 (July to September)? For example, if a restaurant can only use every other table this would be a 50% reduction. Note, this refers to the amount of goods and services you could produce if there was sufficient demand, not actual sales.'**

Figure A9: Contributions to impact of Covid-19 on labour productivity per job



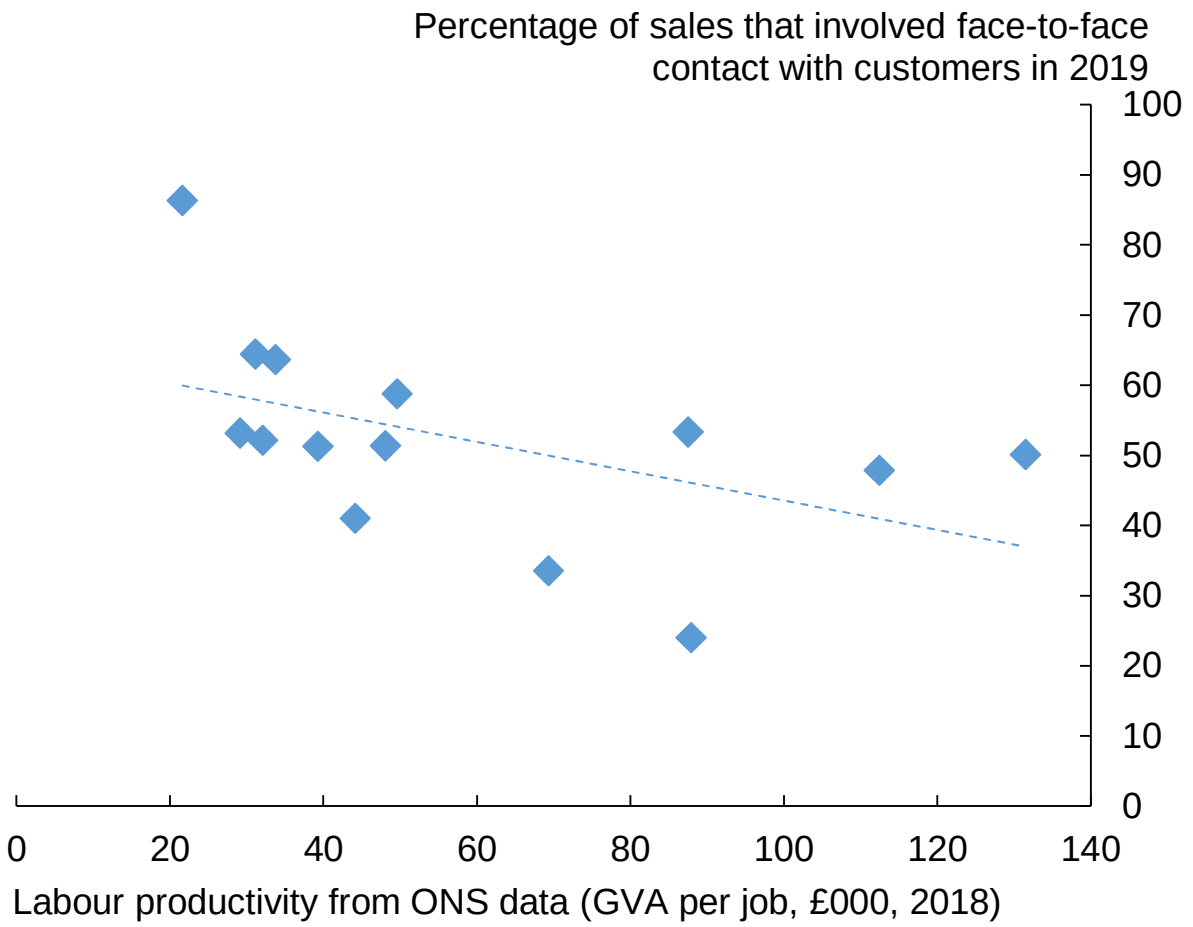


Notes: **Impacts on productivity are estimated as $\Delta\Pi_t = \sum_{i\in Surv}\bar{\varphi}_i\Delta\pi_{i,t} + \sum_{i\in Surv}\Delta\varphi_{i,t}(\overline{\pi_t} - \overline{\Pi})$ where $\pi_{i,t}$ is productivity in firm i at time t, Π_t is productivity at time t, $\varphi_{i,t}$ is the labour input share of firm i at time t and a bar over a variable indicates the average of the variables across times t-1 and t. Changes between t and t-1 are changes due to Covid-19 only. The first term represents the within-firm effects. The second term represents between-firm effects. The impact of Covid-19 on labour productivity for each firm is calculated as $\frac{dLP}{LP} = \frac{dY}{Y} - \frac{dP}{P} - \frac{dL}{L} - \frac{dM}{M}$ $where \frac{dM}{M} = \frac{M}{Y-M}\frac{dM^U}{M^U}$.. LP is labour productivity, Y is nominal sales, P is the price level, L is labour input, M are non-labour intermediate costs and M^U are intermediate unit costs.**

Figure A10: Industry exposure to Covid-19 and pre-Covid labour productivity

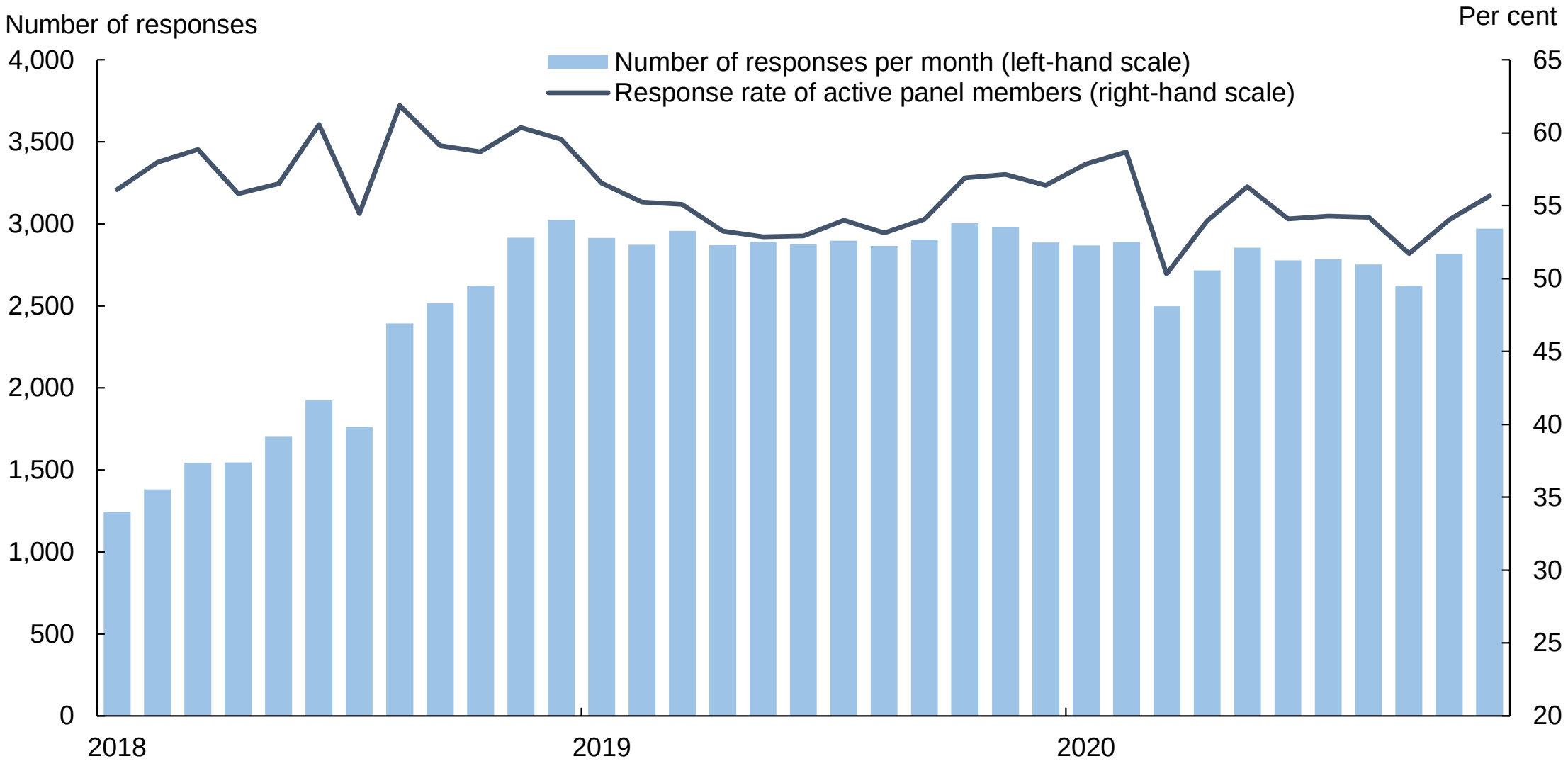
Ever worked from home in 2019 and labour productivity

Percentage of sales in 2019 that involved face-to-face contact with customers and labour productivity



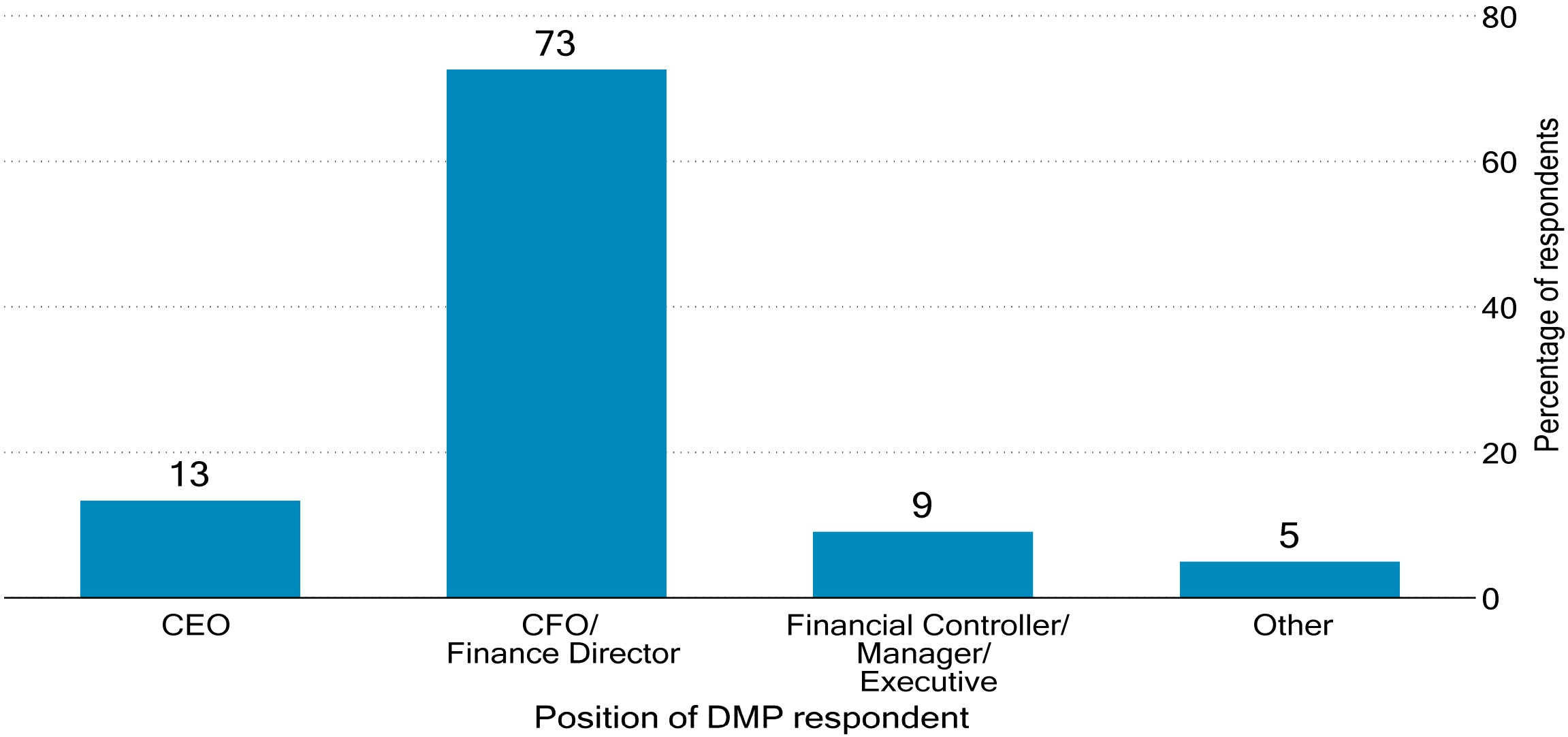
***Notes*: Data are for 1 digit industries. Labour productivity data are from ONS. Data on the percentage of employees who ever worked from home in 2019 are from the ONS Labour Force Survey. Data on the percentage of sales that involved face-to-face contact with customers are from the DMP survey and are based on the question 'What percentage of your sales in 2019 involved face-to-face contact with customers?'. These DMP data were collected in April 2020.**

COVID: DMP response rate roughly flat during the pandemic



Notes: The response rate of active panel members is calculated as the percentage of panel members who had completed at least one survey over the twelve months who responded to the survey in a given month.

86% respondents CEOs or CFOs (median firm has 60 employees)



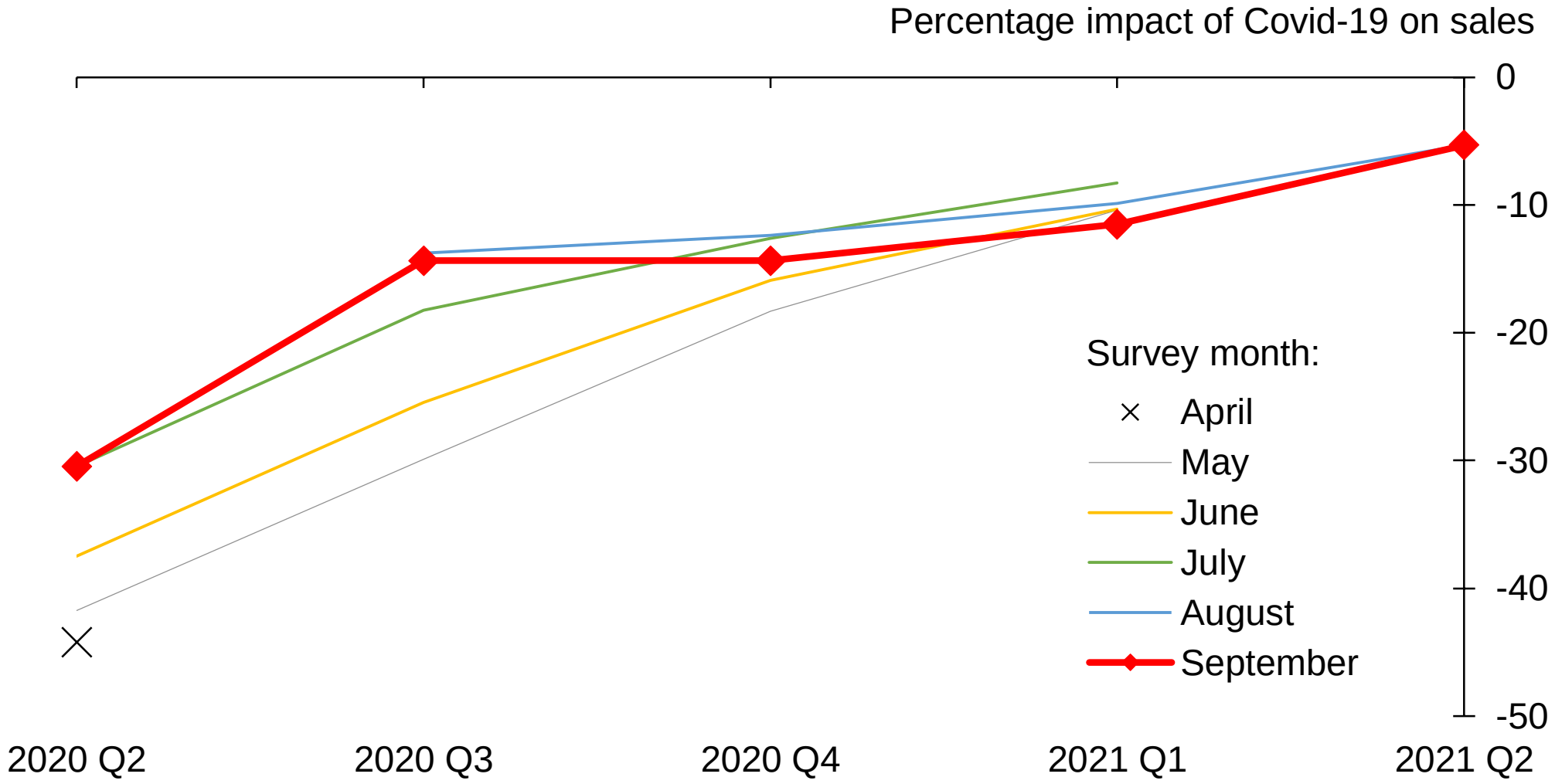
Source: Results are based on the question: 'Could you tell us the position of the person in your business that typically completes the Decision Maker Panel Survey?' and respondents were asked to choose from the following options: 'CFO', 'CEO', 'Other (please state): …'.

Response rates also uncorrelated with COVID industry impact

Sample	(1) Mar-Sep 20	(2) Jan19-Sep 20	(3) Jan19-Sep 20
Industry impact of Covid on sales in 2020 Q2	-0.002		
	(0.007)		
Ln(labour productivity)			0.602***
			(0.042)
Industry impact of Covid on sales in 2020 Q2 interacted with Covid period dummy variable		0.002	
		(0.004)	
Ln(labour productivity) interacted with Covid period dummy variable			-0.016
			(0.071)
Survey wave dummies	Yes	Yes	Yes
1 digit industry dummies	No	Yes	Yes
Individual firm fixed effects	No	No	No
Observations	252,217	793,160	793,160
R-squared	0.004	0.007	0.008

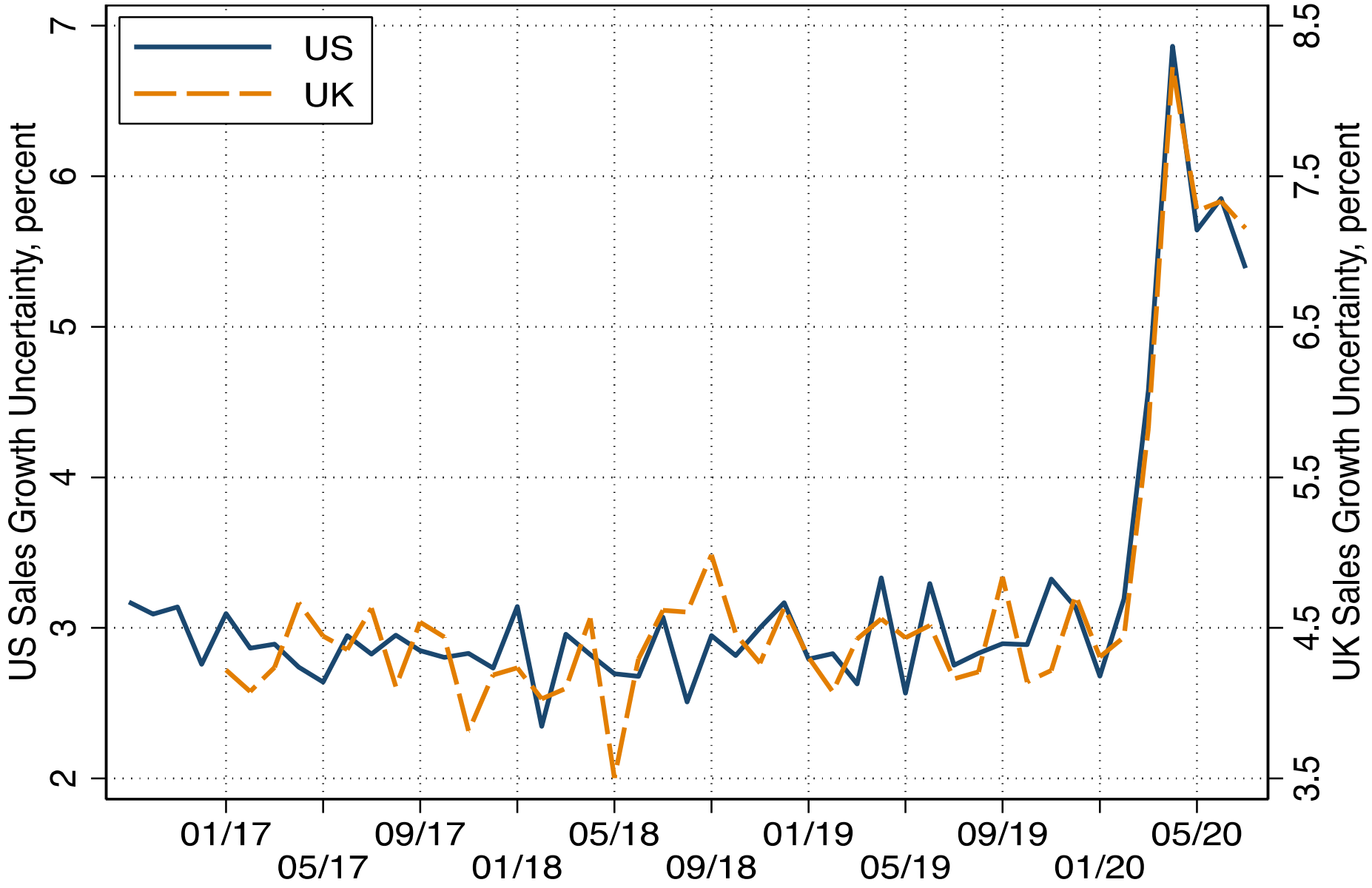
Notes: Linear probability model for whether a firm in the sampling frame responds to the DMP survey in each month between January 2019 and September 2020 (1=responded to DMP, 0=Not responded). Firm characteristics are averages of 2017 to 2019 accounts data from Bureau Van Dijk FAME database. Labour productivity is defined as real value-added (operating profits plus total labour costs divided by the aggregate GDP deflator) per employee using accounting data. Regressions only includes firms who were part of the sampling frame in January 2019 and who have productivity and sales data available from company accounts. Covid period dummy variable takes the value of one for March to September 2020. All equations are estimated by OLS. Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

Businesses have become less pessimistic about Covid-19's likely impact on sales



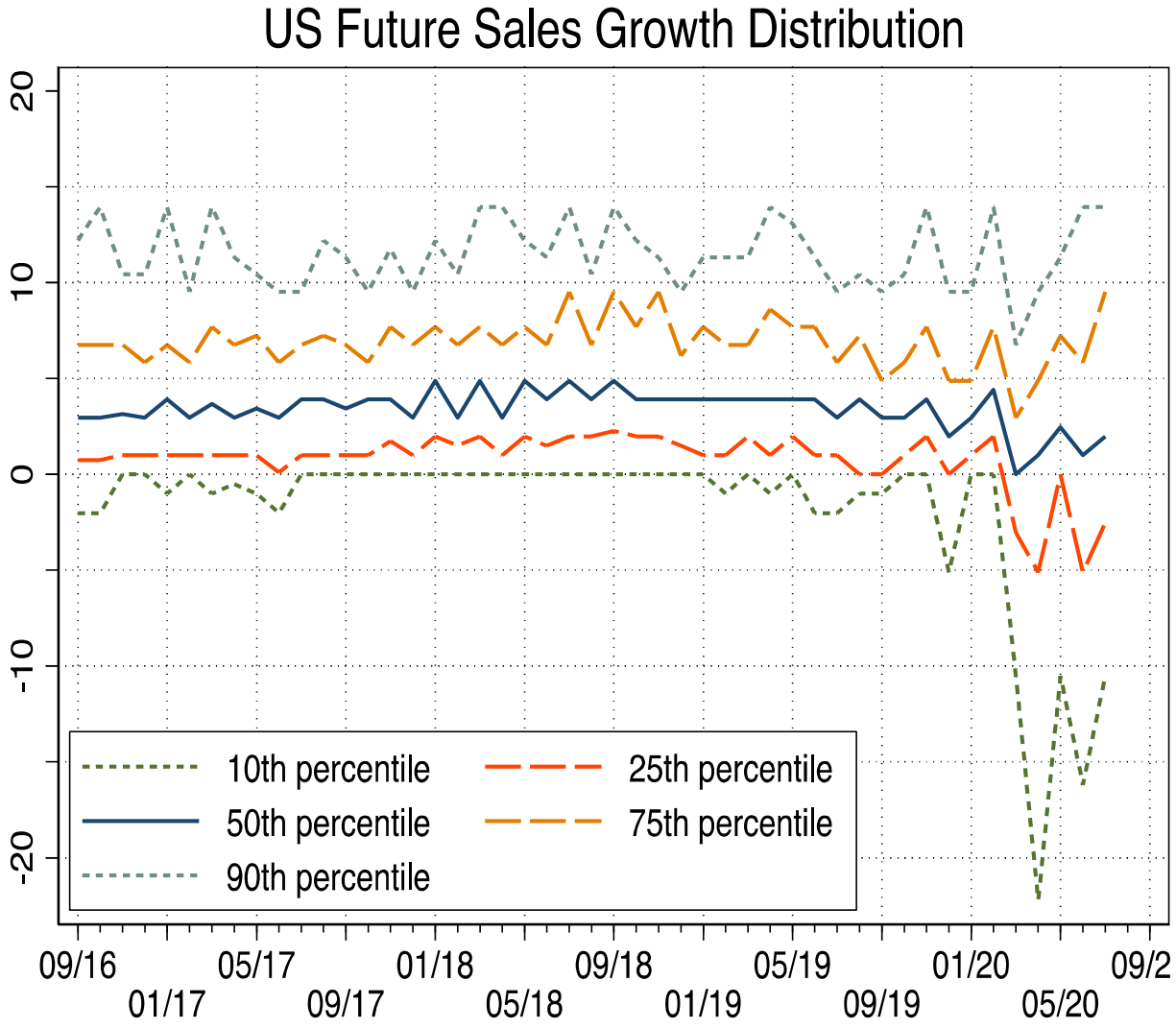
Notes: The results are based on the questions: 'Relative to what would otherwise have happened, what is your best estimate for the impact of the spread of Covid-19 on the sales of your business in each of the following periods?'.

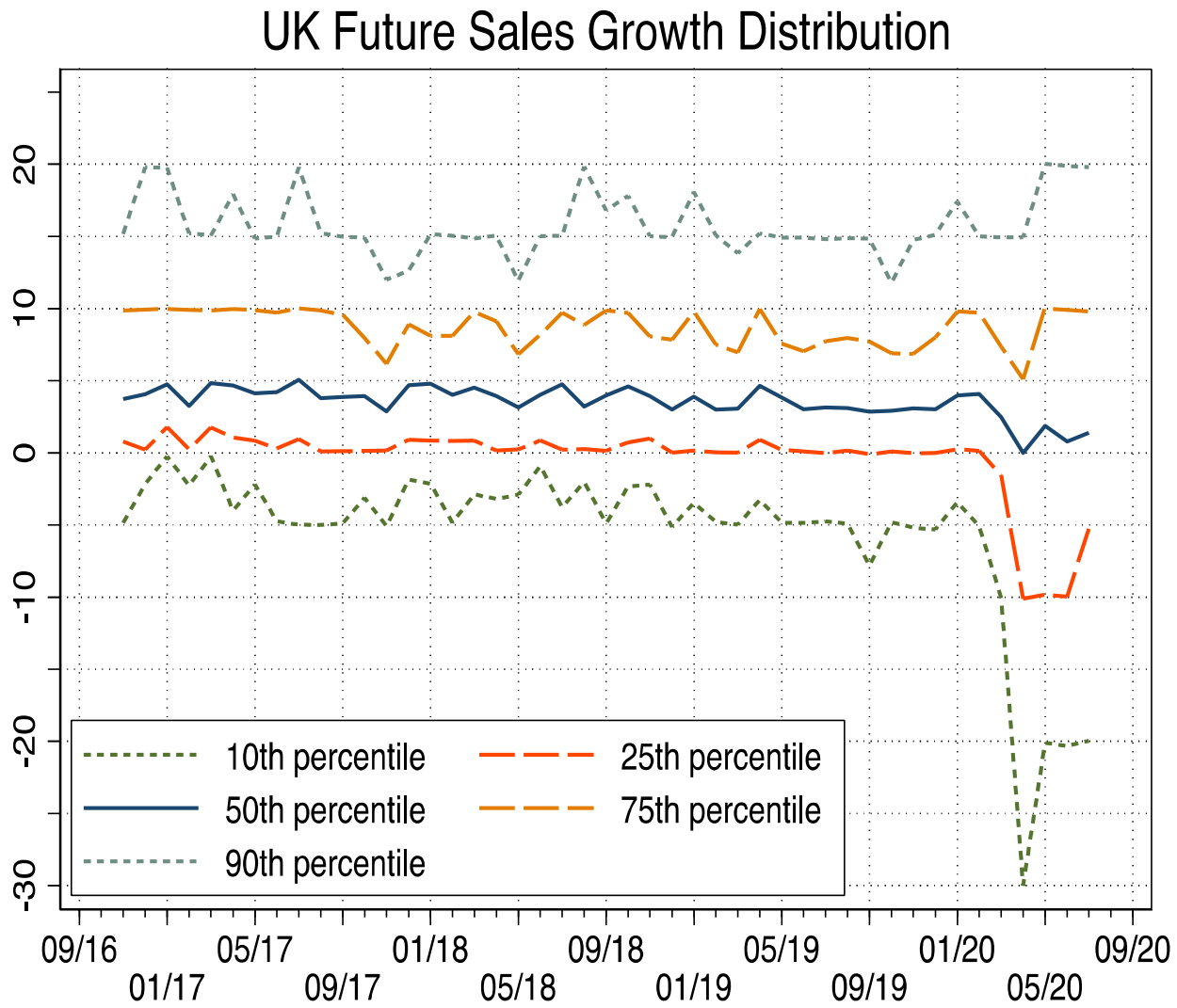
UK (& US) Firm subjective sales uncertainty doubled due to COVID



Notes: Source Altig et al. (2020). Subjective uncertainty measured for the growth rate of 4 quarters ahead firm level sales expectations (details in Altig et al. 2020). US data from the Survey of Business Uncertainty conducted by the Federal Reserve Bank of Atlanta, Stanford University, and the University of Chicago Booth School of Business (https://www.frbatlanta.org/sbu). UK data from the Decision Maker Panel Survey conducted by the Bank of England, Nottingham University and Stanford University (see Bloom et al. (2019) and www.decisionmakerpanel.com).

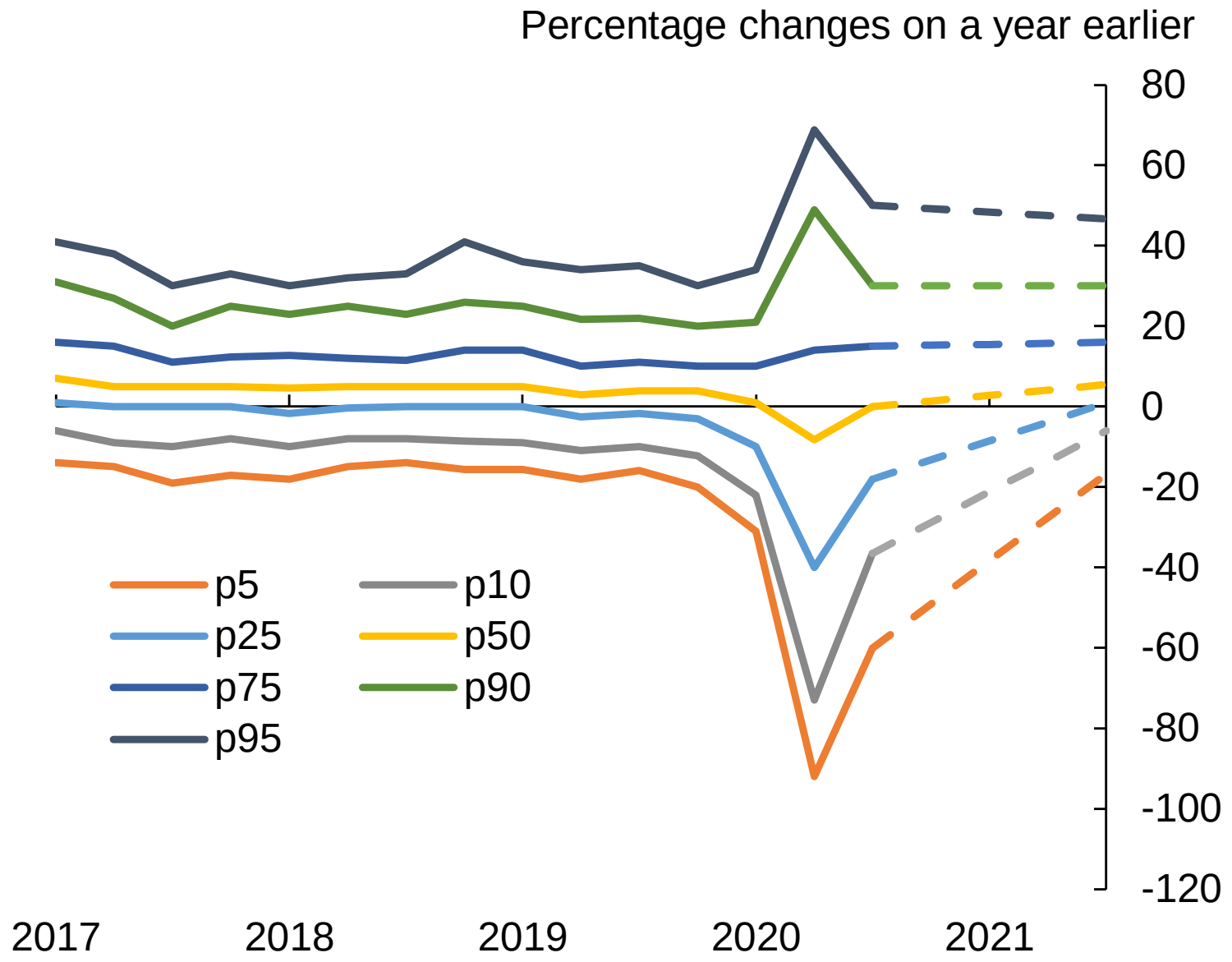
COVID also generated extensive downside tail-risk for UK & US firms





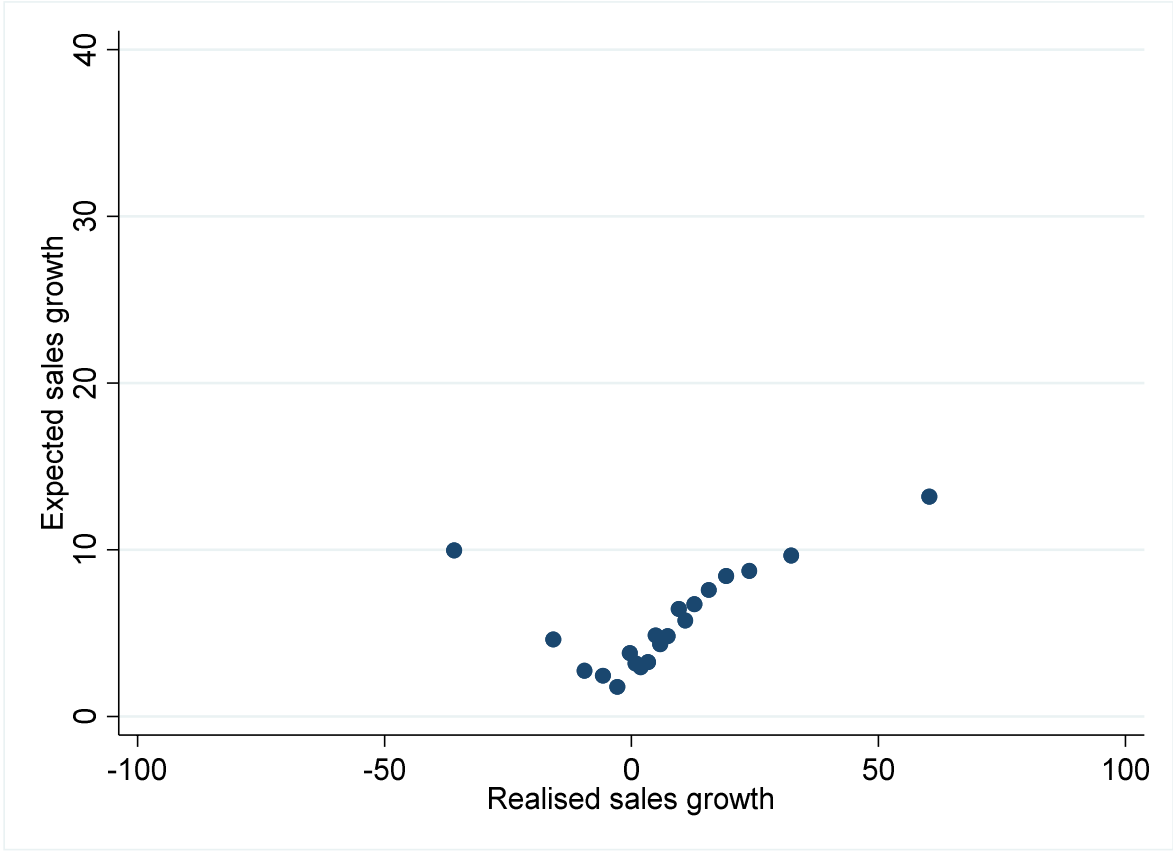
Notes: Each graph displays quantiles of the aggregate distribution of firm's distributional expectations of future sales growth, looking ahead at a four-quarter horizon. In each month, we aggregate individual firms' five-point subjective distributions by weighting a given firm's five support points by their probabilities and then weigh the support points for each firm by its employment. US data are from the Survey of Business Uncertainty conducted by the Federal Reserve Bank of Atlanta, Stanford University, and the University of Chicago Booth School of Business (https://www.frbatlanta.org/sbu) (see Altig et al. 2020). UK data from the Decision Maker Panel Survey conducted by the Bank of England, Nottingham University and Stanford University (see Bloom et al. (2019) and www.decisionmakerpanel.com).

Distribution of sales growth (quarterly)

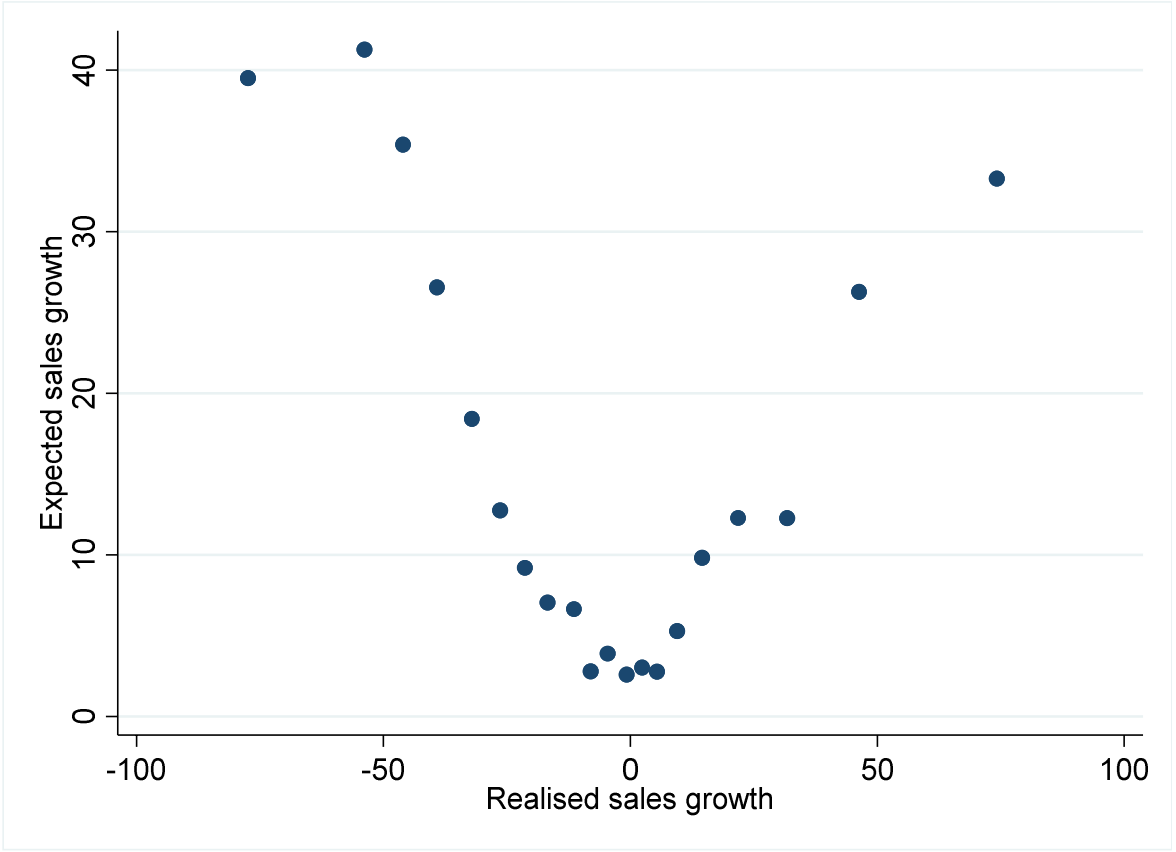


Relationship between realised and expected sales growth

Pre-Covid



2020 Q2



Define productivity growth using the following total derivatives

Productivity concept	Formula for level	Formula for total derivative
Labour productivity	$LP = \frac{\left(\frac{Y-M}{P}\right)}{L} = \frac{\left(\frac{Y-M_U Y}{P}\right)}{L}$	$\frac{dLP}{LP} = \frac{dY}{Y} - \left(\frac{M}{Y-M}\right)\frac{dM_U}{M_U} - \frac{dP}{P} - \frac{dL}{L}$
Total factor productivity	$TFP = \frac{\left(\frac{Y-M}{P}\right)}{L^{\beta}K^{\alpha}} = \frac{\left(\frac{Y-M_U Y}{P}\right)}{L^{\beta}K^{\alpha}}$	$\frac{dTFP}{TFP} = \frac{dY}{Y} - \left(\frac{M}{Y-M}\right)\frac{dM_U}{M_U} - \frac{dP}{P} - \beta\frac{dL}{L} - \alpha\frac{dK}{K}$

Notes: LP is labour productivity, TFP is total factor productivity, Y is nominal sales, P is the price level, L is labour input, M are non-labour intermediate costs, M_U are intermediate unit costs and K is capital input. β is assumed to be 2/3 and α 1/3.

Within-firm productivity

- **We quantify the impact on within-firm productivity using a simple final sales production function**

$$Y = (A_K K)^{\alpha} (A_L L)^{\beta} (A_M M)^{\gamma}$$

- **Taking logs and derivatives yields**

$$dy = \alpha (da_K + dk) + \beta (da_L + dl) + \gamma (da_M + dm)$$

- **And the change in final sales TFP is given by**

$$dt\tilde{f}p = dy - \alpha dk - \beta dl - \gamma dm$$

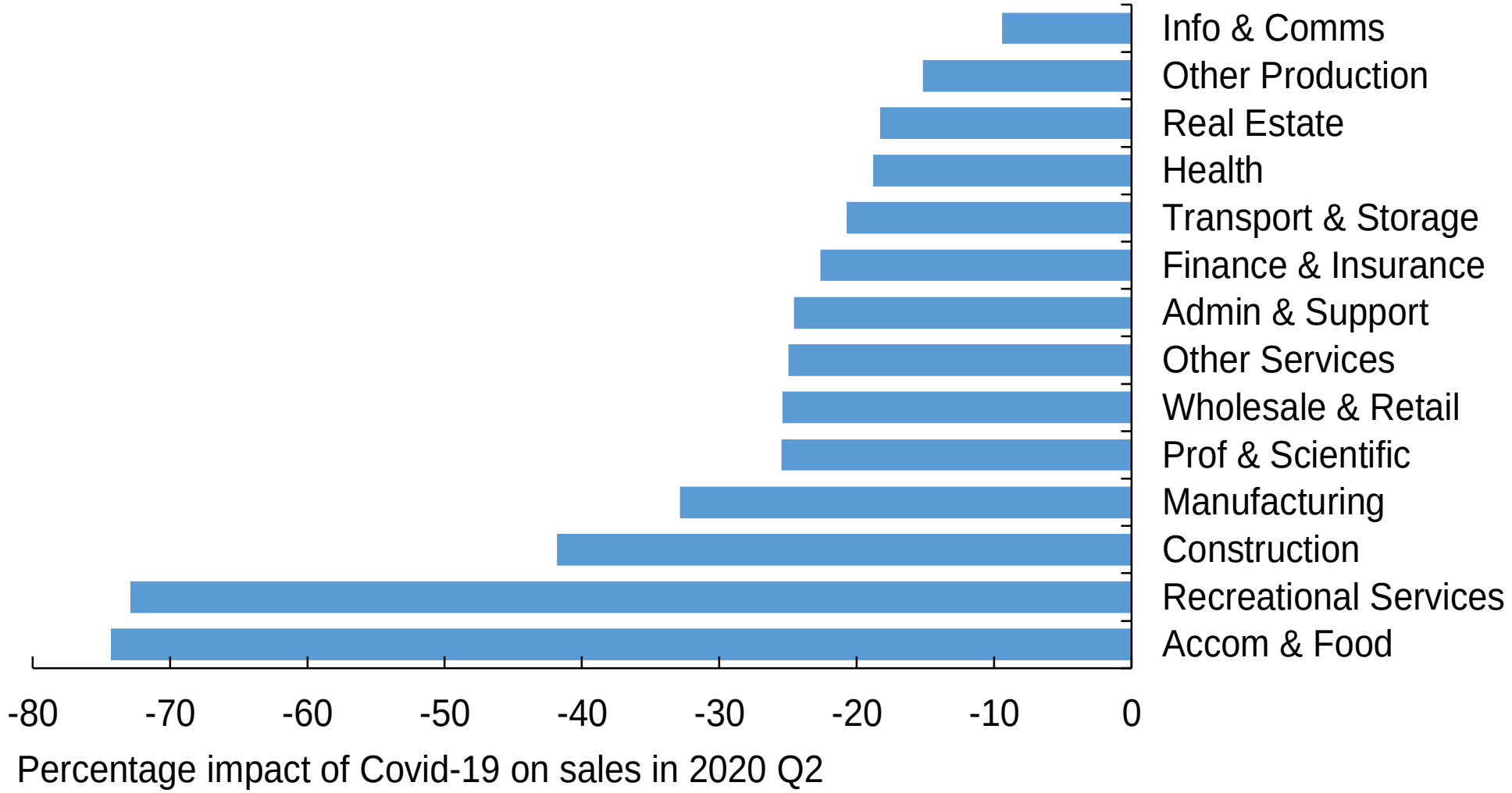
- **One can show that value-added TFP is given by**

$$dtfp = dy - \frac{\gamma}{\alpha + \beta} dm_u - \frac{\alpha}{\alpha + \beta} dk - \frac{\beta}{\alpha + \beta} dl$$

- **And the relation between the two is simply**

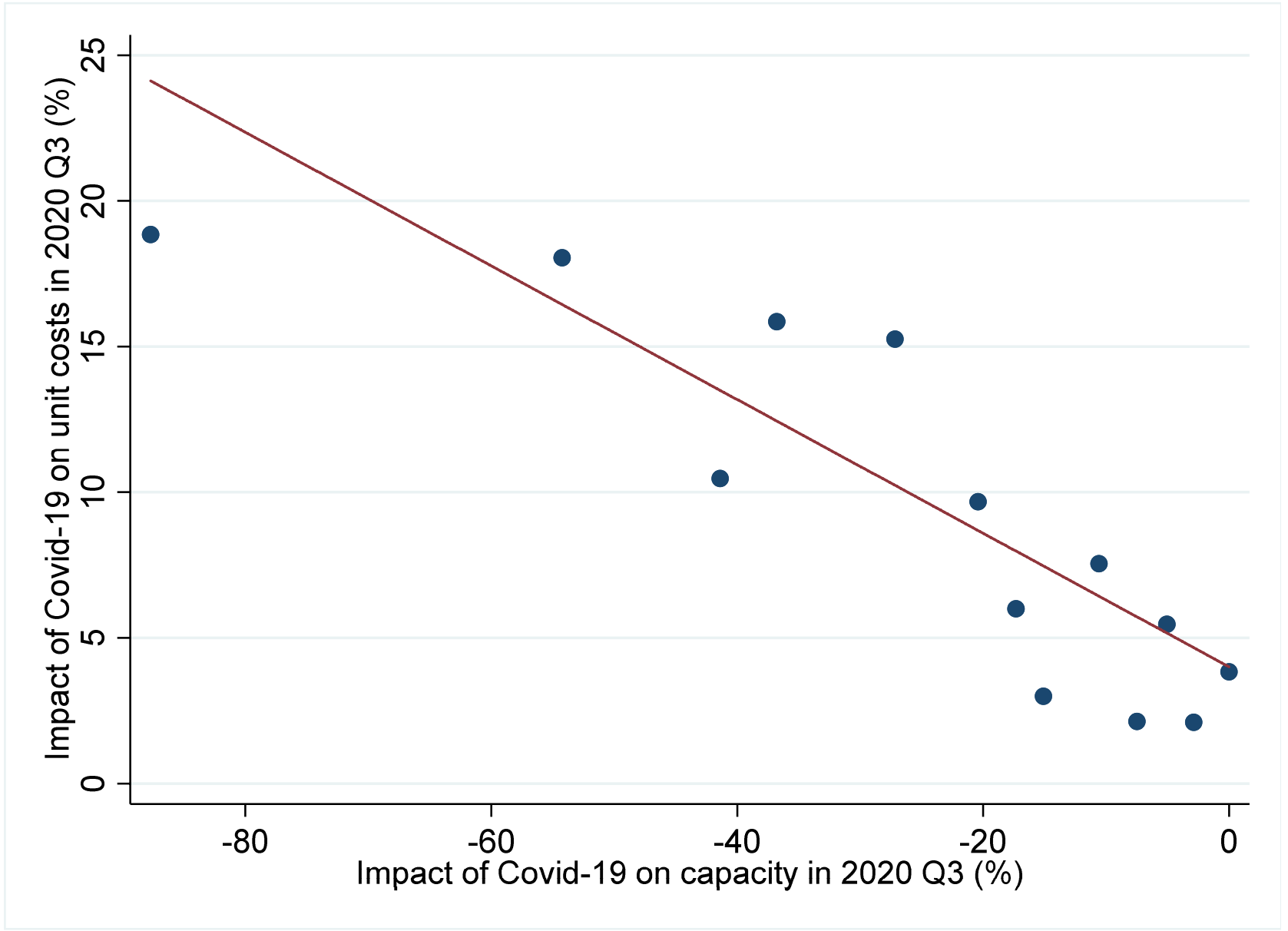
$$dtfp = \frac{1}{\alpha + \beta} dt\tilde{f}p$$

Sales in consumer-facing industries have been hardest hit



Notes: The results are based on the questions: ‘Relative to what would otherwise have happened, what is your best estimate for the impact of the spread of Covid-19 on the sales of your business in each of the following periods?’.

Impact of Covid-19 on unit costs and capacity constraints



Sensitivity of Covid-19 productivity impact to allowing for firm exit

	Firms who enter	Firms who exit
Labour productivity per job relative to average:		
Data: 2016-2019	81%	85%
Assumption: Covid-scenarios	80%	50%

	Lower entry scenario	Higher exit scenario	Combined scenario
Change in total employment	-0.5%	-0.5%	-1%
Impact on aggregate labour productivity	+0.1%	+0.2%	+0.3%

Notes: Labour productivity is defined as real value-added (operating profits plus total labour costs divided by the aggregate GDP deflator) per employee and is estimated using accounting data from Bureau Van Dijk FAME database. Labour productivity of firms who enter is productivity in their first year of accounts after incorporation and is based on firms who have been incorporated since 2016. Labour productivity of firms who die is productivity in their last year of accounts and is based on firms who have entered liquidation or who have been dissolved since 2016.

Figure A9: Estimates of the impact of Covid-19 from overall expectations data versus the marginal impact of Covid-19