The impact of Covid-19 on productivity

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The Covid-19 shock has had asymmetric effects across sectors of the economy, with those sectors that involve the most social contact in consumption bearing the brunt. This column uses data from the Decision Maker Panel business survey data to assess how the spread of Covid-19 and measures to contain it are likely to affect productivity. It estimates total factor productivity in the UK private sector is likely to be lower than it would have been, by up to 5% in 2020 Q4, falling back to a 1% reduction in the medium term. Firms anticipate a large reduction in 'within-firm' productivity, primarily because measures to contain Covid-19 are expected to increase intermediate costs. Since the pandemic disproportionally affected firms in low-productivity sectors, and the least productive firms within these sectors, these become a smaller part of the economy and therefore a positive 'between-firm' reallocation effect partially offsets the negative 'within-firm' effect.

Related

The spread of Covid-19 and measures to contain it are likely to have important implications for productivity (e.g. di Mauro and Syverson 2020, Bartik et al. 2020). To assess this we make use of survey data collected by the Bank of England, Nottingham and Stanford Universities through the monthly Decision Maker Panel (DMP) survey, a large and representative online panel of UK firms established in 2016 (see Bloom et al. 2020a and Bloom et al. 2020b for two previous posts that use these data). An important advantage of the DMP survey relative to other business surveys is the quantitative and forward-looking nature of the data that it collects. This has been particularly important in the context of the Covid-19 pandemic, where the extent to which conditions have become better or worse has varied greatly across firms. It is this feature of the data that allows us to generate quantitative estimates of the impact on productivity in our new paper (Bloom et al. 2020c).

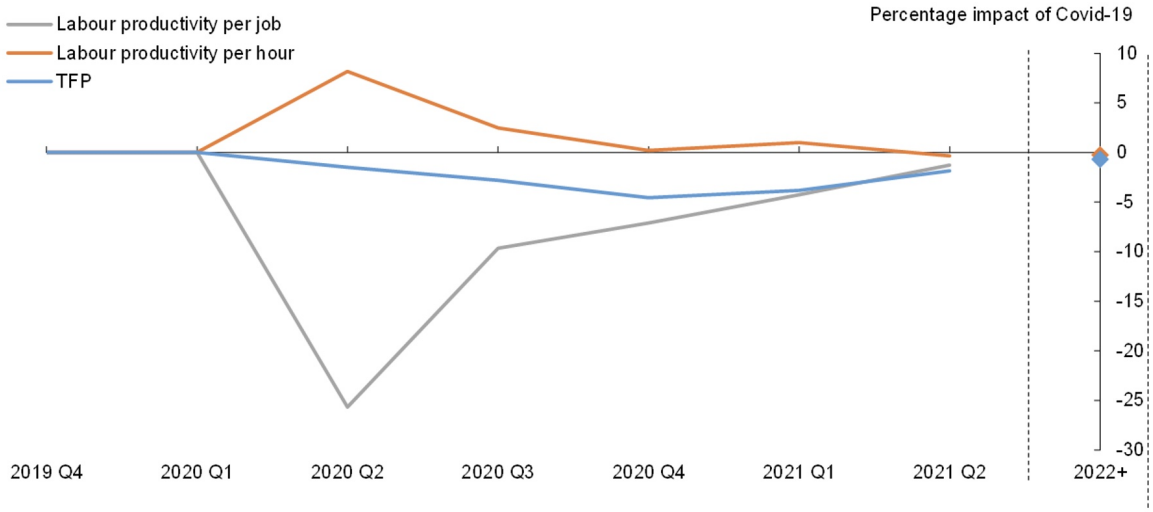
Whilst the DMP survey does not ask about productivity directly, panel members have been asked about the impact of Covid-19 on all of the main components of productivity, covering inputs, outputs, and prices. We take pre-Covid measures of firm-level productivity derived from company accounts data as a starting point and project them forward using more timely and/or forward-looking data from the DMP on the impact of Covid-19 on variables such as sales, employment, and unit costs. We assess the impact of Covid-19 on both measures of labour productivity and total factor productivity (TFP). Using the framework of Baily et al. (1992), we then build our results up from the firm level and decompose the aggregate impacts into 'within-firm' and 'between-firm' effects. In contrast to other studies that must infer the impact of a shock on productivity from some natural temporal or cross-firm variation in exposure, the DMP data allow us to ask this of firms directly.

Covid-19 is likely to lower total factor productivity

Our results suggest that Covid-19 will reduce TFP in the UK private sector, relative to what would otherwise have happened, by about 3% on average between 2020 Q2 and 2021 Q2, peaking at 5% in 2020 Q4 (see the blue line in Figure 1). We estimate that the pandemic will reduce TFP by about 0.7% over the medium term, equivalent to about around one year of pre-pandemic UK productivity growth.

In contrast to a fall in TFP, labour productivity per hour is estimated to have increased in 2020 Q2 as hours worked fell by more than total capital/labour inputs weighted together (see the orange line in Figure 1). But the effects on labour productivity per job are estimated to be negative throughout, particularly in 2020 Q2 and Q3, as the number of jobs has fallen by much less than hours worked (see grey line on Figure 1).

Figure 1 The estimated impact of Covid-19 on productivity varies depending on the measure of productivity used

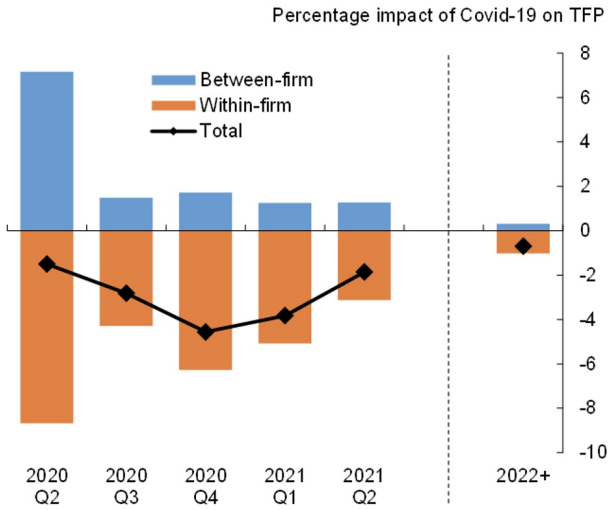


Notes: Impacts on productivity are estimated as $\Delta\Pi_t = \sum_{i\in Surv}\bar{\varphi}_i\Delta\pi_{i,t} + \sum_{i\in Surv}\Delta\varphi_{i,t}(\bar{\pi}_i - \bar{\Pi})$ where $\pi_{i,t}$ is productivity in firm i at time t, Π_t is productivity at time t, $\varphi_{i,t}$ is the employment share of firm i at time t and a bar over a variable indicates the average of the variables across times t-1 and t. Changes between t and t-1 are changes due to Covid-19 only. 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 $\frac{dM}{M}=\frac{M}{Y-M}\frac{dM^U}{M^U}$. The impact of Covid-19 on labour productivity for each firm is calculated as $\frac{dTFP}{TFP}=\frac{dY}{Y}-\frac{dP}{P}-\beta\frac{dL}{L}-\alpha\frac{dK}{K}-\frac{dM}{M}$. 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.

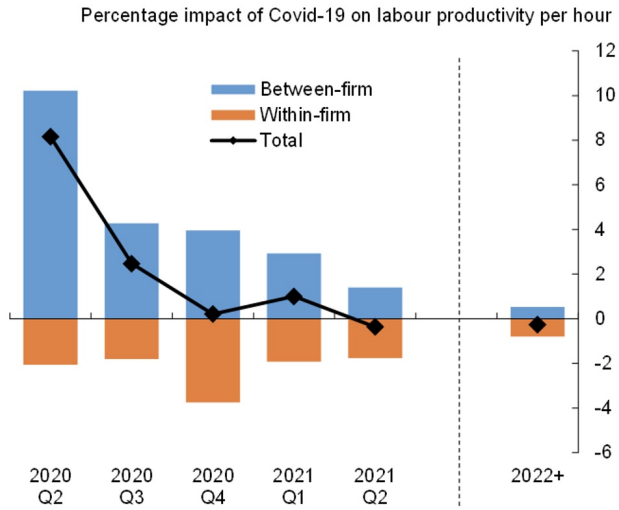
The overall effects of Covid-19 on productivity mask some large and offsetting forces. Businesses anticipate a large reduction in productivity within firms, partly because measures to contain Covid-19 are expected to increase intermediate costs (see the orange bars in Figure 2). The negative within-firm effect is partially offset by a positive between-firm effect as low productivity sectors, and the least productive firms among them, are disproportionately affected and consequently make a smaller contribution to the economy (see the blue bars in Figure 2). We examine these two effects in a little more detail below.

Figure 2 Negative within-firm effects are likely to be partially offset by positive between-firm effects

(a) TFP



(b) Hourly labour productivity



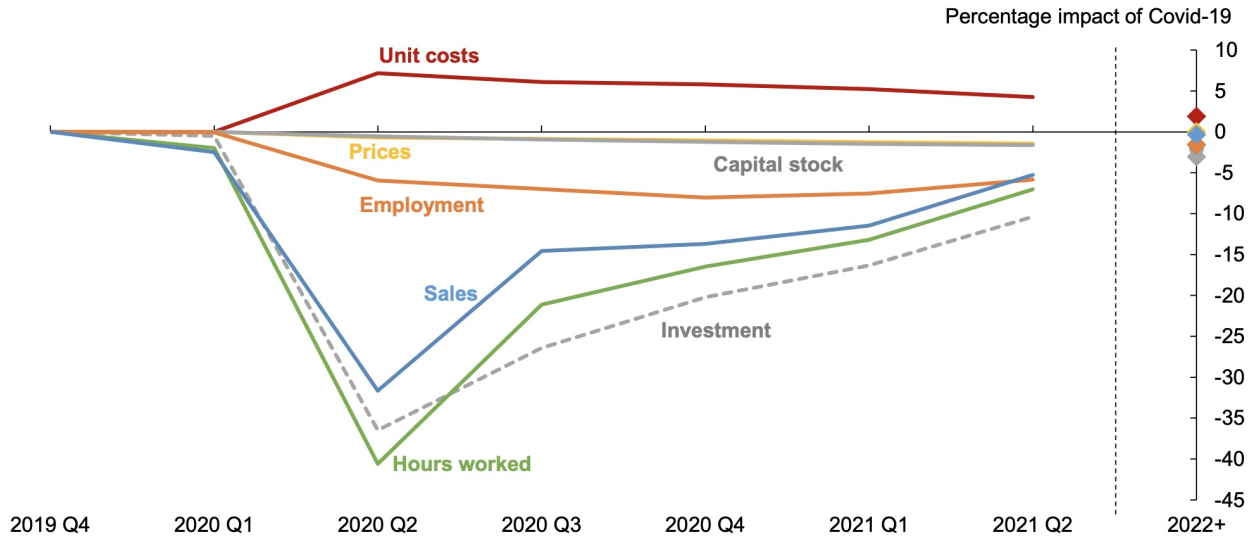
Notes: Impacts on productivity are estimated as $\Delta\Pi_t = \sum_{i\in Surv}\bar{\varphi}_i\Delta\pi_{i,t} + \sum_{i\in Surv}\Delta\varphi_{i,t}(\overline{\pi_t} - \bar{\Pi})$ where $\pi_{i,t}$ is productivity in firm i at time t, Π_t is productivity at time t, $\varphi_{i,t}$ is the employment share of firm i at time t and a bar over a variable indicates the average of the variables across times t-1 and t. 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 $\frac{dLP}{LP}=\frac{dY}{Y}-\frac{dP}{P}-\frac{dL}{L}-\frac{dM}{M}$ $where\ \frac{dM}{M}=\frac{M}{Y-M}\frac{dM^U}{M^U}$. The impact of Covid-19 on TFP for each firm is calculated as $\frac{dTFP}{TFP}=\frac{dY}{Y}-\frac{dP}{P}-\beta\frac{dL}{L}-\alpha\frac{dK}{K}-\frac{dM}{M}$. 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.

Higher intermediate costs are likely to reduce productivity within firms

Figure 3 summarises the inputs into our productivity calculations, using the most recent observation for each firm between July and November. Businesses, on average, estimated that Covid-19 led to a very sharp fall in sales of around 30% in 2020 Q2, relative to what otherwise would have happened. After 2020 Q2, sales were expected to recover, particularly between 2020 Q2 and Q3, but they were still expected to be around 5% lower than they would otherwise have been by 2021 Q2. Over the medium term (2022 onwards), the effects on sales were expected to be small at around -0.5%. Total hours worked were estimated to have fallen by more than sales in 2020 Q2 and Q3, but with the effect becoming closer to the impact on sales in later quarters. Sales falling by less than hours worked implies that Covid-19 led to an increase in sales per hour within firms in 2020 Q2 and Q3.

Increased costs associated with measures to contain Covid-19 (such as social distancing, hand washing, masks, and other measures) will have acted to reduce value-added and productivity within firms. Businesses estimated that Covid-19 increased average unit costs by around 7% in 2020 Q2 and Q3. The unit cost impact of Covid-19 was then expected to taper off somewhat to around 4% by 2021 Q2 (Figure 3). A smaller impact on costs of just under 2% was expected to persist into 2022 onwards.

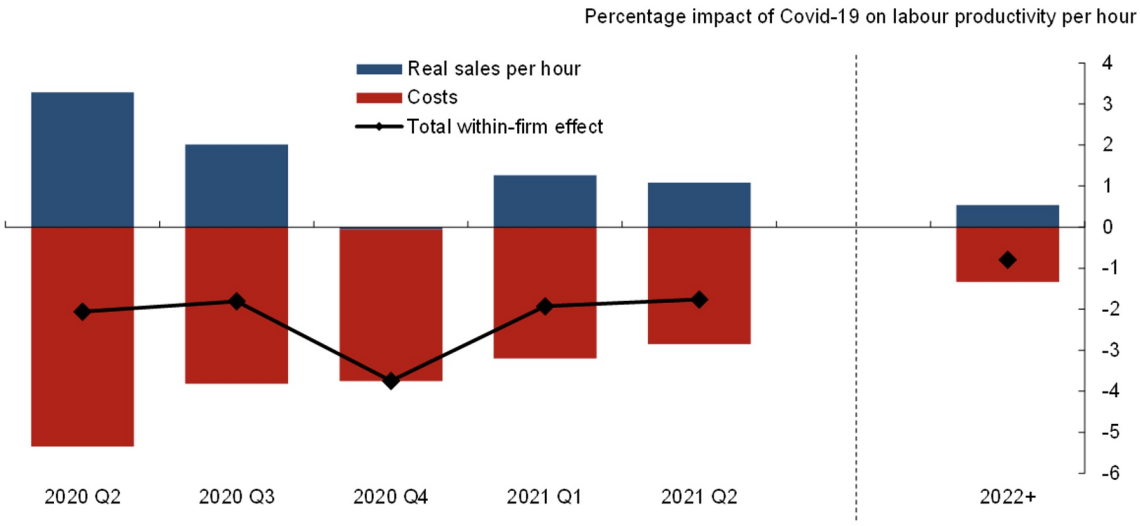
Figure 3 Covid-19 has had a large impact on firms



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/employment/average hours worked per active employee/capital expenditure of your business in each of the following periods?'; '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 'Approximately what percentage of your employees fall into the following categories in each of the following periods? (i) Still employed but not required to work any hours (eg 'on furlough'), (ii) Unable to work (eg due to sickness, self-isolation, childcare etc.), (iii) Continuing to work on business premises, (iv) Continuing to work from home'. Data are the most recent observation per firm for each period collected between July 2020 and November 2020. Data on the impact of Covid-19 in 2020 Q1 have not been collected in the DMP. Data shown for 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 Q1. Effects on the capital stock are estimated using by cumulating the investment impacts. The effects on the price level are estimated using data from DMP questions on actual price inflation and expected year-ahead price inflation: the impact of Covid-19 is estimated as the difference between 2020 Q2 values for actual and expected year-ahead price inflation relative to 2019 at the 1-digit industry level.

The net effect of these two effects on within-firm labour productivity per hour is estimated to be negative (see Figure 4). The contributions from real sales per employee are typically positive. But the overall within effect is negative throughout because of persistent negative contributions from higher intermediate costs, although this contribution starts to become smaller into 2021 and beyond as the extent of these additional costs is expected to fall back. Within-firm TFP is also expected to perform worse than labour productivity given that elasticity-weighted inputs are expected to fall by less than labour input.

Figure 4 The negative within-firm effects are driven mainly by rising intermediate costs related to implementation of measures to contain the pandemic



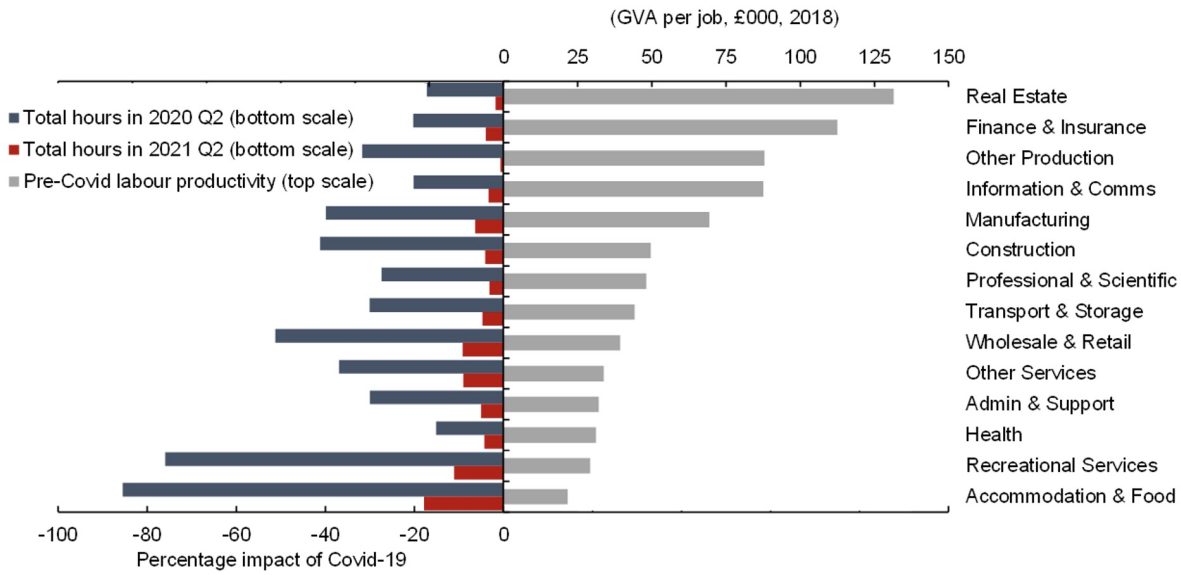
Notes: The impact of Covid-19 on labour productivity for each firm is calculated as $\frac{dLP}{LP}=\frac{dY}{Y}-\frac{dP}{P}-\frac{dL}{L}-\frac{dM}{M}$ $where$ $\frac{dM}{M}=\frac{M}{Y-M}\frac{dM^U}{M^U}$. LP is labour productivity, Y is nominal sales, P is the price level, L is labour input, M are non-labour intermediate costs and M^U are intermediate unit costs. Real sales contribution is $\frac{dY}{Y}-\frac{dP}{P}-\frac{dL}{L}$. Costs contribution is $-\frac{dM}{M}$.

Aside from these two forces, DMP data imply that Covid-19 has lowered R&D expenditure by around 14% in 2020. And Covid-19 has also been extremely time-consuming for senior managers – CEOs have spent about a third of their time directly dealing with the pandemic, which is time that has presumably been taken away from other longer-run productivity-enhancing activities. To some extent these channels may be factored into businesses' longer-term expectations and may help to explain why TFP is expected to be around 1% lower over the medium term. But it may also take time for these effects to become apparent and there may potentially be some additional longer-run negative effects on productivity within firms from diminished innovation and intangible investment by firms.

Between-firm effects push up on average productivity as low-productivity firms and sectors become a smaller part of the economy

Covid-19 has affected some firms and industries more than others. Figure 5 shows how the fall in hours worked in 2020 Q2 was largest for firms in recreational services and in accommodation and food, which are also the two lowest productivity industries that we consider. These are both industries where a large proportion of activity involves face-to-face contact and/or social activity and where it is particularly difficult for these services to be provided from home. This gives rise to a positive between or reallocation effect.

Figure 5 Firms in low productivity sectors recorded largest drop in hours worked



Notes: See notes to Figure 3 for details on how impact of Covid-19 on hours worked is calculated. Industry-level labour productivity data are official ONS data.

The between effects are positive and large in 2020 Q2, around 10% in hourly labour productivity terms and 7% for TFP (Figure 2). The effects then diminish sharply over the subsequent four quarters as overall hours worked begin to recover and as differences between the most- and least-affected sectors/firms become smaller. A positive effect of just over 1% was expected to remain by 2021 Q2 on both measures, although this was expected to decline further over the medium term.

Reallocation between industries, or inter-industry effects, plays an important role in explaining the overall reallocation effects, but there is still some effect from firms within industries, or intra-industry effects. On average, inter-industry reallocation between industries accounts for around 85% of the total between effects on hourly labour productivity. For TFP, the inter-industry component accounts for more like 75% of the positive effect in 2020 and 2021. We estimate that reallocation between surviving firms is the main source of between effects, but firm entry and exit can contribute too. To date, Covid-19 has not had a large impact on net firm entry, but our estimates assume some rise in business failures in 2021, which might add around 0.3% to the level of productivity (given that low productivity firms are more likely to fail).

The positive between-firm effect of Covid-19 on productivity is not entirely the usual Schumpeterian process of *creative destruction*, whereby lower productivity firms are replaced by higher productivity firms. Much of this is simply *destruction* of low productivity sectors. Industries like accommodation and food, and recreational services have experienced substantial contractions with limited expansion of other sectors. So, while the between effect may increase average productivity, it will reduce total economic output, and hence is likely to reduce overall welfare.

Conclusions

We present a detailed bottom-up analysis of the impact of Covid-19 on productivity in the UK, which has experienced a similar impact of Covid-19 to the US and other advanced European countries. Our results suggest that Covid-19 will reduce TFP in the UK private

sector by up to 5% in 2020 Q4 and by around 1% in 2022 and beyond. The effects of Covid-19 on hourly labour productivity are estimated to be less negative than those on TFP because hours worked fall by more than elasticity-weighted capital and labour inputs.

The overall effects of Covid-19 on productivity mask some large and offsetting forces. Businesses anticipate a large reduction in productivity within firms, partly because measures to contain Covid-19 are expected to increase intermediate costs. The negative within-firm effect is partially offset by a positive between effect as low productivity sectors, and the least productive firms among them, are disproportionately affected and consequently make a smaller contribution to the economy. The size of these two offsetting effects is estimated to be largest in earlier quarters, but over time both effects are expected to become smaller.

References

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Endnotes

[1] The Bank of England regularly publishes aggregate level results from the Decision Maker Panel. Visit https://www.bankofengland.co.uk/decision-maker-panel/2020/november-2020 for the latest data. The Decision Maker Panel survey also has a standalone website too. Visit www.decisionmakerpanel.co.uk for more details.

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