BANK OF ENGLAND

Speech

From lockdown to recovery - the economic effects of COVID-19

Speech given by

Professor Jonathan Haskel, External Member of the Monetary Policy Committee

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Good afternoon everyone and thank you for having me here today.

Around the world we've experienced one of the most dramatic slowdowns in economic activity in recorded history. In the case of the UK, the second quarter of 2020 is almost certain to see by far the largest decline in output since quarterly national accounts began. This talk will try to give some insight into how economists have thought about and modelled the initial economic shock caused by COVID-19 and some of things we are thinking about when modelling the recovery. Of course, here at Imperial and elsewhere there are many distinguished scientists working to relieve the world of this disease, including modelling work, and I want to try to relate some of the work economists have done to their incredibly valuable work.

I want to make two main points.[1]

First, this was a huge and adverse shock to the economic system that required an unorthodox initial modelling approach. Usually in economics there is a crucial role for prices to absorb the effect of shocks and thereby trace their outcomes: a frost in Florida lowers the supply of orange juice, but since prices rise, that lowers demand and so absorbs the shock. But with a lockdown prices cannot adjust as freely, so we need a different modelling approach.

Second, the pandemic shock is a shock to public health. The resulting government-mandated lockdown can be thought of as a "supply shock": a closed restaurant for example can serve no one and an opened one is now only able to serve, say, half its customers due to social distancing. But equally important, the behavioural response of consumers can be thought of as a "demand shock". Evidence is emerging that the dominant driver of activity will in fact be on the demand side. When the economy re-opens, customers might still fear infection and therefore stay away from consumption that has a social element to it (pubs, restaurants etc.). It seems likely that such demand weakness will therefore drag on the economy and hold back the recovery. The path of recovery crucially depends therefore on the fear of infection, which in turn depends on the mix of public (e.g. track and trace) and private (e.g. screens in shops) health measures undertaken. It also depends on the fear, or realisation, of unemployment, as weak activity and capacity constraints on the operation of surviving businesses, and insolvencies, translate into a fall in the demand for labour.

[1] Whilst this speech was in its near-final draft I read an excellent speech by my colleague Silvana Tenreyro that, whilst independently written, overlaps in many ways. See Tenreyro (2020).

1. Covid-19 – modelling the initial shock

1. Shocks to the economy

The usual approach to modelling shocks to the economic system is to (a) identify the shock (for example an unexpected change in interest rates) and (b) analyse the mechanisms by which the economy responds to that shock. In particular, it is important to assess whether these mechanisms either ***amplify*** or ***absorb*** the shock's effect on the economy.

To most people, the most intuitive account of the economy's response to a shock is amplification. The amplification effect is, many would say, a natural outcome of a network of billions of economic relations typical of any modern specialised and decentralised economy. A restaurant closes. How is that shock amplified? That restaurant stops buying food which is bad news for the farming industry. Nor does it have any need for accounting services or cleaners, which is bad news for the business services industry. And it doesn't need staff – bad news for the local labour market.

There is however, an offsetting, "shock-absorbing" (or self-righting) effect. Maybe there are rival restaurants to whom farmers can sell, accountants can audit, or workers can apply to. Or maybe the restaurant industry is making low returns, and higher returns can be made by converting the premises into a nursery which needs food, accounting, cleaning and staff.

In this second account, prices act as shock-absorbers, reallocating the quantities in the first account. If the restaurant industry is making low returns, but the delivery industry is booming, prices provide the signal to reallocate resources away from restaurants. If wages are low in the restaurant industry, workers might choose to work elsewhere. Any economy is continually being hit by shocks of various kinds: new technology, fashions and trends and opportunities to trade. No computer could possibly compute the reallocation necessary and so the job is done, in this account, anonymously by the price system which absorbs these shocks by signalling where economic resources need to go.

2. The COVID shock and Input-Output analysis

The COVID shock however is unusual in that much of the reallocation mechanism (at least initially) was shut down through lockdowns and social distancing measures. Prices couldn't readily adjust and firms couldn't switch to other industries because the economy was locked down.

Table 1: A snapshot of the UK supply and use table (2017)

	Intermediate demand										Final Demand	Total Demand
	A	B-E	F	G-I	J	K	L	M-N	O-Q	R-T		
Agriculture [A]	0.3	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.4
Production [B-E]	0.5	19.9	3.1	5.4	0.9	0.5	0.3	1.4	4.1	0.8	27.4	64.1
Construction [F]	0.0	0.4	5.2	0.3	0.0	0.3	1.0	0.2	0.4	0.0	8.1	15.9
Distribution, transport, hotels and restaurants [G-I]	0.1	1.3	0.1	4.1	0.3	1.0	0.0	1.0	0.8	0.1	28.7	37.5
Information and communication [J]	0.0	0.4	0.1	0.6	1.9	1.1	0.1	0.6	0.6	0.2	6.1	11.9
Financial and insurance [K]	0.1	1.0	0.2	0.7	0.2	2.1	1.5	0.5	0.6	0.1	8.1	15.1
Real estate [L]	0.0	0.1	0.0	1.0	0.2	0.2	0.1	0.3	0.5	0.1	16.7	19.2
Professional and support activities [M-N]	0.1	2.3	0.9	3.0	1.3	2.5	0.5	5.1	2.1	0.8	8.8	27.3
Government, health & education [O-Q]	0.0	0.3	0.1	0.4	0.0	0.1	0.2	0.3	1.7	0.0	25.5	28.6
Other services [R-T]	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.3	0.4	5.0	6.0
Domestic Supply	1.7	37.9	15.8	35.2	10.8	13.9	18.9	24.4	28.4	5.5	192.5	
Imports	0.7	26.1	0.1	2.3	1.1	1.2	0.3	2.9	0.2	0.5	35.4	
Total Supply	2.4	64.1	15.9	37.5	11.9	15.1	19.2	27.3	28.6	6.0	227.9	
Value Added	0.7	13.4	6.1	17.4	6.8	7.2	13.6	12.8	18.3	3.6	100.0	

Source: ONS, author calculations.

Note: All values have been normalised by GDP. This table reports values at basic prices that excludes taxes on final goods.

How then do we model the economy under these circumstances? The best model looks like the amplification model as the consequence of the closure of, say, restaurants, "cascades" through the rest of the economy. It turns out we had an ideal data set with which to assess the Covid shock, namely the "input-output" tables collected by the Office for National Statistics (ONS, see here). These tables provide a wonderful overview of the economy by mapping and quantifying industries by the amounts of goods and services they supply to, and demand from, each other. **Table 1** provides an aggregated summary[2] for what this looks like for the UK. The columns show supply, and the rows show use i.e. the columns show what inputs each industry requires to produce and rows shows the sources of demand for each industry.

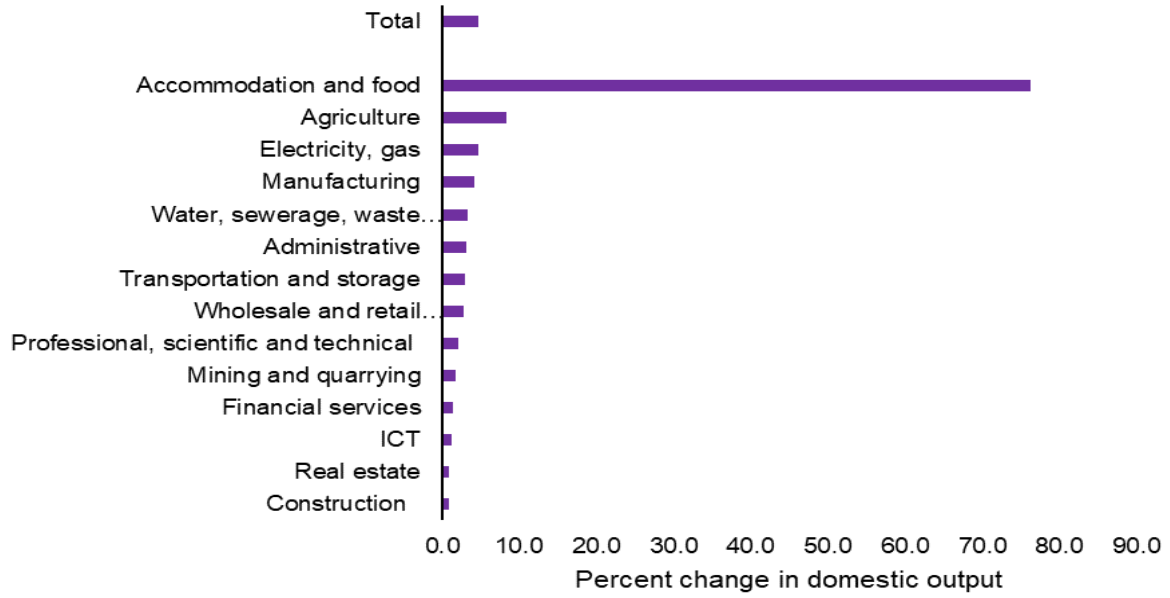
Let's start with agriculture in the top row. It's easier to look at the second cell, which tells you that 0.9% of GDP's worth of agricultural production goes from agriculture into production. Since production includes manufacturing and food processing (e.g. ready meals), this tells you that the agriculture sector is supplying the food processing sector, which makes sense. In the first cell, 0.3% GDP's worth goes to agriculture itself, which tells you that agriculture uses some of its own output as input, subcontracting for example. Each row in the main body of the table gives the supply of each industry/product to other industries. The penultimate column gives final demand – supplies that go directly to consumers, not other producers. Thus the final column tells you the total demand for each sector, which is the supply to other producers and supply to consumers.

[2] Practically one would use a much more granular table that divides the economy into at least 64 product or industry combinations.

As you will know, GDP nets out the producer/producer supplies to avoid double-counting output. Thus the panel on the bottom right tells you that for every £100 of GDP, the economy produces £227.90 of goods, of which £35.40 is imported. We can also see that the logistics, hotels and restaurants demand significant amounts of intermediate goods from the production industries or that hotels and restaurants are primarily producers of final goods, as opposed to goods produced for the benefit of other industries.

More detailed versions of table 1 can be constructed and used to map[3] demand shocks through the supply chain like the cascade we described earlier for restaurants. For example **Figure 1** shows the impact of a 90 percent fall in demand for accommodation and food services. We see that the effect of this shock propagates to other sectors through the input-output linkages as the fall in demand for hotels moves upstream to its suppliers. I should emphasise this is only the first-order impact of the shock and so does not account for demand channels through lost employment or price changes. But as I already stated a lot of these channels have been shut down for now.

Figure 1: Input-Output mapping of a 90 percent demand shock to accommodation and food services



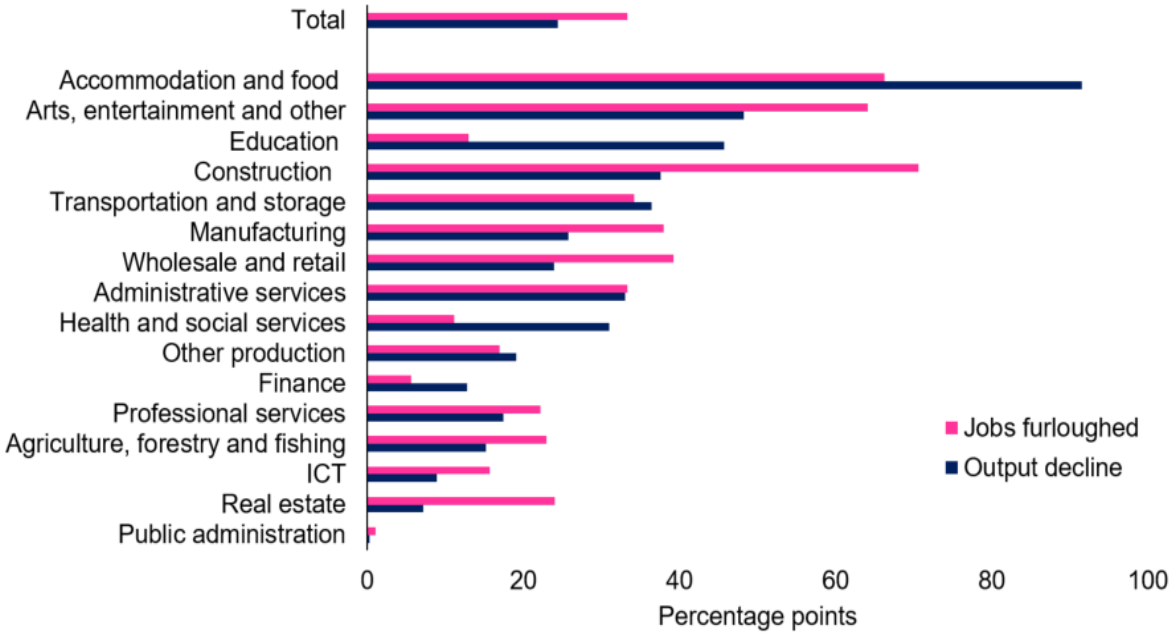
Source: ONS, author calculations
Note: Figure displays the first order impact through the 2016 input-output table multipliers of a 90 percent shock to demand for accommodation and food services.

By mapping the lockdown to final demand in each individual sector this input-output approach helped us to calibrate our estimate of the initial fall in output due to Covid-19 which we published in the May Monetary Policy Report. Based on a range of indicators, we thought GDP might decline by 3% in 2020 Q1 and 25% in 2020 Q2, with the fall in Q2 representing by far the sharpest contraction since

[3] I've posted a spreadsheet here if you are curious and would like to have a go yourself.

quarterly national accounts records began. We have now been able to observe official estimates of output through May 2020, which indicate the level of economic activity in May was about 25% lower than in 2019Q4, close to what we had anticipated. The blue bars in **Figure 2** show the output falls across industries and indicate a broad and marked decline in output across sectors, with the sectors hardest hit corresponding to those most affected by social distancing rules.

Figure 2: Decline in output and furloughed workers since 2019Q4



Source: HMRC, ONS
Note: Fall in the level of real gross value between 2019 Q4 and May 2020 as estimated by the ONS.
Furloughed refers to cumulative claims under the JRS and SEISS relative to the level of employment in that industry in the 3 months to December 2019.

The falls in output so far have coincided with an equally dramatic fall in active employment, with a significant proportion of workers in each industry furloughed under the government's schemes for employed (CJRS) and self-employed (SEISS) workers. We see in **Figure 2** that the numbers of workers furloughed corresponds relatively closely to the declines in output in each industry. At this point in time these workers are not unemployed but temporarily absent from work which in part explains why the headline Figure for the unemployment rate remains 3.9 percent.

However the labour market data and other indicators (released on 16th July 2020) point to troubling times ahead. Indicators such as the PAYE data from HMRC indicate employment through PAYE is down by around 650 thousand since March. We have also seen a significant uptick in claims for job seekers allowance and universal credit with ONS experimental statistics showing a rise of 1.4 million claims for job seekers allowance or work-related universal credit claims since the start of March. These numbers alone indicate the potential for the unemployment rate to rise above levels seen after

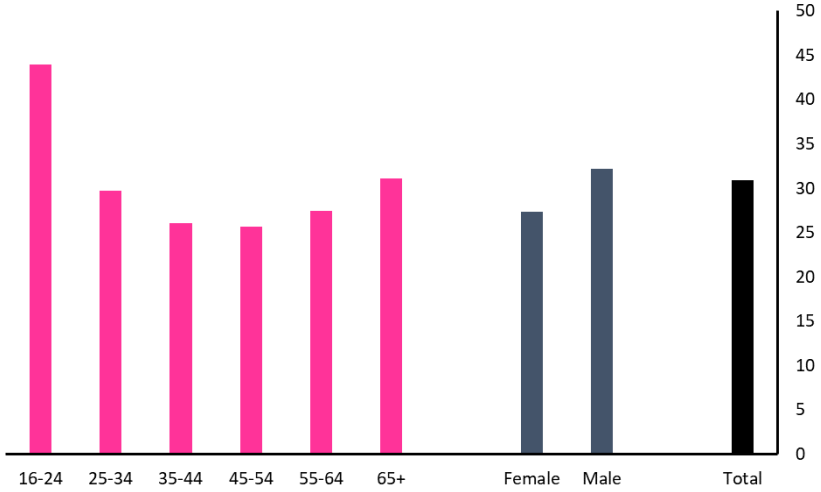
the financial crisis, when the official unemployment rate peaked at 8.5 percent in 2011. It would also seem likely that as the furlough schemes wind down, workers currently furloughed will further add to the numbers already unemployed. It is notable that around 30% of furloughed workers think it's at least "quite likely" they will lose their job, as reported in the 2020H1 NMG survey.

3. A disparate impact across workers

Figure 2 highlights the disparity of the incidence of the lockdown across sectoral activity, with labour-intensive sectors such as hospitality worst affected. We do not yet have the official labour market data to paint a picture of how different types of workers have been affected by the lockdown. But it is possible to get a sense of the incidence of the economic hardship on worker types by documenting their relative reliance on the government's subsidy schemes.

HMRC data on claims received for the CJRS and SEISS schemes shows that the young are particularly exposed to the shutdown sectors. **Figure 3** shows that take-up of the furlough schemes has been concentrated in those aged 16 to 24, with 45% of that age group benefiting from the schemes, compared with only 25% of those aged 35 to 54. The disparity across men and women is perhaps not as stark as might be expected, with both groups experiencing furlough take-up rates of about 25-30%.

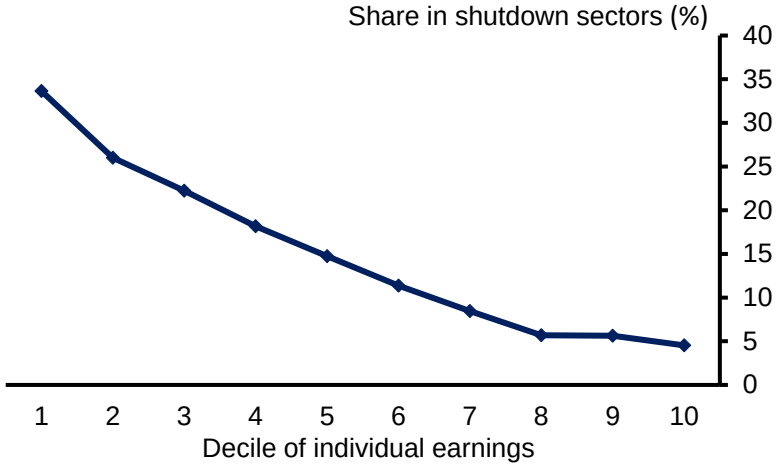
Figure 3: Take-up of furlough schemes by age and gender



Source: HMRC
Note: Figure shows the percentage share of jobs furloughed under the Coronavirus Job Retention Scheme and Self-Employment Income Support Scheme relative to HMRC's estimates of the number of eligible jobs for the furlough schemes. The Figure reflects claims received up until June 30th.

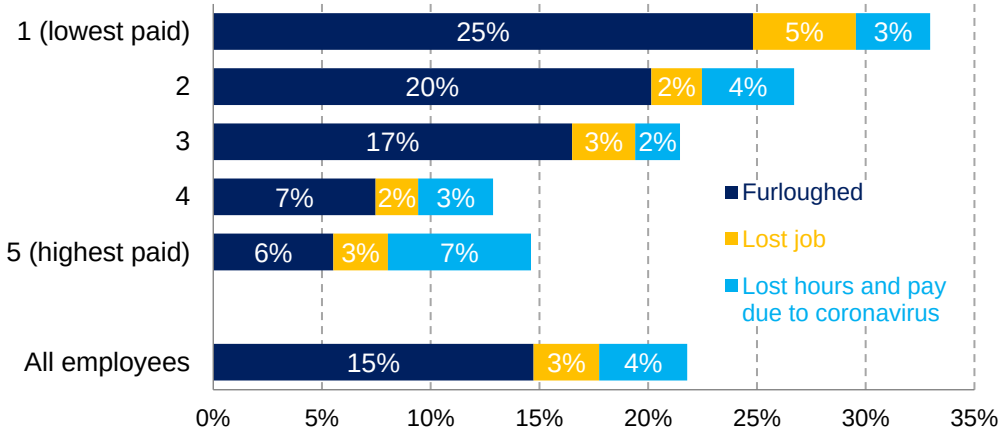
A great disparity also appears across income levels. About 35 percent of the lowest earners worked in shutdown sectors[4] before Covid-19 hit, compared with only 5 percent of the highest earners. Put differently, workers in the bottom tenth of the earnings distribution are seven times more likely to work in shutdown sectors than those in the top tenth of the distribution (**Figure 4**).

Figure 4: Share of employees in shutdown sectors by individual earnings



Source: Institute of Fiscal Studies, BN278, Figure 2, based on Quarterly Labour Force Survey Q1-Q4 2019, Waves 1 and 5 only. Employees only; excludes workers in full-time education.

Figure 5: Proportion of employees who have experienced job changes since the coronavirus outbreak, by employee earnings quintile prior to the outbreak (6-11 May 2020)



Source: Resolution Foundation, A new settlement for the low paid, June 2020. Figure 2. Based on analysis of YouGov, Adults aged 18 to 65 and the coronavirus (COVID-19).
Notes: Base = all UK adults aged 18-65 who had an employee job prior to the coronavirus outbreak, and provided information on their usual earnings prior to the coronavirus outbreak (apart from for the 'all employees' category). Earnings quintiles are based on net (take-home) usual employee pay prior to the coronavirus outbreak. 'Furloughed' and 'lost job' relate to employees' main job; 'lost hours and pay due to coronavirus' captures employees not in either of these first two groups who are working fewer hours than their usual hours before the coronavirus outbreak, which they state has happened for coronavirus-related reasons, and who have also experienced decreases in earnings.

[4] See Sector shutdowns during the coronavirus crisis: which workers are most exposed: Institute of Fiscal Studies Briefing Note BN278. Shutdown sectors are: non-food, non-pharmaceutical retail; passenger transport; accommodation and food; travel; childcare; arts and leisure except 'artistic creation'; personal care; 'funeral and related activities'; domestic services.

And an online survey commissioned by the Resolution Foundation in early May shows that workers on low-pay have been hit the hardest, with 33% of the bottom fifth of earners having lost their jobs, been furloughed or lost hours and pay, compared with only 15% for the top-fifth of earners (**Figure 5**).[5]

4. Can affected workers weather the storm?

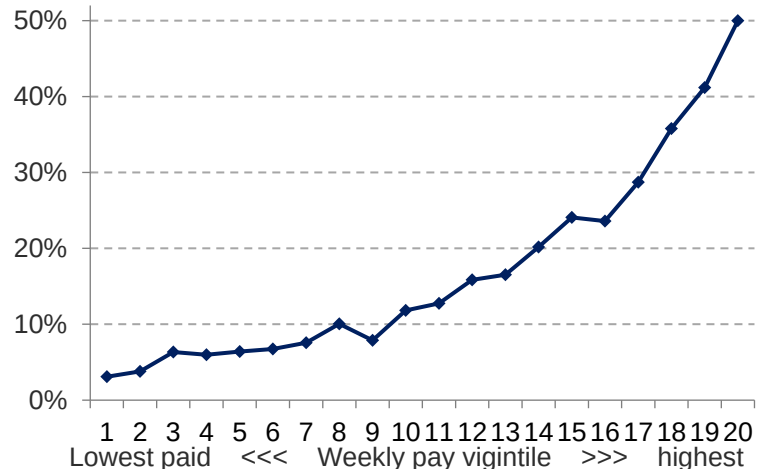
a. Household insurance and working from home

How will these workers weather the storm? Some workers in shutdown sectors can rely on the incomes of other household members whose jobs are not affected by lockdown. For instance, over half of under-25s working in shutdown sectors live with their parents.[6] And more than half of the lowest income-earners working in shutdown sectors have a spouse or parent whose job is not directly affected by the lockdown and who has higher earnings. In these households, a smaller fraction of total household earnings comes from the shutdown sectors, which helps to cushion the financial blow, but by no means offsets it entirely.

We can look at other metrics of resilience. For instance, to what extent can these workers work from home? As you would expect from the high furloughing rates in the shutdown sectors, the answer is very little. Analysis by the Resolution Foundation using the distribution of weekly pay shows that being able to work from home is very much the prerogative of highly-paid workers (**Figure 6**).[7]

[5] See https://www.resolutionfoundation.org/app/uploads/2020/06/A-new-settlement-for-the-low-paid.pdf
[6] See https://www.ifs.org.uk/uploads/BN278-Sector-shutdowns-during-the-coronavirus-crisis.pdf.
[7] See https://www.resolutionfoundation.org/app/uploads/2020/03/Doing-what-it-takes.pdf.

Figure 6: Share of employees who can work from home if needed, by gross weekly pay vigintile (2014-2018)



Source: Resolution Foundation, Doing what it takes, March 2020, Figure 1.
Note: pay vigintiles defined within each calendar year. Pay is usual gross pay.

b. Financial buffers

What about financial buffers? Can workers exposed to the shutdown sectors smooth through the shock by drawing down savings to support consumption?

Before I address this question, let me give you some sense of the saving buffers of the average household. Data from the 2020H1 NMG survey tell us that the median household sets aside £125 a month, has access to £5,000 in deposits and £6,500 in total savings.

But those headline Figures conceal a great deal of disparity across households' employment status. **Figure 7a** shows that, setting aside retirees (the "inactive") who have ample savings, the unemployed and those who have been furloughed have access to no stock of savings or half the median amount, respectively. Both employed and self-employed households do better than the median, with access to £5-7,000 and £10-12,500 of savings respectively. So self-employed households tend to have some of the highest savings, which affords them some measure of resilience to the Covid shock if it is short-lived.

Another metric of household financial resilience is the share of households who report no savings at all, whether as a flow or a stock. By this measure, the 2020H1 NMG survey tells us that slightly less than one in three households reported no flow of savings, and one-fifth reported no stock of savings (either deposits or total savings). But, again, the unemployed were much more likely to report both no flow and no stock of savings, with roughly half of them doing so (Figure 7b). And furloughed workers were marginally more likely to report no stock of savings than the employed and self-employed households.

Figure 7a: Median deposits and total savings by employment status

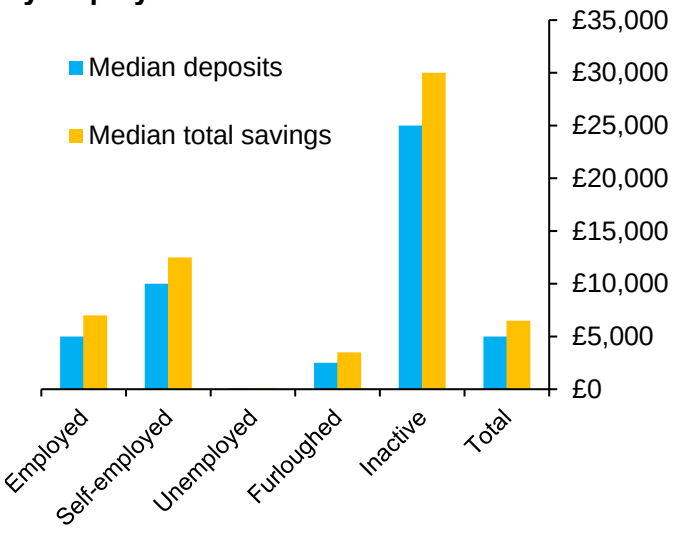
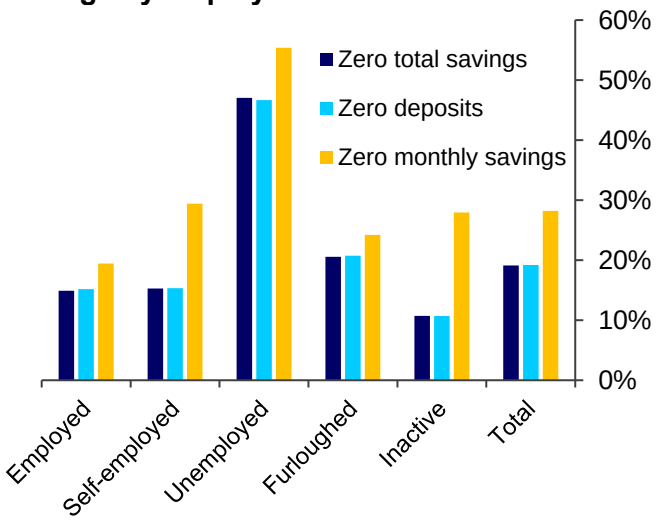


Figure 7b: Share of households with no savings by employment status



Source: NMG Survey 2020H1
Survey of 6,011 households conducted online between 6 and 28 April 2020. Total savings are deposits plus other investments.

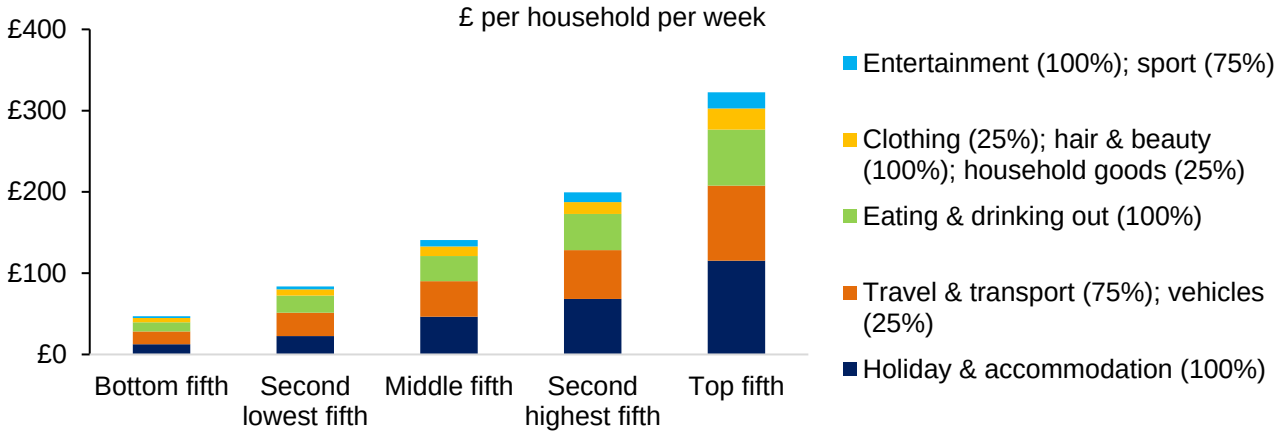
c. Savings under lockdown

Workers are consumers and consumer spending accounts for about 70% of the UK economy. So the consumption and saving decisions of workers will play a crucial role in shaping the recovery and the response of policymakers to support it.

The social distancing measures introduced in late March, and now being gradually unwound, have had dramatic effects on households' consumption and saving behaviour. Households have been unable to spend on social activities – eating out, going on holiday and to museums. Work-related consumption, such as spending on transport and fuel, has also fallen. And households have also postponed spending on "delayables" such as furniture, cars and clothing. Spending on staples – food and drink, utilities – which make up about half of UK consumption, has not risen enough to offset those falls. So overall consumption spending has fallen substantially.[8] At the same time, relative to the declines in consumer spending, incomes have been somewhat maintained, either through working from home or through the government's wage subsidy scheme for those who have been furloughed. So one peculiarity of the Covid-19 downturn is the prevalence of "forced" or "involuntary" savings, with marked differences across the income distribution.

[8] See Chart 3.2 of the May 2020 Monetary Policy Report.

Figure 8: Estimate of money not spent as a result of the lockdown by household income quintile



Source: Figure 1 from 'Excess saving' in lockdown: a big new economic challenge", 31 May 2020, New Policy Institute. Based on the authors' analysis of the Living Costs and Food Survey, 2018-19. The percentages refer to the proportion of each type of spending assumed to no longer being spent during the lockdown.

Figure 8 provides estimates of money not spent per household per week as a result of the lockdown, across quintiles of the income distribution. The top-fifth household will have "saved" roughly £320 per week, almost seven times as much as a household in the bottom fifth of the income distribution.

I have put "saved" in inverted commas because a variable fraction of the money not spent on social activities and transport will have been spent on staples and debt repayments. That is particularly true for households at the bottom of the income distribution, who are more likely to have suffered income losses, forcing them to run down any savings and turn to the government for income support, such as Universal Credit.

Evidence from the latest Bank of England/Ipsos Mori Survey shows a stark difference between the lowest and the highest earners in their saving response to the Covid-19 shock. The survey breaks out the net balance of households that increased savings, by household income. Low- and median-income households reported their savings have decreased, while above-median and high-income households reported an increase (**Figure 9a**).

The same survey also looks at the net balance of households that increased savings in response to the Covid shock, by employment status. Again, there is a marked disparity across employment cohorts, with a net balance of 18-28% of self-employed households reporting a decline in savings, compared with reports of broadly unchanged savings by full-time employees (**Figure 9b**).

So, against the backdrop of their above-median saving buffers, as reported earlier in the NMG survey, the self-employed have been decreasing their savings in response to Covid.

It is not surprising. The self-employed are some of the most likely to have seen a fall in income as a result of the containment measures. According to the NMG survey, while a net balance of 5% of those in employment or inactive reported an income decline, a net balance of more than 60% of the self-employed and furloughed employees reported a fall in income. Now, the fieldwork for the NMG survey pre-dated the introduction of the self-employment income support scheme (SEISS) on 13 May, so it could be that a slightly smaller net balance of self-employed is now reporting a fall in income.

Figure 9a: Change in savings by low and high earners

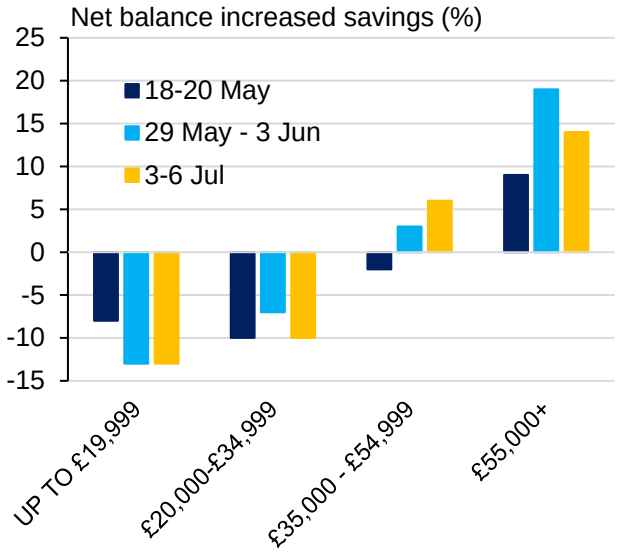
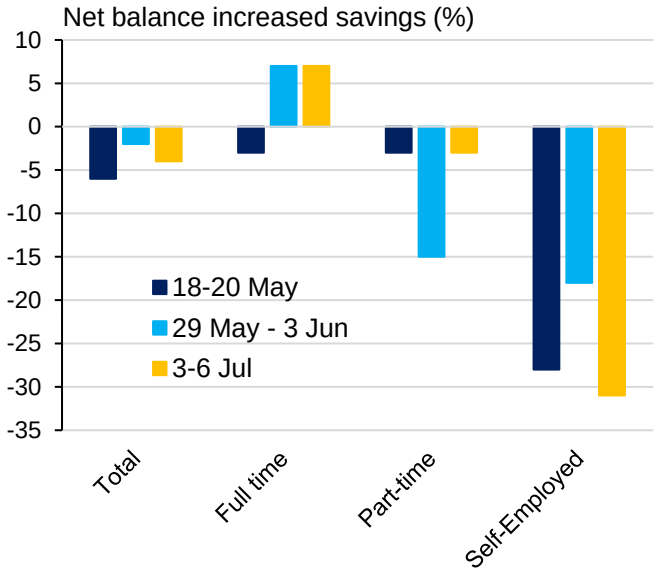


Figure 9b: Change in savings by employment status



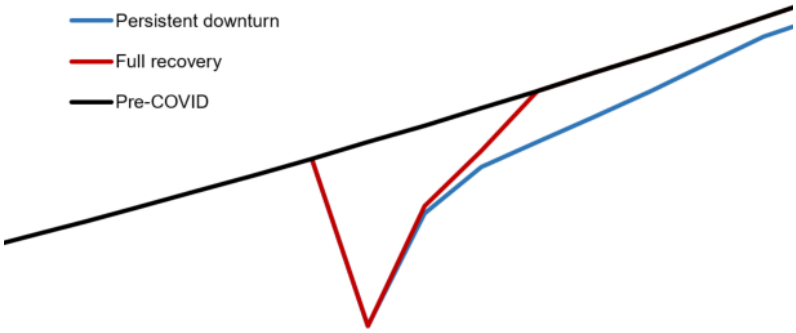
Source: BoE/Ipsos Mori survey. The question asked is “As a result of the measures taken around the coronavirus pandemic, would you say that your household savings have increased, decreased, or stayed the same? Net balances are simple/unweighted, calculated as e.g. (increased a lot + increased a little) – (decreased a lot + decreased a little). Research for this survey was carried out by Ipsos MORI on behalf of the Bank of England. It surveyed a nationally representative quota sample of over 2,200 adults in the United Kingdom aged 16–75 using its online i:omnibus for each wave. Data have been weighted to the known offline population proportions for age, gender, government office region, working status and social grade.

2. Modelling the recovery

We have seen then a model that describes the downturn and the very heterogeneous experience across sectors and individuals. What about the recovery?

Those attempting to model the recovery have drawn various pictures, such as in **Figure 11**.

Figure 11: Shapes of the recovery?



Understandably, this has been labelled as corresponding to various letters of the alphabet. It's worth reminding ourselves that the correspondence to a "V" for example depends very much on how one draws the scale of the x-axis. In the May MPR, we described a scenario with a very sharp downturn and incomplete recovery over several years like the blue line in **Figure 11**. This blue line is clearly not a V though but if you zoom out far enough then it will start to look more and more like a V. So let us ask: what factors may determine whether we experience the red or blue line: what forces drive GDP growth faster or slower and what happens to inflation?

So far we have discussed how the input-output approach helped us forecast what would happen under lockdown, which as it turned out, was not such a bad approach given subsequent economic data. This approach worked well because the lockdown was in part a large forced shutdown in final demand, where many of the normal adjustment mechanisms through prices were at least temporarily shut down.

If this model is right, then the release of lockdown should reverse the cascade, resulting in a full and V-shaped recovery. Therefore once demand is allowed to recover, according to this model, the economy will restore itself to the status quo ante.

While a useful and intuitive framework, the I-O approach has some weaknesses. There is little account of how demand might return to the economy other than the assumption of releasing

lockdown. What about prices? In this I-O setup, restaurants use fixed amounts of food and accountancy services and hence a fall in demand cascades down via this ratio. Yet anyone with a working knowledge of economics will know that supply and demand are brought into balance by prices rising and falling, which in turn are the signals for consumers and firms to buy and sell more or less.

In the light of this, economists do not tend to use these I-O models. Rather, they focus on the role of the price system, and the individual decisions[9] of economic agents concerning consumption and saving.

1. Representative Agent New Keynesian (RANK) models

Given the focus on heterogeneity in the previous section it may surprise you that most of these models feature little or no heterogeneity amongst firms and workers. The textbook models of macroeconomics tend to rely on what is called a "representative agent" framework[10].

The dynamics in these models are driven by slow moving trends like technological progress and population growth around which the economy sustains 'shocks', unanticipated events that throw the economy off course and interact with frictions such as price and wage rigidity that mean the economy takes time to self-correct. An important element in these models is "consumption smoothing". An impatient consumer planning their consumption over time prefers jam today rather than jam tomorrow. But equally, they are unlikely to want to consume everything today and nothing tomorrow. Rather, they will "smooth their consumption": if they hit a temporary patch of low income they will try to run down savings and build them up again when times are better.

2. Supply and demand shocks

Economists like to broadly categorise shocks to the economy as either demand or supply shocks. Demand shocks are events that change households demand for goods and services relative to some baseline, often caused by changes in household confidence or unanticipated changes in income, sometimes due to fiscal or monetary policy. Supply shocks are those shocks that raise or lower the productive capacity of the economy.

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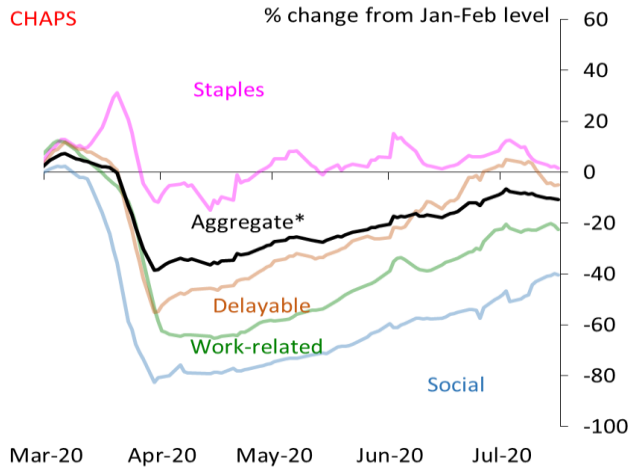
[9] Cochrane (2020) relates this point to SIR models used by epidemiologists. The points out the simplest SIR models takes the R number as a given, defined by the fundamental transmissibility of the disease and deduces the spread of infection. But if economic agents respond to the risk of infection by working less and consuming less then the R number is driven as well by individual choices.

[10] It should be noted that in using these models, most policy institutions are not ignoring these other frictions or heterogeneity but analysing those aspects alongside their main models which provide the central organising framework for policy analysis and forecasting. Furthermore embedded in most policy institutions' general equilibrium models, including the Bank of England's (Burgess et al, 2013), are usually two household types, constrained and unconstrained. The constrained are a fixed share of households cut off from financial markets and therefore must consume all their income. This helps capture more accurately the response of the modelled economy to different shocks (Gali, 2017).

So what is COVID-19? In my view it is best described as a “supply shock”. That is, it is a change to the extent to which the economy can provide goods and services: restaurants must now be 1/2 full for example. I will return to exactly what type of shock it is below.

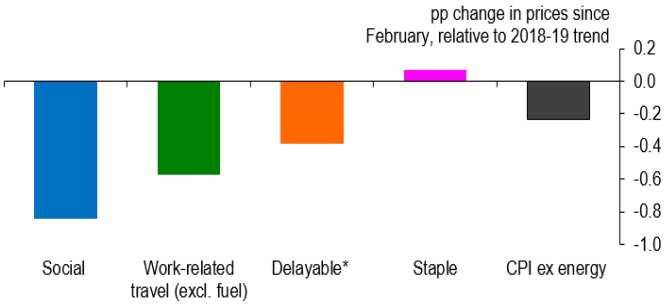
Let us think of COVID-19 as a temporary supply shock, whereby some sectors are unable to supply goods and services but we know that at some point these constraints will be released. What do our standard models say? Remember that consumers wish to smooth consumption. If they expect to be better-off tomorrow than today, then now is a good time to *lower* saving in order to maintain consumption. Now, of course with a lockdown, they may simply be unable to buy what they want. This means a combination of increased savings (involuntarily) and increased prices as consumers try to buy more of what is in short supply. What happens when consumption restrictions are released? Consumers confident in the return to pre-lockdown conditions will resume spending. Thus these models would tend to predict a rather smooth recovery in line with the unwinding of the supply shock, like the red line in **Figure 11**. As social distancing measures come off we should therefore anticipate a quick and full recovery.

Figure 12: CHAPS payments



Sources: ONS and Bank calculations.
Note: CHAPS data is based on a sample of around 100 UK companies payments received from their merchant acquirers on a daily basis. These payments reflect the sales that companies make through debit and credit card purchases, which are summed to estimate rolling seven-day revenues. Social consumption includes corporate revenues from hotels, restaurants, air travel and cultural events. Delayable consumption includes household goods, clothing, vehicle purchases and recreational goods. Work related includes travel and fuel. Staples include housing, food and health. Spending data shown through 16 July.

Figure 13: **Consumer prices**



Source: ONS and Bank calculations
Note: Including the drag from fuel, prices of 'work-related travel' items fell 5.4% since February relative to 2018-2019 trend. This chart excludes regulated prices such as tobacco, water supply, sewerage collection and education which fell 2.4% since February relative to trend. *Delayable items exclude audio-visual goods and purchase of vehicles.

Thus the “supply shock plus smoothing” models suggest that (a) we restore the economy when the shock wears off and (b) that whilst supply is impaired there is inflation.

At first glance high-frequency payment indicators such as in Figure 12 below give some support to this idea. It shows that spending on a number of consumer items has recovered (black line). That looks like consumption is bouncing back.

We can get some more insight however by looking at changes in consumption and changes in price. That gives a different picture (**Figure 13**): prices appear to have fallen.

So it doesn’t look like this supply shock is inflationary at the moment. That means that demand must have fallen more than supply. Thus we cannot presume that restoring supply will be sufficient. We have to figure out what will happen to demand.

To do this, we have to isolate the mechanisms that might cause this supply shock to become a demand shock. There are at least two channels that could cause demand to be deficient as the productive capacity of the UK economy returns: 1) Fear of infection and (2) fear of unemployment. Both these channels will mean the recovery is likely to resemble more the blue than red line in the **Figure 11**.

3. Fear of infection

To understand the demand implications of the supply shock, it is helpful, in my view, to describe further the supply shock. Here’s one way of thinking about it.

For a pub to offer a valuable service it needs four main inputs. Three of them are eminently visible: (1) intermediate inputs, the beer to be delivered, the sound system, lighting etc. (2) labour, such as bar staff, and (3) capital, such as the building and fitments.

The fourth has only become salient with the pandemic and might be called “a healthy environment”. Of course pubs have always had to have such an environment in the sense of clean kitchens, cellars etc. But there was also the publically provided element of a safe environment, whereby one can think of public health as being a part of publically provided infrastructure. The pandemic has both raised that cost, since we need new medicines and the like, but also, in effect privatised it, by obliging private businesses to install Perspex screens, enforce distancing etc.

Thus the “supply shock” is not just the collapse in the production of goods and services; it’s also the collapse in the ability of the pub to supply “health” services, previously mostly publically provided. Now, part of the incidence of that shock has fallen on private business. How then does this help us think about how the supply shock turns into a demand shock? It does so because potential customers might quite reasonably worry about the health safety of their destination and so releasing from lockdown might not hasten demand recovery if consumers remain worried.[11] Can we get a sense of how big this effect is?

Let us return to the high-frequency payment data we looked at earlier.

Figure 12 breaks down payments data by category. You can see that spending on staples, after a sharp uptick in late March and compensatory fall in April, rose above pre-Covid levels in May and June. That points to some substitution away from social spending, which now stands close to 60% below its pre-Covid level as people shun going out and stay home. Spending on “delayables” has been rising too, and is now exceeding its pre-Covid level.

But these data don’t tell us what is driving the spending recovery. Maybe people are consuming more because lockdown measures have been gradually lifted. Maybe they’re consuming more because infection rates have come down and they feel more confident going out. Yes, lifting the lockdown is a necessary condition for people to resume social spending, but is it sufficient? How can we identify the relative effects of voluntary versus mandatory social distancing? Eyeballing **Figure 12** does not allow us to disentangle effects.

So what evidence do we have on voluntary and mandatory measures?

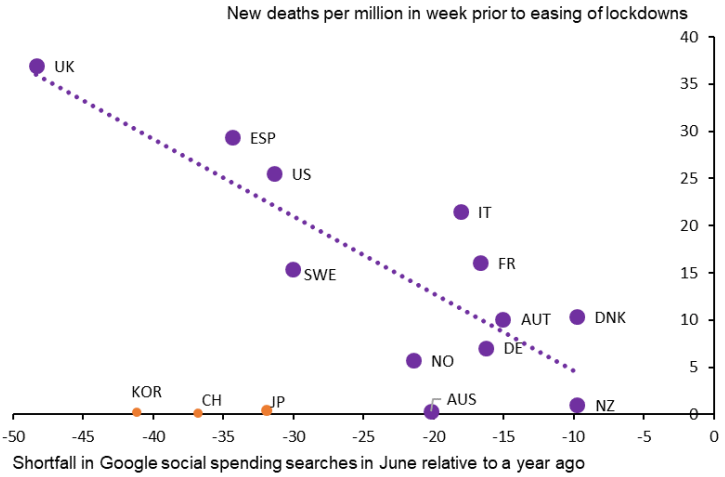
The most obvious thing to do is simply to ask people about their worries. **Figure 14** shows data from the latest ONS Impact survey, which asked about the fraction of individuals who are comfortable/very comfortable and uncomfortable/very uncomfortable about eating out, indoors and outdoors, in the sample week and week before. A clear majority are uncomfortable about eating inside at least.

[11] Similarly, Hacioglu et al (2020) find that the bulk of the fall in consumption in the UK started from the second week of March, before the imposition of the national lockdown on 23 March.

Figure 14: Attitudes to Eating Out

Source: ONS survey, 8-12 July

Figure 15: Recovery in social spending and the risk environment



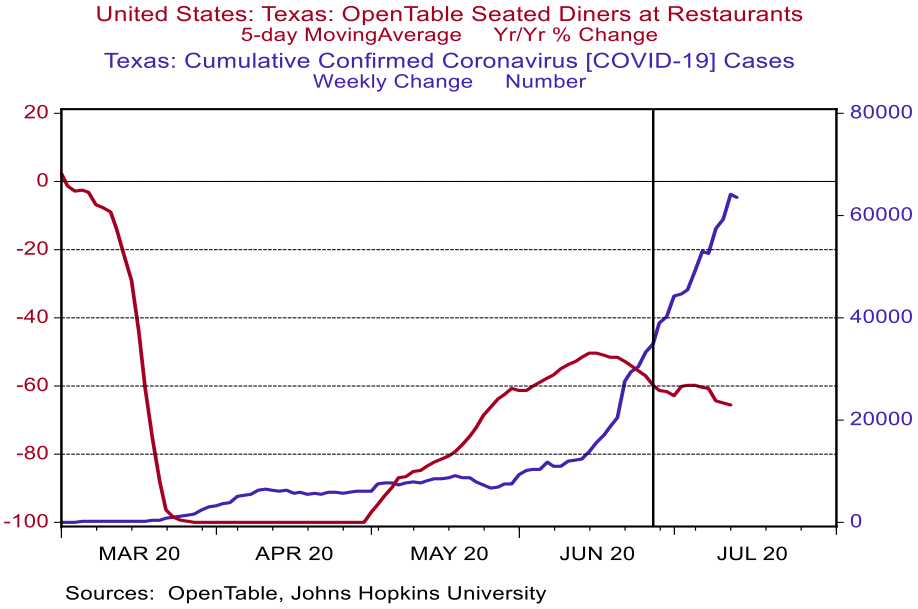
Source: Google and Bank calculations

Note: The Google Search data is taken from Google Trends. The "social spending" indicator is a composite of a number of terms, including items such as "café", "bar", "restaurant", etc. Our indicator is an index and the shortfall is calculated as the % deviation of June 2020 search volumes from June 2019 search volumes.

Let us turn next to cross-country data. **Figure 15** plots the shortfall of consumer interest in eating out (proxied by the deficit of Google searches for "restaurants" and the like relative to last year) measured in June against the prevalence of the virus (captured by Covid-19 deaths) in the week before lockdowns were eased. Notice the shape of the scatter and the timing of the data points. You can see that the deadlier the environment *before* mandatory lockdowns were lifted, the lesser consumer interest in social spending *now*. The UK is a case in point, having relaxed its official lockdown amidst high virus prevalence, and exhibiting the largest shortfall in social spending intent amongst all countries in the sample. But even in countries that had a lower death count before lifting lockdowns,

for instance South Korea, China and Japan, social spending interest remained depressed relative to pre-Covid. This points to a risk of persistence in consumer risk-aversion and spending activity.

Figure 16: Eating out in Texas



A second piece of evidence is in a specific location, namely Texas and **Figure 16** shows the story. From 13 March to 2 April, the US federal government and local authorities declared a state of emergency and imposed lockdowns in Texas, whereupon restaurant bookings fell to zero. From 1 May, restaurants reopened but with dining-in capacity constraints. Those were lifted from 25% on 1 May to 75% on 12 June, which coincided with a continuous pickup in bookings until a peak in mid-June. From that peak, bookings started to fall consistently, concomitant with a sharp uptick in cumulative Covid-19 cases. On 26 June, the governor of Texas announced a reduction of indoor restaurant seating capacity to 50% from 75% and closed bars other than for take-away, effective 29 June.

Since 26-29 June, bookings have fallen further but at a slower pace than commensurate with the steady rise of Covid-19 cases. This suggests that patrons' reluctance to dine out is abating, perhaps because of relatively greater confidence in the provision of a safe indoor environment following the governor's announcement, (but also, perhaps, reflecting anecdotal evidence of increasing availability in outdoor seating capacity.)

This Texan case study suggests that consumer behaviour responds not just to the prevalence of the virus, as measured by the number of Covid cases, but also to the provision of a safe environment by both the public and private sectors.

Finally, I turn to more formal econometric evidence (Goolsbee and Syverson (2020)). The authors use US mobile phone data to track movements of people to business locations. They exclude manufacturing but look at visits to, for example, shops, theatres and gyms, where location is a meaningful indicator of consumer activity. The US has seen widely differing experiences across counties of lockdowns and releases from lockdowns. Thus they can compare county A, which has released from lockdown, with adjacent county B, which has not, but both face the same death rate. If foot traffic recovered in county A, then this would suggest that exiting the lockdown, not fear of infection, would be driving behaviour.

Their main finding is that of the measured 60% fall in consumer traffic, only 7% was estimated to be due to official lockdowns. Rather, consumer visits are strongly correlated with the number of local Covid deaths, which suggests that fear of infection is driving consumer behaviour (similar to the visual impression from the Texas data).

4. Fear of unemployment

I've discussed how our standard models are built around a single representative household, yet we also know this economic shock has had a highly heterogeneous impact on sectors and households. Some household have lost their jobs, many of whom will be on lower incomes with little savings. Many more fear the prospect of losing their job once the furlough schemes end or might feel insecure working from home. Therefore it might be important to dispense with our representative household in order to properly model the prospects for the recovery.

Since the Global Financial Crisis, there has been an expansion of and innovations to another class of models: Heterogeneous Agent New Keynesian (HANK) models. As you might suspect, HANK models build on the New Keynesian assumption of price and wage rigidity, by modelling the distribution of household income and wealth with incomplete financial markets[12]. In these models individual households' decisions are contingent on their wealth, income, access to financial markets, liquidity of their assets and government policy. Other modellers have gone on to introduce labour-market frictions, such as search-and-matching frictions, meaning that individuals worry about the risk of unemployment and finding a new job, which in turn varies with the business cycle. Finally there are also models that emphasise heterogeneous firms and sectors, and input-output linkages between them.

[12] Incomplete credit markets mean that some households cannot borrow to insure against unemployment risk. Households are constrained in their ability to insure themselves against individual risk e.g. there may be limit to how much they can borrow.

This class of models tends to be quite intuitive in its description of the economy and the effects of macroeconomic policy relative to RANK models. For example in HANK models, contrary to RANK models, monetary policy works as much through its indirect, general-equilibrium effects on income and employment, as it does by direct spending responses to changes in interest rates (Kaplan & Violante, 2018; for an extension of these models into models incorporating fears of infection, see Kaplan, Moll & Violante 2020). The basic intuition is that credit-constrained households cannot smooth consumption by borrowing, so their spending decisions depend in part on current income from employment.

Furthermore, these household need not be asset-poor. Wealthy households, who hold a large share of their wealth in illiquid assets such as housing, are also a driver in these models. HANK models also create a larger role for fiscal policy as credit -constrained households are likely to be more responsive to changes to taxes or transfers than wealthy households. In the RANK model however, wealth is pooled and so transfers, taxes and borrowing net out to zero within the household.

So what can these models tell us about the risks we face as we enter the recovery?

1. Wealth distribution

The disproportionate exposure of the young, self-employed and low income households to the job losses and reduction in income related to Covid-19 gives a much more Keynesian flavour to the prospects for any recovery. That is to say, the fortunes of these households is going to depend upon aggregate demand in the economy as these households tend to have lower savings and spend a higher share of their incomes. Models that capture the wealth distribution and its interactions with consumption and labour supply will be useful for understanding the effects of monetary and fiscal policy on these households.

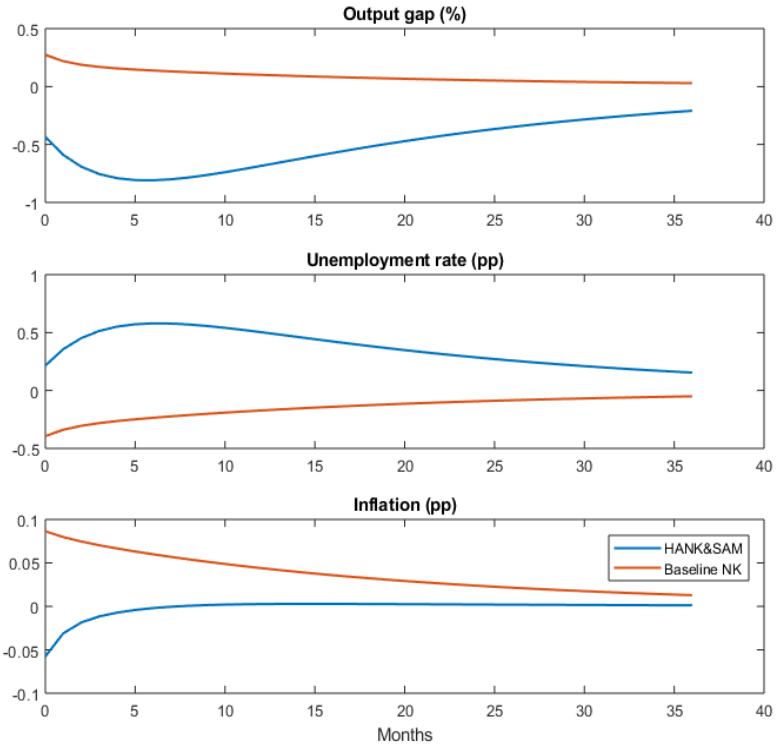
2. Unemployment

An important channel that these models can help describe is the interaction between job uncertainty and the need for precautionary savings. Job uncertainty can take two forms: the risk of job loss or the risk of poor job-finding prospects once unemployed. A feedback loop can develop where a rise in the risk of unemployment causes workers to save more for precautionary reasons. This rise in demand for saving amplifies the effects of the initial shock, supply or demand, and provides a mechanism for a supply shock to morph into a demand shock[13] [14].

[13] In some sense, this is also everyone's model of the economy. In the I-O model, there is a mechanical relation whereby low demand cascades down to lower demand along the supply chain.

These models capture a behavioural response whereby the fear of poor economic prospects, and related precautionary economic behaviour sustains low demand. When a negative shock hits, people worry about their own future and employment prospects, which leads to an increase in desired savings and lower demand. Notice that this model is in contrast to a standard approach where the onset of bad times, if perceived as temporary, is a time to reduce savings in order to smooth consumption. This stabilises the effects of the shock as opposed to amplifying it.

Figure 17: Supply shock amplification in a heterogeneous agent model with labour market frictions



Note: Graph shows the response of macroeconomic variables to a persistent supply shock. The blue line is the response in a model of Ravn and Sterk (2020) which includes incomplete markets, sticky wages and search and matching frictions. The orange line is a similar model but with complete markets and no labour market frictions, and reflects the textbook New Keynesian response to a supply shock. The models have been parametrized to be the same along all other dimensions and produce the same steady states. The output gap is output relative to what output would be in a frictionless version of the model i.e no price or wage rigidity or labour market frictions.

To see if this makes an appreciable difference, **Figure 17** illustrates the responses to a supply shock in a model based on that of Ravn and Sterk (2020) that includes incomplete markets and unemployment risk (HANK&SAM), and compares it to the more orthodox New Keynesian response to a supply shock. The panel shows the responses of output, unemployment and inflation following an illustrative negative shock to supply (Total Factor Productivity).

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[14] Another related model is that of Guerrieri et al (2020) which demonstrate how sectoral heterogeneity and household heterogeneity can combine to produce instances of supply shocks that ultimately result in inefficiently low demand.

Under the HANK&SAM simulation, the response of output is amplified beyond the effect of the initial shock due to a rise in unemployment. The persistent rise in unemployment, and crucially unemployment risk, pushes down on household demand, which in turn pushes down on inflation. In the baseline New Keynesian model the supply shock pushes down on unemployment as firms hire more workers to try to meet unchanged demand, which in turn pushes up on inflation through higher labour costs. For the monetary policymaker the difference is important. In the baseline RANK model the supply shock has created a positive output gap and higher inflation, whereas in the HANK&SAM model we have a negative output gap and lower inflation.

3. Policy and prospects

In recent months I have voted for more accommodative monetary policy. As I have tried to set out, in Haskel (2019) for example, I am concerned about the economy "getting stuck" and recovering only slowly and undershooting the inflation target.

Regarding the current downturn, I believe the I-O models were very helpful in modelling the magnitude and incidence of the decline. As for the recovery, I would put weight on the logic that suggests that as a behavioural response to the supply shock, cautious consumers, worried about unemployment and health risks, will hold back the economy. In addition to that, the heterogeneous response means each individual's economic fortunes depend strongly on the general behaviour of other consumers in the economy in a way that, without policy, may not be self-correcting.

If the worries about infection are an important determinant of behaviour, then the evolution of the economy likely depends on the provision of "health" services, both public (e.g. track/trace) and privately (e.g. screens in shops).[15] To the extent these services are privately provided, then I would expect to see a new wave of competition and innovation as firms compete by offering safe environments. To the extent these services are publically provided, there is a crucial link between the economy and such provision in at least two ways. First, the economy will crucially depend on the provision and understanding of high quality local information on infection by the health and statistical authorities. Second, the social returns to developing a cheap, fast and non-invasive test will be enormous. [16,17] This multiple set of interactions will be key to determining the path of the recovery.

[15] For example, in the UK, theatres are closed. In South Korea, the theatre showing Phantom of the Opera is open. Patrons are tested and have to wear masks, but seating is at full capacity. At the same time South Korea has strict quarantining and track and trace system, enforced by the civil authorities. In other words, both the theatre and public sector have supplied health services.

[16] For example, Eichenbaum et al (2020) study a model where workers decide whether to consume and go to work but those activities involve human contact and hence some chance of catching the disease. Lockdown stops contacts and the disease, but stops economic activity. The economy recovers as herd immunity is built up and, eventually, consumption and work are restored. In an extension Eichenbaum (2020) considers a model where agents don't know if they are infected and can choose to take a test. They typically show very large benefits from quarantining the sick relative to locking everyone down.

[17] A third point is the social and political interactions between testing and quarantining. For example, Eichenbaum et al (2020) point out that with no, or ineffective quarantine policies, an agent who tests positive can still work and consume. Indeed, other things equal, they have every incentive to do so, since they cannot catch the disease. However, the non-infected realise this is so and thus, correctly, work out that

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those group working and consuming are predominantly infected. Thus the non-infected withdraw from activity and so economic activity is worsened. With a strong quarantine policy, by contrast, the non-infected do not have this fear and economic activity is improved. In their simulations, such containment via quarantine saves 1.7trillion US dollars. As they note, Ferguson 2006 argue that much virus transmission does not occur in economic activity and so, for the maximum effect there would have to be very strict confinement around economic and social activity. Issues around quarantine policy and testing are of course not for the monetary authorities to decide, but these models suggest the outcomes for the economy depend upon their effects.

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